MEAT INSPECTION

The Pathoanatomic Basis

Henrik E. Jensen, Páll S. Leifsson, Ole L. Nielsen, Jørgen S. Agerholm and Tine Iburg

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Meat Inspection – The Pathoanatomic Basis

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Foreword

For many years there has been a need for a new veterinary textbook on meat inspection. The previous textbook, *Forelæsninger over kødkontrol [Lectures on Meat Inspection]* by professor Aage Jepsen, was published in the 1960's.

Furthermore, there has been a desire for an illustrated textbook which could provide the basis for homogeneous assessment of lesions in slaughter animals based on current meat hygiene legislation.

Special pathology and meat inspection are closely linked in the education of veterinary students because meat inspection is founded on diagnostic pathoanatomy, together with elucidation of pathogenesis and aetiology in livestock. A textbook with a pathoanatomic foundation would thus be highly useful. An illustrated textbook on meat inspection would also provide an excellent supplement to the existing teaching material in special pathology. A textbook with colour illustrations has been on the wish list for many years by those studying veterinary medicine. The publication of *Meat Inspection – The Pathoanatomic Basis* hopefully will meet these needs.

This book only covers conditions in domestic mammals. It focuses on those diseases and types of lesions most commonly found in slaughter animals in Denmark. Diseases in game and poultry are not covered, but the principles described in this book can be applied to mammalian game in particular. A number of diseases are not mentioned or only mentioned in connection with differential diagnosis. This applies specifically to exotic notifiable diseases. These have been omitted not only because the book is intended primarily as a tool at routine meat inspection, but also because there is inadequate relevant photographic material available for these diseases.

The chapters are arranged according to organs, but we have also found it useful to include special sections on important cross-disciplinary areas within meat inspection such as pyaemia, granulomatous and pyogranulomatous inflammations, forensic and animal welfare, and neoplasms.

The illustrations originate primarily from the Section for Pathology, University of Copenhagen, phototek archive for educational use in veterinary pathology, and have been provided by the authors as well as previous employees including A. Basse, E. Bindseil, E. Brummerstedt, N.-I. Heje and S. Larsen. In connection with collation of images we have also received a large number of preparations and illustrations from official veterinarians at Danish Crown in Tønder, Horsens, Rønne, Esbjerg, Sæby, Herning, Ringsted, Blans, Holstebro, Ålborg and Thisted. We are grateful for these contribu-

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tions. Illustrations from master theses and PhD studies carried out by the department have also been used, as well as individual illustrations from S. N. Olsen, T. M. Søland, M. B. Christensen, K. K. Kristensen, L. L. Mortensen, S. Jakobsen, S. Andersen, T. Skovgaard, K. Blaabjerg, M. E. Busch and Professor L. Carrasco, University of Cordoba, Cordoba, Spain, for which we are grateful. Many thanks to Charlotte Vilstrup (The Danish Veterinary and Food Administration) and Lissi Vestergaard Karlsen (The Danish Advisory Committee on Animal Health) for their comments on Chapter 1 and Chapter 22.

We would also like to offer our very special thanks to Dennis Brok for his unwavering support and enthusiasm in the editing and layout of these innumerous images. We would like to thank especially Kirsten Chemnitz and Benedicte Kragh for their editorial work.

Compared to the 1st edition published in 2006, the 2nd edition was updated with current legislation on meat inspection and some simple text amendments. The 2nd edition was supplemented with 132 new illustrations. This 3rd edition, which is the first in English, has been updated with a few new illustrations and current legislation on meat inspection.

Frederiksberg, June 2017

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1 General Conditions

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Introduction

Inspection and scoring of slaughter animals is based on the provisions of the Regulation on controls on products of animal origin intended for human consumption[1] which stipulates a requirement that all parts of the animal must be inspected immediately after slaughter to ensure that the meat is fit for human consumption. The Regulation describes the investigations that must be performed for particular species as well as the conditions on which the meat can be approved for consumption.

The rules governing inspection are stipulated in the Regulation on controls on products of animal origin intended for human consumption. The scoring rules are stipulated in the current circular on implementation of meat inspection (Cirkulære om udøvelse af kødkontrol).

The Regulation stipulates rules for the practical implementation of inspection of slaughter animals both before and after slaughter at the slaughterhouse. The judgment rules for individual diseases are based on current international standards[2] and are notified in the circular on implementation of meat inspection (Cirkulære om udøvelse af kødkontrol)[3].

1 Regulation (EC) No 854/2004 of the European Parliament and of the Council of 29 April 2004 laying down specific rules for the organisation of official controls on products of animal origin intended for human consumption. Commision regulation (EU) No. 219/2014 of 7 March 2014 amending Annex 1 to Regulation (EC) No 854/2004 as regards the specific requirements for post-mortem inspection of domestic swine.

2 Recommended international code for ante-mortem and post-mortem inspection of slaughter animals and for ante-mortem and post-mortem judgement of slaughter animals and meat (Codex Alimentarius Committee (CAC/RCP 58-2005)).

3 Circular on the implementation of meat inspection of 1 January 2012.

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Post-mortem inspection [1.01 - 1.09]

All parts of the animal must be inspected immediately after slaughter in accordance with the Regulation on controls on products of animal origin intended for human consumption. According to the Commission Regulation (EU) No. 218/2014 of 7th March 2014 amending Annexes to Regulations (EC) No. 853/2004 and (EC) No. 854/2004 of the European Parliament and of the Council and Commission Regulation (EC) No. 2074/2005 and Commission Regulation (EU) No. 219/2014 of 7th March 2014 amending Annex 1 to Regulation (EC) No. 854/2004 of the European Parliament and of the Council as regards the specific requirements for post-mortem inspection of all domestic swine are subjected to visual inspection. Pigs from non-integrated production systems and intented for export to USA must be examined as stated in Table 1-1. The official veterinarian must ensure that the results of meat inspection are registered. A list of investigations that must be performed routinely for each species is presented in Table 1-1. It must be emphasised that in cases of doubt, the official veterinarian can carry out those incisions in, and inspection of, the relevant parts of the animal that are necessary to make a final decision. In addition to the routine inspections listed in Table 1-1, systematic inspection must be undertaken for cysticercosis caused by *Cysticercus cellulosae* in pigs, glanders in horses, and trichinoses in pigs and horses.

Table 1-1. Routine inspections that must be performed on each species

Specified inspections	Cattle younger than 6 weeks	Cattle older than 6 weeks	Swine	Sheep and goats	Solipeds[6]
Head and throat: visual inspection	+	+	+	+[5]	+
Head: dehide				+[5]	
Retropharyngeal lymph nodes: visual inspection	+	+		+[5]	+/palpation
Retropharyngeal lymph nodes: Incision	+	+			
Mandibular lymph nodes: visual inspection		+			+/palpation
Mandibular lymph nodes: Incision		+	+[7]		
Parotid lymph nodes: visual inspection		+			+/palpation
Parotid lymph nodes: Incision		+			
External m. masseters: two parallel incisions		+			
Internal m. masseters: incised along one plane		+			
Tongue: visual inspection	+	+	+	+[5]	+
Tongue: palpate	+	+			+
Oral cavity and fauces: visual inspection	+	+	+	+[5]	+

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Trachea: visual inspection[1]	+	+	+	+	+
Oesophagus: visual inspection	+	+	+	+	+
Lungs: visual inspection and palpate[1]	+	+	+	+	+
Lnn. bifurcations (tracheobronchial lymph nodes, left and middle):					
Incision	+	+		+	+
Palpate			+		
Lnn. eparteriales (tracheobronchial lymph nodes, cranial):					
Incision	+	+			
Palpate			+	+	+
Lnn. mediastinalis:					
Incision	+	+			
Palpate			+	+	+
Heart: visual inspection	+	+	+	+	+
Pericardium: visual inspection	+	+	+	+	+
Cardiac chambers: open	+	+	+[7]		+
Cardiac septum: cut through	+	+	+[7]		+
Diaphragm: visual inspection	+	+	+	+	+
Liver: visual inspection	+	+	+[7]	+	+
Liver: incision on rear (visceral surface) and at the base of the papillary process		+[8]		+[8]	
Hepatic and pancreatic lymph nodes:					
Visual inspection			+	+	
Visual inspection and palpate	+	+			+
Gastro-intestinal tract: visual inspection	+	+	+	+	+
Opening of vena cava caudalis		+			
Mesentery: visual inspection	+	+	+	+	+
Gastric lymph nodes: visual inspection[2]	+	+	+	+	+
Gastric lymph nodes: palpate[2]	+	+	+		
Mesenteric lymph nodes (cranial and caudal): visual inspection	+	+	+[7]	+	+
Mesenteric lymph nodes (cranial and caudal): palpate	+	+	+[7]		
Spleen: visual inspection	+	+	+	+	+
Spleen: visual inspection and palpate			+		
Kidneys: visual inspection	+	+	+	+	+[6]/palpation
Kidneys: visual inspection and incession in the kidneys and lln. renales			+[7]		
Peritoneum: visual inspection	+	+	+	+	+
Pleura: visual inspection	+	+	+	+	+
Genitals: visual inspection (except for the penis, if already discarded)		+	+	+	+
Udder: visual inspection[3]		+	+	+	+
Mammary lymph nodes: visual inspection[3]			+	+	+
Incession in the supra mammary lymph nodes			+[7]		

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Umbilical area: visual inspection and palpate[4]	+		+	+	+
If necessary incession of the umbilical region	+		+	+	+
Joints: visual inspection and palpate[4]	+		+	+	+
If necessary opening of joints	+		+	+	+

1 The trachea and the main branches of the bronchi must be opened lengthwise and the lungs must be incised in their posterior third, perpendicular to their main axes; however, these incisions are not necessary where the lungs are excluded from human consumption.
2 Including lymph nodes of the forestomachs and the abomasum in ruminants.
3 In cows, each half of the udder must be opened by a long, deep incision as far as the lactiferous sinuses (sinus lactiferes) and the lymph nodes of the udder must be incised, except when the udder is excluded from human consumption. In sows incision of the supramammary lymph nodes.
4 Applies only for young swing, sheep, goats and solipeds, i.e. animal of less than four weeks of age.
5 Without prejudice to animal-health rules, these examinations are not necessary if the competent authority is able to guarantee that the head, including the tongue and the brains, will be excluded from human consumption.
6 All grey or white horses must be inspected for melanosis and melanomas by examination of the muscles and lymph nodes (lnn. subrhomboidei) of the shoulders beneath the scapular cartilage after loosening the attachment of one shoulder. The kidneys must be exposed and examined by incision through the entire kidney.
7 When the epidemiological or other data from the holding of provenance of the animals, the food chain information or the findings of ante-mortem inspection and/or post-mortem visual detection of relevant abnormalities indicate possible risks to public health, animal health or animal welfare, the carcases and offal of pigs are to undergo additional post-mortem procedures using incision and palpation.
8 Incision on the visceral surface of the liver to examine the bile ducts.

CATTLE YOUNGER THAN SIX WEEKS

Carcases and offal of bovine animals under six weeks old are to undergo the following post-mortem inspection procedures:

1) visual inspection of the head and throat; incision and examination of the retropharyngeal lymph nodes (lnn. retropharyngiales); inspection of the mouth and fauces; palpation of the tongue;
2) visual inspection of the lungs, trachea and oesophagus; palpation of the lungs; incision and examination of the bronchial and mediastinal lymph nodes (lnn. bifucationes, eparteriales and mediastinales). The trachea and the main branches of the bronchi must be opened lengthwise and the lungs must be incised in their posterior third, perpendicular to their main axes; these incisions are not necessary where the lungs are excluded from human consumption;
3) visual inspection of the pericardium and heart, the latter being incised lengthwise so as to open the ventricles and cut through the interventricular septum;
4) visual inspection of the diaphragm;
5) visual inspection of the liver and the hepatic and pancreatic lymph nodes, (lnn. portales); palpation and, if necessary, incision of the liver and its lymph nodes;
6) visual inspection of the gastro-intestinal tract, the mesentery, the gastric and mesenteric lymph nodes (lnn. gastrici, mesenterici, craniales and caudales); palpation and, if necessary, incision of the gastric and mesenteric lymph nodes;
7) visual inspection and, if necessary, palpation of the spleen;
8) visual inspection of the kidneys; incision, if necessary, of the kidneys and the renal lymph nodes (lnn. renales);

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9) visual inspection of the pleura and peritoneum;
10) visual inspection and palpation of the umbilical region and the joints. In the event of doubt, the umbilical region must be incised and the joints opened; the synovial fluid must be examined.

CATTLE OLDER THAN SIX WEEKS

Carcases and offal of bovine animals over six weeks old are to undergo the following post-mortem inspection procedures:

1) visual inspection of the head and throat; incision and examination of the sub-maxillary, retropharyngeal and parotid lymph nodes (lnn. retropharyngiales, mandibulares and parotidei); examination of the external masseters, in which two incisions must be made parallel to the mandible, and the internal masseters (internal pterygoid muscles), which must be incised along one plane. The tongue must be freed to permit a detailed visual inspection of the mouth and the fauces and must itself be visually inspected and palpated;
2) inspection of the trachea and oesophagus; visual examination and palpation of the lungs; incision and examination of the bronchial and mediastinal lymph nodes (lnn. bifucationes, eparteriales and mediastinales). The trachea and the main branches of the bronchi must be opened lengthways and the lungs must be incised in their posterior third, perpendicular to their main axes; these incisions are not necessary where the lungs are excluded from human consumption;
3) visual inspection of the pericardium and heart, the latter being incised lengthways so as to open the ventricles and cut through the interventricular septum;
4) visual inspection of the diaphragm;
5) visual inspection and palpation of the liver and the hepatic and pancreatic lymph nodes, (lnn. portales); incision of the gastric surface of the liver and at the base of the caudate lobe to examine the bile ducts;
6) visual inspection of the gastro-intestinal tract, the mesentery, the gastric and mesenteric lymph nodes (lnn. gastrici, mesenterici, craniales and caudales); palpation and, if necessary, incision of the gastric and mesenteric lymph nodes;
7) visual inspection and, if necessary, palpation of the spleen;
8) visual inspection of the kidneys and incision, if necessary, of the kidneys and the renal lymph nodes (lnn. renales);
9) visual inspection of the pleura and the peritoneum;
10) visual inspection of the genital organs (except for the penis, if already discarded);
11) visual inspection and, if necessary, palpation and incision of the udder and its lymph nodes (lnn. supramammarii). In cows, each half of the udder must be opened by a long, deep incision as far as the lactiferous sinuses (sinus lactiferes) and the lymph nodes of the udder must be incised, except when the udder is excluded from human consumption.

SWINE

Carcases and offal of pigs are to undergo the following post-mortem inspection procedures:

1) visual inspection of the head and throat; visual inspection of the mouth, fauces and tongue;
2) visual inspection of the lungs, trachea and oesophagus;
3) visual inspection of the pericardium and heart;
4) visual inspection of the diaphragm;
5) visual inspection of the liver and the hepatic and pancreatic lymph nodes, (lnn. portales);
6) visual inspection of the gastro-intestinal tract, the mesentery, the gastric and mesenteric lymph nodes (lnn. gastrici, mesenterici, craniales and caudales)
7) visual inspection of the spleen;
8) visual inspection of the kidneys;
9) visual inspection of the pleura and peritoneum;

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10) visual inspection of the genital organs (except for the penis, if already discarded);
11) visual inspection of the udder and its lymph nodes (lnn. supramammarii);
12) visual inspection of the umbilical region and joints of young animals.

When the epidemiological or other data from the holding of provenance of the animals, the food chain information or the findings of ante-mortem inspection and/or post-mortem visual detection of relevant abnormalities indicate possible risks to public health, animal health or animal welfare, the carcases and offal of pigs are to undergo additional post-mortem procedures using incision and palpation. Depending on the identified risks these procedures may include:

1) incision and examination of the submaxillary lymph nodes (lnn. mandibulares);
2) palpation of the lungs and the bronchial and mediastinal lymph nodes (lnn. bifucationes, eparteriales and mediastinales). The trachea and the main branches of the bronchi must be opened lengthwise and the lungs must be incised in their posterior third, perpendicular to their main axes; those incisions are not necessary where the lungs are excluded from human consumption;
3) incision of the heart lengthwise so as to open the ventricles and cut through the interventricular septum;
4) palpation of the liver and its lymph nodes;
5) palpation and, if necessary, incision of the gastric and mesenteric lymph nodes;
6) palpation of the spleen;
7) incision of the kidneys and the renal lymph nodes (lnn. renales);
8) incision of the supramammary lymph nodes;
9) palpation of the umbilical region and joints of young animals and, if necessary incision of the umbilical region and opening of the joints;

SHEEP AND GOATS

Carcases and offal of sheep and goats are to undergo the following post-mortem inspection procedures:

1) visual inspection of the head after flaying and, in the event of doubt, examination of the throat, mouth, tongue and retropharyngeal and parotid lymph nodes. Without prejudice to animal-health rules, these examinations are not necessary if the competent authority is able to guarantee that the head, including the tongue and the brains, will be excluded from human consumption;
2) visual inspection of the lungs, trachea and oesophagus; palpation of the lungs and the bronchial and mediastinal lymph nodes (lnn. bifucationes, eparteriales and mediastinales); in the event of doubt, these organs and lymph nodes must be incised and examined;
3) visual inspection of the pericardium and heart; in the event of doubt, the heart must be incised and examined;
4) visual inspection of the diaphragm;
5) visual inspection of the liver and the hepatic and pancreatic lymph nodes, (lnn. portales); palpation of the liver and its lymph nodes; incision of the gastric surface of the liver to examine the bile ducts;
6) visual inspection of the gastro-intestinal tract, the mesentery and the gastric and mesenteric lymph nodes (lnn. gastrici, mesenterici, craniales and caudales);
7) visual inspection and, if necessary, palpation of the spleen;
8) visual inspection of the kidneys; incision, if necessary, of the kidneys and the renal lymph nodes (lnn. renales);
9) visual inspection of the pleura and peritoneum;
10) visual inspection of the genital organs (except for the penis, if already discarded);
11) visual inspection of the udder and its lymph nodes;

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12) visual inspection and palpation of the umbilical region and joints of young animals. In the event of doubt, the umbilical region must be incised and the joints opened; the synovial fluid must be examined.

SOLIPEDS

Carcases and offal of solipeds are to undergo the following post-mortem inspection procedures:

1) visual inspection of the head and, after freeing the tongue, the throat; palpation and, if necessary, incision of the sub-maxillary, retropharyngeal and parotid lymph nodes (lnn. retropharyngiales, mandibulares and parotidei). The tongue must be freed to permit a detailed visual inspection of the mouth and the fauces and must itself be visually examined and palpated;
2) visual inspection of the lungs, trachea and oesophagus; palpation of the lungs; palpation and, if necessary, incision of the bronchial and mediastinal lymph nodes (lnn. bifucationes, eparteriales and mediastinales). The trachea and the main branches of the bronchi must be opened lengthwise and the lungs must be incised in their posterior third, perpendicular to their main axes; however, these incisions are not necessary where the lungs are excluded from human consumption;
3) visual inspection of the pericardium and the heart, the latter being incised lengthwise so as to open the ventricles and cut through the interventricular septum;
4) visual inspection of the diaphragm;
5) visual inspection, palpation and, if necessary, incision of the liver and the hepatic and pancreatic lymph nodes, (lnn. portales);
6) visual inspection of the gastro-intestinal tract, the mesentery and the gastric and mesenteric lymph nodes (lnn. gastrici, mesenterici, craniales and caudales); incision, if necessary, of the gastric and mesenteric lymph nodes;
7) visual inspection and, if necessary, palpation of the spleen;
8) visual inspection and palpation of the kidneys; incision, if necessary, of the kidneys and the renal lymph nodes (lnn. renales);
9) visual inspection of the pleura and peritoneum;
10) visual inspection of the genital organs of stallions (except for the penis, if already discarded) and mares;
11) visual inspection of the udder and its lymph nodes (lnn. supramammarii) and, if necessary, incision of the supramammary lymph nodes;
12) visual inspection and palpation of the umbilical region and joints of young animals. In the event of doubt, the umbilical region must be incised and the joints opened; the synovial fluid must be examined;

In addition to the mandatory inspections listed in Table 1-1, the following inspections must be carried out systematically:

1) Cysticercosis caused by *Cysticercus cellulosae* in pigs: Inspection of the exposed muscle surfaces, in particular the thigh muscles, diaphragm, intercostal muscles, heart, tongue and larynx as well as the abdominal wall and psoas muscle trimmed of fat.

2) Glanders in solipeds: Careful inspection of the mucous membranes in the trachea, the pharynx and the nasal cavities as well as the sinuses after mid-line split of the head and excision of the nasal septum.

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3) Trichinoses in pigs and horses: In slaughterhouses with export authorisation, all pigs and horses must be inspected for trichinoses using one of the methods proscribed by the Danish Veterinary and Food Administration. If the presence of trichinoses is demonstrated, the Danish Veterinary and Food Administration must be notified immediately. Inspection can be omitted if the meat is frozen in accordance with the regulations of the Danish Veterinary and Food Administration. Inspection can also be omitted if the meat has been approved solely for consumption in the Danish market. Denmark has been approved by the European Commission and the other Member States as a region with negligible risk for trichinoses in domestic pigs. Rather than inspection of just about all slaughtered pigs, this enables risk-based monitoring in which animals particularly at risk are inspected (all outdoor pigs, sows and boars, wild boar, horses, etc.).

4) Bovine spongiform encephalopathy: As part of the monitoring and prevention of bovine spongiform encephalopathy (BSE) in cattle, the brain and spinal cord are sampled routinely and samples sent for examination at a laboratory approved by the Danish Veterinary and Food Administration. All countries (including Denmark) in negligible risk for BSE must ensure, that all cattle 48 months or older, which have undergone emergency slaughtering, ante mortem animals, animals under official supervision and dead and killed cattle must be examined for BSE. In countries with controlled or undetermined risk for BSE, the BSE test must be performed for cattle with an age limit of 30 months and older and all cattle of 24 months and older for emergency slaughter, ante-mortem animals, animals under official monitoring and dead and killed cattle.

Expanded inspections [1.10 – 1.14]

Mid-split of the body and head

In addition to the general regulations on mid-split, the Regulations on controls on products of animal origin intended for human consumption, the official veterinarian must, when expanded inspection is mandatory, demand the body mid-split to inspect the thereby exposed surfaces of bones and muscles, as well as the spine and spinal cord with associated membranes. Mid-split of the head must take place when justified, and the brain with associated membranes must be inspected.

Bovine cysticerci

If bovine cysticerci (*Cysticercus bovis*) are present the masseters, diaphragm, and heart must be cut into thin slices. All muscle surfaces must be inspected carefully for the presence of cysticerci. If 10 viable or dead cystercerci are detected, the tongue and underlying muscles must be cut into thin slices and examined.

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Caseous lymphadenitis and tuberculous lesions

If caseous lymphadenitis (caseous necroses in lymph nodes) or tuberculous organ lesions are present, all organs must be inspected carefully for spread. The skeletal system and soft brain membranes must also be inspected.

In pigs, expanded inspection is only necessary when lesions are demonstrated at sites other than the mandibular lymph nodes or the intestinal lymph nodes.

In pigs, numerous incisions are made and inspected in the following lymph nodes: superficial cervical (dorsal and ventral); retropharyngeal lymph nodes (lateral and medial); parotid and mandibular lymph nodes; caudal deep cervical lymph nodes; lumbar lymph nodes; subiliacal lymph nodes; ischiatic lymph nodes; superficial inguinal or supramammary lymph nodes; deep inguinal lymph nodes; and the popliteal lymph nodes.

In cattle, numerous incisions are made and inspected in the following lymph nodes: superficial cervical lymph nodes; axillary lymph nodes; subiliacal lymph nodes; superficial inguinal or supramammary lymph nodes; deep inguinal lymph nodes; ischiatic lymph nodes; and popliteal lymph nodes.

Pyaemia

If pus forming processes which could be part of a generalised spread (pyaemia) are present, all organs must be carefully inspected, and must include thorough palpation of lung tissue to determine whether disseminated embolic processes are present. Hereafter, the entire spine must be examined from the cervical vertebrae to the tail bone. Pelvic bones, ribs (in particular the costochondral transition), as well as growth lines in the other bones must be inspected, too. All areas must be inspected for embolic osteomyelitis (new bone formation, abscess formation, sclerosis, and connective tissue formation). The new bone formation, tenderloin/ileopsoas muscles and the shoulders and inner thigh rump must be exposed. In cattle, an incision must also be made in the thigh muscles.

General scoring rules [1.15 – 1.42]

Unconditional approval (UA)

At UA, the entire carcase with associated organs is approved. Can be applied for meat that is unconditionally fit for human consumption, regardless of how it is prepared.

Total condemnation (TC)

At TC, the entire carcase and all associated organs are condemned. TC must be applied for all animals that are unfit for human consumption due to generalised conditions (e. g. fever), or localised lesions, ailments, or contaminants which cannot be stripped out, or which have affected the general state of health.

Partial condemnation (PC)

At PC, parts of the carcase, individual organs, or parts of organs are condemned in connection with stripping of regional lymph nodes. It must be underscored that PC al-

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ways involves regional lymph nodes. PC must be applied at localised lesions, or ailments that do not affect the general state of health. Any material that has been rejected but which does not display signs of disease that can be transferred to humans or animals, and which originates in carcases that are fit for consumption can, as described in the regulations on by-products, be approved for production of animal feed.

Approved for deboning (AD)

At AD, all bones, joints, and visibly pathologic lesions must be rejected. AD is applied in ailments in which the skeletal muscles and organs can be approved for human consumption. In cases in which additional lesions are found during deboning, these lesions must be taken into account in the overall judgement of the carcase and organs. It must be underscored that these carcases and organs have to be registered.

Approved for pre-processing (AP)

Meat from animals with limited muscle lesions as PSE (pale, soft and exudative) and DFD (dark, firm and dry) can after deboning be used for pre-processing (production of meat products). Parts with high-grade lesions are subject to partial condemnation, and unaffected parts are approved.

Conditional approval (CA)

Conditional approval can be applied for meat from cattle containing up to 10 viable or dead cysticerci. Stomachs, intestines, and fat can be unconditionally approved. The head, heart, diaphragm, oesophagus, and tongue are rejected if sliced. Cysticerci in the carcase are excised, after which the carcase and other organs can be conditionally approved for human consumption conditional on the meat being taken directly to controlled treatment (freezing at or below -10°C for at least 10 days) at an authorised freezer centre. Meat from the slaughter house's own slaughters may be frozen at the slaughterhouse.

Specified risk material (SRM)

Specified risk material is those parts of an animal that are the most likely predilection sites at infection with a transmissible spongiform encephalopathy, aetiology e.g. BSE or scrapie.

The following tissues shall be designated as specified risk material if they come from animals whose origin is in a Member State with a negligible BSE risk:

1) *Cattle:*
   – the cranium excluding the mandible and including the brain and eyes, and the spinal cord of animals aged over 12 months.

2) *Sheep and goats regardless of age:*
   – the spleen and
   – the ileum (i.e. the final section of the small intestine immediately before the caecum).

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3) *Sheep and goats older than 12 months, or which have an erupted front tooth, in addition:*
   – the cranium with brain and eyes,
   – the tonsils, and
   – the spinal cord.

SRM must in principle be removed at slaughter, but the individual parts (spine from cattle, and spinal cord from sheep and goats) may also be removed in connection with dressing.

The BSE status of Member States or third countries or regions thereof (hereinafter referred to as 'countries or regions') shall be determined by classification into one of the following three categories:

– negligible BSE risk
– controlled BSE risk
– and undetermined BSE risk

Denmark (and other EU countries like Belgium, Czech Republic, Cyprus, Estonia, Finland, France, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland Portugal, Slovakia, Slovenia, Spain, United Kingdom, Sweden, Germany and Austria) belongs to countries with negligible BSE risk. In according to the EU legislation on monitoring and control of bovine spongiform encephalopathy in cattle, these bovine animals shall be tested for BSE:

• bovine animals over 48 months of age where:
– they have undergone emergency slaughter
– by an ante mortem inspection there were observed physiological and functional signs where the animal is suspected of being infected with a disease which can be transmitted to humans or animals, or disorder which may make the meat unfit for human consumption
– they have died or been killed in a herd which is supervised by the competent authorities because of BSE

The slaughterhouse is responsible for taking samples from brainstem and the samples must be sent to a laboratory to be investigated for the presence of BSE.
The competent authorities have ensured, that no parts of examined animals will leave the slaughterhouse until a negative result has been obtained.

The regulations governing implementation of meat inspection are continuously updated and amended. Consult the website of the Danish Veterinary and Food Administration (www.foedevarestyrelsen.dk) regularly for the current legislation.

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1.01



Animal species/Organ	Cattle/Retropharyngeal lymph nodes
Lesion	The retropharyngeal lymph nodes must be routinely incised
Scoring	The cut surfaces must be inspected for lesions
Comments	If lesions are present inspection of the drainage area must be performed

1.02



Animal species/Organ	Cattle/Mandibular lymph nodes
Lesion	The mandibular lymph nodes must be routinely incised
Scoring	The cut surfaces must be inspected for lesions
Comments	If lesions are present inspection of the drainage area must be performed

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1.03



Animal species/Organ	Cattle/Masseters
Lesion	Two incisions must be made routinely in the outer masseters; the first incision superficially
Scoring	The cut surfaces must be inspected for lesions
Comments	The masseters are inspected in particular for cysticerci (*Cysticercus bovis*)

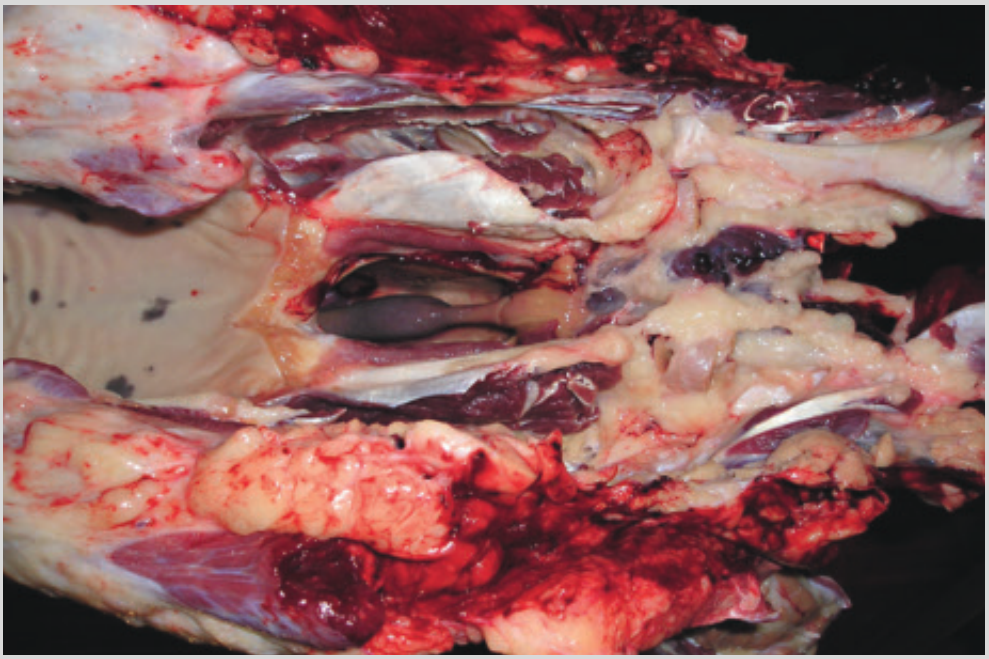
1.04



Animal species/Organ	Cattle/Masseters
Lesion	Two incisions must be made routinely in the outer masseters; the second incision in the deep tissue
Scoring	The cut surfaces must be inspected for lesions
Comments	The masseters are inspected in particular for cysticerci (*Cysticercus bovis*)

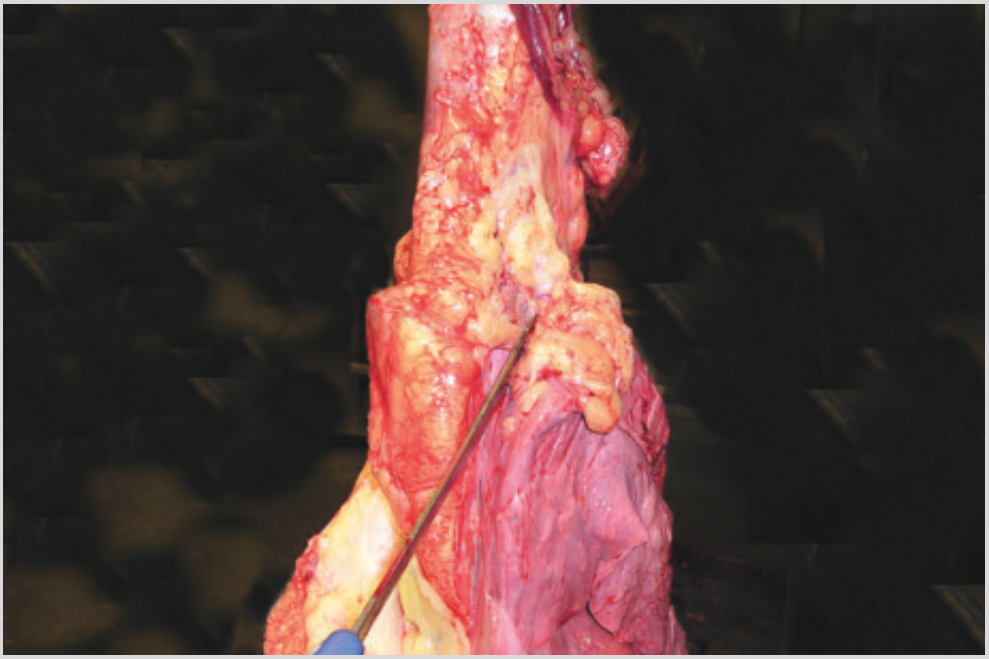
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1.05



Animal species/Organ	Cattle/Pharynx
Lesion	The tonsils must be removed when inspecting the larynx
Scoring	The larynx and adjacent areas must be inspected for lesions
Comments	The tonsils are removed to reduce contamination risk, including BSE/scrapie

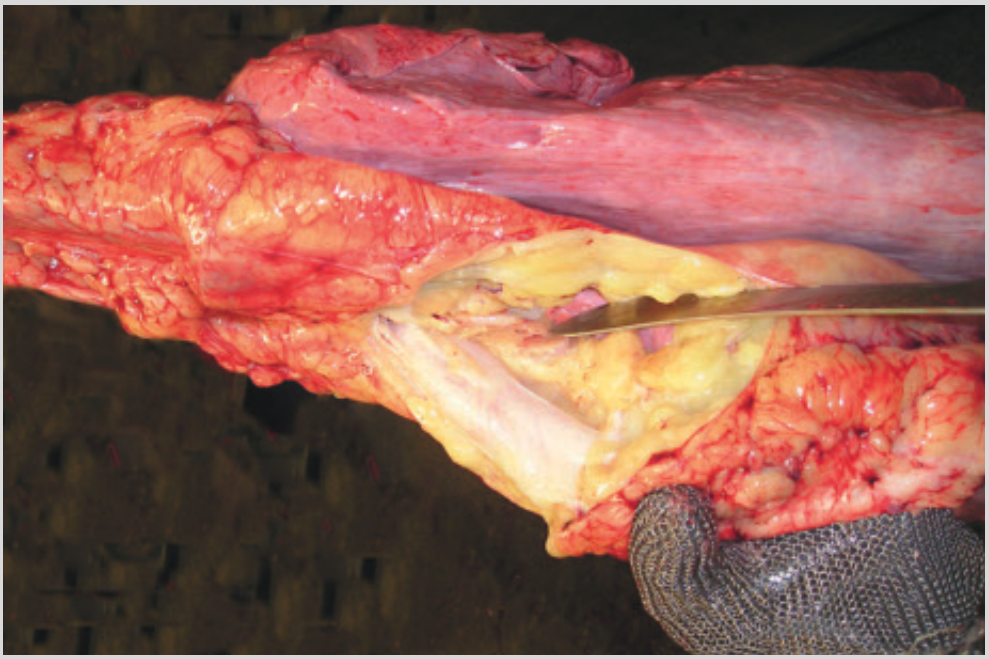
1.06



Animal species/Organ	Cattle/Cranial tracheobronchial lymph nodes
Lesion	The cranial tracheobronchial lymph nodes must be routinely incised
Scoring	The cut surfaces must be inspected for lesions
Comments	If lesions are present inspection of the drainage area must be performed

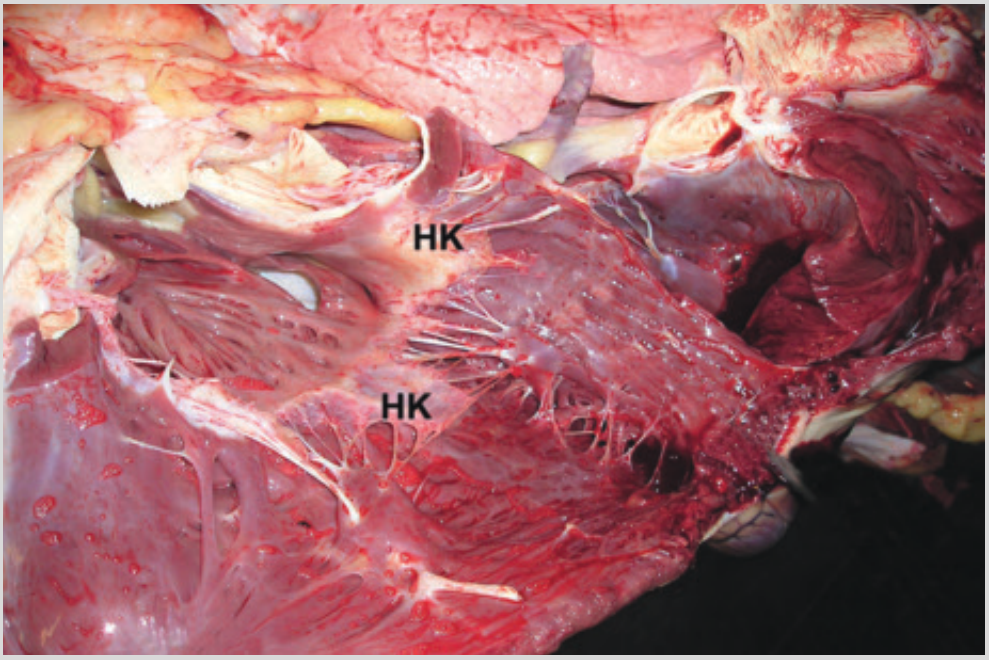
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1.07



Animal species/Organ	Cattle/Mediastinal lymph nodes
Lesion	The mediastinal lymph nodes must be routinely incised
Scoring	The cut surfaces must be inspected for lesions
Comments	If lesions are present inspection of the drainage area must be performed

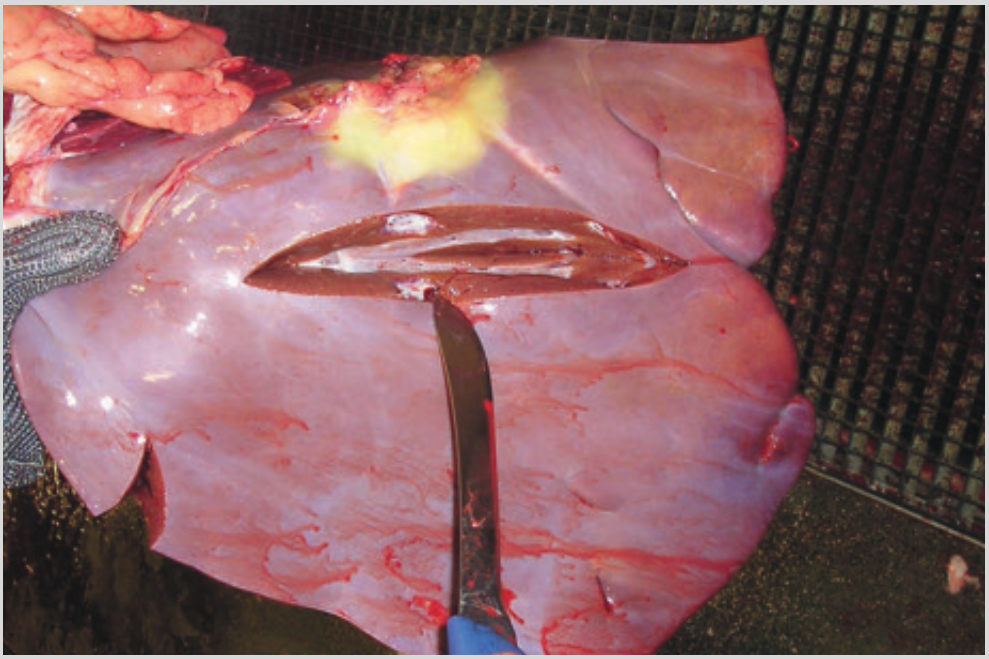
1.08



Animal species/Organ	Cattle/Heart
Lesion	The heart chambers must be opened and the septum cut through
Scoring	The valve (HK) in the opened heart should be inspected
Comments	The localisation of any lesions should be determined (cysts, endocarditis, etc.)

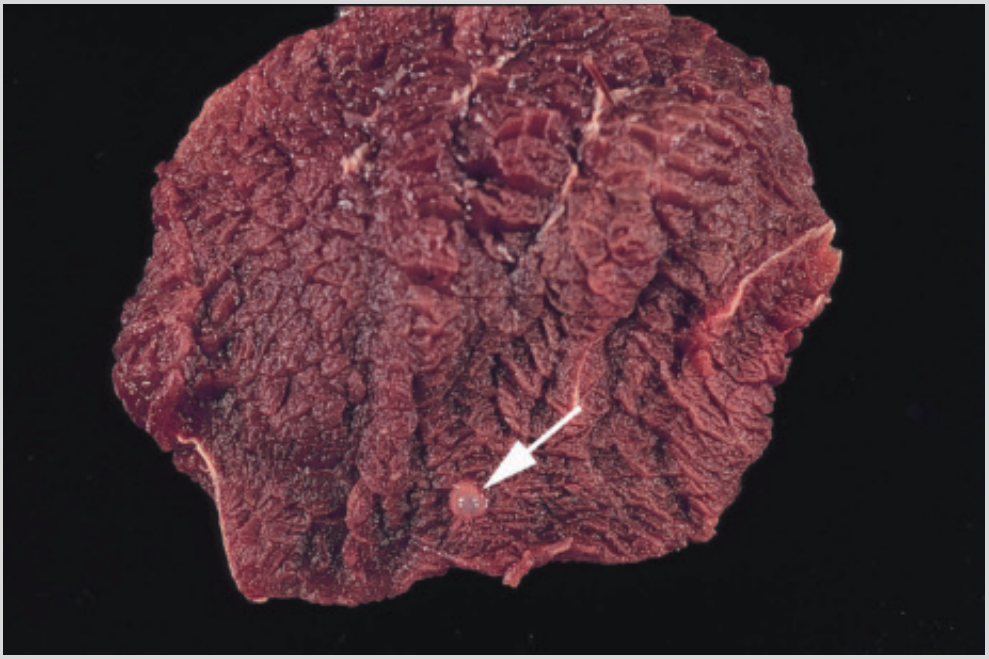
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1.09



Animal species/Organ	Cattle/Liver
Lesion	The surface of the liver is routinely incised
Scoring	The appearance and texture of the liver is assessed
Comments	The localisation of any lesions must be determined. In cattle older than 6 weeks of age, the caudal vena cava must be opened

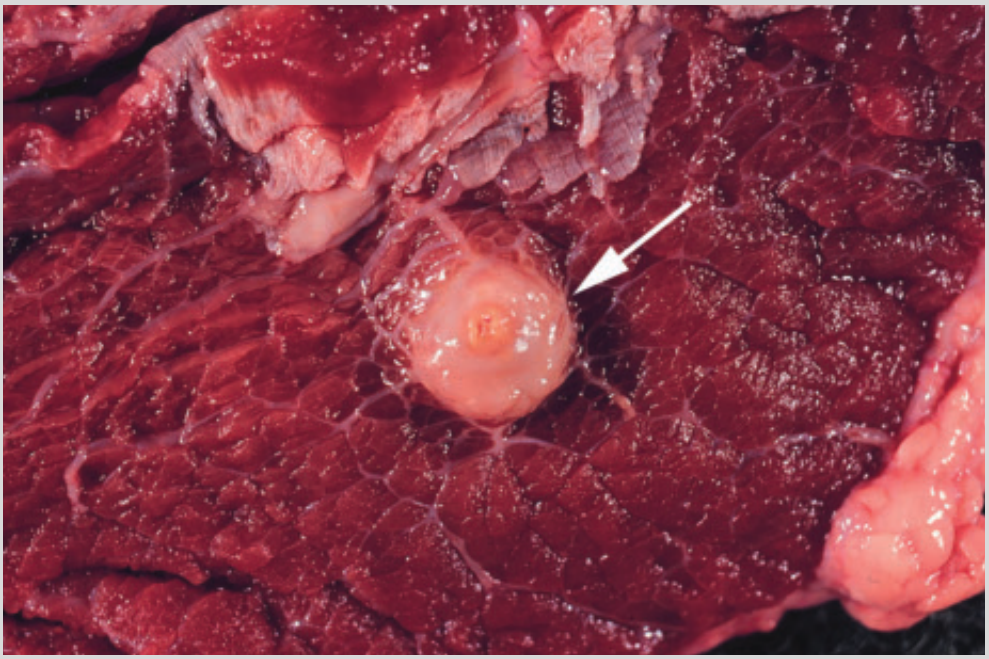
1.10



Animal species/Organ	Cattle/Masseter
Lesion	Viable *Cysticercus bovis cyst* (→)
Scoring	This finding necessitates slicing up the masseters, diaphragm and heart
Comments	Findings of more than 10 cysticerci necessitate total condemnation

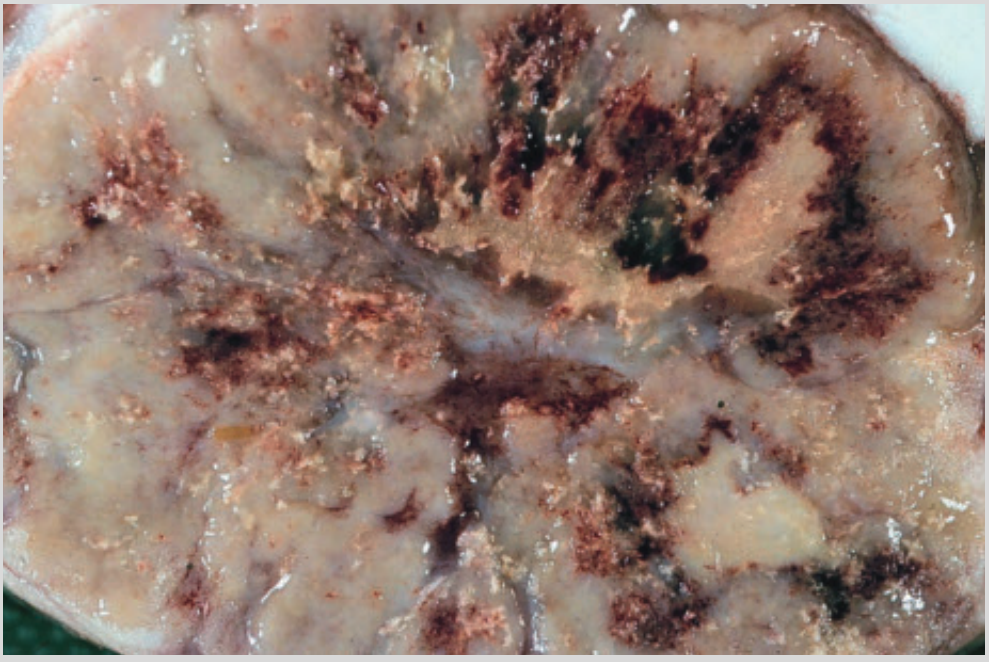
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1.11



Animal species/Organ	Cattle/Masseter
Lesion	Dead, calcified *Cysticercus bovis* cyst (→)
Scoring	This finding necessitates slicing up the masseters, diaphragm and heart
Comments	Findings of more than 10 cysticerci necessitate total condemnation

1.12



Animal species/Organ	Cattle/Caudal mesenteric lymph nodes
Lesion	Caseous lymphadenitis
Scoring	Findings of caseous lymphadenitis necessitates expanded inspection
Comments	Necessitates cutting slices from several specified lymph nodes

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1.13



Animal species/Organ	Cattle/Kidney
Lesion	Disseminated, purulent nephritis with poorly encapsulated lesions
Scoring	Total condemnation
Comments	In cases of encapsulated processes, scoring is based on the general scoring rules for pyaemia

1.14



Animal species/Organ	Pig/Rib
Lesion	Chronic, purulent osteomyelitis (the lesion is not encapsulated by connective tissue towards the cartilage) (→)
Scoring	Total condemnation
Comments	Processes in the costochondral junction must be split longitudinally

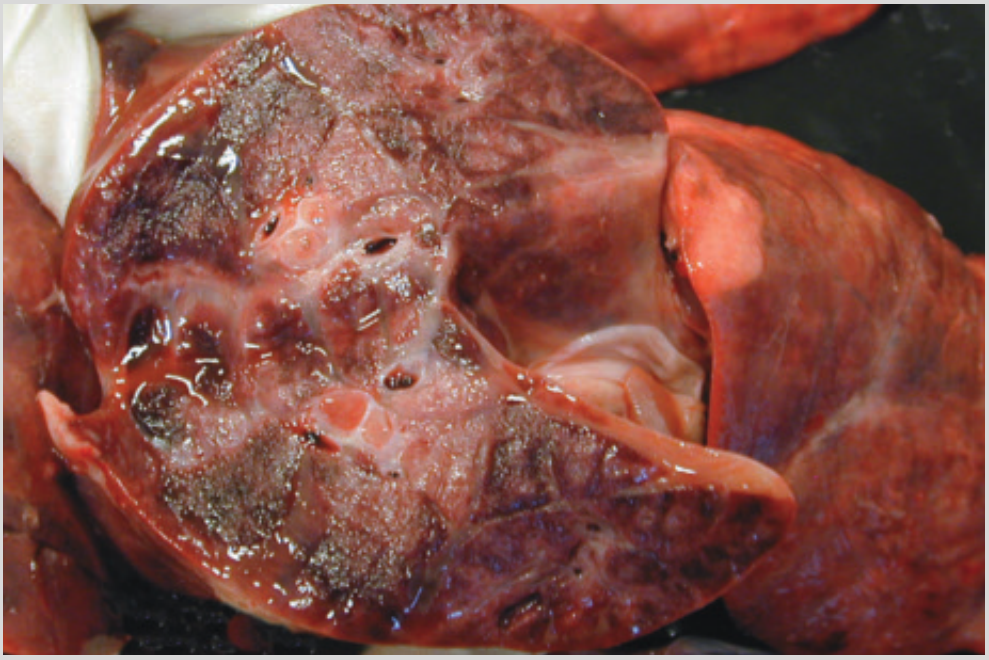
Vet-ebooks.com

1.15



Animal species/Organ	Pig/Lung
Lesion	Peracute, haemorrhagic, fibrinonecrotising bronchopneumonia
Scoring	Total condemnation
Comments	The lesion is also termed “red hepatisation”

1.16



Animal species/Organ	Pig/Lung
Lesion	Acute, fibrinonecrotising bronchopneumonia
Scoring	Total condemnation if more than 25% of lung tissue is affected
Comments	The lesion is also termed “grey hepatisation”

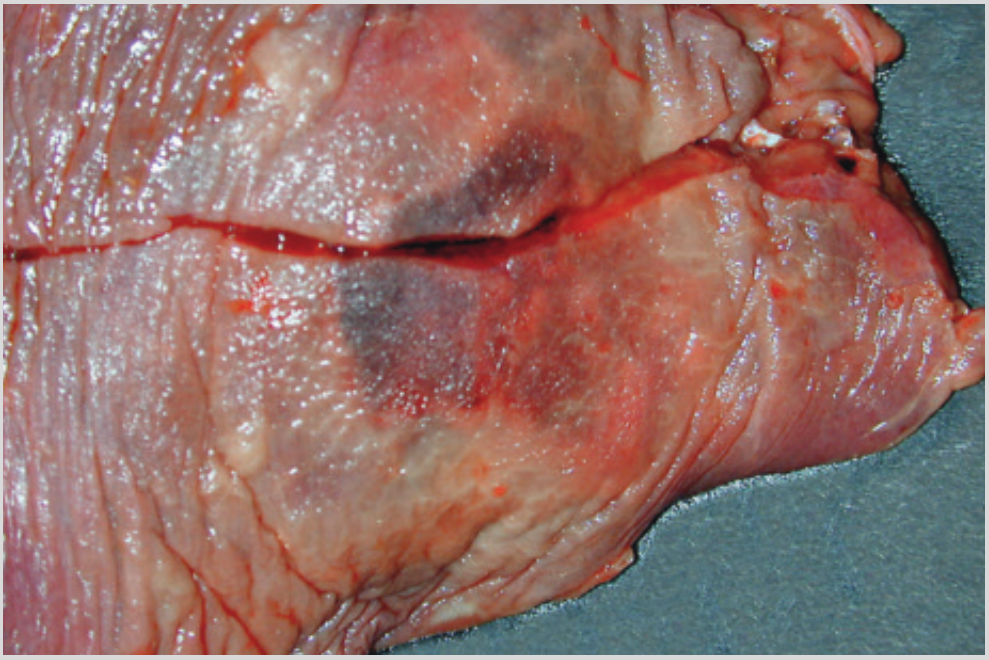
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1.17



Animal species/Organ	Pig/Lung
Lesion	Acute, diffuse, fibrinous pleuritis localised to the right lung
Scoring	Total condemnation if more than 25% of the pleural surface is affected
Comments	The 25% threshold is related to either the visceral or the costal pleura

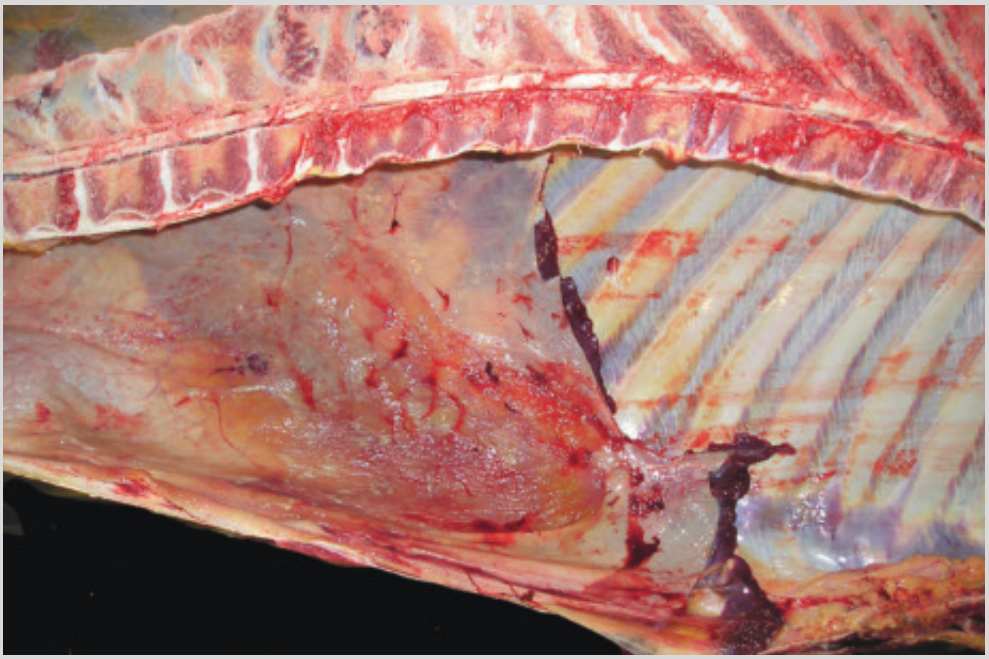
1.18



Animal species/Organ	Pig/Lung
Lesion	Local, fibrinous pleuritis
Scoring	Total condemnation if more than 25% of the pleura surface is affected
Comments	The 25% threshold is related to either the visceral or the costal pleura

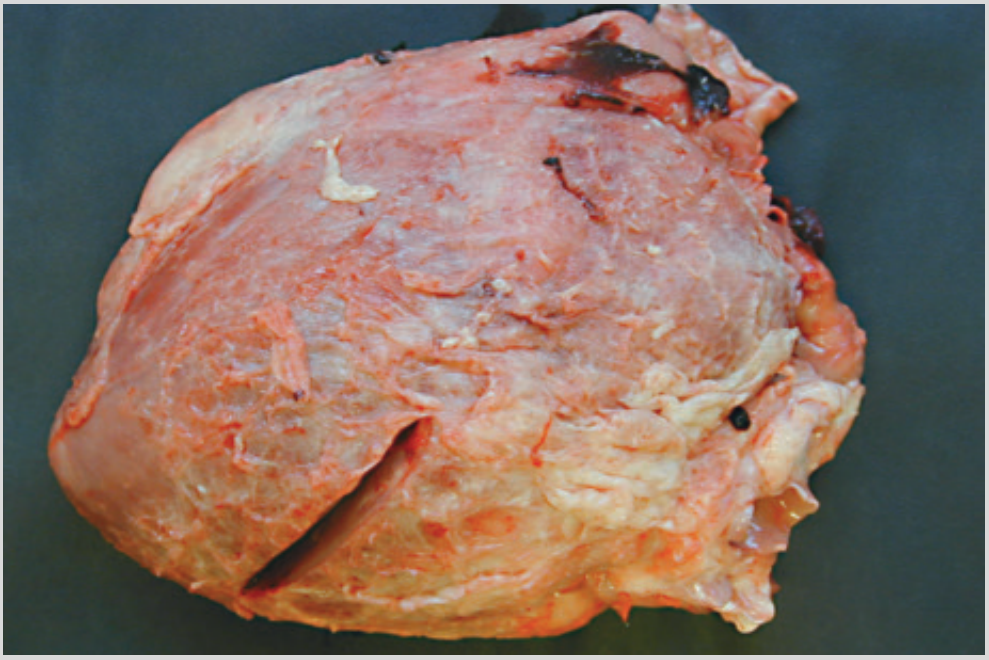
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1.19



Animal species/Organ	Cattle/Peritoneum
Lesion	Acute, diffuse, fibrinous peritonitis
Scoring	Total condemnation
Comments	If the lesions are restricted, partial condemnation may be applied

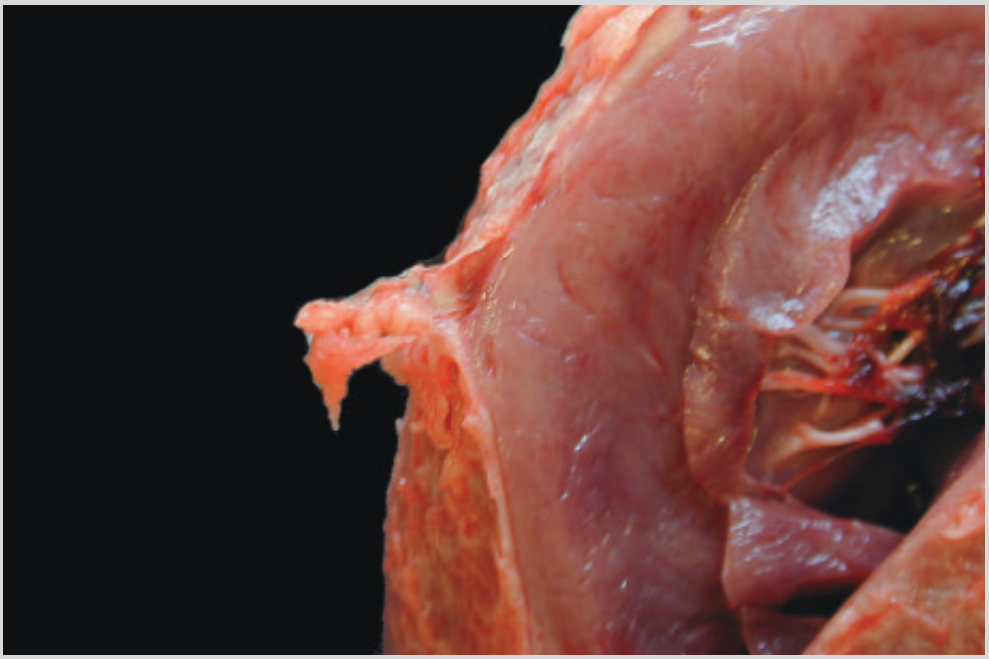
1.20



Animal species/Organ	Pig/Epicardium (pericardium)
Lesion	Acute, diffuse, fibrinous epicarditis (pericarditis)
Scoring	Total condemnation
Comments	In cases of exudative pericarditis, the age of the condition affects scoring

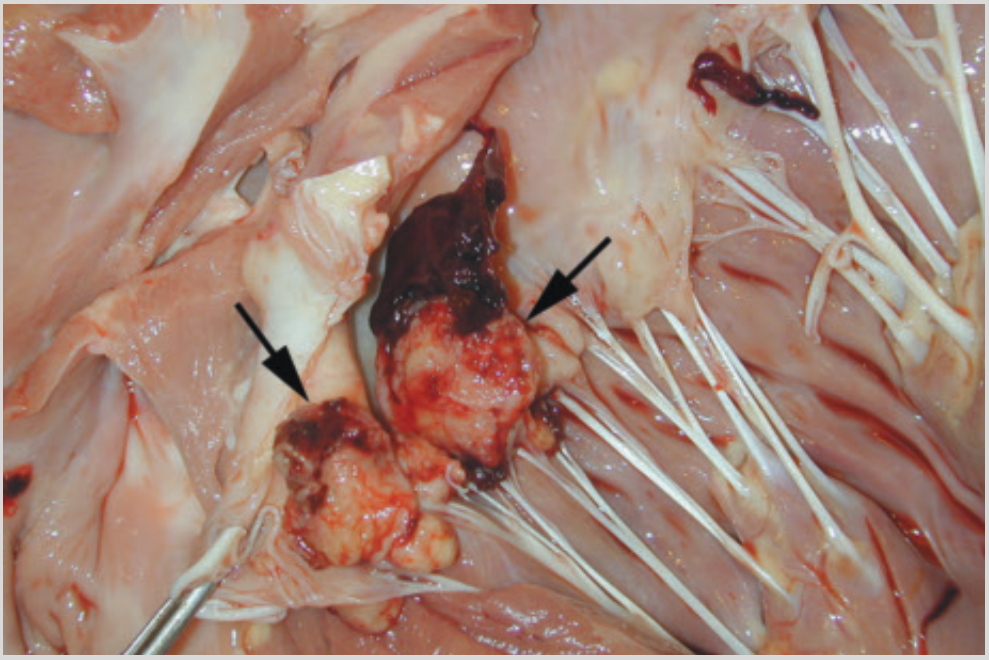
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1.21



Animal species/Organ	Pig/Epicardium (pericardium)
Lesion	Acute, diffuse, fibrinous epicarditis (pericarditis)
Scoring	Total condemnation
Comments	In cases of exudative pericarditis, the age of the condition should be determined

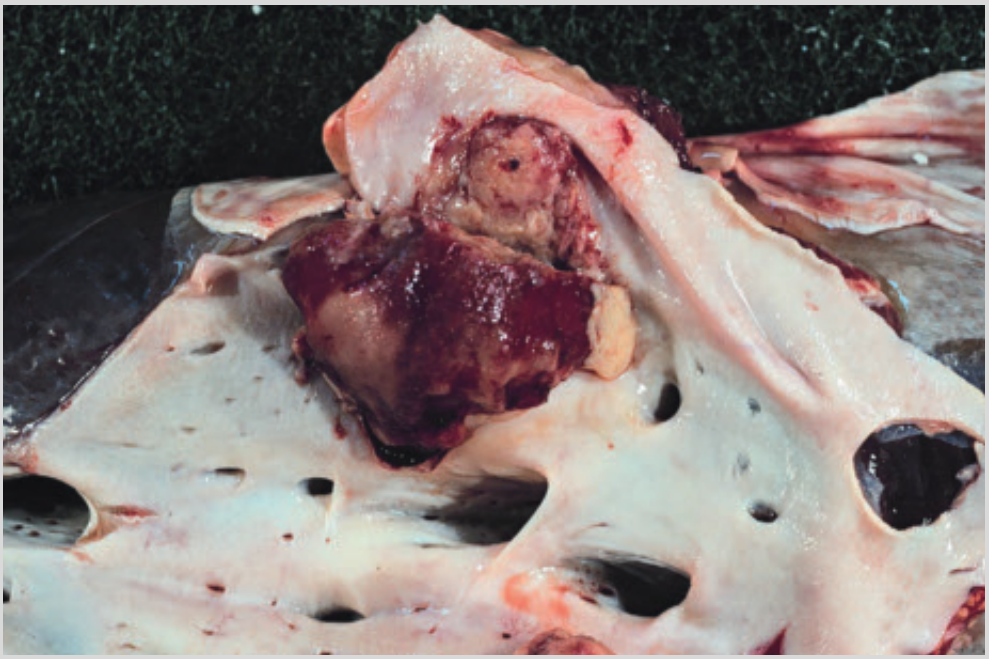
1.22



Animal species/Organ	Cattle/Heart
Lesion	Chronic, valvular, thrombotic, endocarditis (→)
Scoring	Total condemnation. May be approved following bacterial examination
Comments	In cases of healed lesions without complications partial condemnation may be applied

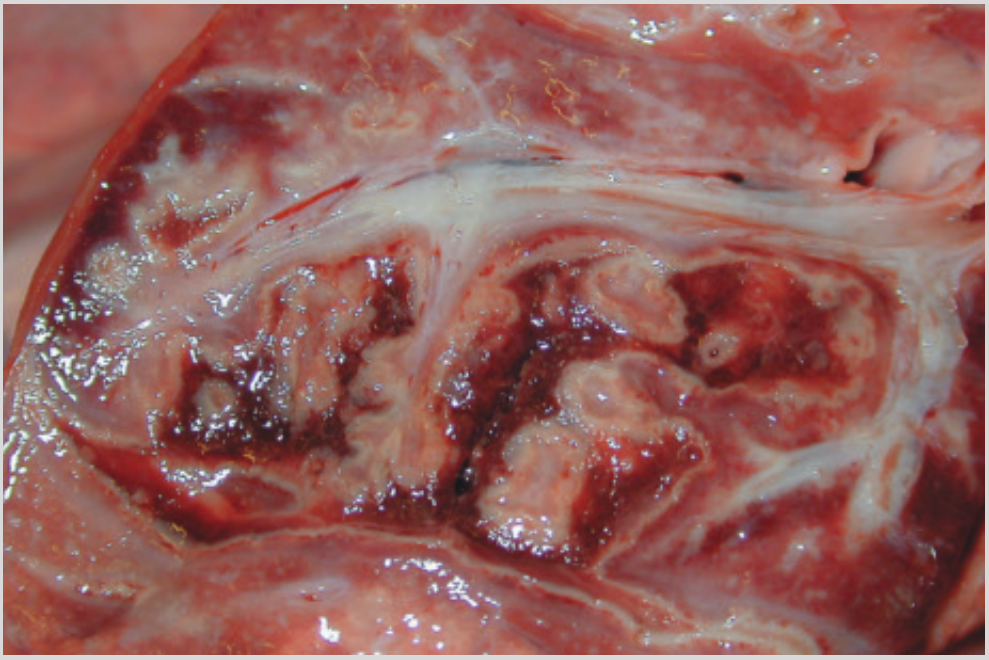
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1.23



Animal species/Organ	Cattle/Caudal vena cava (opened)
Lesion	Chronic, thrombotic endophlebitis
Scoring	Total condemnation
Comments	In cattle older than 6 weeks, the caudal vena cava must be opened routinely

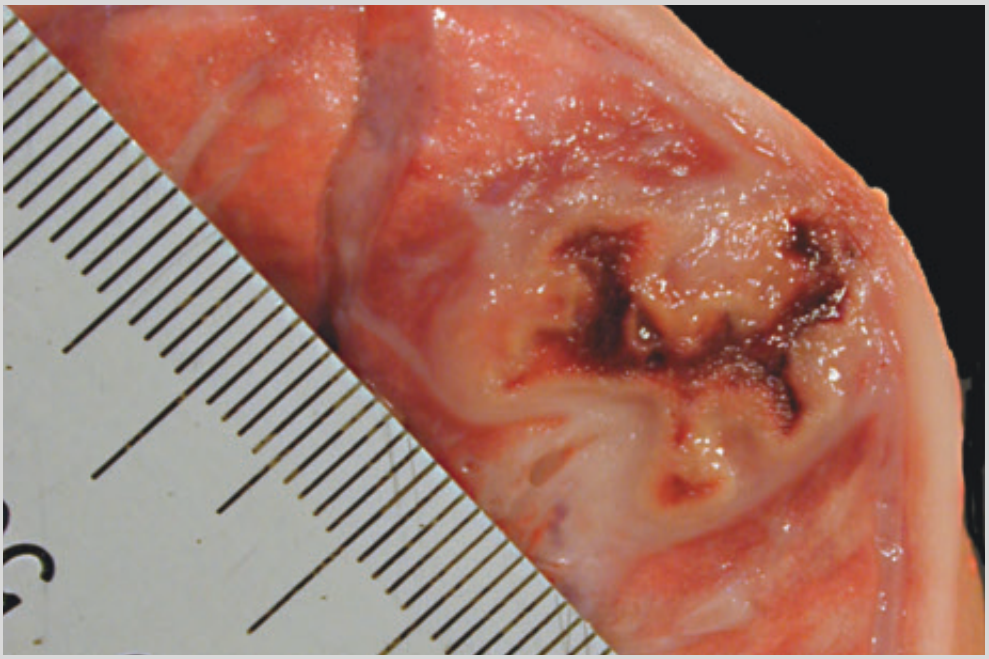
1.24



Animal species/Organ	Pig/Lung
Lesion	Chronic, fibrinonecrotising bronchopneumonia
Scoring	Partial condemnation
Comments	The extent of chronic fibrinonecrotising bronchopneumonia is not taken into consideration in the judgement

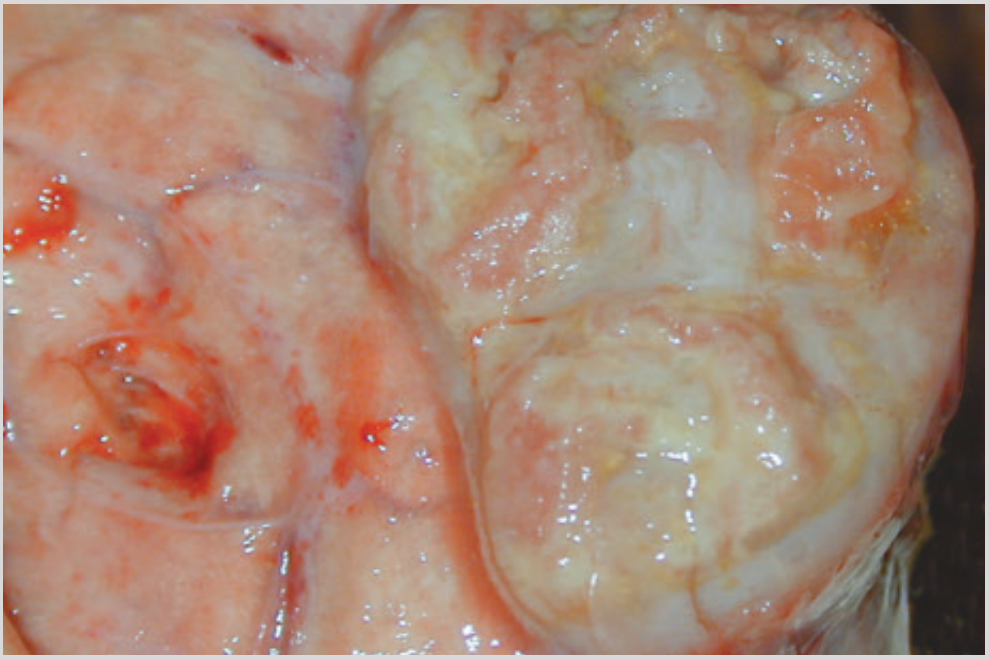
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1.25



Animal species/Organ	Pig/Lung
Lesion	Chronic, fibrinonecrotising bronchopneumonia
Scoring	Partial condemnation
Comments	The extent of chronic fibrinonecrotising bronchopneumonia is not taken into consideration in the scoring

1.26



Animal species/Organ	Pig/Lung
Lesion	Chronic, purulent bronchopneumonia
Scoring	Partial condemnation
Comments	The extent of chronic bronchopneumonia is not taken into consideration in the scoring

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1.27



Animal species/Organ	Pig/Lung
Lesion	Localised, fibrinous pleuritis
Scoring	Partial condemnation if less than 25% of the lung surface is affected
Comments	The age of the lesion is not taken into consideration

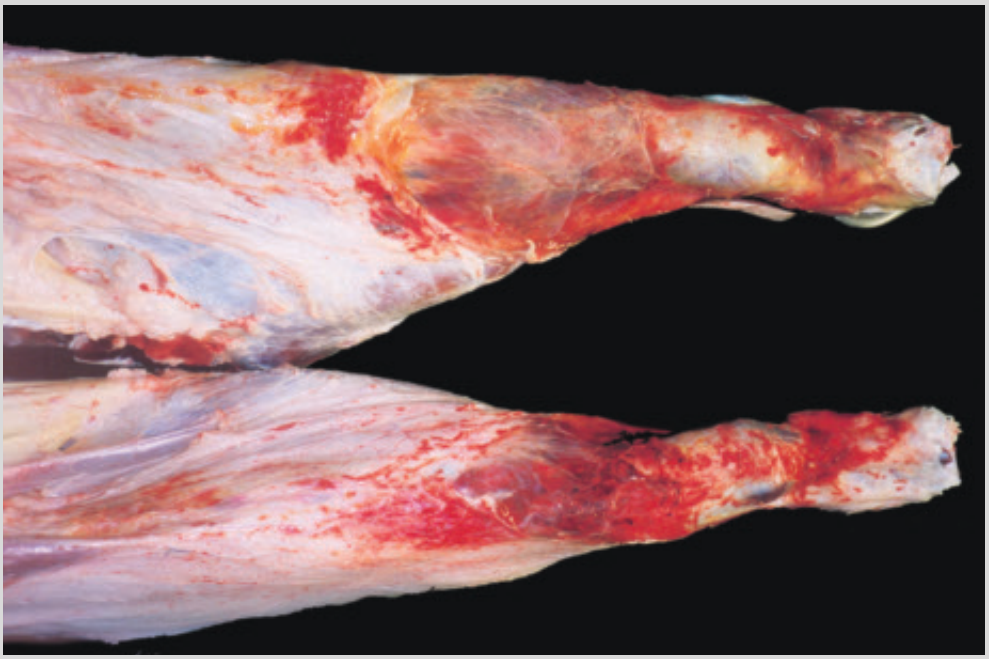
1.28



Animal species/Organ	Cattle/Body
Lesion	Extensive, subcutaneous muscular haemorrhage
Scoring	Partial condemnation
Comments	In cases of icteric discolouration, scoring can be postponed for 24 hours

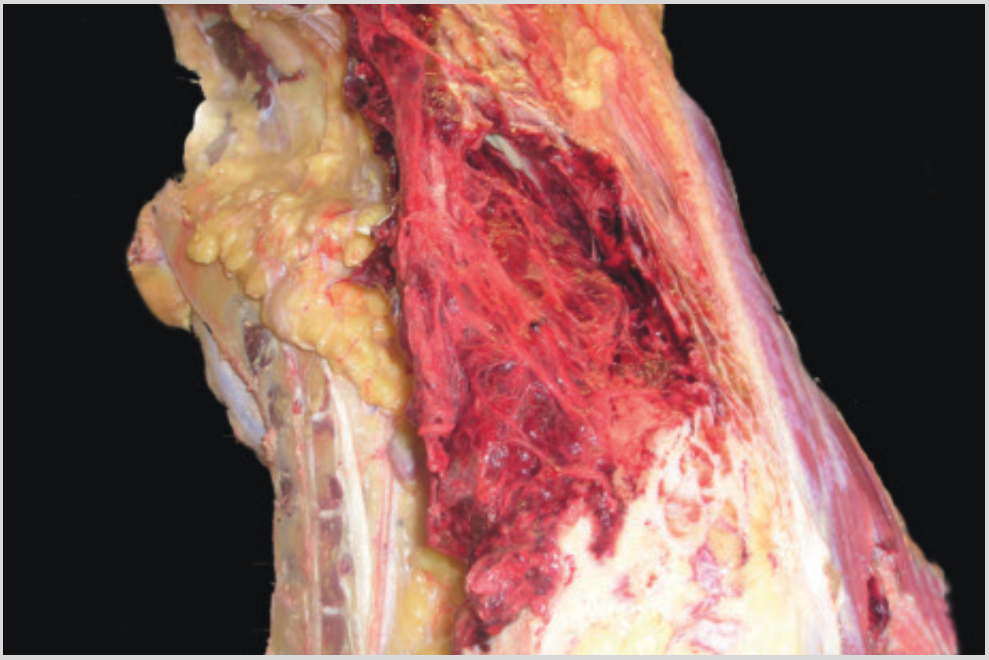
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1.29



Animal species/Organ	Cattle/Distal part of the hind limbs
Lesion	Localised, acute, superficial haemorrhage
Scoring	Partial condemnation
Comments	In cases of icteric discolouration, scoring can be postponed for 24 hours

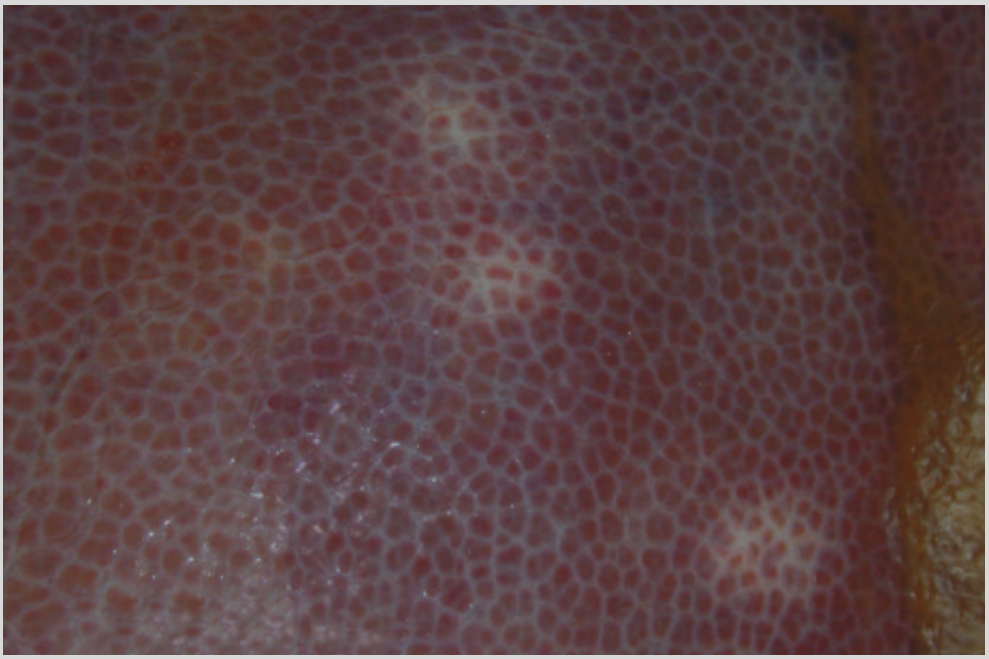
1.30



Animal species/Organ	Cattle/Subperitoneal tissue
Lesion	Localised, acute, haemorrhage
Scoring	Partial condemnation
Comments	In cases of icteric discolouration, scoring can be postponed for 24 hours

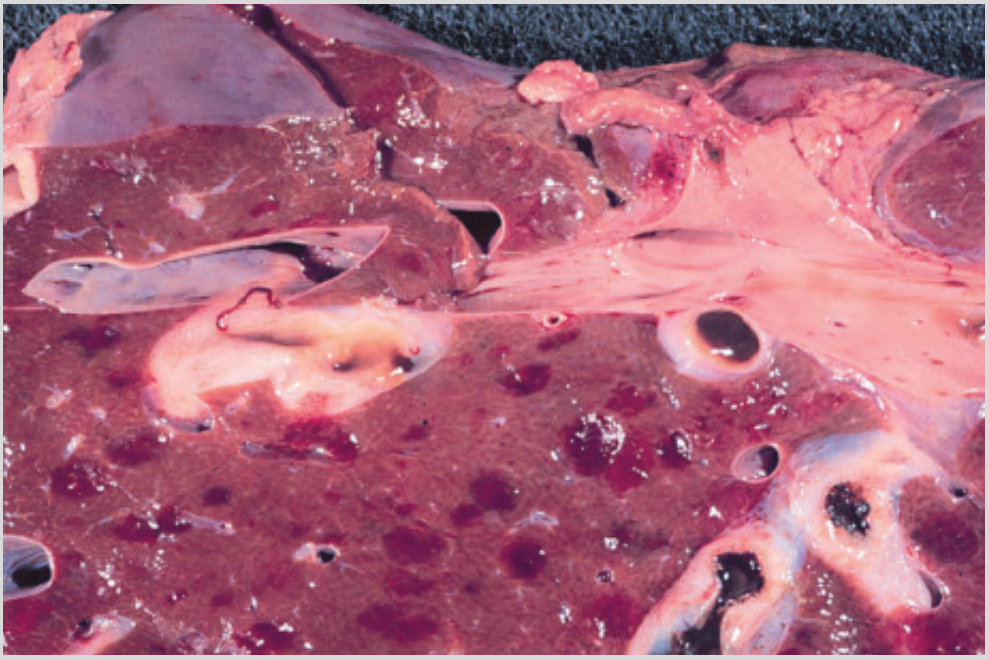
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1.31



Animal species/Organ	Pig/Liver
Lesion	Chronic, multifocal, fibrous, interstitial hepatitis (“milk spots”)
Scoring	Partial condemnation
Comments	The rejected liver can be used for production of animal feed

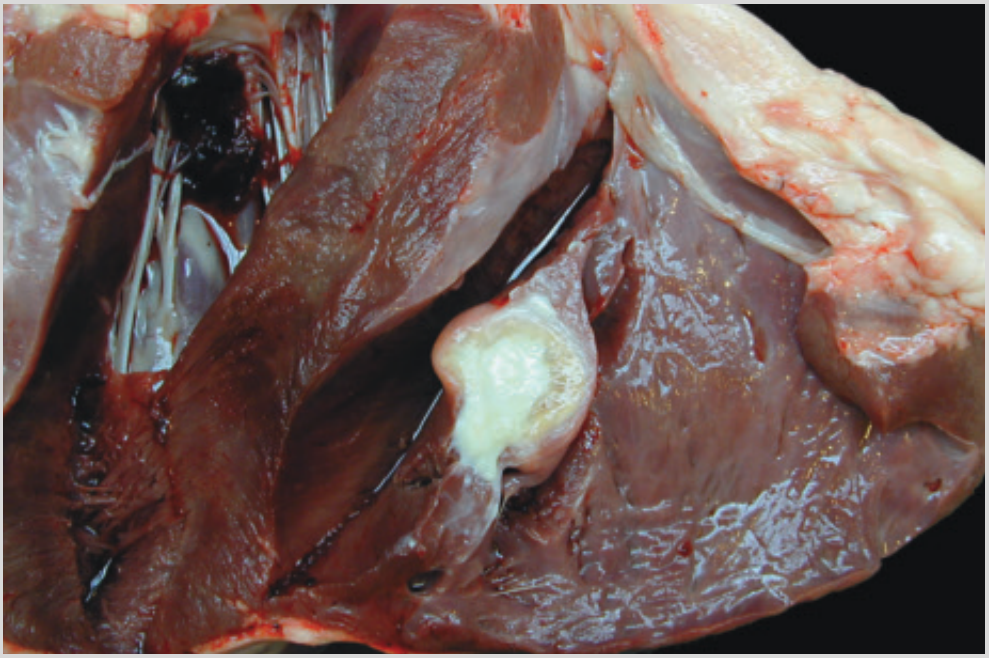
1.32



Animal species/Organ	Cattle/Liver
Lesion	Multiple teleangiectasias
Scoring	Partial condemnation
Comments	The rejected liver can be used for production of animal feed

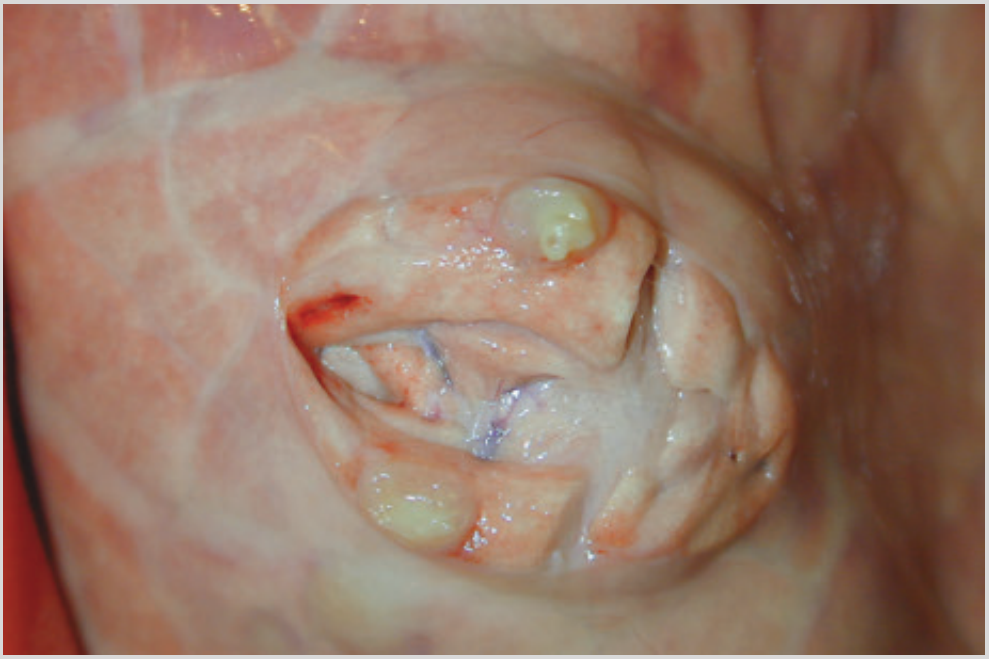
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1.33



Animal species/Organ	Cattle/Heart
Lesion	Chronic, embolic, myocarditis with abscess formation
Scoring	Approved for deboning
Comments	Findings of non-encapsulated lesions necessitate total condemnation

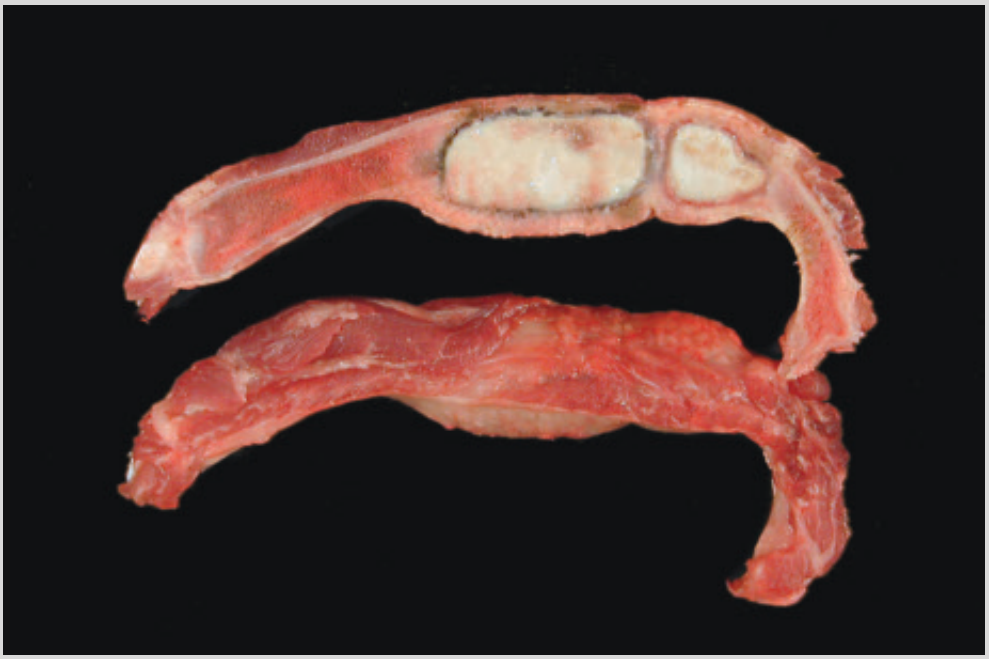
1.34



Animal species/Organ	Cattle/Lung
Lesion	Chronic, embolic, pneumonia with abscess formation
Scoring	Approved for deboning
Comments	Findings of non-encapsulated lesions necessitate total condemnation

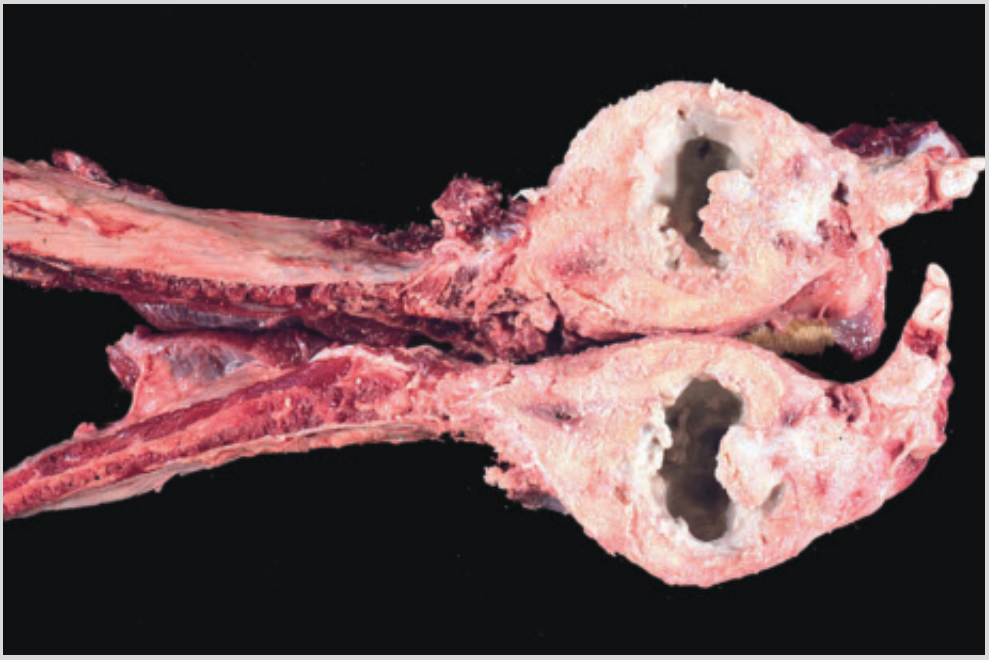
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1.35



Animal species/Organ	Pig/Rib
Lesion	Chronic, embolic, purulent osteomyelitis
Scoring	Approved for deboning
Comments	Findings of non-encapsulated lesions necessitate total condemnation

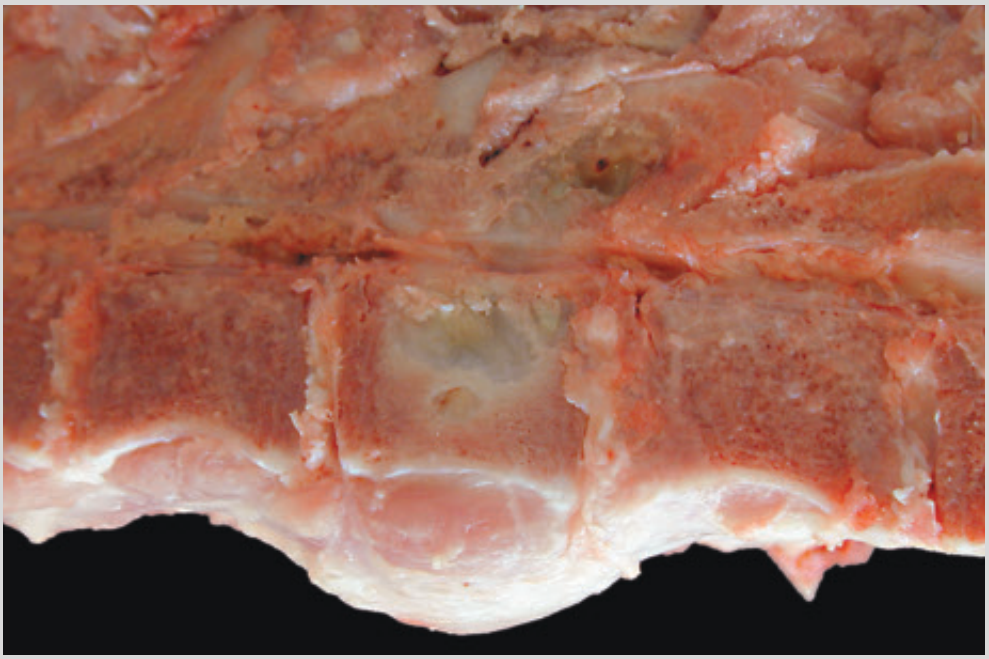
1.36



Animal species/Organ	Cattle/Rib
Lesion	Chronic, embolic, purulent osteomyelitis
Scoring	Approved for deboning
Comments	Findings of non-encapsulated lesions necessitate total condemnation

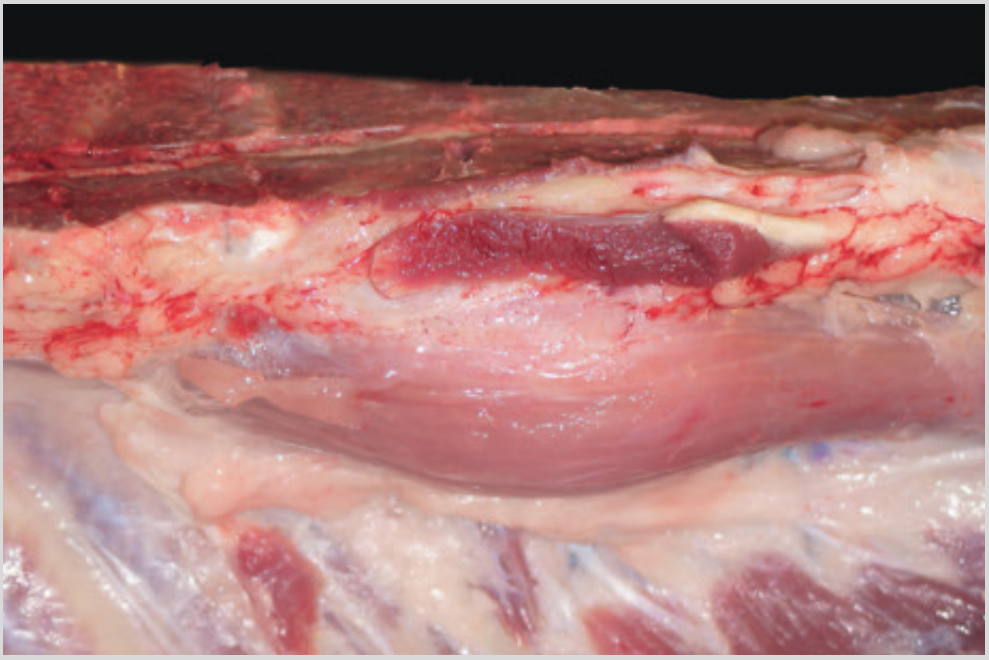
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1.37



Animal species/Organ	Pig/Vertebrae
Lesion	Chronic, purulent, embolic osteomyelitis
Scoring	Approved for deboning
Comments	Findings of non-encapsulated lesions necessitate total condemnation

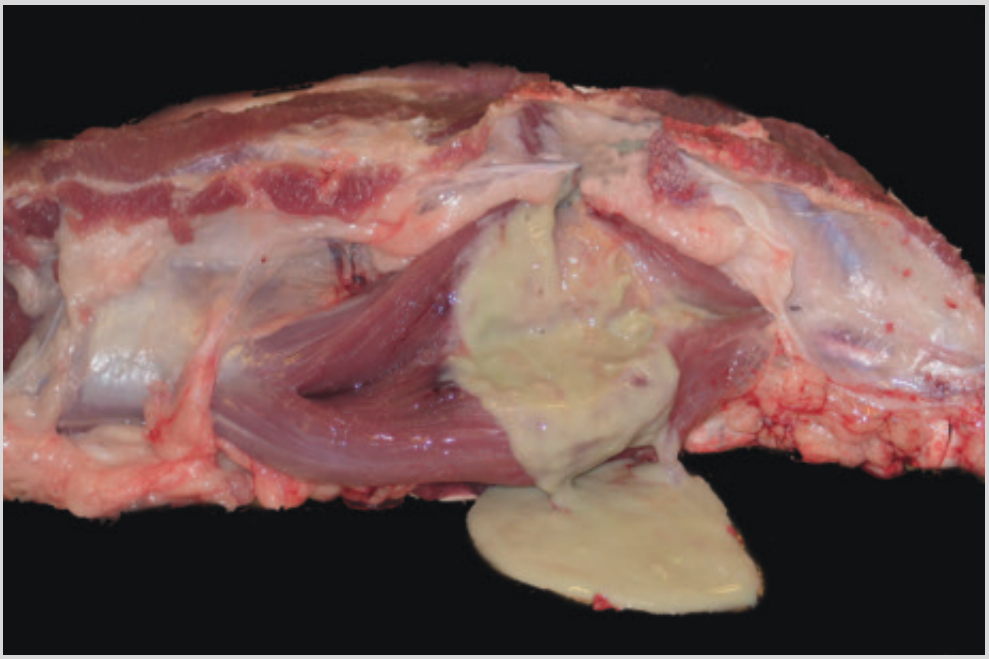
1.38



Animal species/Organ	Pig/Psoas muscle
Lesion	Myositis developed secondary to dissecting embolic abscess formation
Scoring	Approved for deboning if encapsulated
Comments	Complications or non-encapsulated lesions necessitate total condemnation

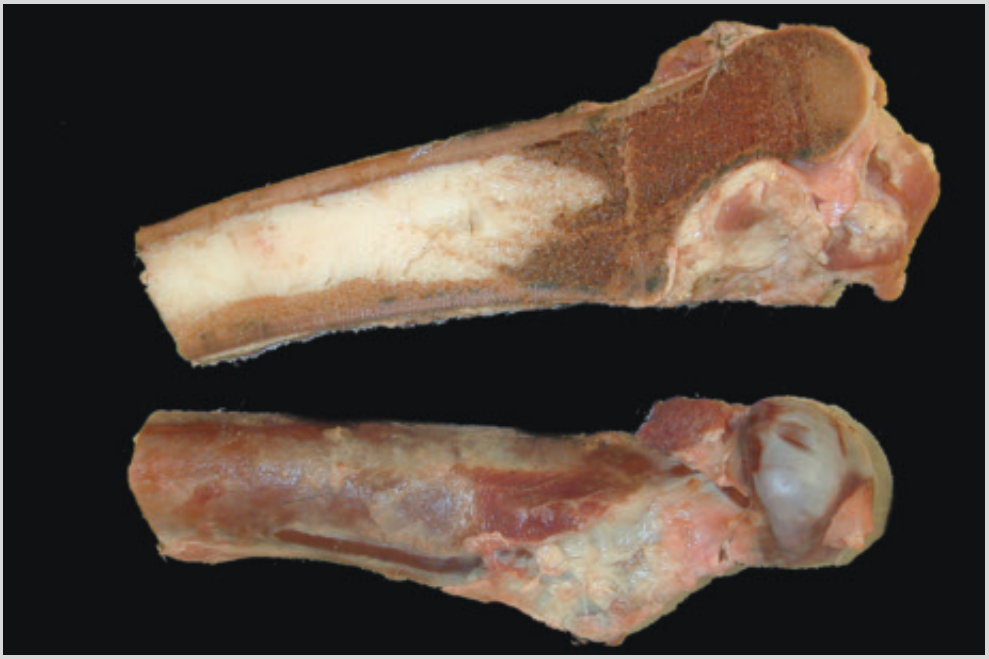
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1.39



Animal species/Organ	Pig/Psoas muscle
Lesion	Chronic, embolic, encapsulated purulent myositis developed secondary to dissecting abscess formation
Scoring	Approved for deboning
Comments	Findings of non-encapsulated lesions necessitate total condemnation

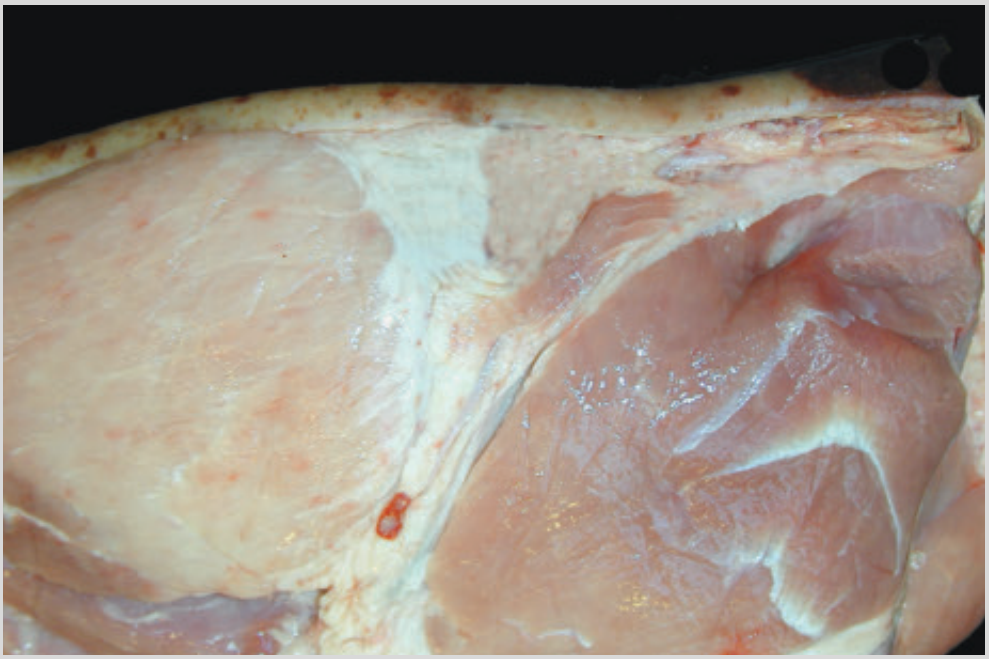
1.40



Animal species/Organ	Pig/Femur
Lesion	Porphyria
Scoring	Approved for deboning
Comments	The teeth will also often be discoloured

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1.41



Animal species/Organ	Pig/Muscle
Lesion	PSE (pale, soft and exudative) localised to the muscle (on the left)
Scoring	After stripping, muscle containing low-grade lesions may be approved for pre-processing
Comments	The carcase must always be deboned, and high-grade lesions necessitate partial condemnation

1.42



Animal species/Organ	Pig/Muscle
Lesion	PSE (pale, soft and exudative)
Scoring	After stripping, muscle containing low-grade lesions may be approved for pre-processing
Comments	The carcase must always be deboned, and high-grade lesions necessitate partial condemnation

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2 Special Implications

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General findings p. 42
Complications p. 43

Introduction

At meat inspection, the presence of lesions necessitates investigation for specific conditions before a final decision can be taken. Regardless of whether the lesion is due to toxic substances, functional disorders, or spread of an infectious agent, it is critical to determine if the lesion is solely locally extensive, or if it could be generalised/systemic. In case of a local lesion in an organ, it is essential to determine if the lesion has had a systemic effect, or whether there is a risk of spread of infectious material or toxic substances by the blood.

When diagnosing inflammatory conditions, including pyaemia, it is essential to be able to distinguish between chronic and early stages (peracute, acute and subacute) in the temporal development of the inflammatory process. Macroscopically, the chronic condition is characterised by repair, which in the vast majority of cases is apparent as formation of granulation tissue or connective tissue, including encapsulation of abscesses. A third aspect which must be considered is whether or not the lesion is due to infection. In principle, infectious lesions are always scored more stringently at meat inspection than aseptic lesions.

The purpose of meat inspection is to ensure that only healthy meat is released for human consumption. Meat that is, or is assumed to be, a health hazard must be condemned. However, in the vast majority of cases requiring total or partial condemnation of the carcase, the decision is based on aesthetic factors. In certain cases, the decision may be conditional on pre-set procedures. For example, if up to 10 viable or dead cysticerci are found, the meat must be frozen, before it can be released for human consumption (conditional approval). Another example is approval for pre-processing in cases of limited muscle changes in the form of PSE (pale, soft and exudative) or DFD (dark, firm and dry).

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General findings [2.01 – 2.07]

Animals with fever, or other clinical signs of acute generalised infectious diseases, must always be totally condemned. If the elevated temperature is considered to be due to external factors such as long transportation time, or very high ambient temperatures, a new reading may be taken after a short period of acclimatisation. If the temperature does not return to normal, the animal must be totally condemned to ensure that infection is not spread to other animals or humans during the slaughter process. Slaughter of excited, weakened, or severely exhausted animals with no signs of acute disease should also be postponed. If normal conditions are not found at later inspection, the animal must be scored in compliance with the regulations on emergency slaughter. If the animal is considered to be suffering unnecessarily, it must be euthanized and immediately disposed of. The same procedures can be applied to febrile animals thus avoiding the risk of contamination during slaughter. Animals that are dead or moribund on arrival, and animals that have died as the result of an accident may not be slaughtered but must be disposed of immediately.

Animals suffering from anaemia (including "milk veal calves"), hydraemia (increase in the water content of plasma due to a at reduced protein content and colloid osmotic pressure), dropsy (non-inflammatory accumulation of fluid in the entire body (anasarca), or in pre-formed cavities such as hydrothorax and ascites (hydropsy), or emaciation must be totally condemned. Total condemnation must also be applied in cases of sepsis and toxaemia, and in general at poisonings and viraemia.

Total condemnation is also demanded in cases where there is a significant risk for sepsis such as in acute umbilical infection in young animals. Abnormal odour, colour, texture or incomplete exsanguination normally also necessitate total condemnation. In cases of delayed evisceration, special attention must be paid to abnormal odours. If it is known that an abnormal colour or odour is due to feed, the meat may be approved for animal feed. However, this does not apply if there is icteric discolouration, or if ketosis (acetone odour) or a urine odour is present. In the presence of abnormal odour and discolouration, the final decision may be postponed for 24 hours. This does not apply to cases of jaundice caused by hepatic insufficiency. If the cause of a suspected abnormal odour cannot be immediately identified, the meat can be subjected to a cooking/boiling test. If incomplete exsanguination is not due to a pathological condition, but for example to incorrect sticking, partial condemnation can be applied with rejection of the affected parts.

Meat from animals with a pronounced sexual odour (e.g. billy-goats) must be totally condemned as unfit for human consumption but can be approved for animal feed. In the absence of lesions at meat inspection, meat from breed boars is unconditionally approved but the carcase must be boar-stamped. The same applies to non-castrated young boars, hermaphrodites, and male pseudohermaphrodites weighing more than 80 kg. However, the boar stamp can be omitted if approved methods (the skatole method, boiling, or frying, etc.) do not detect a pronounced sexual odour. If no lesions are found in young boars, hermaphrodites, or malepseudohermaphrodites weighing less than 80 kg but, using the above mentioned methods, pronounced sexual

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odour is detected, the carcases must be boar-stamped. The company is responsible for the procedures related to boar stamping.

Animals which have recently given birth or aborted can be unconditionally approved in the absence of lesions and complications associated with the birth or abortion. Foetuses (including those surgically removed or pre-term) and newborn must as a general rule be totally condemned.

Meat inspection of animals culled at emergency slaughter follow the general regulations for scoring of lesions in organs and carcase apply at meat inspection. An otherwise healthy animal must have suffered an accident that prevented its transport to the slaughterhouse for welfare reasons. The animal must be accomplished by:

- declaration by the food business operator who reared the animal, stating the identity of the animal and indicating any veterinary products or other treatments administered to the animal, dates of administration and withdrawal periods, must accompany the slaughtered animal to the slaughterhouse.
- declaration issued by the veterinarian recording the favourable outcome of the ante-mortem inspection, the date and time of, and reason for, emergency slaughter, and the nature of any treatment administered by the veterinarian to the animal, must accompany the slaughtered animal to the slaughterhouse.

Permission must be obtained from the Danish Veterinary and Food Administration for slaughter and scoring of experimental animals. This applies when it is uncertain whether the meat comprises a health hazard for humans and animals. Similarly, animals must be totally condemned if it is known that they contain, or could potentially contain, residual medicine or other substances which could comprise a health risk for humans or animals at consumption of the meat or other products from the animals. If the presence of medicine or other substances in slaughter animals is suspected or known, appropriate laboratory investigations must be performed. If this is not possible, the animal must be totally condemned.

Complications [2.08 – 2.14]

Complications can be detected as clinical signs at ante-mortem inspection or as lesions found at post-mortem inspection of the carcase and organs. Clinical signs that may be present as complications to lesions include fever, debilitated general health, and impaired general functions. Debilitated health may also necessitate total condemnation even in the absence of demonstrable lesions; for example in connection with metabolic diseases such as milk fever, grass tetany and eclampsia, as well as botulism and tetanus. Complications observed post-mortem include changes in muscles or other organs, such as changes in form (e.g. hepatomegaly and splenomegaly due to infections); colour (e.g. paleness due to anaemia and yellowness due to jaundice); texture (e.g. oedema associated with renal disease and starvation); dryness (e.g. due to dehydration associated with insufficient fluid intake or enteritis); abnormal odour (such as urine in various urinary tract diseases); acetone (associated with ketosis, regardless of whether this is

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due to incorrect feed or starvation); fecal or putrid (e.g. in connection with retained, rotten foetus, or delayed evisceration); emaciation with development of serous fatty tissue atrophy and cachexia; or signs of circulatory disorders such as extensive oedema and congestion. In general, complications must always be considered in relation to the primary condition. The presence of complications always necessitates a more stringent scoring. The rules relating to special aspects of meat inspection, also emphasises that any scoring of carcase and organs can, to a certain extent, only be guiding. This is because the final scoring must be based on consideration of all other pathological findings at inspection, including in particular the presence of complications. In other words, scoring is always based on an overall assessment of each slaughter animal. With regard to this, it is also important to remember that the meat inspector is authorised to perform any incisions and to examine all relevant parts of the animal necessary to make a final decision. If the final decision based on the observed lesions results in partial condemnation or approval for deboning, any hygiene issues when executing a limited approval must also be considered in the final decision.

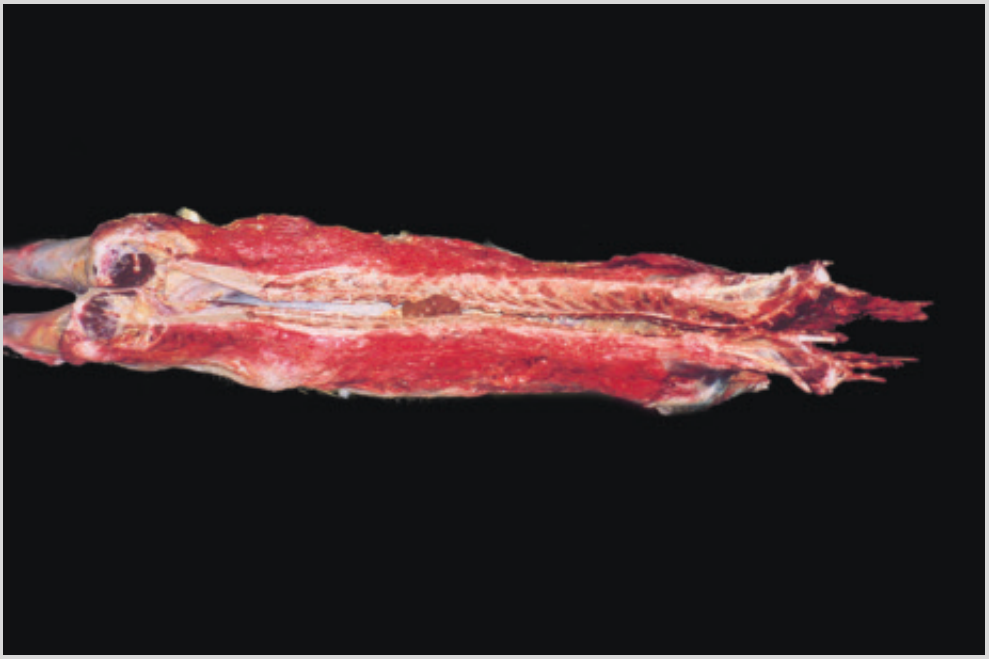
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2.01



Animal species/Organ	Cattle/Entire animal
Lesion	Weakened or extremely exhausted animal
Scoring	The animal must be euthanized and immediately disposed of
Comments	Any suspected breach of the Animal Protection laws must be notified

2.02



Animal species/Organ	Cattle/Carcase
Lesion	Extensive haemorrhagic areas due to being trampled on during transport
Scoring	Haemorrhagic areas must be condemned
Comments	Any suspected breach of the Animal Protection laws must be notified

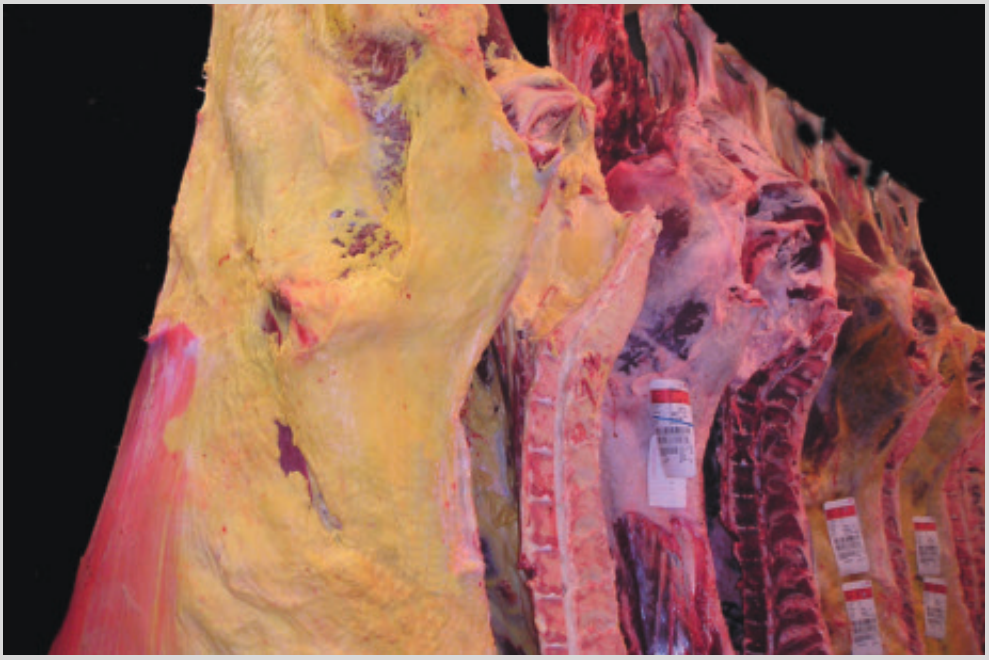
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2.03



Animal species/Organ	Pig/Carcase
Lesion	Extensive haemorrhagic areas due to being crushed during transport
Scoring	Haemorrhagic areas must be condemned
Comments	Any suspected breach of the Animal Protection laws must be notified

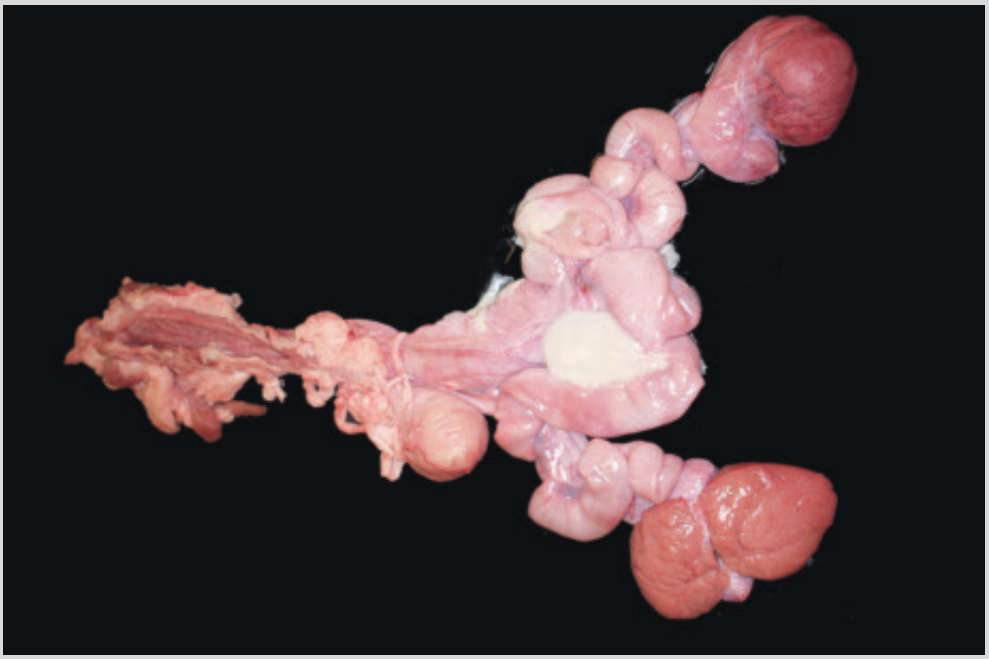
2.04



Animal species/Organ	Cattle/Carcase
Lesion	Icteric discolouration
Scoring	Total condemnation. Scoring can be postponed for 24 hours but not if liver disease is present
Comments	It should be noted that the fat of certain cattle breeds has a yellowish colour

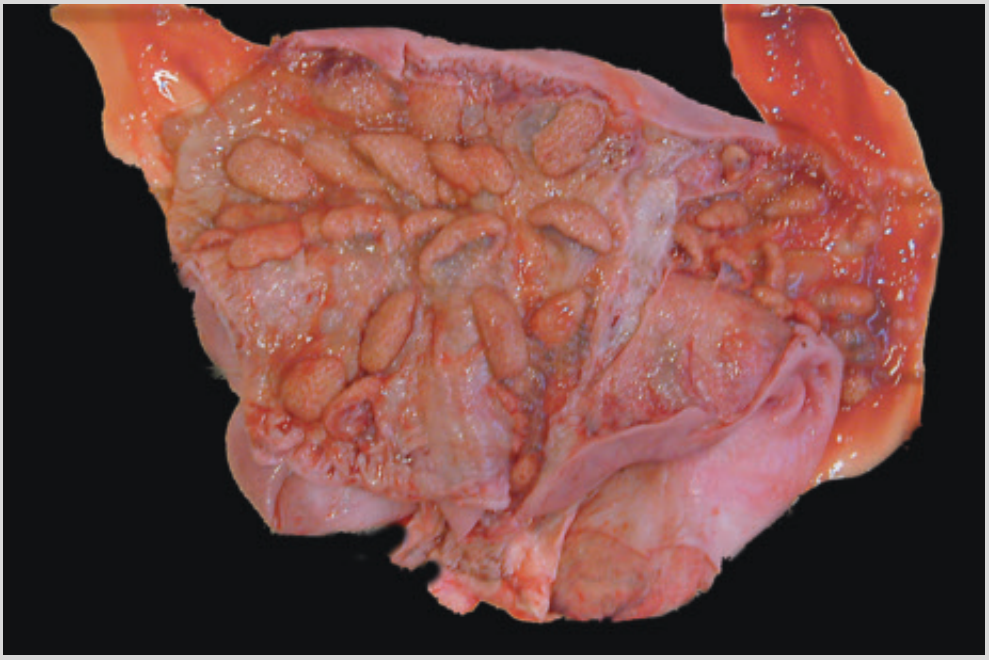
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2.05



Animal species/Organ	Pig/Genitals
Lesion	Male pseudohermaphrodite and pyometra
Scoring	Partial condemnation
Comments	Boars and male pseudohermaphrodites weighing more than 80 kg must be boar-stamped

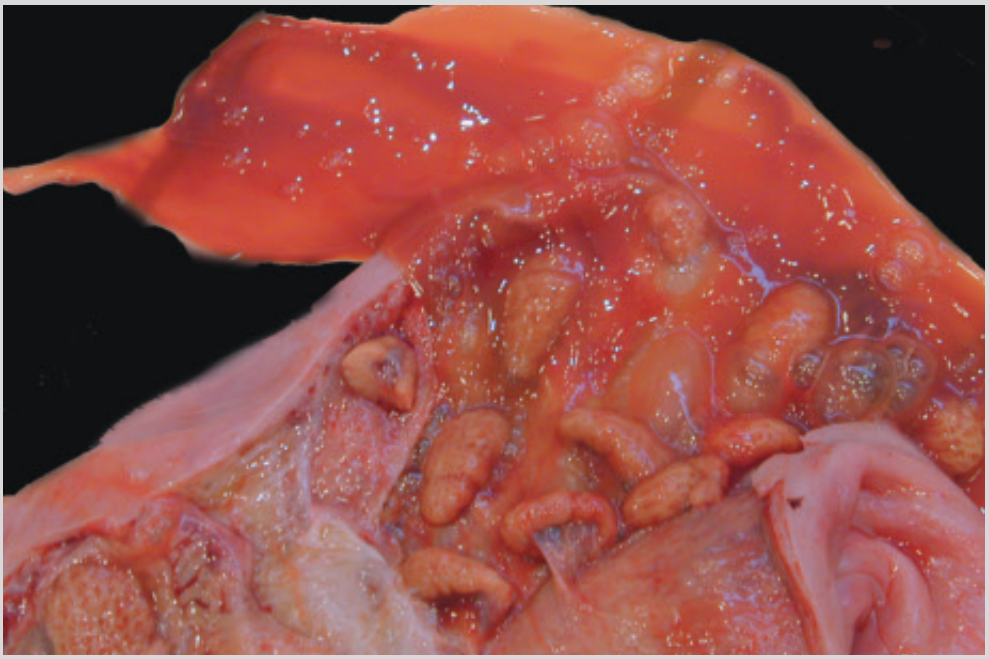
2.06



Animal species/Organ	Cattle/Uterus
Lesion	Recently calved
Scoring	Partial condemnation
Comments	The normal lochial content (puerperal uterus secretion) is odourless

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2.07



Animal species/Organ	Cattle/Uterus
Lesion	Recently calved (close-up of 2.06)
Scoring	Partial condemnation
Comments	The normal lochial content (puerperal uterus secretion) can be confused with pus

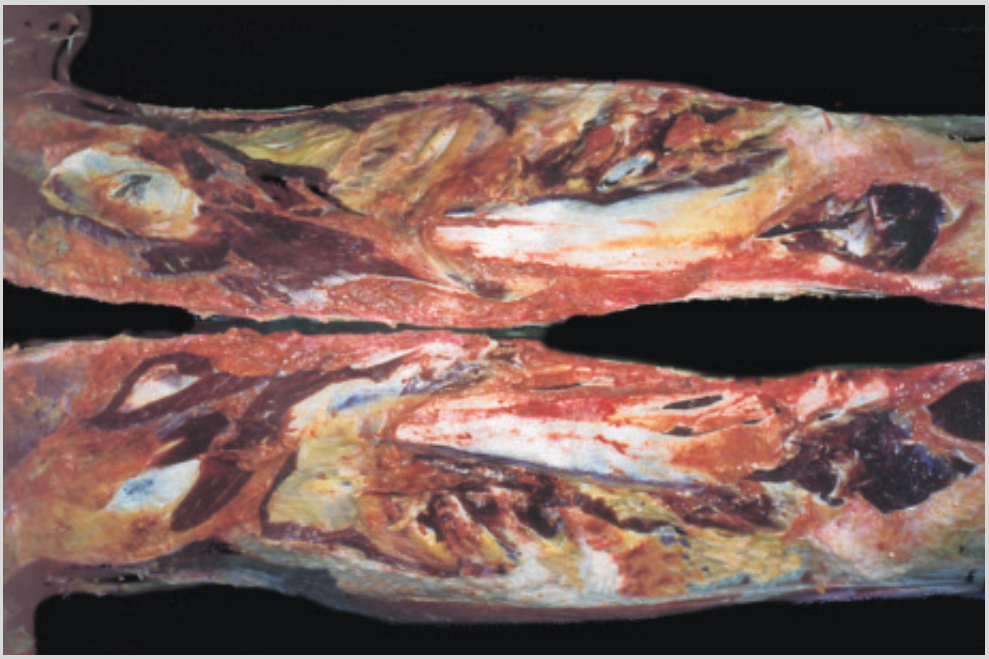
2.08



Animal species/Organ	Cattle/Carcase
Lesion	Discoloured muscle (carcase on the left)
Scoring	Total condemnation; scoring can be postponed for 24 hours
Comments	Discoloured muscle can e.g. be due to lesions in the liver, kidneys and uterus

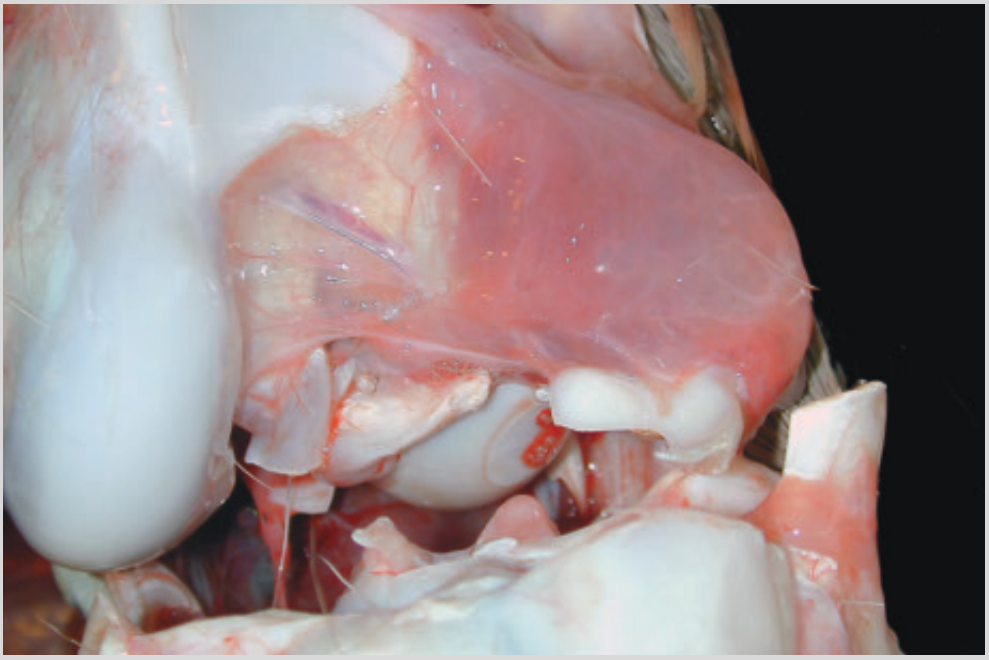
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2.09



Animal species/Organ	Cattle/Carcase
Lesion	Discoloured muscle
Scoring	Total condemnation; scoring can be postponed for 24 hours
Comments	Discoloured muscle can e.g. be the due to lesions in the liver, kidneys and uterus

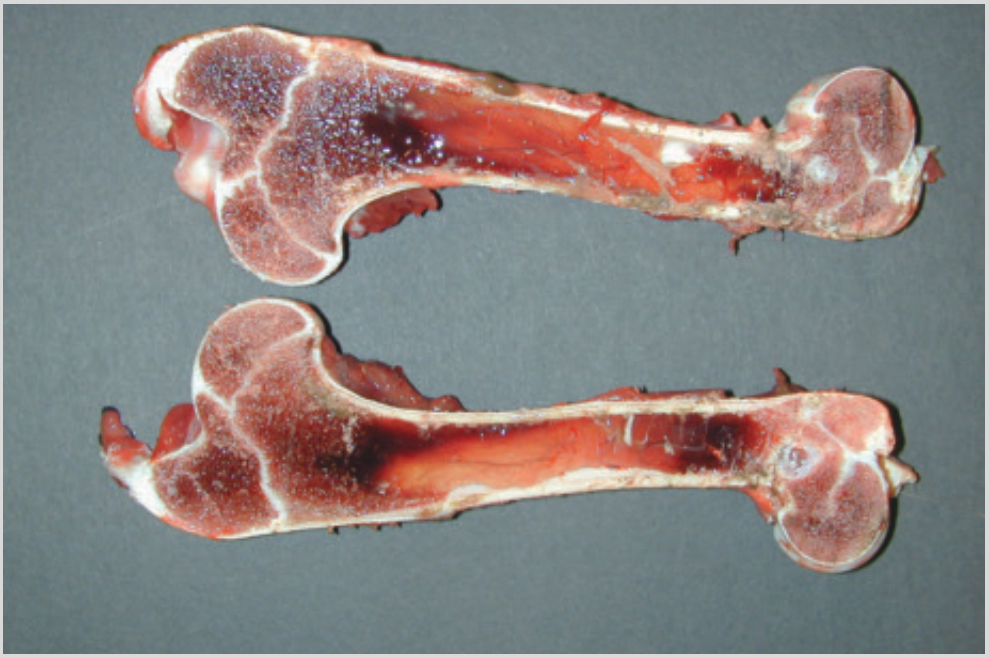
2.10



Animal species/Organ	Sheep/Knee joint with periarticular fatty tissue
Lesion	Serous fatty tissue atrophy
Scoring	Total condemnation
Comments	Any suspected breach of the Animal Protection laws must be notified

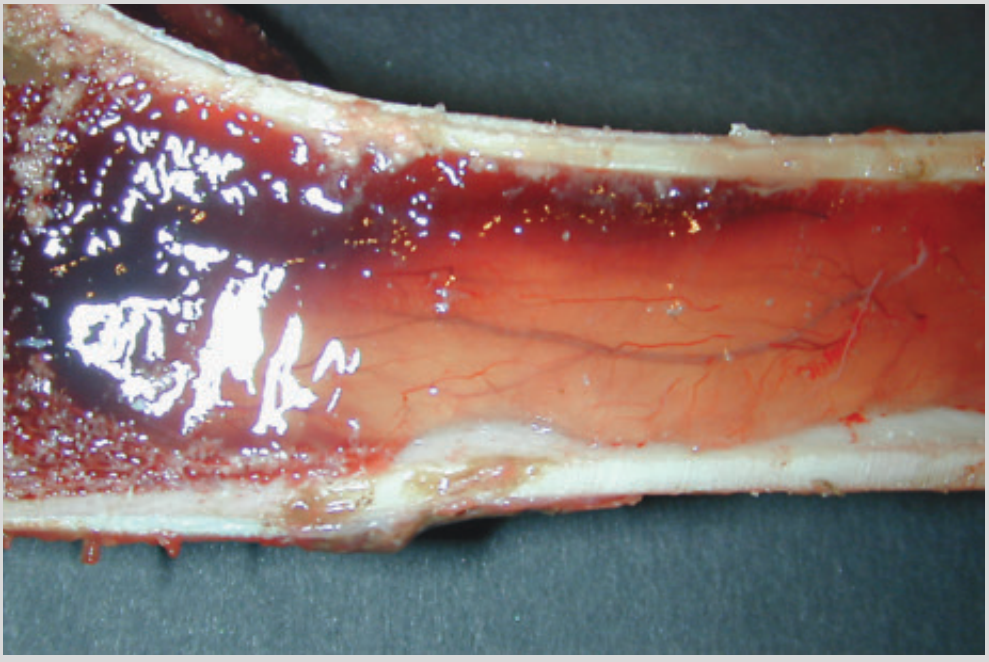
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2.11



Animal species/Organ Cattle/Femur
Lesion Serous fatty tissue atrophy
Scoring Total condemnation
Comments Any suspected breach of the Animal Protection laws must be notified

2.12



Animal species/Organ Cattle/Femur (close-up of 2.11)
Lesion Serous fatty tissue atrophy
Scoring Total condemnation
Comments Any suspected breach of the Animal Protection laws must be notified

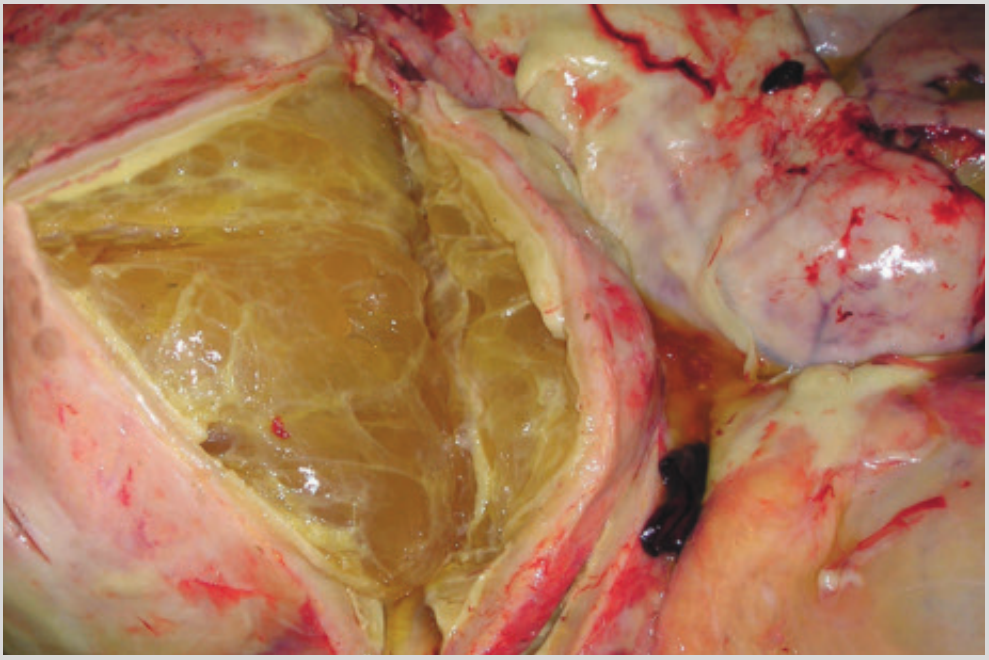
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2.13



Animal species/Organ	Cattle/Subcutaneous connective tissue
Lesion	Extensive oedema
Scoring	Total condemnation
Comments	Oedema can be localised or generalised. Exclusively localised oedema necessitates partial condemnation

2.14



Animal species/Organ	Cattle/Subperitoneal connective tissue
Lesion	Extensive oedema
Scoring	Total condemnation
Comments	Oedema can occur as a complication associated with lesions, e.g. in the heart, liver, and kidney

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3 Nervous System

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Introduction

A significant number of the diseases that occur in the nervous system cannot be identified at visual post-mortem inspection mainly because the conditions either cause only microscopic lesions, or no morphologic changes at all. Furthermore, examination of the central nervous system requires opening of the skull and the spinal canal. This is normally done by a lengthwise split of the head and the spine. In pigs and horses, the head and spine are routinely split in the median plane. Because this is a relatively coarse technique, lesions can be masked or even destroyed. Ante-mortem inspection is thus an invaluable tool in detecting diseases of the nervous system in animals for slaughter.

The central nervous system is not only a preferred site for some zoonotic infections, a number of intoxications also cause predominantly neurological symptoms. A general characteristic for such conditions is that they can rarely be identified macroscopically. In these cases, scoring based solely on macroscopic examination of the slaughtered animal may not ensure food safety. Animals with neurological symptoms in which no lesions are demonstrated should raise suspicion of a toxic or infectious aetiology. Animals requiring emergency slaughter comprise a special risk group because animals with neurological conditions may have unsteady movements and, consequently, an increased risk of trauma. Therefore the incidence of neurological conditions is expected to be higher in animals requiring emergency slaughter.

Neurological symptoms are also found as a complication to lesions in other organs, in particular the liver (e.g. nervous ketosis); the kidneys (e.g. renal encephalopathy); and the skeletal system (e.g. spondylitis). The scoring of such cases are determined by the general rules and the organ-specific rules.

A number of complications are associated with neurological diseases, as well as symptoms that can be interpreted as being due to a lesion in the nervous system. These include in particular trauma to bones, joints, and tendons, as well as to soft tissues (decubital lesions, muscle necrosis and muscle rupture). Moreover, a primary neurologi-

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cal condition can also increase the risk of lesions in the internal organs. For example, pharyngeal paralysis can occur due to botulism or calcium deficiency ("milk fever"), and can predispose to aspiration of foodstuff to the lungs (aspiration bronchopneumonia). Evidence of such lesions in animals for slaughter should trigger suspicion of a pre-existing neurological disease.

Developmental anomalies [3.01 – 3.03]

Anomalies in the central nervous system can affect both the brain and the spinal cord. The neurological symptoms will vary greatly depending on the location, character, and progression of the anomaly. Anomalies occur in particular in younger animals, and are typically identified because the animal exhibits a clinical neurological abnormality that necessitates more detailed examination of the nervous system. In certain cases, concomitant skeletal abnormalities are also found e.g. curving of the spine and spinal cord (kyphosis, lordosis or scoliosis) or increased size of the calvarium. Anomalies in the central nervous system necessitate partial condemnation including condemnation of adjacent abnormal bones. Complications, which may be seen in association with anomalies must be included in the general evaluation of the carcase.

The aetiology of anomalies in the nervous system can only rarely be determined. They could be due to teratogenic damage to the foetus from viruses, chemical compounds, parasites, etc. as well as genetic defects. The actual cause of the anomaly often disappears during gestation or early postnatal development, and only in exceptional cases do these animals comprise a food safety hazard. However, if several animals with malformations are delivered for slaughter from the same farm or region, one must be alert to the risk that the livestock has been exposed to chemicals that could constitute a food safety hazard.

Anomalies in the brain often present as hydrocephalus, hydranencephaly or cerebellar hypoplasia. In some cases, hydrocephalus causes expansion of the skull and is thus immediately recognisable. In cattle, these conditions can be caused by intrauterine infection with viruses such as bovine viral diarrhoea (BVD) virus, blue tongue virus type 8, Akabane virus and Schmallenberg virus. While calves with cerebellar hypoplasia have generally eliminated the BVD virus while still in the uterus, calves with hydrocephalus or hydranencephaly may have persistent infection and thus be viraemic. These animals may also be subject to the general regulations on viraemia (total condemnation).

Acquired hydrocephalus can be observed in all animals. The condition is often due to obstruction of the mesencephalic duct due to neoplasm or inflammation. In horses, cholesterol granulomas in the choroid plexus of the lateral ventricles are occasionally found as the cause of hydrocephalus. Hydrocephalus necessitates partial condemnation unless the condition is due to purulent spread to the ventricles, in which case total condemnation is necessary.

Trauma, including compression [3.04 – 3.13]

Trauma to the central nervous system is seen not only in acute-onset conditions but also in chronic conditions. A general characteristic of acute-onset conditions is distinct

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neurological symptoms, while chronic conditions can progress more slowly with milder clinical signs.

Acute trauma often occurs as a result of major impact to the animal's exterior. In livestock, such lesions are frequently localised to the spine because the brain is well-protected by the skull and sinus system. At meat inspection, haemorrhage and oedema may be observed in the nervous tissue, the surrounding connective tissues, the musculature, and the skin. Dislocation of the vertebrae may be seen with compression of nervous tissue, or even fracture and laceration. As a minimum, the affected areas necessitate partial condemnation, but the meat inspection also includes assessment of fractures (see Chapter 14) as well as application of the general rules. Note that fracture of the spine could also be indicative of spondylitis or other bone changes that can predispose to fractures.

Chronic trauma to the central nervous system is frequently associated with progressive or intermittent compression of the nervous system. Due to the chronic nature of the condition, there is ongoing vascular anastomoses and neovascularisation which reduces the extent of ischaemic damage. This is the overall reason for the generally weaker neurological symptoms. The cause of the trauma may be found in or outside the nervous system and may be inflammatory or non-inflammatory in character. The affected areas necessitate partial condemnation as a minimum, but the scoring must also take into account the underlying condition.

Inflammatory changes in the structures surrounding the central nervous system can cause compression of the nervous tissue. This can occur through 1) spread from lesions in the surrounding bones and joints, 2) periostal/periarticular reaction to the lesions or 3) dilatation of sinuses in chronic sinusitis. While 2) and 3) mostly lead to compression, inflammation of the meninges can develop due to spread from the surroundings with the potential for more profound involvement of the neural parenchyma. The underlying lesion in 1) and 2) will most frequently have an haematogenous origin associated with pyaemia, and the scoring will depend on the overall evaluation of the carcase. As a minimum, local trimming must be performed. Chronic sinusitis and other locally occurring and limited lesions necessitate partial condemnation. Inflammatory lesions in the nervous tissue itself can also cause compression. Scoring will depend on the age and pathogenesis of the lesions, and is discussed in the section on Inflammation.

Furthermore, non-inflammatory lesions in the central nervous system and adjacent structures can cause compression. Primary neurogenic neoplasms, including neoplasms in the meninges, are generally benign, but such neoplasms may cause compression of the nervous tissue as they grow. The presence of neoplasms necessitates partial condemnation. Neoplasms in the adjacent structures can be either benign or malignant, and the scoring thus depends on the overall findings. Multicentric lymphoma in cattle are occasionally localised in the epiphyseal cartilage of the vertebrae and, during continued growth, can compress the spinal cord. Multicentric lymphoma is classified as a malignant tumour (total condemnation). Osteomas and osteosarcomas are occasionally observed in the adjacent bones with subsequent compression of the nervous tissue. The scoring depends on the primary tumour, but necessitates as a minimum partial condemnation. Instability of the cervical (neck) vertebrae of the spine occurs

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in horses ("wobbler", cervical stenotic myelopathy). The dynamic form necessitates partial condemnation of the spine while the static form, with periarticular new bone formation, necessitates partial condemnation of the pertinent areas of the spine. The same applies at evaluation of non-infected healed fractures, malformations, and other chronic, non-infectious conditions.

Intoxications and deficiencies [3.14 – 3.15]

Intoxications with organic compounds or inorganic compounds may cause neurological symptoms. The organic compounds include naturally occurring substances, toxins produced by microbes, and industrially-manufactured products and their derivatives. The potential number of toxic compounds present in the carcase is therefore high. Characteristic for these intoxications is that they are rarely associated with specific macroscopic changes; thus routine meat inspection is of limited value in such cases. Supplementary laboratory investigations must be conducted if it is known or suspected that the carcase contains substances that could comprise a health risk at human consumption. If laboratory investigations are not possible, the carcase cannot be approved for consumption. Tests for toxins are normally performed on the liver and kidneys, but in certain circumstances must be supplemented with other tissues such as brain tissue.

In animals delivered for slaughter with neurological disorders, particular attention must be paid to the presence of botulism toxin, tetanus toxin, lead, insecticides, and antiparasitic agents.

Deficiency conditions in livestock are often associated with neurological symptoms. Magnesium deficiency occurs in cattle and sheep ("grass tetany"), and calcium deficiency occurs in cattle ("milk fever"), and sheep and pigs (eclampsia). In the acute stage, the conditions necessitate total condemnation of the animal. In cattle, calcium deficiency at the time of calving can result in calving problems and unsteady movements. This can predispose to nerve damage in the pelvis as well as damage to the skeleton, muscles, and joints ("downer syndrome"). If the calcium deficiency has been remedied at the time of slaughter, the scoring is based on the findings in the carcase. Vitamin B_1 (thiamine) deficiency in ruminants can result in cerebrocortical necrosis (polioencephalomalacia). In certain cases, this condition can be diagnosed based on discolouration, oedema, malacia, and possibly loss of cerebral cortex. Partial condemnation is necessary.

Rehydration damage ("salt poisoning") can be seen after long-term water deficit followed by sudden rehydration. In cattle and pigs, the condition often occurs at the same time in many animals from one herd. The acute stage is characterised by congestion and diffuse oedema of the central nervous system. An inflammatory reaction develops which in the acute stage necessitates total condemnation.

Encephalopathy

Encephalopathies include a number of conditions of the central nervous system with both infectious and non-infectious aetiology. They are generally characterised by

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lesions which can only be identified microscopically (histopathology). At meat inspection, special attention must be given to the transmissible spongiform encephalopathies caused by infection with prions. Bovine spongiform encephalopathy (BSE, "mad cow disease") occurs in cattle while scrapie and other forms of spongiform encephalopathies occur in small ruminants, and chronic wasting disease (CWD) in deer. There are several known prion strains with varying pathogenicity. The prion that causes BSE is a human pathogen and causes the human variant Creutzfeldt-Jakob's disease. There is a risk that similar human pathogenic prion strains can occur in other animal species. Prions can only be demonstrated using laboratory tests. Infection with prions necessitates total condemnation.

Special regulations apply for testing for transmissible spongiform encephalopathies and evaluation of the organs (Specified Risk Material, SRM) (see Chapter 1).

Hepatic encephalopathy and renal encephalopathy can be seen in association with hepatic and renal insufficiency, respectively.

Inflammation [3.16 – 3.28]

Inflammation in the central nervous system can affect the neural parenchyma causing encephalitis, myelitis, choroiditis, vasculitis, and ependymitis, as well as the meninges causing leptomeningitis and pachymeningitis. Conditions affecting the brain/spinal cord and the meninges are scored in the same way at meat inspection as it is usually not possible to determine the extent of the lesion based on gross morphology.

At inflammation in the central nervous system, it is important to determine whether the condition is acute or chronic, and whether it is localised or part of a generalised condition such as pyaemia or sepsis. Acute inflammation always necessitate total condemnation, regardless of the extent, while chronic lesions necessitate partial condemnation. In the case of circumscribed chronic abscesses without complications due to pyaemia, the carcase is approved for deboning. Complications, typically as rupture and spread to the ventricles, necessitate total condemnation regardless of the age of the lesion.

Macroscopic demonstration of inflammation in the central nervous system, in particular in the neural parenchyma itself, is often difficult, as mentioned previously. Note therefore the risk of overlooking an infectious condition at post-mortem inspection. The ante-mortem inspection becomes highly important if fever and abnormal behaviour (excitability, unusual habits and swellings, etc.) in particular are present.

Macroscopic age assessment of inflammatory conditions in the neural parenchyma will often be based on the presence of fibrous margins on the lesion, and will therefore primarily be used in severe, chronic, purulent, or necrotic inflammations. Acute conditions can result in swelling of the brain due to increased blood supply, oedema and exudation. In locally spread lesions, the swelling can be defined or unilateral. In acute inflammation, the meninges will appear oedematous, hyperaemic, cloudy, and often with a fibrin-rich exudate, typically observed in the sulci and the ventral surface of the brain. Chronic lesions will be dominated by fibrous adhesions to the periosteal layer and dura mater.

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Inflammation in the central nervous system can develop from 1) haematogenous spread, 2) ascending infection through the peripheral nerves, 3) local invasion (e.g. from adjacent bones), 4) nerve endings located in the mucosa of the nasal cavity or 5) direct penetration. Haematogenous spread will often cause disseminated or diffuse lesions while at embolic spread a disseminated lesion pattern is observed. The other infection routes will result in focal or locally spread multifocal lesions.

Acute diffuse fibrinopurulent inflammation of the meninges is seen in calves, lambs, and kids at septicaemic spread of *Escherichia coli*. In addition to the meningeal lesions, fibrinopurulent inflammation is frequently observed in serous cavities and joints (polyserositis). Septicaemic salmonellosis can similarly cause acute diffuse inflammation of the central nervous system. In pigs, infection with *Streptococcus suis*, *Haemophilus parasuis* and *E. coli* also causes disseminated to diffuse inflammation in the meninges. The infections will often be associated with widespread lesions in other serous membranes and joints. In the acute stage, the infections necessitate total condemnation. The chronic stage is most frequently seen in animals for slaughter, where thoracic and abdominal cavity lesions are the most obvious findings. These cases necessitate partial condemnation of the central nervous system and meninges as well as a number of non-neural tissues.

Encephalitis in cattle, sheep, and goats is often caused by *Listeria monocytogenes*. In these cases, there is ascending infection from the oral cavity via the trigeminal nerve to its entry point in the brain stem. From here, the infection spreads within the brain stem. The entry site in the oral cavity cannot be determined. In some cases, focal bleeding or discolouration is observed in a cross-section of the brain stem, but definite diagnosis of the inflammation requires histopathologic assessment. It is rarely possible using macroscopic examination to determine the age of the condition as chronic.

Chronic encephalitis with abscess formation is seen in all animal species. The pathogenesis is frequently unclear, but profound lesions are generally considered to have occurred after haematogenous spread. Aetiology can be one of a large number of pyogenic bacteria, but *Trueperella pyogenes* is commonly isolated. The most probable cause of focal encephalitis with abscess formation localised to the rostral part of the brain is ascending infection from the mucosa of the nasal cavity. In uncomplicated cases this necessitates partial condemnation. Chronic disseminated encephalitis with abscess formation is considered to occur in connection with pyaemia regardless of whether or not lesions are found in the other organs. The carcase is approved for deboning. If focal or solitary abscesses occur near the surface of the central nervous system, including pituitary abscesses, careful consideration must be given to whether the lesion has occurred as a result of pyaemia, or whether it is due to local spread. Local spread of an infection may be observed after injury to the nasal membranes, for example when inserting nose rings in bulls. The carcase and other organs should therefore be checked carefully for lesions in order to clarify whether pyaemia is present. Local spread without complications necessitates partial condemnation.

Infection in the nervous system can occur in particular with fractures of the skull. Chronic, circumscribed processes necessitate partial condemnation. Acute nervous tissue lesions necessitate total condemnation.

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In pigs in particular, focal or multifocal encephalitis with abscess formation occurs localised to the brain stem. The condition is considered to occur as a result of haematogenous spread of pyogenic bacteria, with localisation in the meninges or neural parenchyma, and must thus be classified as pyaemia. Invasion to the structures of the inner ear (local spread) can be observed. On the other hand, otitis media is most frequently caused by ascending infection via the Eustachian tube (see Chapter 18). Porcine endocarditis is often associated with microscopic foci of inflammation in the brain.

In horses infected with *Streptococcus equi* subsp. *equi* (strangles), haematogenous spread can be observed with localisation to the brain. In well-defined, uncomplicated, chronic lesions in pyaemia, the carcase can be approved for deboning.

The most frequent complication in suppurative lesions in the central nervous system, in particular in the brain, is spread to the ventricles with subsequent development of pyocephaly. This complication can also be seen in cases of suppurative choroiditis. The infection can spread through the ventricles to the central nervous system and the plexus system, where there is close contact with the systemic circulation. Involvement of the ventricles necessitates total condemnation even in chronic cases. Spread of suppurative lesions to the surface of the brain and spinal cord enables spread through the subarachnoid spaces. This also necessitates total condemnation.

Viral infections in the central nervous system are rarely diagnosed in animals for slaughter. Macroscopic lesions are identified only rarely and in those cases are unspecific. Scoring is based on the general rules. Chronic non-suppurative myelitis seen in herpes paralysis after infection with equine herpes virus type 1, is difficult to see macroscopically. The brain and the entire spinal cord must therefore always be condemned. Polyneuritis equi ("Hammel-Schwanz") is diagnosed in the acute stage by oedema and hyperaemia in the cauda equina, while in the chronic stage, which is most frequently diagnosed, it is characterised by fibrous thickening of the cauda equina and the nerves that arise here. The condition necessitates partial condemnation of the spinal cord and the caudal section of the spine, as well as removal of affected nerves.

The central nervous system is also the preferred site for a number of parasites which are important to detect at meat inspection. The most important of these is the tape worm *Taenia multiceps* (definitive host: dog and fox; intermediate host: small ruminants and cattle), of which the metacestode stage, *Coenurus cerebralis* can be localised in the the brain, and more rarely, in the spinal cord. The coenurus can be seen as thin-walled cysts with several scolices. The infection may cause "gid" or paralysis when located in the brain or spinal cord, respectively. The condition necessitates partial condemnation. Occasionally, parasitic granulomas are observed after aberrant migration of nematodes. These necessitate partial condemnation.

Peripheral nervous system [3.29 – 3.31]

Lesions that are limited to the peripheral nervous system are rarely important at meat inspection. On the other hand, complications of nerve damage occur regularly, and the peripheral nervous system can also be involved in local lesions.

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Neuritis is rarely seen as an isolated condition, but often occurs in association with infection in the central nervous system. In cases of acute inflammation, the clinical picture will therefore be dominated by general neurological symptoms and a change in general heath. This necessitates total condemnation. Of particular importance at meat inspection is encephalitis in ruminants caused by *L. monocytogenes*. This condition which is difficult to diagnose macroscopically, is associated with neuritis in the trigeminus nerve. The bacteria invade the nervous system via the nerve endings of the trigeminus nerve, and migrate via this to the brain stem. If encephalitic listeriosis is suspected, the entire head must be condemned, because infected nerves cannot be removed safely.

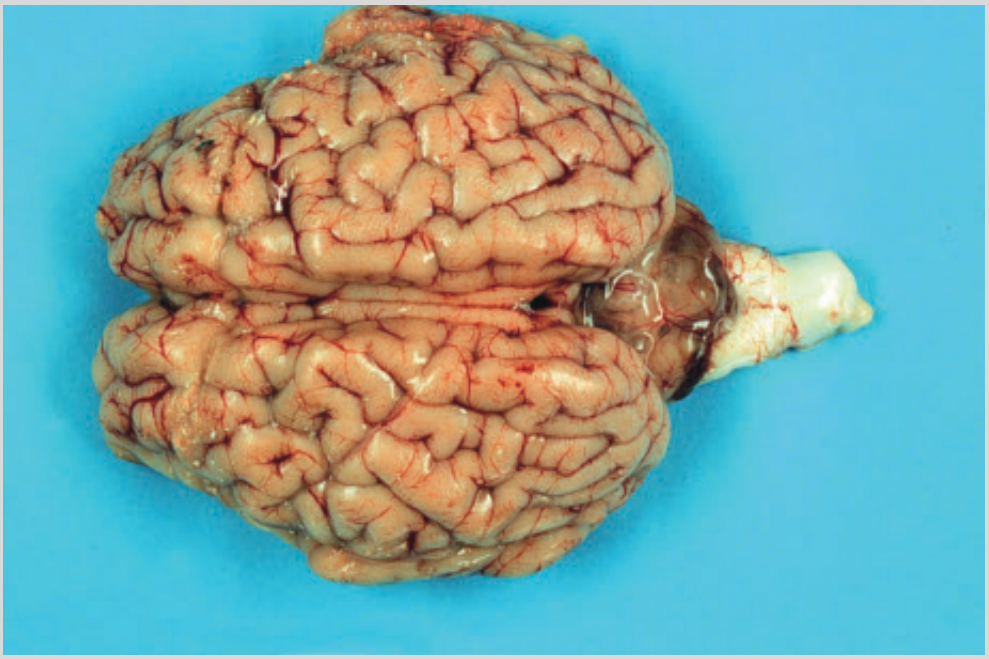
Trauma to the peripheral nerves necessitates partial condemnation. Concomitant lesions such as bleeding and oedema occur frequently, necessitating not only partial condemnation of the nervous tissue but also of the adjacent tissues. In animals with postpuerperal paresis, the nerves on the internal surface of the pelvis must be inspected for lesions.

Complications to lesions in the peripheral nervous system are most frequently due to trauma, and scoring focusses on these. In particular in cattle with paresis, lesions can occur in the deep thigh musculature (see Chapter 15).

In adult cattle, neoplasms in the peripheral nervous system are comprised primarily of multicentric schwannomas. Schwannomas are peripheral nerve sheath tumours that originate in Schwann cells. The tumour has a preferred site in the autonomous nervous system and is seen especially in the throat and neck sympathetic ganglions, the mediastinal, epicardial, hepatic and brachial nerve plexus as well as in the intercostal nerves and on the tongue. Schwannomas are seen as multiple firm swellings in the nerves. Because these are not metastases but multicentric, only partial condemnation of the affected nerves is necessary.

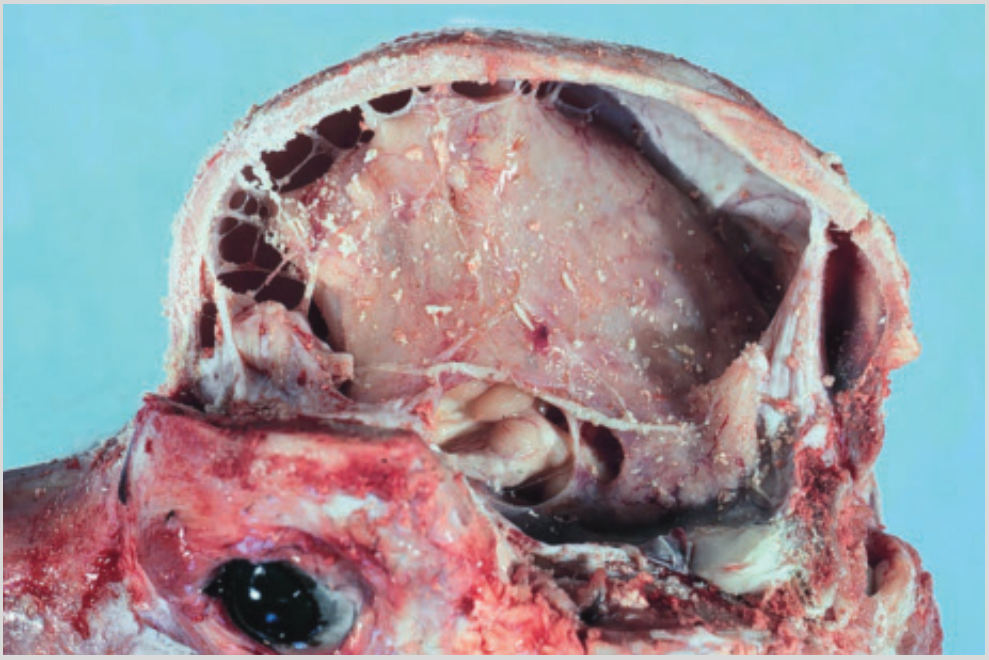
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3.01



Animal species/Organ	Cattle/Brain
Lesion	Cerebellar hypoplasia
Scoring	Partial condemnation
Comments	The condition is often caused by virus. Often, calves do not have viraemia, therefore partial condemnation

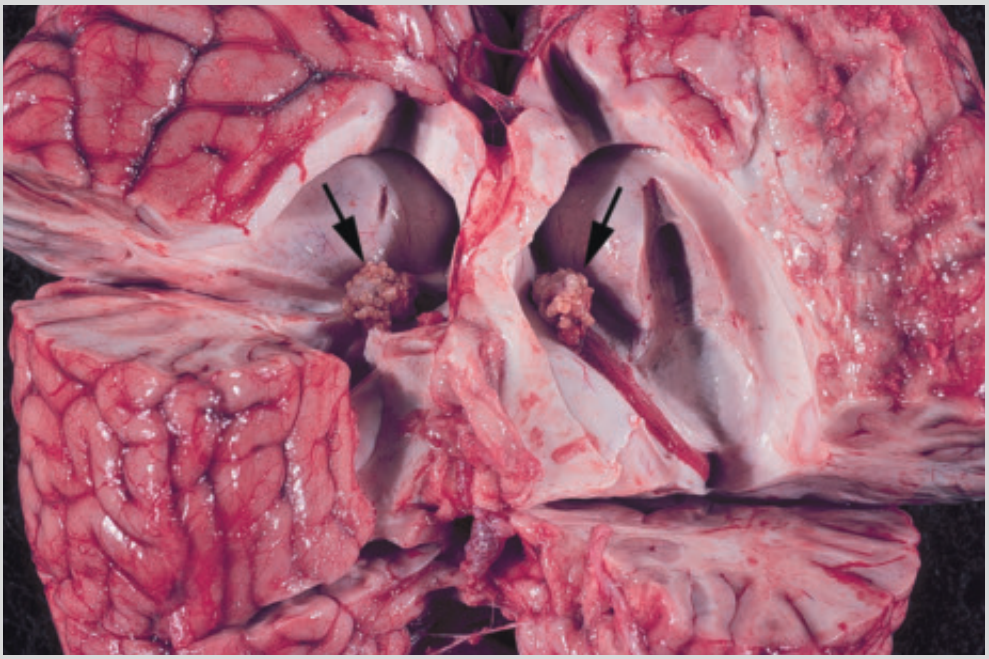
3.02



Animal species/Organ	Cattle/Brain
Lesion	Hydranencephaly
Scoring	Total condemnation
Comments	The remnants of the cerebrum are partially collapsed. The calf tests positive for bovine viral diarrhoea virus and is classified as viraemic

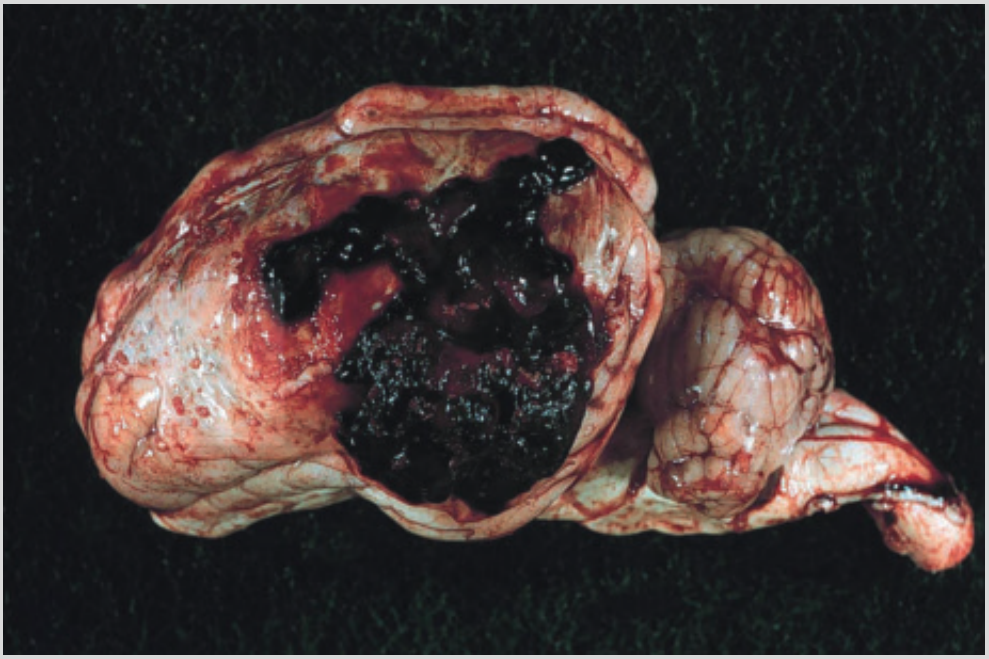
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3.03



Animal species/Organ	Horse/Brain
Lesion	Cholesterol granulomas in choroid plexus (→) in the lateral ventricles
Scoring	Partial condemnation
Comments	This condition is an incidental finding that can cause hydrocephalus. The choroid plexus should be inspected in animals with neurological signs

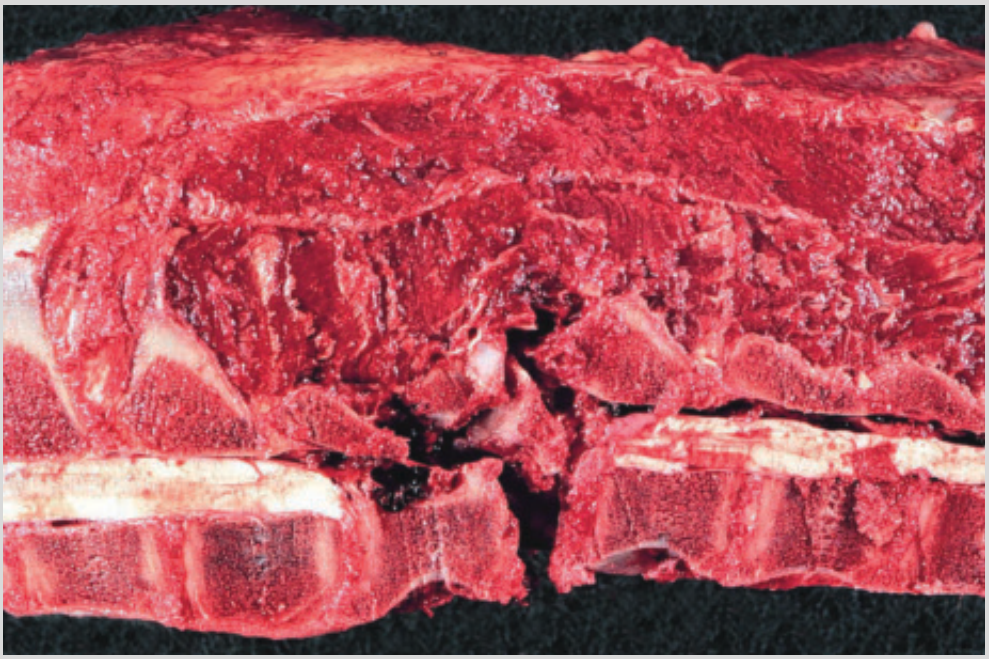
3.04



Animal species/Organ	Pig/Brain
Lesion	Acute epidural haematoma
Scoring	Partial condemnation
Comments	The condition is associated with trauma

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3.05



Animal species/Organ	Horse/Spine
Lesion	Acute closed fracture of the lumbar section of the spine with laceration of the spinal cord
Scoring	Partial condemnation
Comments	The animal must be euthanized before transport to the slaughter house

3.06



Animal species/Organ	Cattle/Spine
Lesion	Anomaly of the cervical vertebrae with compression of the spinal cord
Scoring	Partial condemnation
Comments	The cause of the condition in this case is unknown

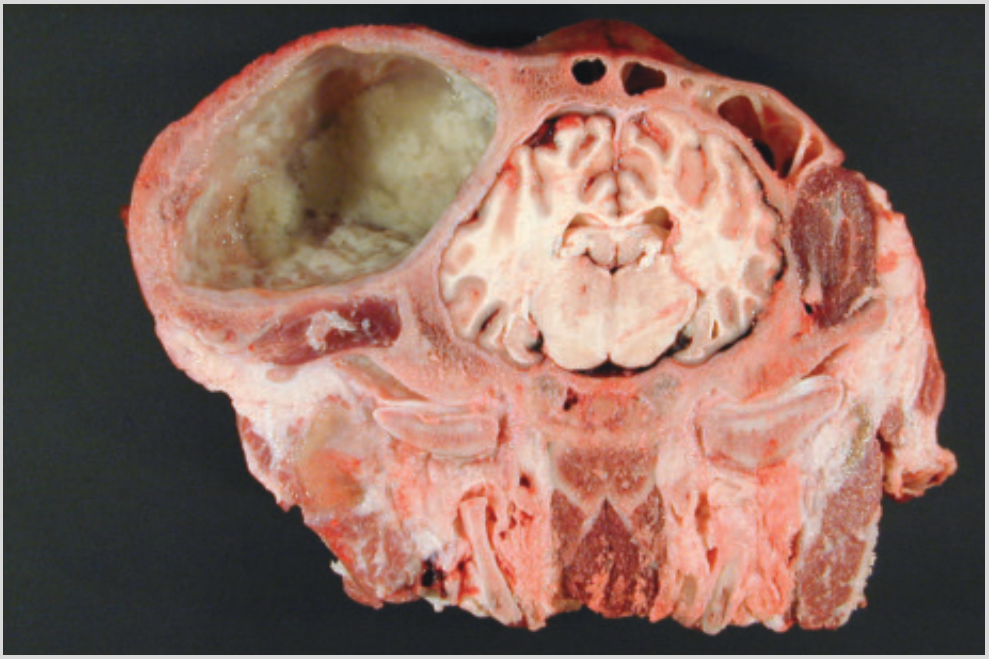
Vet-ebooks.com

3.07



Animal species/Organ	Pig/Spine
Lesion	Chronic osteomyelitis with ankylosis and compression of the spinal cord
Scoring	Approved for deboning
Comments	The lesion occurs in connection with pyaemia

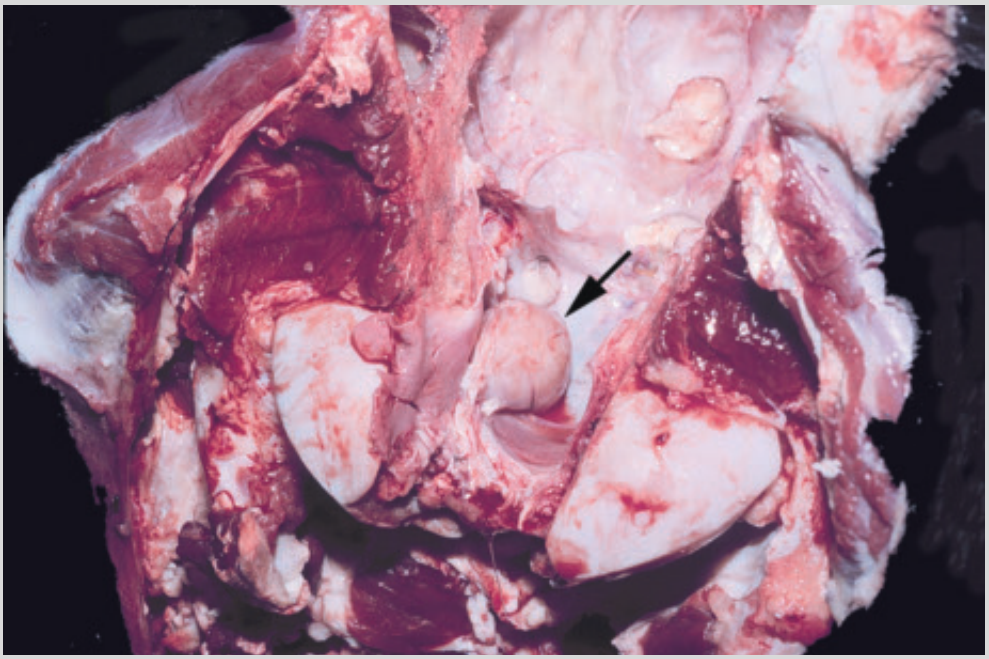
3.08



Animal species/Organ	Cattle/Head
Lesion	Chronic, purulent sinusitis with ectasia and compression of the brain
Scoring	Partial condemnation
Comments	Slow-onset atrophy of the central nervous system often results only in mild neurological symptoms

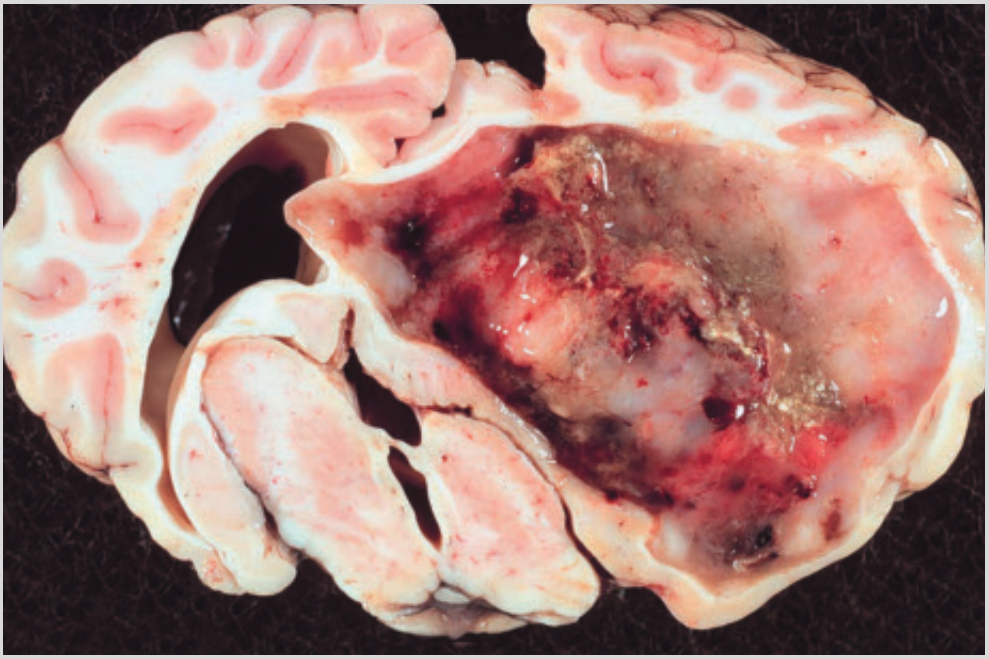
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3.09



Animal species/Organ	Cattle/Brain
Lesion	Meningioma (→)
Scoring	Partial condemnation
Comments	Benign neoplasms without complications necessitate partial condemnation

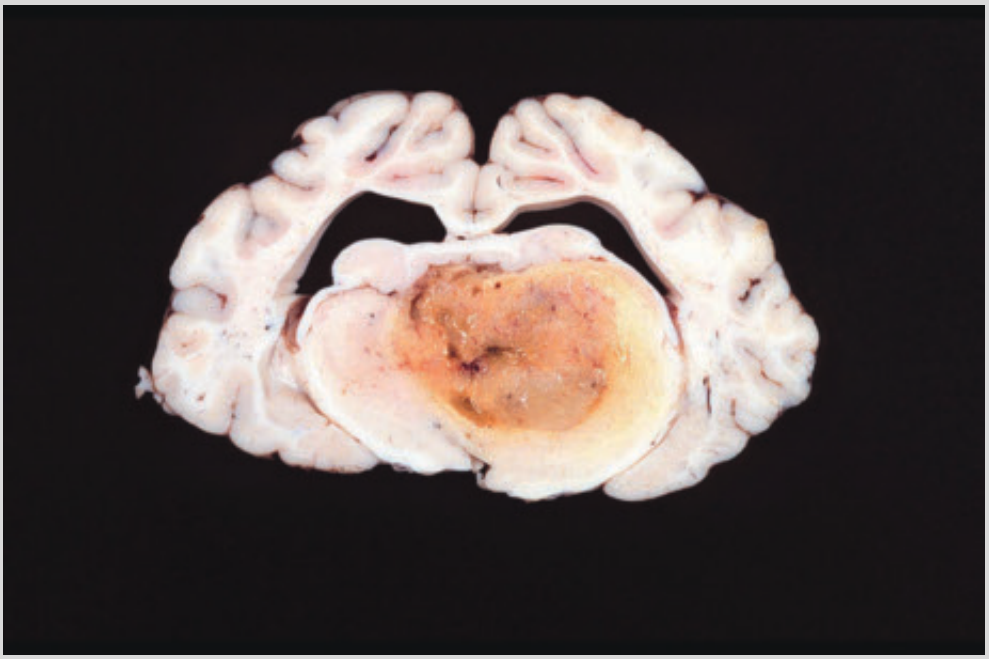
3.10



Animal species/Organ	Cattle/Brain
Lesion	Astrocytoma
Scoring	Partial condemnation
Comments	Benign neoplasms without complications necessitate partial condemnation

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3.11



Animal species/Organ	Cattle/Brain
Lesion	Oligodendroglioma
Scoring	Partial condemnation
Comments	Benign neoplasms without complications necessitate partial condemnation

3.12



Animal species/Organ	Cattle/Spine
Lesion	Epidural lymphosarcoma with compression of the spinal cord (→)
Scoring	Total condemnation
Comments	Malignant neoplasms always necessitate total condemnation

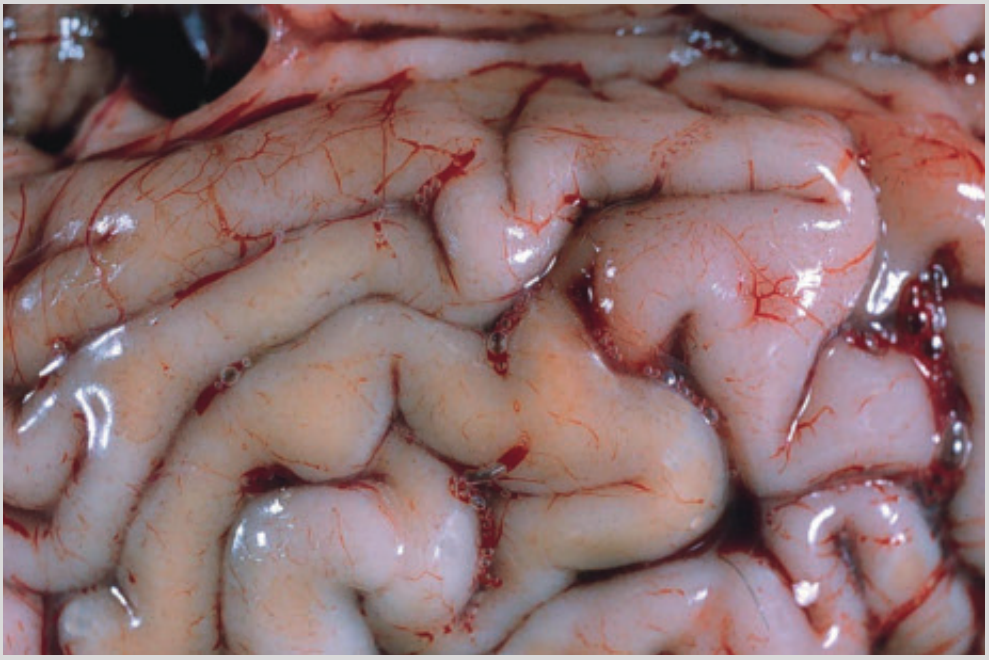
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3.13



Animal species/Organ	Cattle/Spine
Lesion	Infiltrative growing lymphosarcoma in vertebrae and the dura mater
Scoring	Total condemnation
Comments	Malignant neoplasms always necessitate total condemnation

3.14



Animal species/Organ	Cattle/Brain
Lesion	Polioencephalomalacia (cerebrocortical necrosis)
Scoring	Partial condemnation
Comments	Oedema and discolouration of gyri interspersed with normal-coloured gyri

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3.15



Animal species/Organ	Cattle/Brain
Lesion	Polioencephalomalacia (cerebrocortical necrosis) with onset of sequestration
Scoring	Partial condemnation
Comments	Random brownish discolouration (malacia) of the cerebral cortex

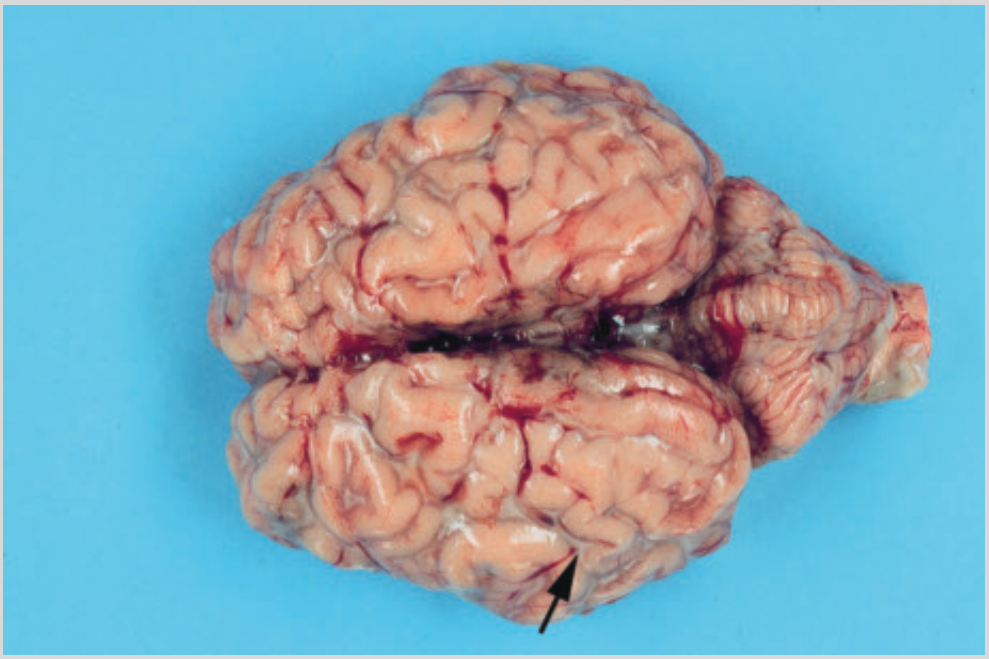
3.16



Animal species/Organ	Cattle/Brain
Lesion	Acute, diffuse leptomeningitis
Scoring	Total condemnation
Comments	The inflammation is characterised by hyperaemia and oedema

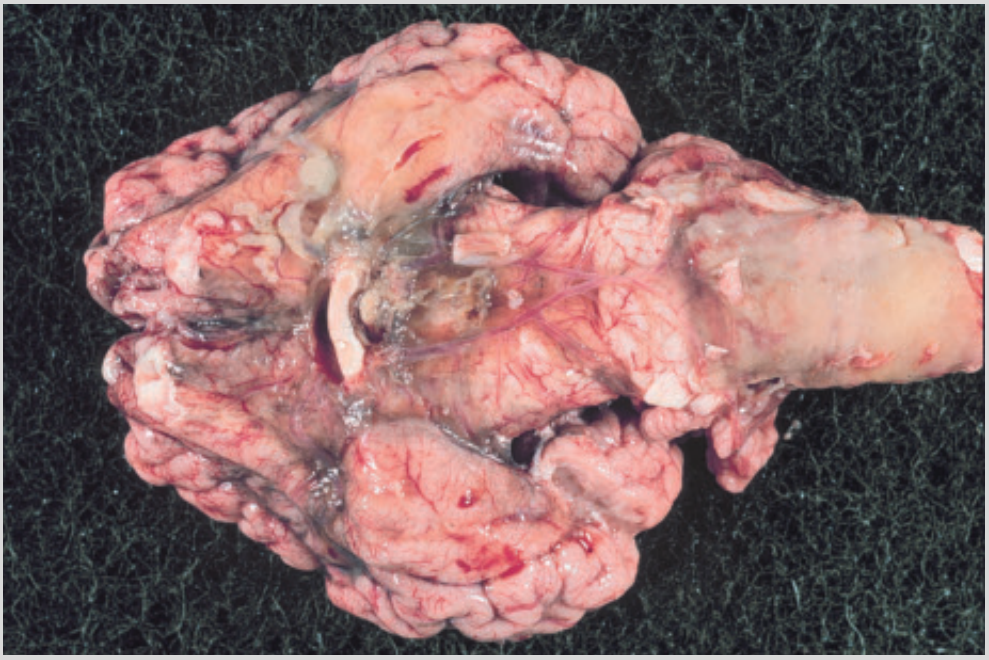
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3.17



Animal species/Organ	Cattle/Brain
Lesion	Acute, diffuse, purulent leptomeningitis
Scoring	Total condemnation
Comments	Septicaemia with *Escherichia coli*. Note pus accumulation in the sulci (→)

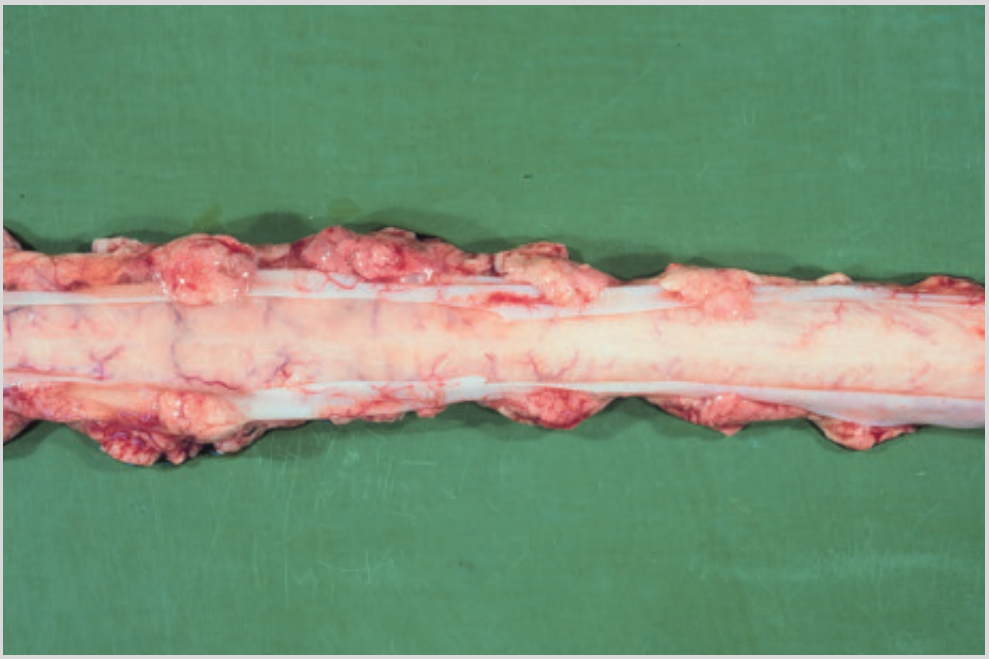
3.18



Animal species/Organ	Cattle/Brain
Lesion	Acute, sporadic, diffuse, fibrinopurulent leptomeningitis
Scoring	Total condemnation
Comments	Complication of focal encephalitis (“pituitary abscess”)

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3.19



Animal species/Organ	Cattle/Spinal cord
Lesion	Acute, diffuse, fibrinopurulent meningitis in the spinal cord canal
Scoring	Total condemnation
Comments	Acute inflammation in the meninges necessitates total condemnation

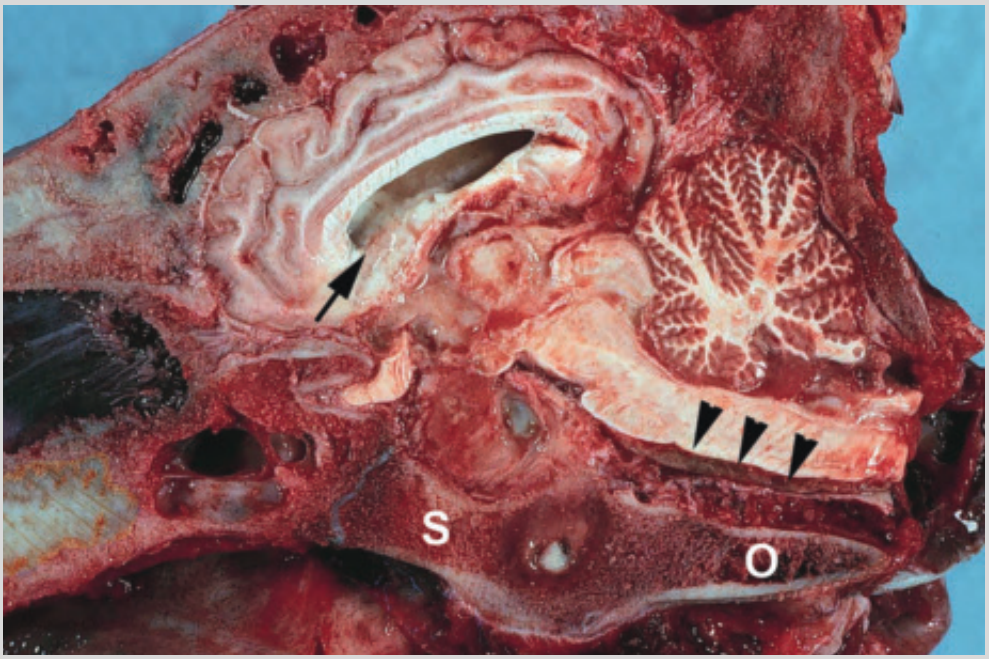
3.20



Animal species/Organ	Pig/Spine
Lesion	Local, diffuse, chronic, purulent meningitis in the lumbosacral region.
Scoring	Approved for deboning
Comments	The lesion is considered to have occurred in connection with pyaemia

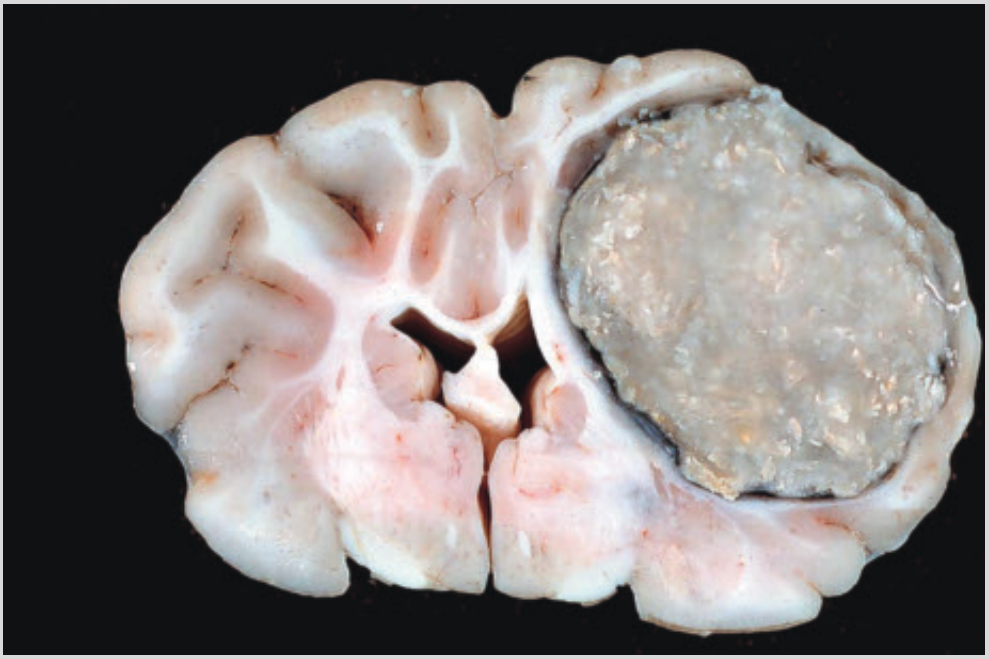
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3.21



Animal species/Organ	Cattle/Head
Lesion	Chronic, focal, osteomyelitis with abscess formation in the growth zone between the sphenoid bone (S) and the occipital bone (O) with spread to the pituitary. Chronic, meningitis (►), purulent encephalitis, and pyocephalus (➡)
Scoring	Total condemnation

3.22



Animal species/Organ	Sheep/Brain
Lesion	Chronic, solitary brain abscess
Scoring	Approved for deboning
Comments	Based on the deep localisation in the the brain, the lesion is considered to have occurred in connection with pyaemia

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3.23



Animal species/Organ	Cattle/Mesencephalon
Lesion	Chronic, focal, encephalitis with abscess formation
Scoring	Approved for deboning
Comments	Considered to have occurred in connection with pyaemia

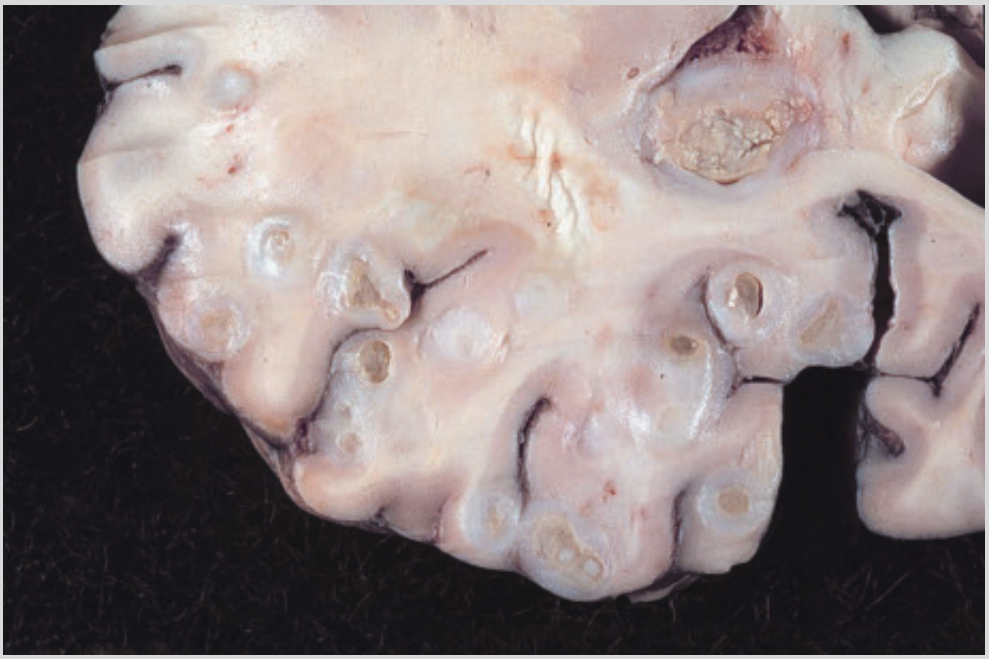
3.24



Animal species/Organ	Cattle/Brain
Lesion	Chronic, disseminated, encephalitis with abscess formation
Scoring	Approved for deboning
Comments	Occurred in connection with pyaemia

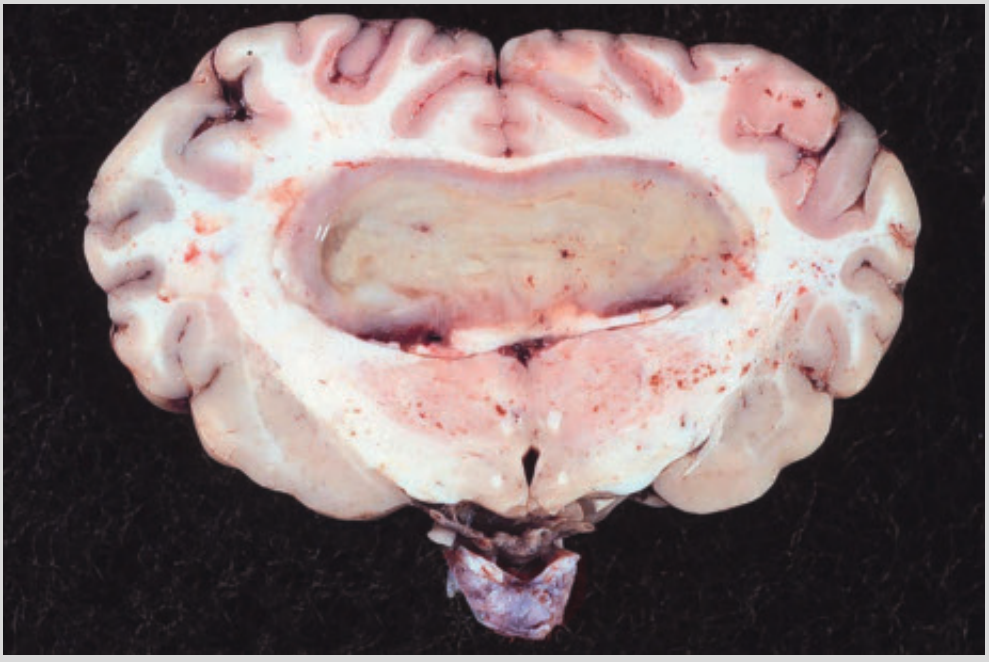
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3.25



Animal species/Organ	Cattle/Brain
Lesion	Chronic, disseminated, encephalitis with abscess formation
Scoring	Approved for deboning
Comments	Section of brain shown in 3.24. The abscess does not communicate with the ventricle system and is therefore approved for deboning.

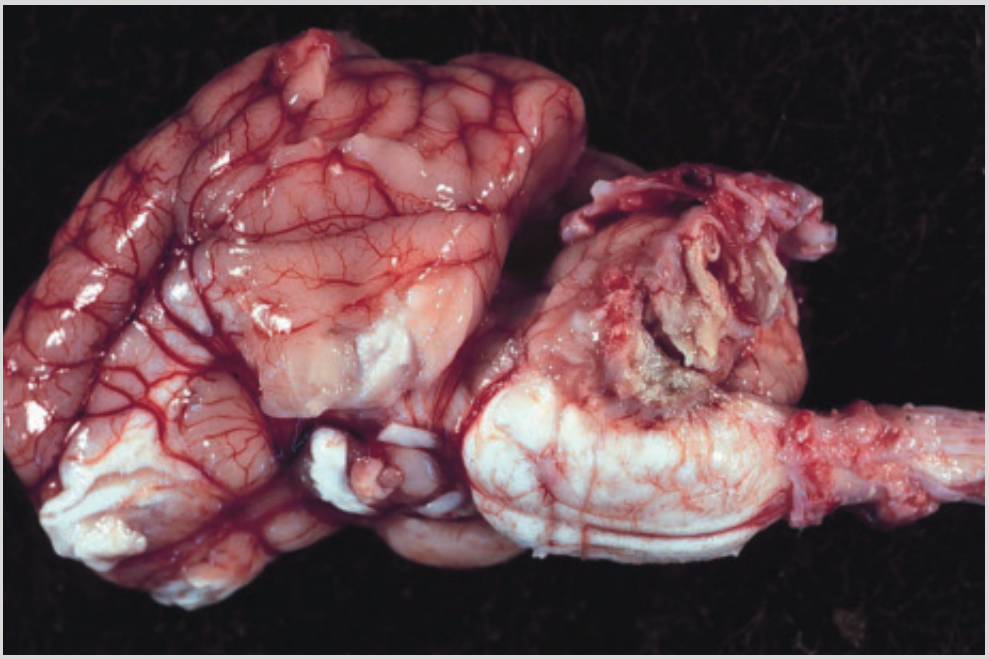
3.26



Animal species/Organ	Cattle/Brain
Lesion	Chronic, diffuse pyocephalus with dilatation of the ventricles
Scoring	Total condemnation
Comments	Inflammation in the ventricles is considered to be a complication that necessitates total condemnation regardless of the age of the lesion

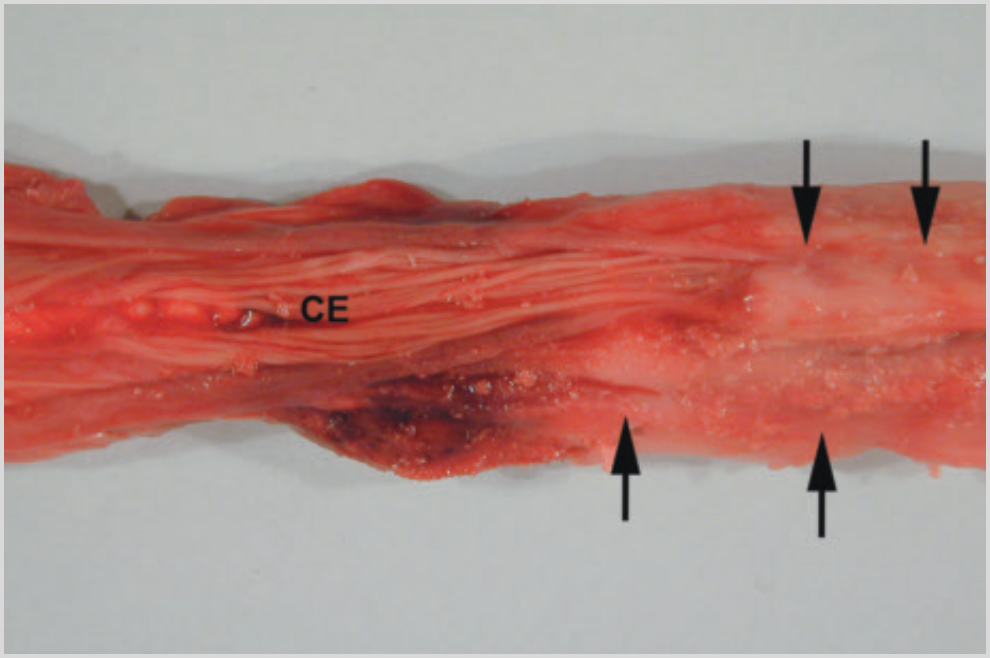
Vet-ebooks.com

3.27



Animal species/Organ	Pig/Brain
Lesion	Chronic, focal, necrotic meningoencephalitis
Scoring	Approved for deboning
Comments	The lesion is considered to have occurred in connection with haematogenous spread

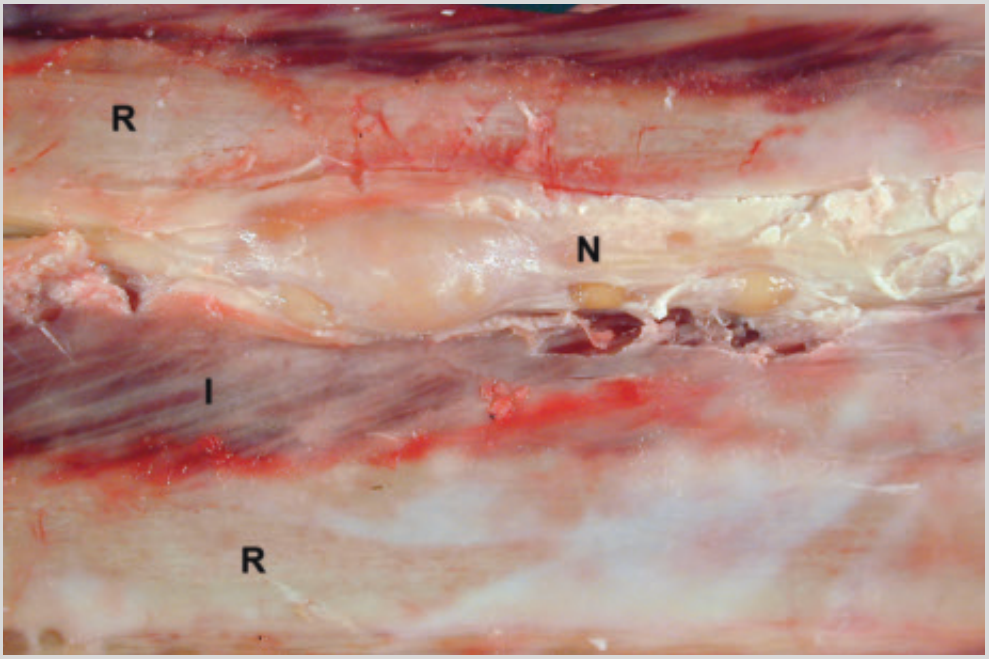
3.28



Animal species/organ	Horse/Spinal cord
Lesion	Chronic fibrous neuritis
Scoring	Partial condemnation
Comments	Polyneuritis equi seen as extensive fibrosis (→) of the nerves radiating from the cauda equina (CE)

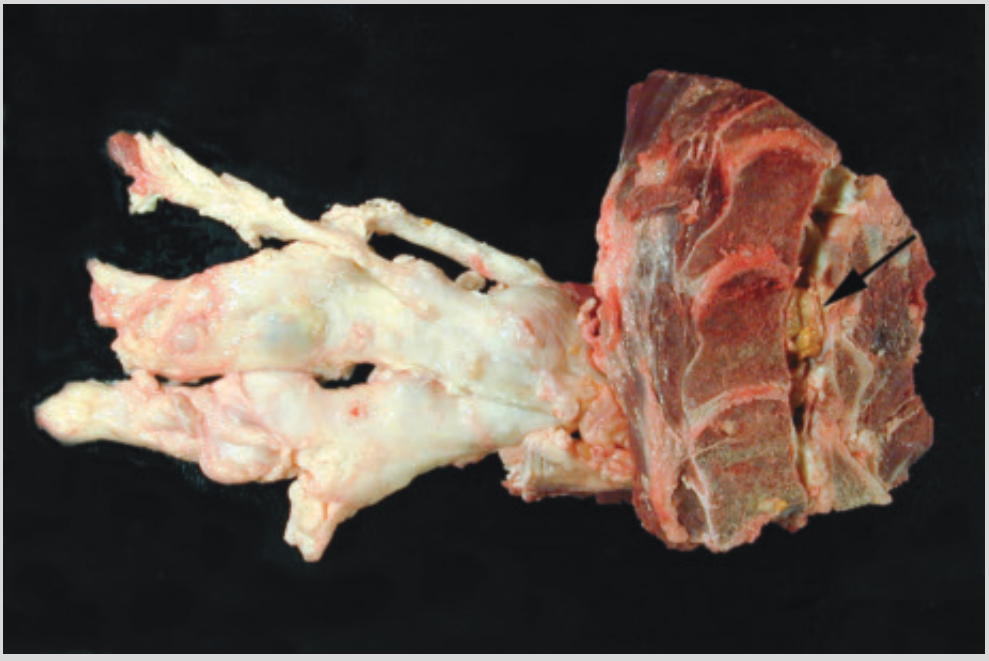
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3.29



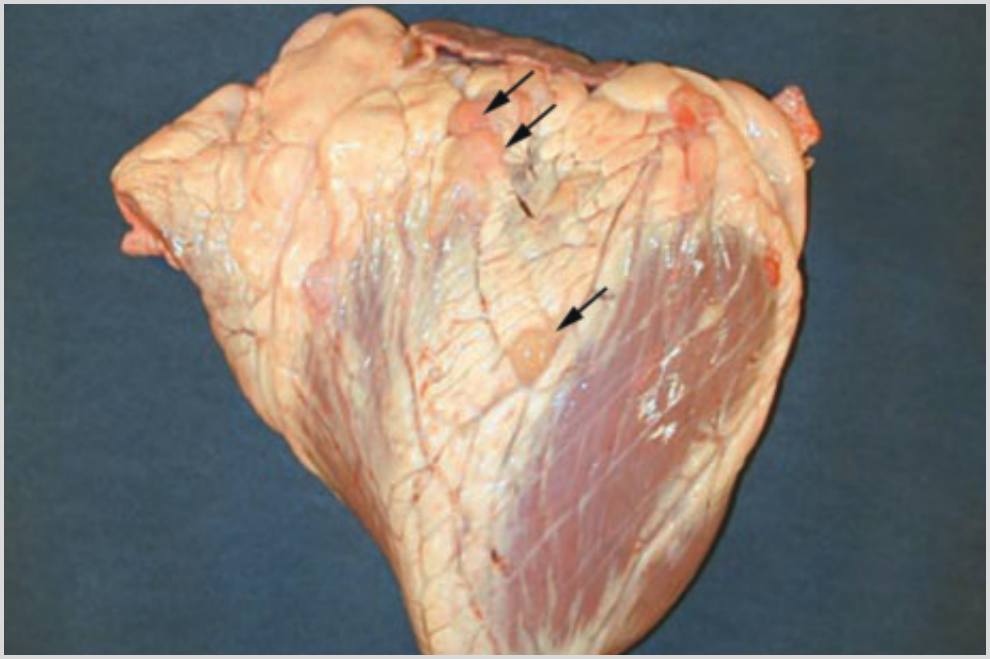
Animal species/Organ	Cattle/Intercostal nerves
Lesion	Multiple schwannomas
Scoring	Partial condemnation
Comments	The peripheral nervous system, including the paravertebral ganglia, must be inspected. The ribs (R), nerves (N) and intercostal musculature (I)

3.30



Animal species/Organ	Cattle/Peripheral nervous system (brachial plexus)
Lesion	Widespread occurrence of schwannomas
Scoring	Partial condemnation
Comments	Note also the presence of tumour tissue in the spinal canal (→)

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Animal species/Organ	Cattle/Peripheral nervous system
Lesion	Multiple schwannomas (→) originating in the nerves of the epicardium
Scoring	Partial condemnation
Comments	If schwannomas are present, the remainder of the peripheral nervous system must be inspected for lesions. Schwannomas are classified as benign neoplasms

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4 Cardiovascular System

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Developmental anomalies p. 78
Circulatory disorders p. 78
Vascular changes in the heart p. 79
Pericardial lesions p. 79
Endocardial lesions p. 80
Myocardial lesions p. 81
Neoplasms p. 84
Vascular system p. 85

Introduction

The cardiovascular system is comprised of the heart and the vascular system, including the lymph vessels. The diseases that are relevant at meat inspection are those located in the heart. Diseases of the vascular system are discussed at the end of this chapter.

Diseases of the heart often result in impaired function or heart failure with complications such as congestion and/or oedema in other organs. Left-sided heart failure presents typically as pulmonary oedema and pulmonary congestion, or hydrothorax. In contrast, right-sided heart failure presents typically as hepatic congestion, and is often associated with oedema in other abdominal organs, and ascites.

At meat inspection, heart changes can be divided into two main categories:

1) Diseases that necessitate total condemnation: non-healed endocarditis in animals other than finisher pigs from integrated production systems, embolic myocarditis (with occurrence of acute, non-defined lesions), acute exudative pericarditis, and malignant tumours.
2) Diseases that necessitate partial condemnation of the heart, unless accompanied by complications (all other diseases that primarily affect the heart) which necessitates total condemnation.

In addition, there is a large number of generalised diseases in which the heart is one of several involved organs. In these cases, meat inspection must comply with current regulations on septicaemia, pyaemia, toxinaemia, tumours, etc.

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Developmental anomalies [4.01 – 4.05]

Serious heart anomalies will rarely be demonstrated in slaughter animals, as they normally cause an early death. Heart malformations are primarily seen in calves and finisher pigs, but can be found occasionally in adult animals. The anomalies discussed in this chapter are classified into three categories: Inadequate separation between the two halves of the heart; stenoses; and valve defects.

An opening between the two ventricles is called a ventricular septal defect and is most frequently localised to the dorsal septum immediately below the semilunar valves. The size and significance of the defect varies. Severe defects result in pressure equalisation between the two ventricles causing equally thick ventricle walls in both sides. This is in contrast to the normal heart in which the left ventricular wall is considerably thicker than the right. An opening between the two atria is called an atrial septal defect, but the term persistent foramen ovale is often used incorrectly for this condition. The foramen ovale is normally open for a time after birth. If the pressure in the heart is normal this does not result in any functional changes.

Subaortic stenosis occurs relatively frequently in Danish finisher pigs. The stenosis is located a few centimetres below the aortic valve and demonstrates varying degrees of connective tissue proliferation in the ventricle wall. The secondary changes often comprise severe left-sided concentric cardiac hypertrophy and chronic pulmonary congestion. Pulmonic stenosis occurs particularly in Tetralogy of Fallot in which a ventricular septal defect, overriding aorta (the aorta overlies the interventricular septum and receives blood from both ventricles), and hypertrophy of the right ventricle also occur.

Developmental anomalies of the valves are relatively common, but are not normally detected unless they result in secondary changes such as dilatation of the heart or thrombosis.

Congenital focal or multifocal melanosis (melanosis maculosa) presents as areas of black pigmentation and is occasionally seen on the endocardium and/or epicardium in cattle and pigs. The condition is benign and must not be confused with melanin-containing neoplasms (see Chapter 21).

Heart anomalies necessitate partial condemnation. However, the presence of any systemic complications necessitates total condemnation.

Circulatory disorders [4.06 – 4.07]

Petecchial subepicardial and subendocardial haemorrhages can occur at slaughter (non-specific blood splash) but they can also be a sign of septicaemia. At meat inspection, scoring must be based on the overall picture. More severe haemorrhages that often also involve the myocardium are seen at selenium/vitamin E deficiency (including "mulberry heart disease" in pigs), clostridial infections and coagulation defects.

Meat inspection scoring of haemorrhage on and in the heart is thus dependent on the cause of the changes and the presence of complications.

Myocardial infarctions are relatively rare, and their cause is often unknown. In horses, aberrant migration of *Strongylus vulgaris* larvae can result in myocardial infarc-

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tions and, in left-sided endocarditis, spread to the coronary vessels can be seen with development of embolic myocarditis and consequent infarctions.

Acute infarctions necessitate total condemnation. Chronic infarctions without purulent content are considered to be aseptic and result in partial condemnation of the heart. Cases with only encapsulated pus-containing chronic lesions without complications are scored in accordance with the regulations on pyaemia (partial condemnation and approval for deboning).

Vascular changes in the heart [4.08 – 4.09]

Hearts with highly thickened arteries occur occasionally, particularly in pigs. This condition is called polyarteritis nodosa and is discussed on p. 86.

Cattle hearts can be the site of characteristic vascular changes in which extreme proliferation and dilatation of the arteries is observed. The condition does not have a special term and its cause or significance is not known. It is most probably a growth anomaly (hamartoma). Malformed hearts are condemned.

Pericardial lesions [4.10 – 4.18]

Fluid accumulation in the pericardium (hydropericardium) most often occurs in connection with conditions such as generalised oedema, regardless of whether the cause is impaired heart function, hypoproteinaemia or increased vessel permeability. At increased vessel permeability, the fibrin content of the fluid will often increase to such an extent that fibrin threads are visible. Increased vessel permeability is seen in particular at selenium/vitamin E deficiency in pigs ("mulberry heart disease") and clostridial infections, when other heart lesions (haemorrhages) can generally be found. Scoring depends on the cause and the presence of any complications.

Serous atrophy of the pericardial fatty tissue can be seen in cachectic animals. Hydropericardium may also occur, and serous atrophy of fatty tissue may be present elsewhere in the animal. The myocardium can be dark in colour due to deposits of lipofuscin in the myocardial cells. Cachexia necessitates total condemnation.

Steatitis affecting the pericardial fatty tissue is observed occasionally, particularly in horses and cattle. Often, other fatty tissues are also affected. The cause is unknown, but selenium and/or vitamin E deficiency may be involved. Pericardial steatitis necessitates partial condemnation of the heart.

In adult cattle, smaller villous pericardial proliferations occur so frequently that they almost can be considered to be normal. They are localised to the base of the heart particularly around the major vessels, and comparable proliferations may also be present on the visceral and parietal pleura (particularly on the diaphragmatic surfaces of the lungs and intercostally on the thoracic wall). More widespread proliferations occur occasionally and can include most of the pericardium. However, these changes do not cause adhesions between the pericardium sheets. The cause of these proliferations is not known.

Widespread changes that extend to the muscular part of the heart necessitate partial condemnation of the heart. In most cases, local stripping out is sufficient.

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Pericarditis

Pericarditis can have either a haematogenous or traumatic origin. Haematogenous pericarditis occurs in all animal species, but is particularly prevalent in pigs. The agent is typically *Mycoplasma* spp., *Haemophilus parasuis, Streptococcus suis* or *Pasteurella multocida*, but other bacteria may also be involved. The exudate is often fibrinous or has a purulent character, particularly if *Trueperella (Arcanobacterium) pyogenes* is involved. Chronic pericarditis is generally fibrous and adhesive, but if the agent persists the changes can develop into a chronic fibrinous direction with a layer of granulation tissue covered by a layer of fibrin. Acute exudative pericarditis necessitates total condemnation. Chronic exudative pericarditis necessitates partial condemnation unless complications are present. Chronic fibrous pericarditis necessitates partial condemnation.

Pericarditis in cattle is often caused by trauma, and typically results from perforation of the forestomachs by a foreign body. In traumatic pericarditis the bacterial flora is generally mixed, and the exudate is purulent to putrid or ichorous. The changes at traumatic pericarditis are often extreme with copious amounts of exudate and a thick layer of connective tissue on the epicardium ("constrictive pericarditis"). Occasionally the foreign body can move into the myocardium and the endocardium giving rise to traumatic myocarditis and traumatic endocarditis.

Acute traumatic pericarditis necessitates total condemnation. Chronic cases also necessitate total condemnation if they are associated with exudate pooling, circulatory disorders, emaciation or other complications. Other cases necessitate partial condemnation.

Endocardial lesions [4.19 – 4.30]

Valvular cysts occur relatively frequently, particularly in cattle. They can contain blood (haemocysts) or lymph (serous cysts) and originate in the blood and lymph vessels, respectively. They are presumably of no consequence for the animal.

Subendocardial mineralisation is most often seen in cattle and manifests as more or less diffuse, hard, whitish deposits. The lesions occur often at the same time in the major arteries, particularly in the aorta. Subendocardial mineralisation can be caused by exposure to high concentrations of vitamin D, or compounds with vitamin D-like actions, including plants. However, it is also well-known that animals with granulomatous inflammations, mostly Johne's disease (paratuberculosis), occasionally exhibit subendocardial mineralisation due to release of calcinogenic compounds during the inflammatory process. Focal mineralisations in horses are most probably due to larval migrations (*S. vulgaris*).

Fibrous diffuse or nodular thickening of the valves is seen particularly in pigs. This may be a sign of healed endocarditis, but is most probably due to blood turbulence secondary to valve insufficiency or congenital defects.

Mineralisations and fibrous thickening of the valves necessitate partial condemnation of the heart.

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Endocarditis

Endocarditis in slaughter animals is nearly always thrombotic and due to bacteria. Endocarditis in cattle is generally caused by *T. pyogenes* or streptococci. In pigs, *Erysipelothrix rhusiopathiae* and *S. suis* are most frequently isolated. Endocarditis begins by colonisation of the endocardium (generally along the free border of a valve) which triggers an inflammatory reaction with activation of the coagulation cascade. This forms a network of fibrin which is an ideal medium for bacteria. This thrombus is invaded by blood vessels and inflammatory cells but, due to the continuous deposition of fibrin, eventually increases in size to fill large areas of the cardiac lumen. In verrucous endocarditis, the thrombi in the heart have a typical cauliflower or wart-like appearance. A cut section of the thrombus reveals the characteristic layers comprising an outer red layer of fibrin (towards the cardiac lumen), then a lighter, bacteria-containing fibrin layer, followed by a layer of pus adjoins a border of granulation tissue. This gradually changes to light-coloured connective tissue at the base of the thrombus. If pyogenic bacteria are not the cause, the pus layer is missing. The term ulcerative endocarditis is used if the inflammation is particularly characterised by purulent waste and ulceration of the underlying valve and myocardium.

Endocarditis is most frequently valvular, i.e. originating in a cardiac valve, but as a rule major lesions will also affect the mural endocardium. Mural endocarditis alone, occurs rarely. In cattle, endocarditis most often originates from the right side of the heart, particularly on the tricuspid valve, but has a strong tendency to spread to the left side. About 50% of the cases are thus bilateral. In pigs and other species, most cases originate in the mitral valve on the left side. Bilateral cases are relatively rare.

Acute endocarditis is demonstrated very rarely. In these cases, the changes are dominated by endocardial haemorrhages, possibly with small amounts of fibrin. Often, the diagnosis "acute endocarditis" can only be made after histological examination.

Only rarely is chronic healed endocarditis demonstrated in which the lesions are covered by endothelium. These will frequently be the site of mineralisation.

Endocarditis is frequently associated with complications, particularly in cattle. In addition to the typical signs of impaired cardiac function, lung infarctions and embolic pneumonia will frequently be observed in cattle. Cutting the pulmonary arteries will reveal infected thrombi. In left-sided endocarditis there is often spread to the kidneys and possibly other organs, including the cardiac muscle.

Cases of endocarditis in animals other than pigs from integrated production systems necessitate total condemnation. However, endocarditis in piglets, sows and boars necessitates total condemnation. Endocarditis in pigs from integrated production systems, and healed endocarditis in all animals, necessitates partial condemnation of the heart. Complications, including spread of the thrombus mass to the aorta or the pulmonary trunk, necessitate total condemnation.

Myocardial lesions [4.31 – 4.41]

The myocardium can undergo atrophy, hypertrophy, or dilatation. Atrophy is seen in particular in older animals, primarily cattle, and is often associated with brown dis-

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colouration as a result of deposition of lipofuscin in the myocardial cells. Deposits of lipofuscin in cardiac muscle often occurs in cases of cachexia but can also be seen in nutritionally normal animals. Atrophy and lipofuscinosis necessitates partial condemnation of the heart. Cardiac hypertrophy is due to increased load and therefore represents so-called exercise hypertrophy. The increased load can be either a result of increased resistance (pressure overload) or increased blood volume (volume overload). Thickened ventricular walls and reduced ventricular volume are often observed in the former. This condition is called concentric hypertrophy and is normally due to stenoses, as in subaortic or pulmonic stenosis, but diffuse pulmonary lesions can also induce similar changes in the right side of the heart. In increased volume load, dilatation of the ventricles and atria is observed with increased myocardial mass. In spite of the increased myocardial mass, the cardiac wall appears thin-walled and flaccid. The cause of this condition, which is called eccentric hypertrophy, is generally defective atrioventricular valves or semilunar valves which results in backflow of blood to the atria and ventricles. Communication between the two halves of the heart, as in ventricle or atrial septal defect, results typically in concentric hypertrophy of the right ventricle and excentric hypertrophy of the left ventricle. The result is that the two ventricles resemble each other with regard to volume size and wall thickness.

At dilatation, the volume of the atria or ventricles is increased. The boundary between dilatation and excentric hypertrophy is vague, and it can be very difficult in some cases to decide which one it is. Dilatation of the heart is seen as a late stage in a number of heart conditions, including concentric and eccentric hypertrophy, myocarditis, myocardial necroses and cardiomyopathy.

Cardiac hypertrophy and cardiac dilatation necessitate partial condemnation of the heart, unless the cause or any complications necessitate total condemnation.

Lipomatosis and steatosis

The occurrence of excessive quantities of fatty tissue in the myocardium is called lipomatosis and represents a congenital malformation. Lipomatosis necessitates partial condemnation of the heart.

Steatosis is due to accumulation of triglycerides in the myocardial cells. Generally, the condition occurs secondary to metabolic disorders and intoxications. It tends to occur together with hepatic steatosis and occasionally with renal steatosis. The heart appears pale in colour, and the consistency can be reduced. The occurrence of myocardial steatosis at the same time as fatty liver must be considered as an aggravating finding at meat inspection that normally necessitates total condemnation.

Myocarditis

Myocarditis is seen as a complication to a number of viral and bacterial diseases that necessitate total condemnation. Pyaemia can result in spreading to the heart with formation of abscesses in the myocardium. The presence of other conditions (e.g. endocarditis or any complications) necessitates total condemnation. The presence of encapsulated, chronic lesions only, necessitates partial condemnation with approval for deboning of the carcase. Alternatively, total condemnation.

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Parasitic myocarditis is seen particularly in cattle and is generally due to infection with sarcosporidia (*Sarcocystis* spp.). The changes manifest as multifocal or sometimes disseminated greenish lesions in the myocardium. The lesions can be the site of mineralisation. Meat inspection scoring of sarcosporidiosis depends on whether the skeletal muscles are affected. The heart is condemned in all cases, and the lesions in the skeletal muscles are stripped out. Total condemnation is necessary if complete stripping is not possible.

The heart is one of the preferred sites for bovine cysticerci (*Cysticercus bovis*). The appearance of the lesions depends on the viability of the cysticerci. The viable cysticercus appears as a clear, fluid-filled oval cyst 7-10 mm long and about 5 mm wide, surrounded by a whitish host capsule. After a certain time, the cysticercus undergoes degeneration and is converted into a yellow-greenish mass surrounded by an eosinophilic reaction which macroscopically appears green. If bovine cysticerci are demonstrated at meat inspection, the chewing muscles, diaphragm and heart are cut into thin sections and carefully examined. If 10 viable or dead cysticerci are detected at this examination, the tongue and underlying muscles must be examined in the same way. Findings of more than 10 viable or dead cysticerci necessitates total condemnation. Findings of up to 10 viable and dead cysticerci necessitate approval of carcase and organs conditional on freezing. Notwithstanding, the head, heart, diaphragm, oesophagus and cysticerci-infected organs as well as the tongue, if it has been cut for examination, must always be condemned. Findings of up to 10 dead cysticerci in cattle older than 2 years necessitates unconditional approval of the carcase which must be health marked to show that it is not to be exported.

Occasionally in cattle, and more rarely in pigs, eosinophilic myocarditis is found for which no agent can be demonstrated. Similar lesions with diffuse or multifocal green discolouration are often seen in the skeletal muscle. It is not possible to distinguish this condition macroscopically from sarcosporidiosis. It is therefore processed in the same way at meat inspection.

Cardiomyopathy

Cardiomyopathy occurs sporadically in Danish cattle, particularly in Danish Red Cattle. This condition, which is also called myocardial fibrosis is inherited. It manifests as diffuse deposits of connective tissue in the myocardium thereby giving it a very firm consistency. The appearance of the heart can be quite unremarkable but, at cutting, the myocardium appears somewhat pale and the ventricles can be dilated. Secondary changes such as oedema and congestion can be quite extensive. Uncomplicated cases of cardiomyopathy necessitate partial condemnation of the heart. The presence of any complications necessitates total condemnation.

Myocardial necrosis

Necrosis of the myocardium is associated with a number of systemic muscle diseases that are characterised by necrosis of the myocytes (see Chapter 15). These include necrosis caused by deficiency conditions (particularly vitamin E and/or selenium deficiency), intoxications, infections and extreme stress, for example in connection with transport.

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Regardless of the cause, the changes are characterised by pale cardiac muscle, which can be wet, and the site of calcification and haemorrhage. The latter is particularly prevalent in pigs with "mulberry heart disease" (see Circulatory disorders p. 78).

Uncomplicated cases necessitate partial condemnation of the heart. However, the presence of toxicity or infections necessitates total condemnation.

Infarctions of the cardiac muscle have been discussed under the section on circulatory disorders.

Neoplasms [4.42 – 4.49]

Neoplasms in the heart are relatively rare. Occasionally, tumour-like growths that are covered by endothelium and project into the cardiac lumen are found in calves. These are called rhabdomyomas, but it is uncertain whether they are a malformation or a benign tumour. The condition necessitates partial condemnation.

Bovine angioleiomyomas are benign subendocardial tumours that are found close to the atrioventricular valves or the papillary muscles. They are most often solitary but multiple tumours are occasionally seen. They tend to protrude into the ventricular lumen in a thrombus-like fashion, but they are smooth and covered with endothelium. Transection of the tumours usually reveals a characteristic structure with areas consisting of white connective tissue and dark areas containing blood-filled vascular spaces.

So-called heart base tumours originating from chemoreceptors in the aortic body and ectopic thyroid tissue can be seen particularly in cattle. The tumours can be benign or malignant, and they can result in compression of the arteries and the major vessels at the base of the heart with consequent circulatory disorders. Malignant basal heart tumours necessitate total condemnation. Benign tumours without complications necessitate partial condemnation of the heart.

In Danish slaughter animals, the most frequently occurring cardiac tumour is undoubtedly multicentric schwannomas. The condition is also called neurofibromatosis and manifests as oval, yellowish, fleshy lesions that originate in the epicardial nerves. In certain cases, the tumours can originate in the endocardial nerves and may then be confused with thrombotic endocarditis. Multicentric schwannomas originate in the Schwann cells surrounding the nerves in and around the thoracic cavity. They are also frequently found around the brachial plexus, intercostally, in the mediastinum and at the spinal nerve roots. The tumours can be numerous and grow to a large size. However, these are not metastases but discrete tumours that have arisen more or less at the same time, probably because of a genetic defect. At meat inspection, all tumour tissue is stripped out, with partial condemnation of the affected areas. It is particularly important to loosen the shoulders and inspect both brachial plexus. If the changes are pronounced, the carcase may be approved for deboning, otherwise total condemnation. The heart, in particular the right auricle, is one of the preferred sites for lymphosarcomas in cattle. The tumour is greyish and has a fleshy consistency. Infiltration of the myocardium is observed, and generally lesions are also found in other organs. This condition necessitates total condemnation.

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Vascular system [4.50 – 4.57]

A number of infectious and non-infectious conditions are characterised macroscopically by extensive haemorrhage that is due to primary involvement of the vascular system. Because some of these diseases (e.g. hog cholera and African swine fever) result in extremely high losses, it is particularly important to be familiar with their pathoanatomic picture. The diseases included in the differential diagnosis of extensive haemorrhage may also be due to defects of the coagulation system. Hog cholera and other diseases characterised by extensive haemorrhage are discussed in detail in Chapter 10.

Mineralisations

Subendothelial mineralisation is occasionally seen in the larger arteries in cattle and manifests as more or less diffuse, hard, whitish deposits. There are often concomitant changes in the heart. The changes could be due to high concentrations of vitamin D or substances, including plants, with vitamin D-like actions. It is also well-known that animals with granulomatous inflammations, mostly Johne's disease, can have subendothelial mineralisations. Focal mineralisations in horses are most probably due to larval migrations (*S. vulgaris*).

Aneurysms

Arterial aneurysms are defined as dilatation of an artery due to a weakness in the arterial wall. In slaughter animals, aneurysms are nearly always due to an inflammatory condition in the arterial wall, and there is thus concomitant arteritis. In horses, aneurysms are seen at the root of the mesenteric arteries, particularly in the ileocolic artery, due to thrombotic arteritis caused by *S. vulgaris* larvae. The condition normally necessitates partial condemnation. However, it can result in infarctions in the intestines and other complications which necessitates total condemnation.

In cattle, aneurysms are most often seen in the pulmonary artery secondary to pyaemic spread and consequent thrombotic endarteritis. The bacterial infection results in weakening and dilatation of the artery wall which can rupture causing haemorrhage to the bronchial system. Pyaemic thrombotic endarteritis in the pulmonary artery necessitates total condemnation.

Arteritis and phlebitis

Thrombotic endophlebitis is most frequently seen in the caudal vena cava in cattle and is normally due to purulent spread from a subphrenic or hepatic abscess. The condition which can result in congestive changes in the liver and pyaemic spread to the lungs necessitates total condemnation.

Omphalophlebitis is due to infection in the navel in the young animal with ascending spread in the umbilical vein, possibly to the liver. Acute cases necessitate total condemnation, while chronic cases without complications necessitate partial condemnation.

Iatrogenic thrombotic phlebitis and periphlebitis are seen particularly in the jugular vein and the superficial epigastric cranial vein (milk vein) in cattle. The condition is the result of repeated injections or injections with caustic compounds (e.g. calcium prepara-

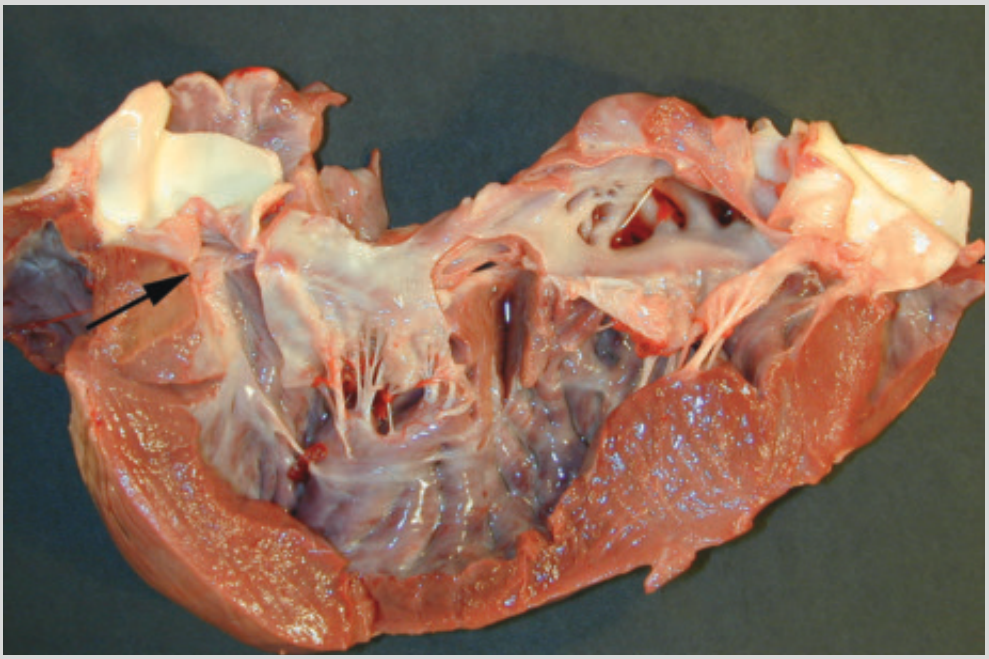
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tions), which damage the vein wall and the surroundings thus initiating a thrombus. The thrombi can become infected. Complications such as widespread congestive changes or infected embolisms necessitate total condemnation. Uncomplicated cases necessitate local stripping.

Polyarteritis (also called panarteritis or periarteritis) nodosa occurs sporadically in pigs. This is a necrotising inflammation in the small and intermediate arteries. The chronic stage is characterised by severe periarterial fibrosis, which means that even small arteries become highly prominent. The cause of the disease in pigs is not known, but it is presumed that this is an immunological reaction (type 3) with deposition of immune complexes in the arterial wall. The changes are seen most frequently in the kidneys, but are also found in other organs in particular the liver, spleen and heart. Polyarteritis nodosa without complications necessitates partial condemnation of the affected organs.

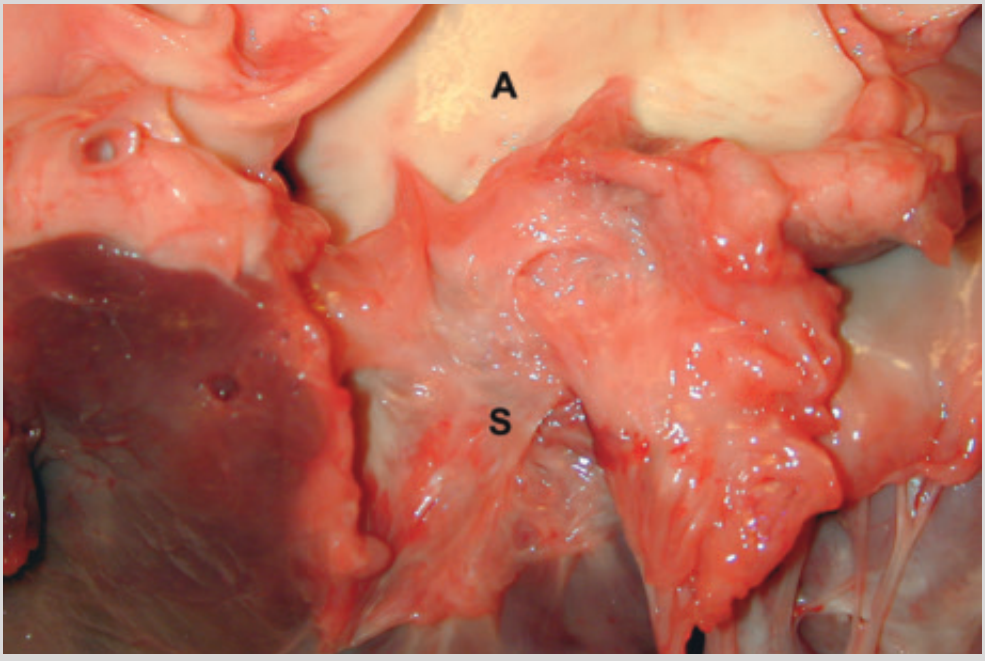
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4.01



Animal species/Organ	Pig/Heart
Lesion	Subaortic stenosis
Scoring	Partial condemnation
Comments	The stenosis manifests as a fibrous cord below the aortic ostium (→)

4.02



Animal species/Organ	Pig/Heart
Lesion	Subaortic stenosis
Scoring	Partial condemnation
Comments	Close-up of the stenosis (S). Aorta (A)

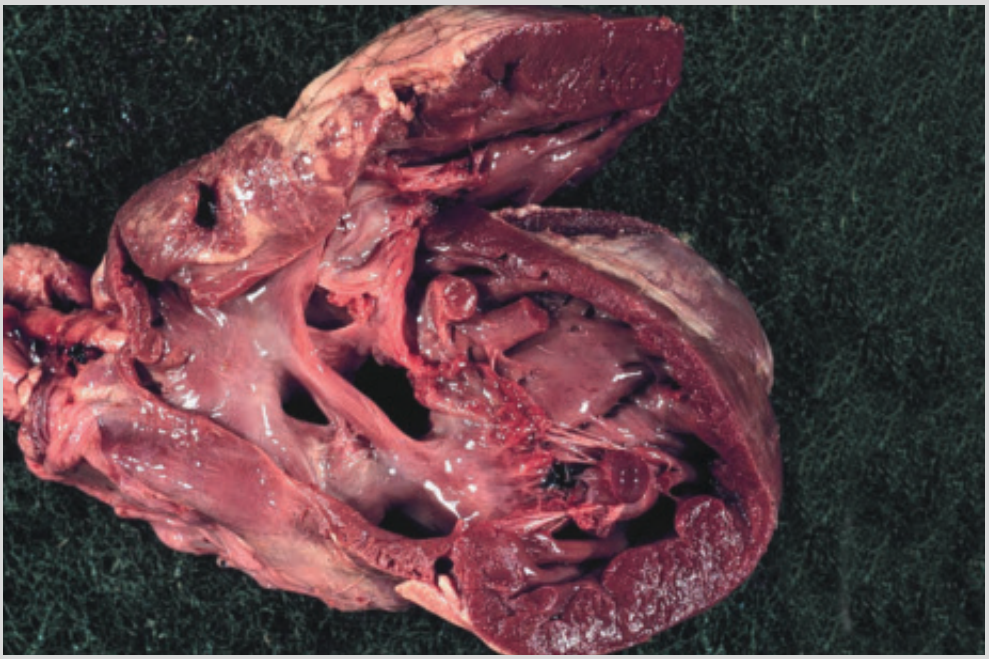
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4.03



Animal species/Organ	Cattle/Heart
Lesion	Ventricular septal defect
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

4.04



Animal species/Organ	Pig/Heart
Lesion	Atrial septal defect
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

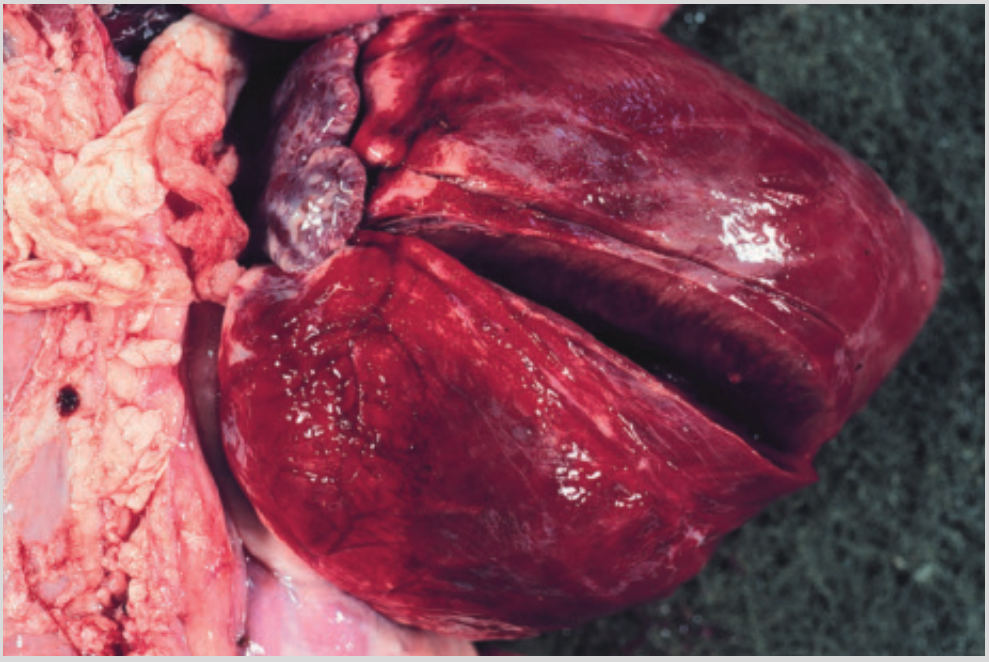
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4.05



Animal species/Organ	Cattle/Heart
Lesion	Multifocal melanosis
Scoring	Partial condemnation
Comments	The changes disappear with age

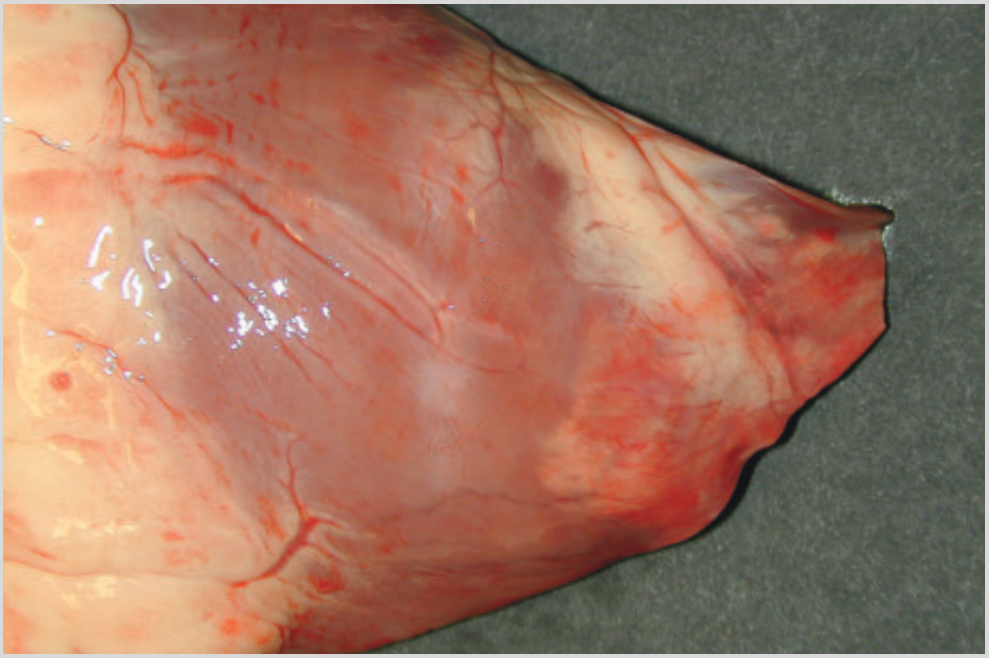
4.06



Animal species/Organ	Pig/Heart
Lesion	Acute myocardial necrosis (“mulberry heart disease”)
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

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4.07



Animal species/Organ	Pig/Heart
Lesion	Chronic infarction
Scoring	Partial condemnation
Comments	Acute infarctions necessitate total condemnation

4.08



Animal species/Organ	Pig/Heart
Lesion	Polyarteritis nodosa
Scoring	Partial condemnation
Comments	Note the prominent arteries

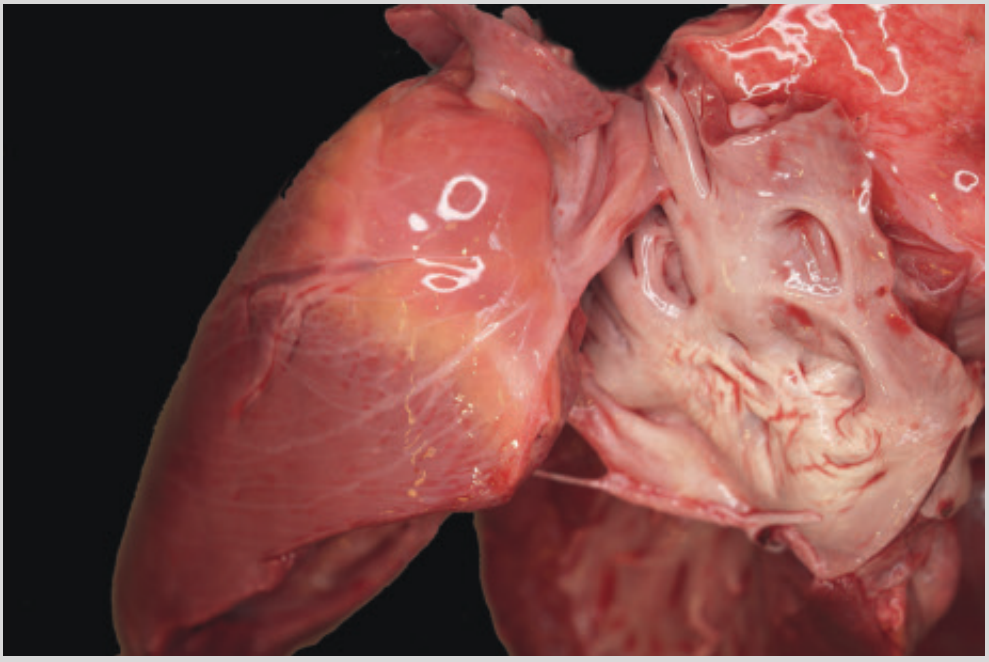
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4.09



Animal species/Organ	Cattle/Heart
Lesion	Vascular malformation
Scoring	Partial condemnation
Comments	Note the many conspicuous blood vessels

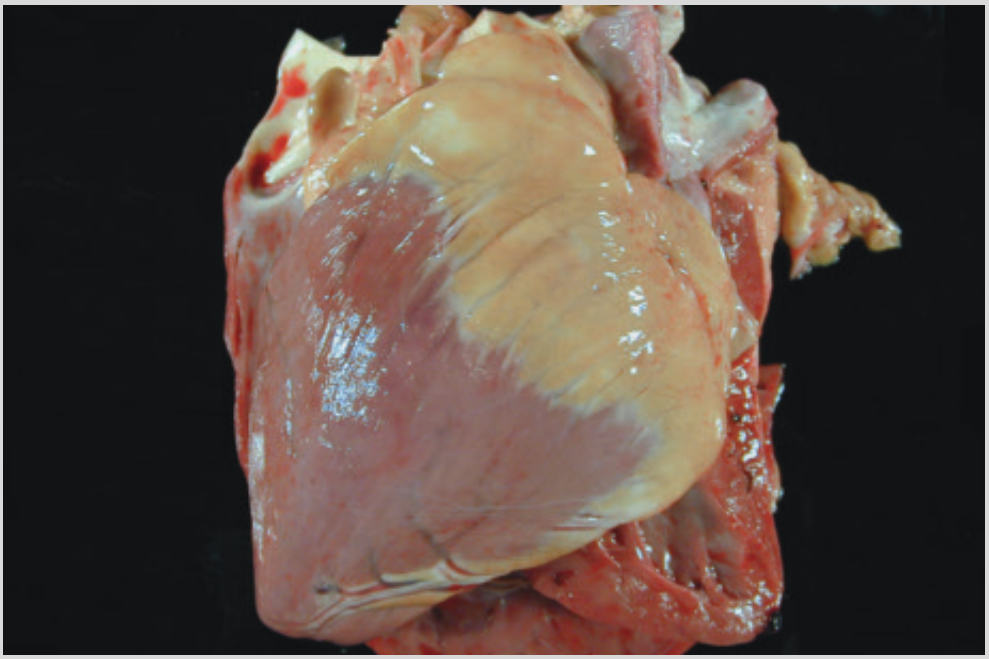
4.10



Animal species/Organ	Sheep/Heart
Lesion	Serous fat atrophy
Scoring	Total condemnation
Comments	The condition is characteristic for cachexia

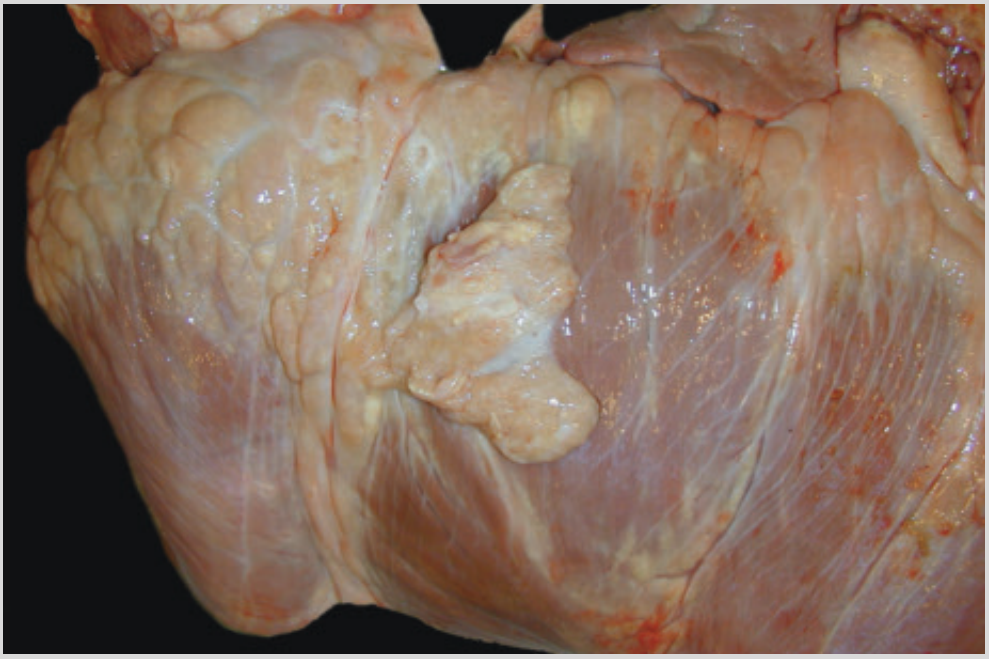
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4.11



Animal species/Organ Horse/Heart
Lesion Steatitis
Scoring Partial condemnation
Comments Extensive changes throughout the carcase necessitate total condemnation

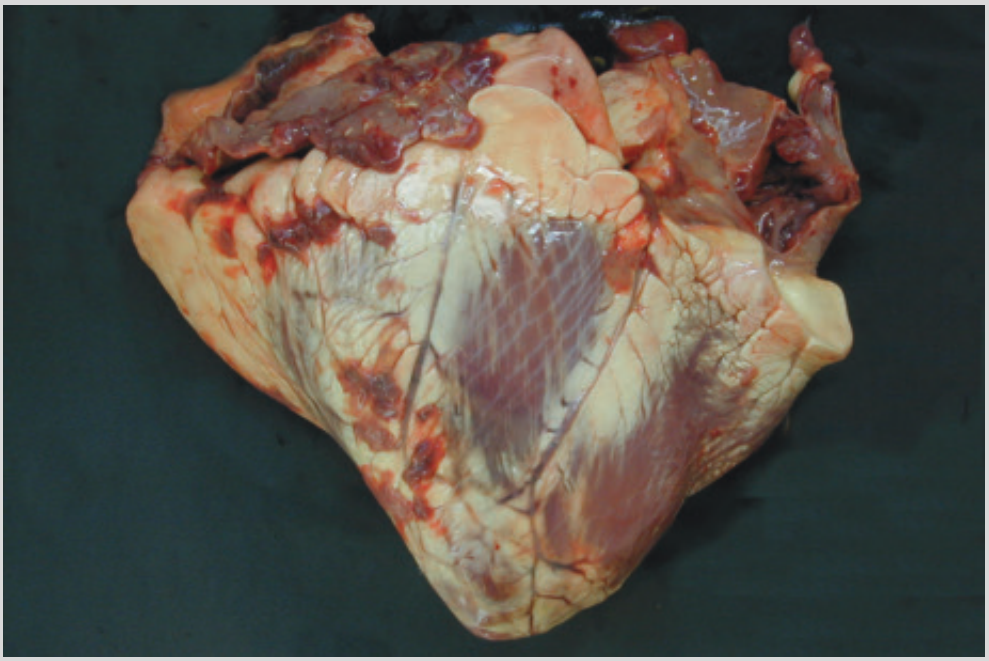
4.12



4.12
Animal species/Organ Cattle/Heart
Lesion Steatitis
Scoring Partial condemnation
Comments Extensive changes throughout the carcase necessitate total condemnation

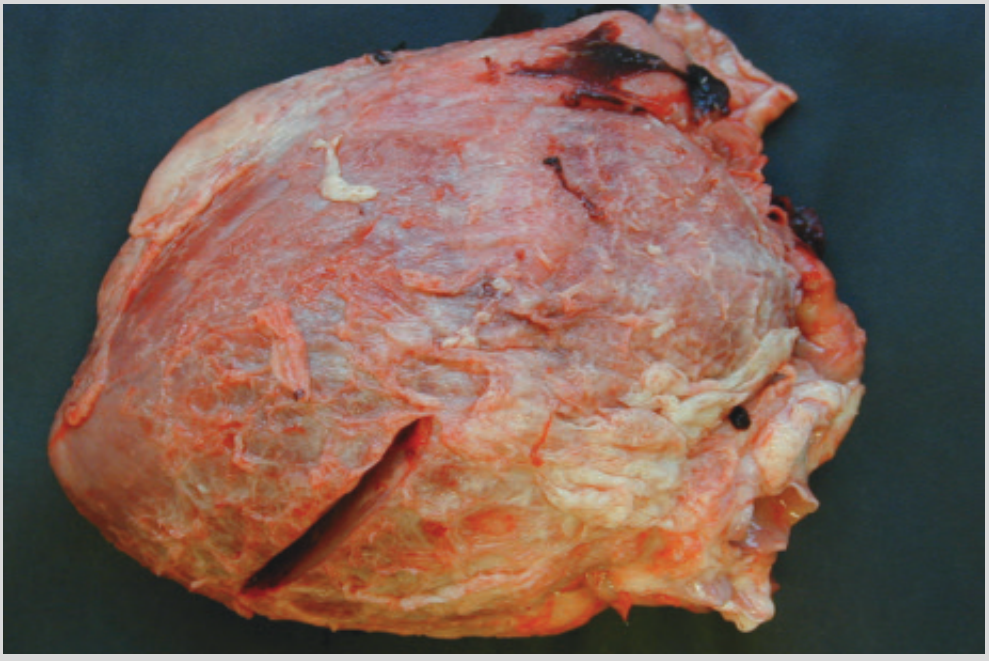
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4.13



Animal species/Organ	Cattle/Heart
Lesion	Pericardial proliferations
Scoring	Partial condemnation
Comments	A frequent finding particularly at the base of the heart

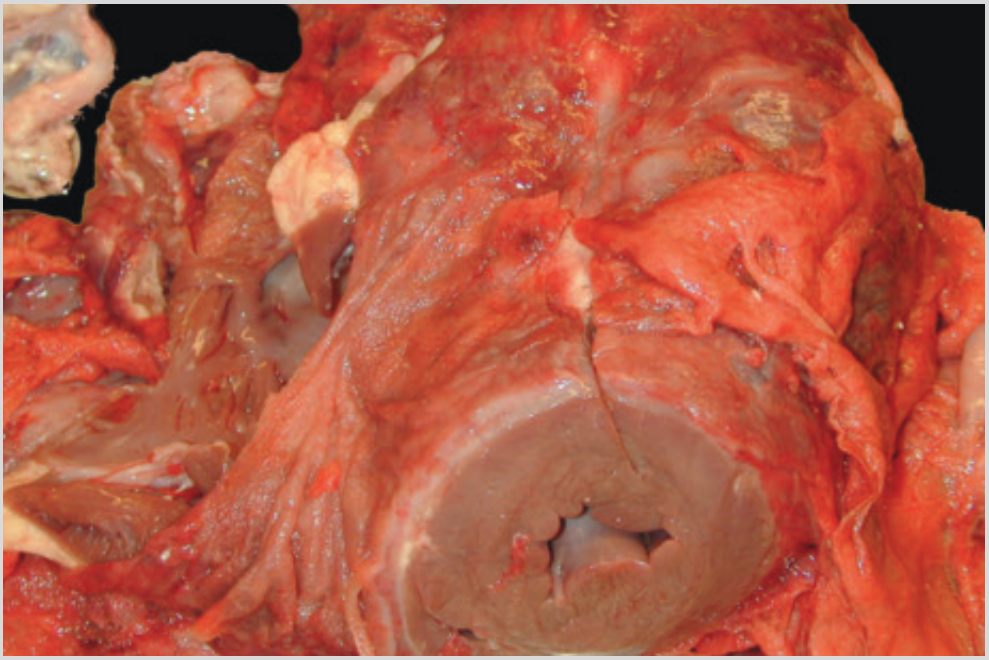
4.14



Animal species/Organ	Pig/Heart
Lesion	Acute, diffuse, fibrinous pericarditis
Scoring	Total condemnation
Comments	Chronic cases necessitate partial condemnation

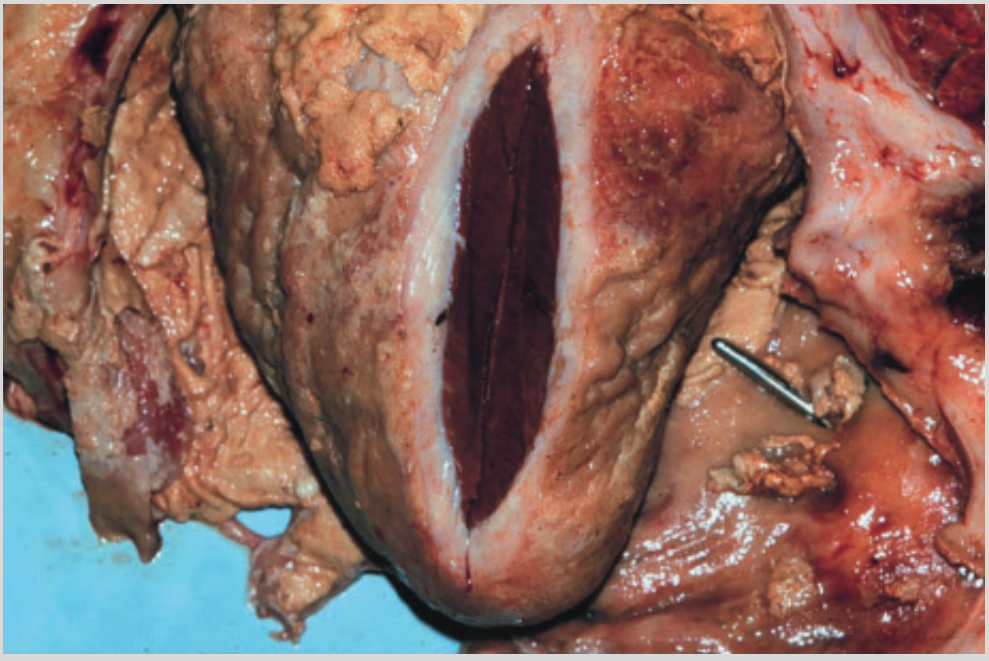
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4.15



Animal species/Organ	Pig/Heart
Lesion	Chronic, diffuse, fibrinous pericarditis
Scoring	Partial condemnation
Comments	Note the thick connective tissue layer between the heart and the fibrin layer

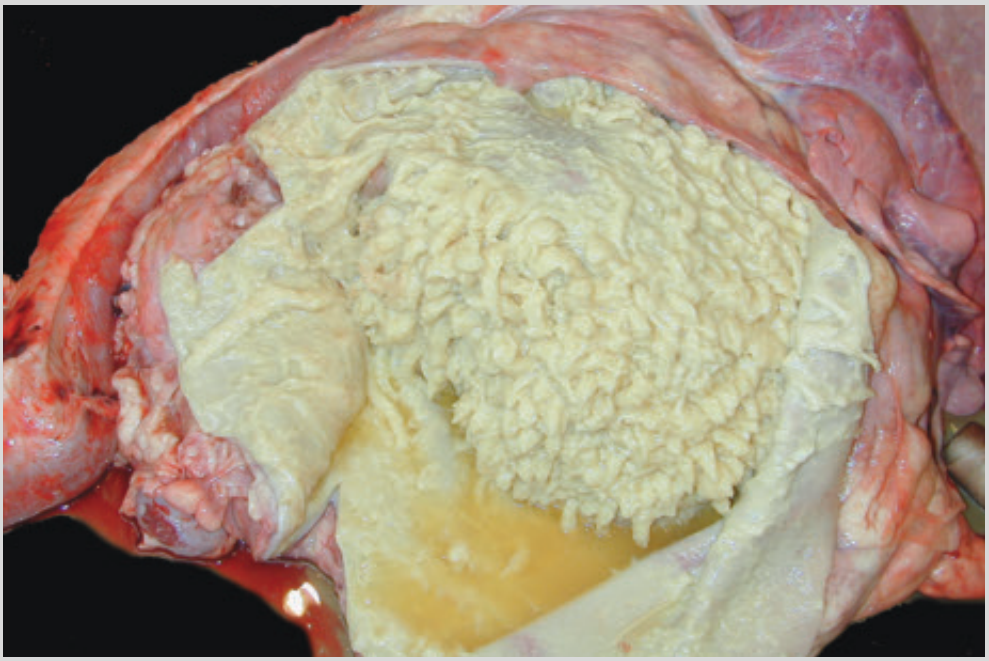
4.16



Animal species/Organ	Cattle/Heart
Lesion	Chronic, diffuse, purulent traumatic pericarditis
Scoring	Total condemnation
Comments	Partial condemnation in absence of exudate pooling and other complications

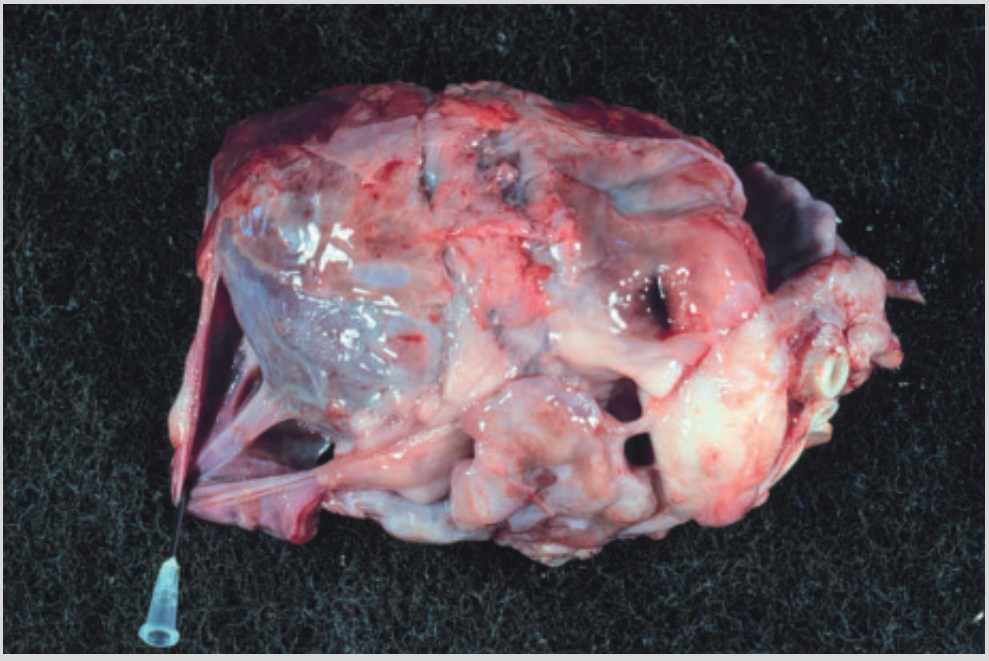
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4.17



Animal species/Organ	Cattle/Heart
Lesion	Chronic, diffuse, fibrinopurulent traumatic pericarditis
Scoring	Total condemnation
Comments	Partial condemnation in absence of exudate pooling and other complications

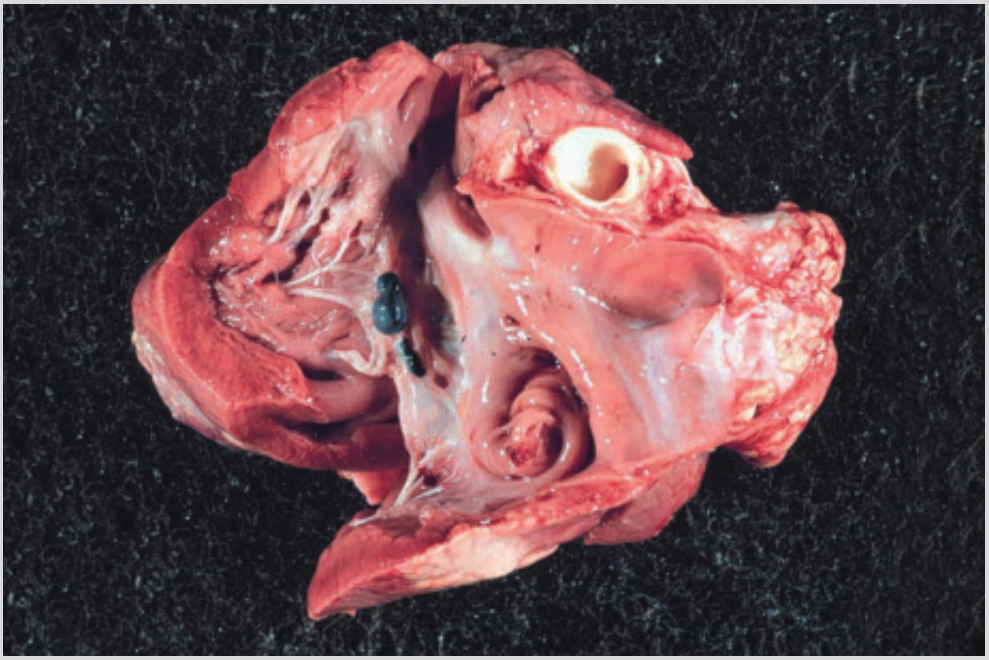
4.18



Animal species/Organ	Pig/Heart
Lesion	Chronic, diffuse, fibrous, adhesive pericarditis
Scoring	Partial condemnation
Comments	Is the most common cardiac finding in pigs

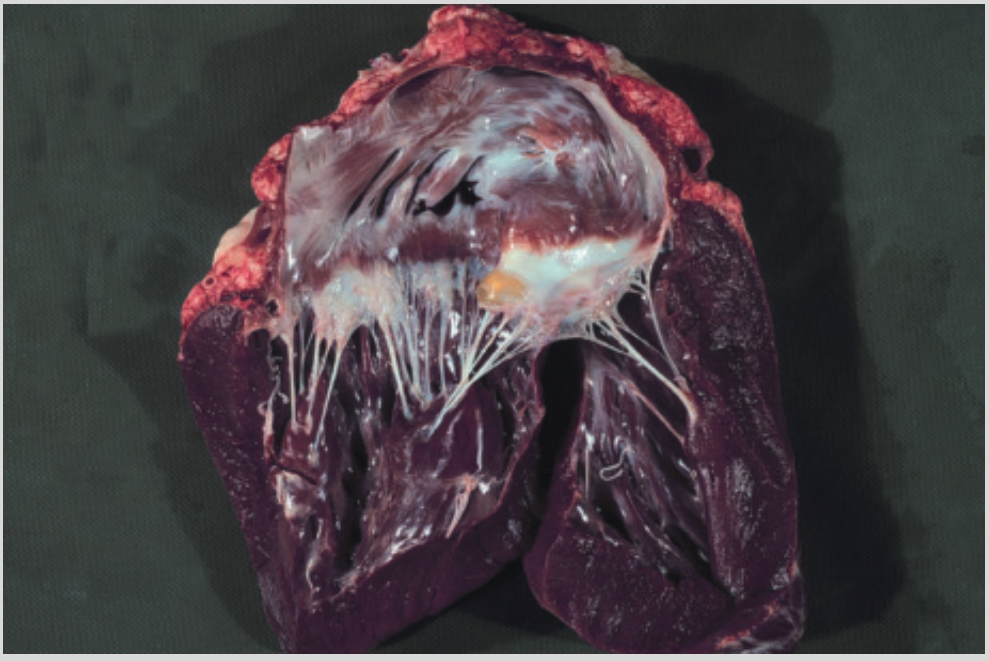
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4.19



Animal species/Organ Cattle/Heart
Lesion Valvular haemocysts
Scoring Partial condemnation
Comments The cysts originate in the capillaries

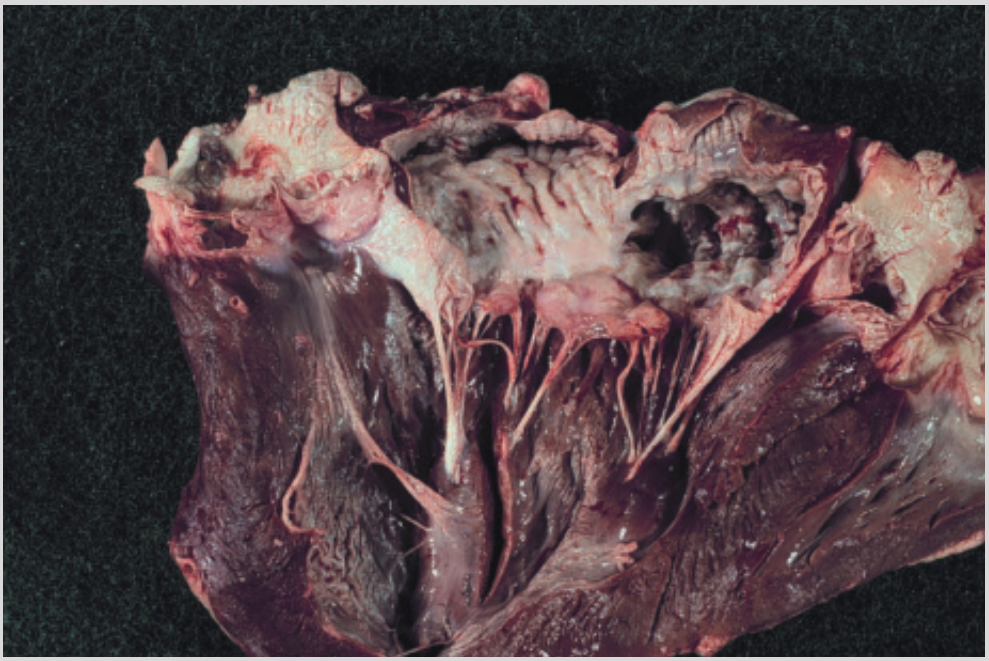
4.20



Animal species/Organ Cattle/Heart
Lesion Valvular serous cyst
Scoring Partial condemnation
Comments The cyst originates in lymph vessels

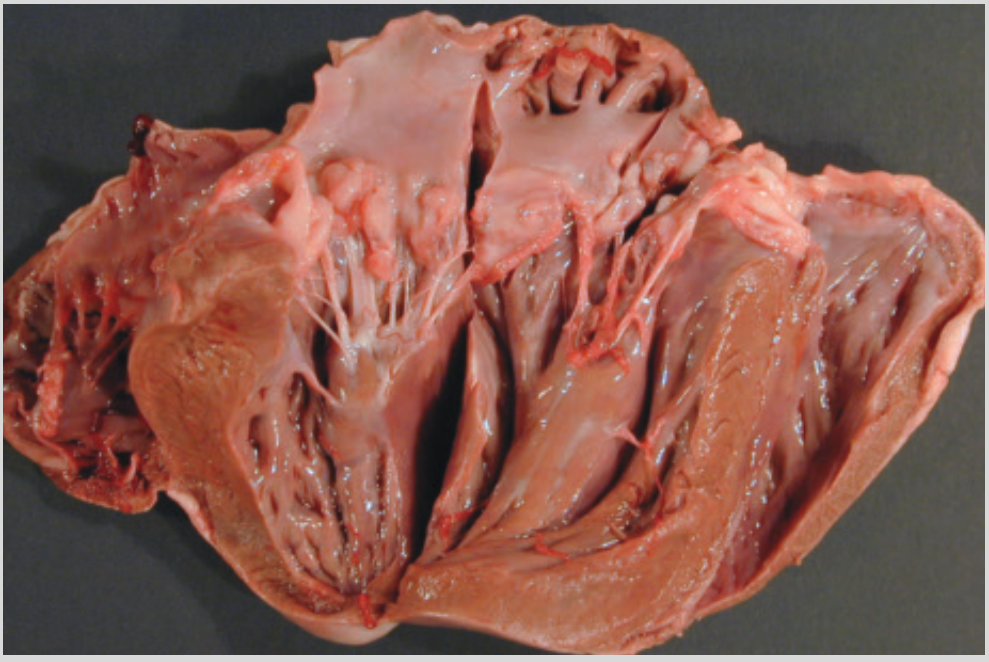
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4.21



Animal species/Organ	Cattle/Heart
Lesion	Endocardial mineralisation
Scoring	Partial condemnation
Comments	Comparable lesions are often seen in the major arteries

4.22



Animal species/Organ	Pig/Heart
Lesion	Valvular fibrosis
Scoring	Partial condemnation
Comments	The changes could represent healed endocarditis

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4.23



Animal species/Organ	Pig/Heart (close-up of 4.22)
Lesion	Valvular fibrosis
Scoring	Partial condemnation
Comments	The changes could be due to turbulence

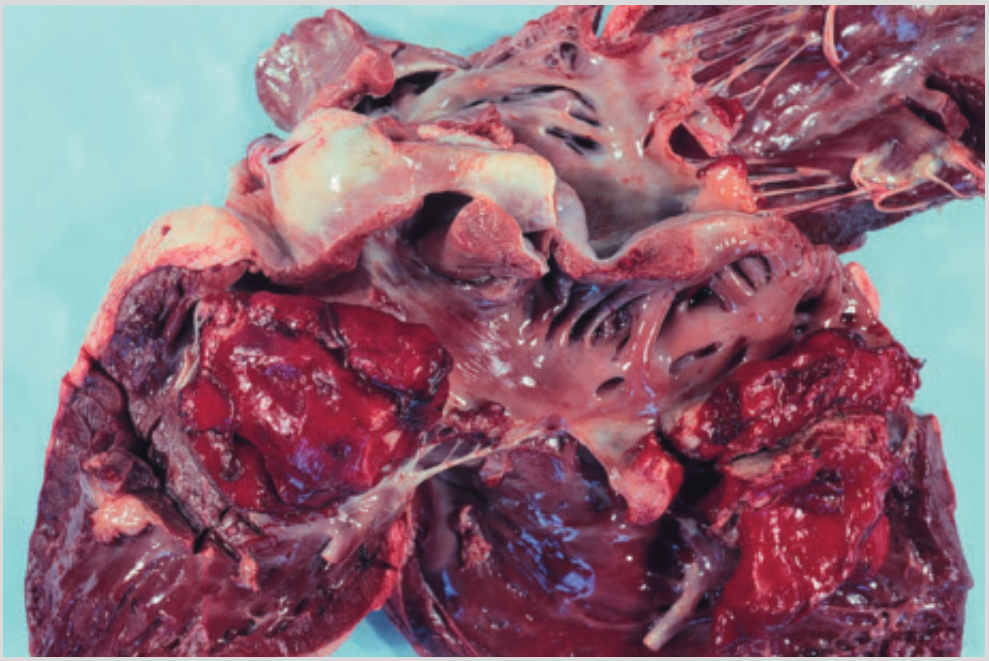
4.24



Animal species/Organ	Pig/Heart
Lesion	Acute, valvular endocarditis
Scoring	Partial condemnation in finisher pigs from integrated production systems
Comments	Haemorrhage in the valves is not always due to endocarditis

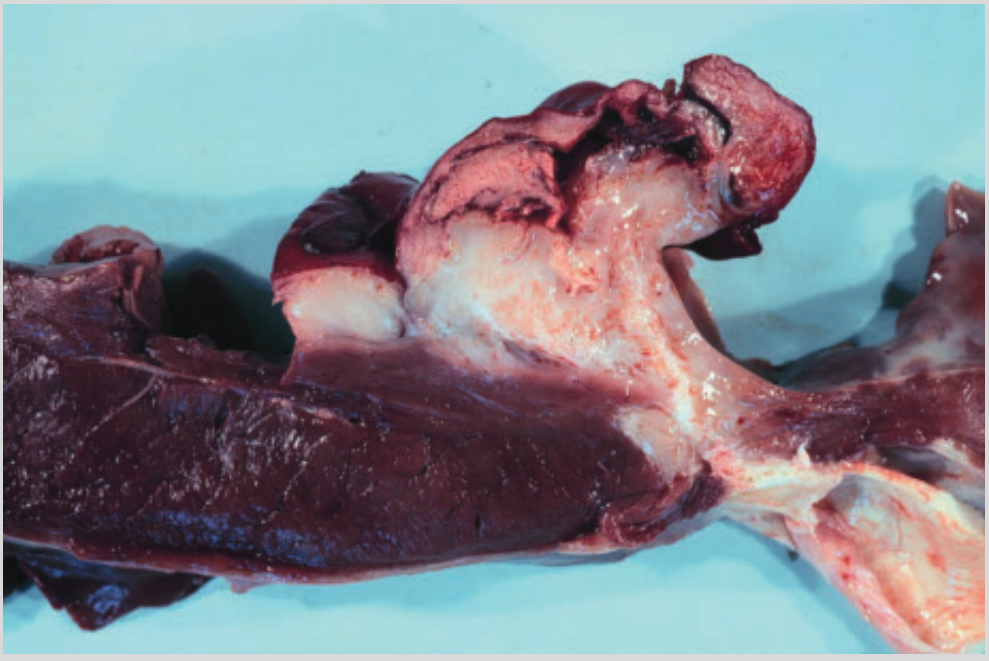
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4.25



Animal species/Organ	Cattle/Heart
Lesion	Chronic, thrombotic, valvular endocarditis
Scoring	Total condemnation
Comments	Note the large thrombi covered by coagulated blood

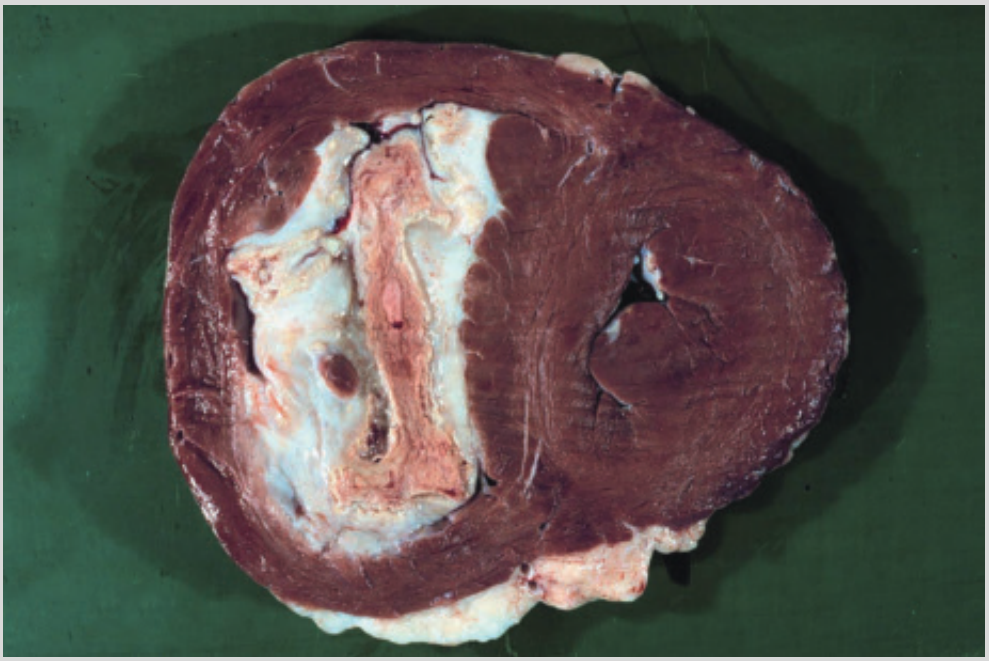
4.26



Animal species/Organ	Cattle/Heart
Lesion	Chronic, thrombotic, valvular endocarditis
Scoring	Total condemnation
Comments	Longitudinal section showing the different layers of the thrombus

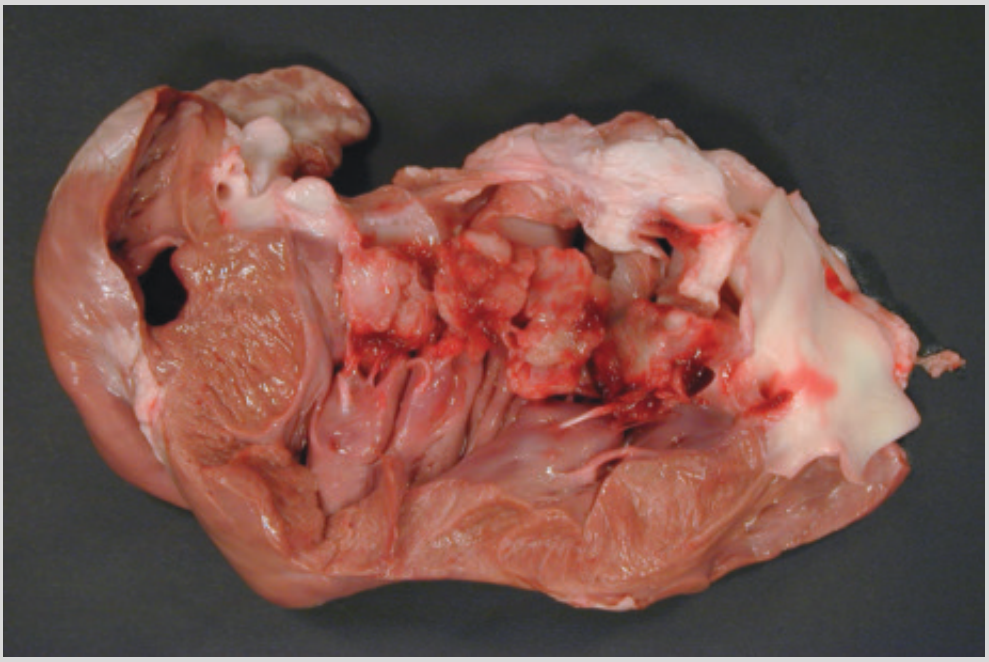
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4.27



Animal species/Organ	Cattle/Heart
Lesion	Chronic, thrombotic, valvular endocarditis
Scoring	Total condemnation
Comments	Cross-section showing a filled right ventricle

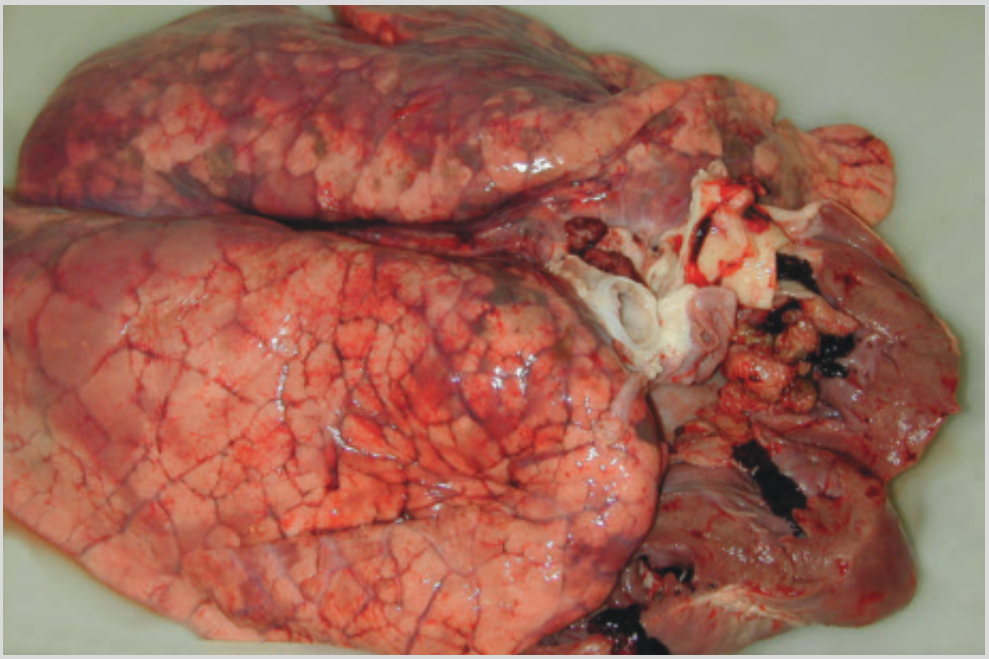
4.28



Animal species/Organ	Pig/Heart
Lesion	Chronic, thrombotic, valvular endocarditis of the mitral valve
Scoring	Partial condemnation in finisher pigs from integrated production systems; in other pigs total condemnation
Comments	Presence of complications necessitates total condemnation

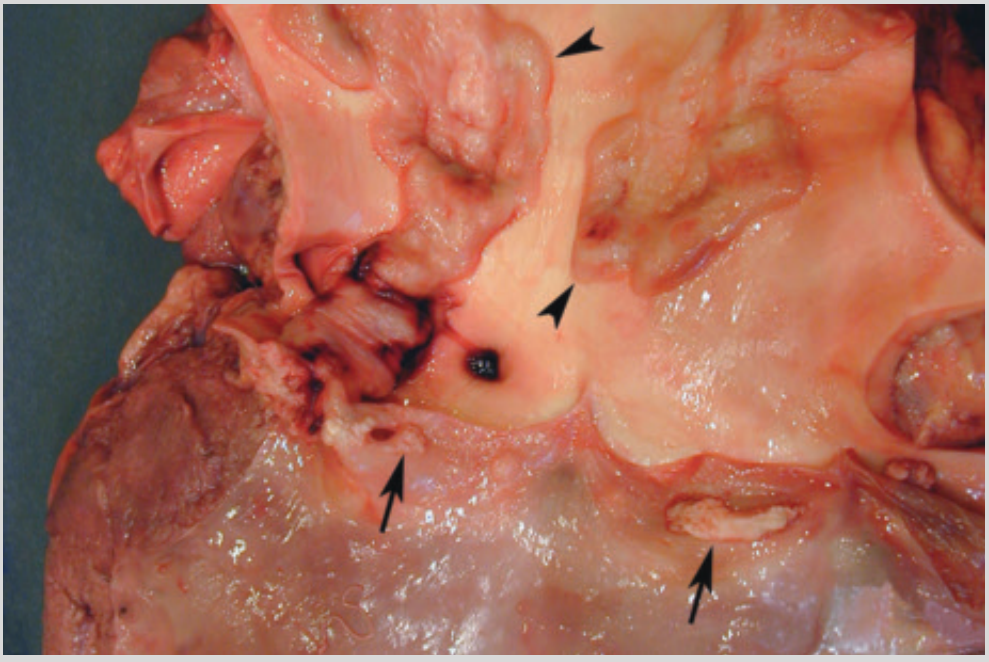
Vet-ebooks.com

4.29



Animal species/Organ	Pig/Heart and lungs
Lesion	Chronic, thrombotic, valvular endocarditis and chronic lung congestion
Scoring	Total condemnation
Comments	Complications (lung congestion) necessitate total condemnation in finisher pigs

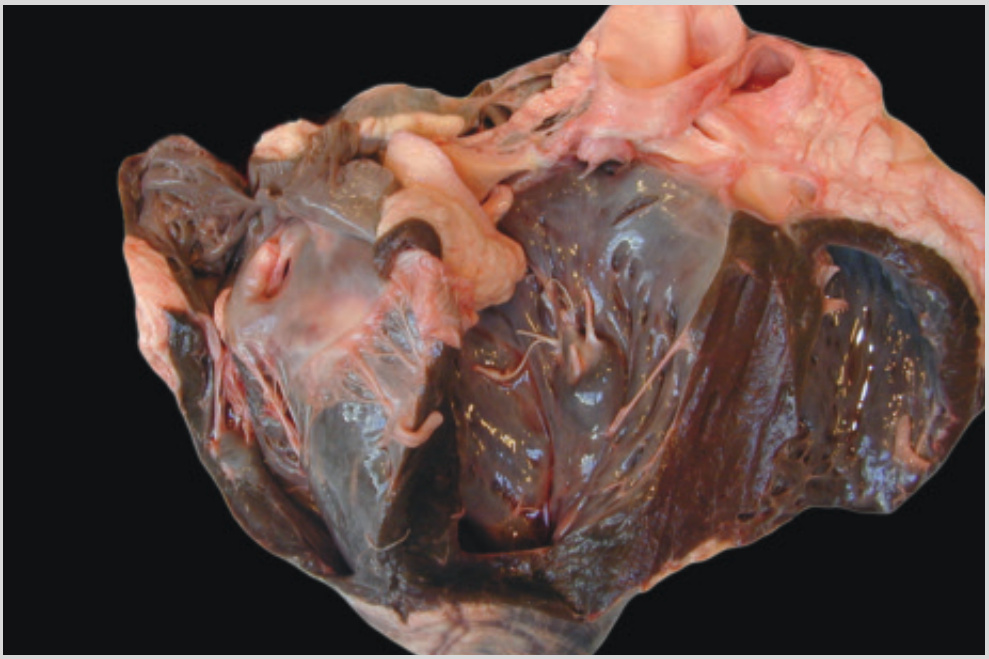
4.30



Animal species/Organ	Pig/Heart and aorta
Lesion	Chronic, thrombotic, valvular endocarditis in the aortic ostium (→) and chronic, thrombotic endarteritis in the aorta (➤)
Scoring	Total condemnation
Comments	The changes in the aorta necessitate total condemnation in finisher pigs

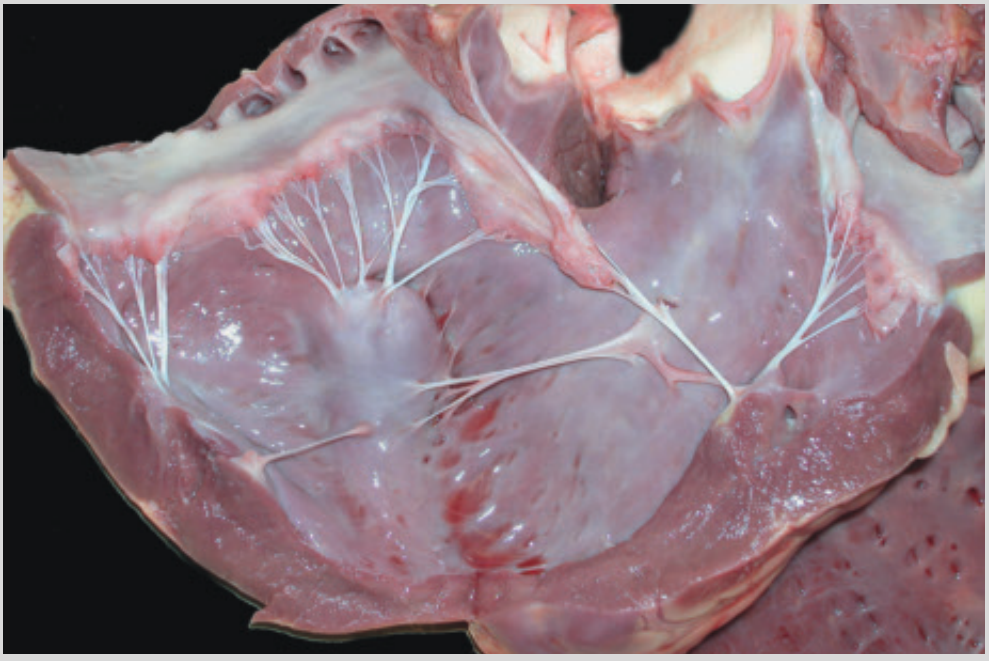
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4.31



Animal species/Organ	Cattle/Heart
Lesion	Lipofuscinosis
Scoring	Partial condemnation
Comments	The condition may be associated with atrophy of the heart

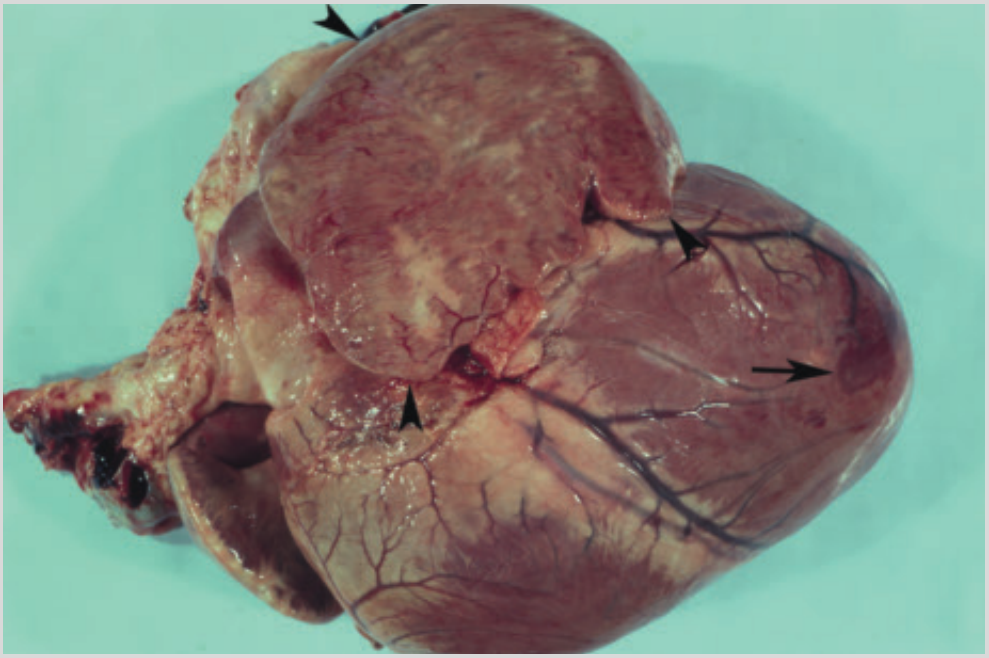
4.32



Animal species/Organ	Horse/Heart
Lesion	Dilatation of the left ventricle
Scoring	Partial condemnation
Comments	Complications (particularly congestive changes) necessitate total condemnation

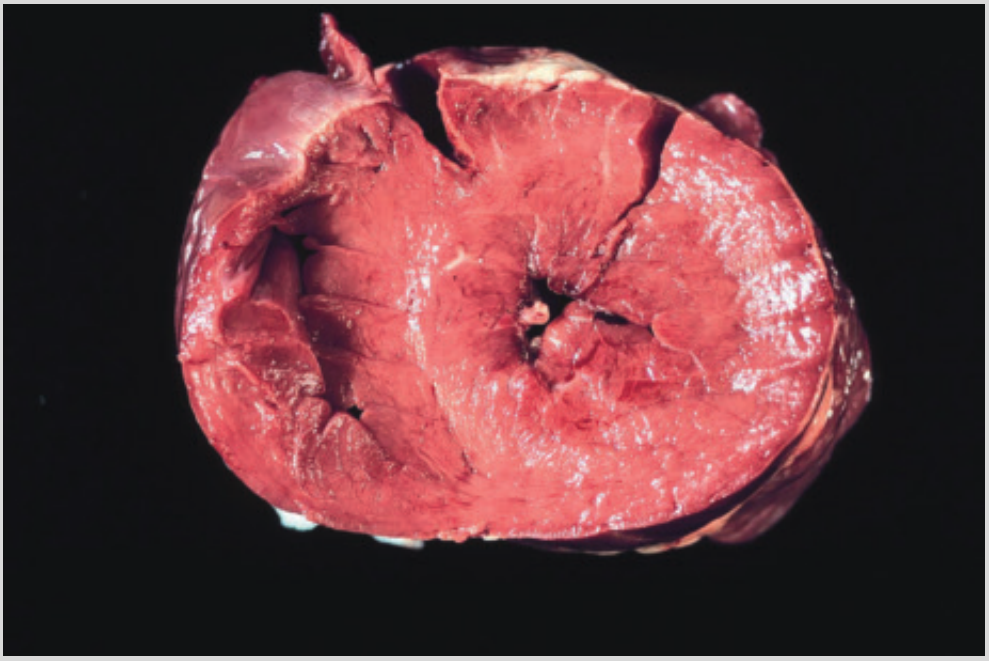
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4.33



Animal species/Organ	Sheep/Heart
Lesion	Acute infarct (→) and dilatation (➤) of the left auricle
Scoring	Total condemnation
Comments	Acute infarcts necessitate total condemnation

4.34



Animal species/Organ	Pig/Heart
Lesion	Concentric hypertrophy
Scoring	Partial condemnation
Comments	In pigs the cause is most often subaortic stenosis

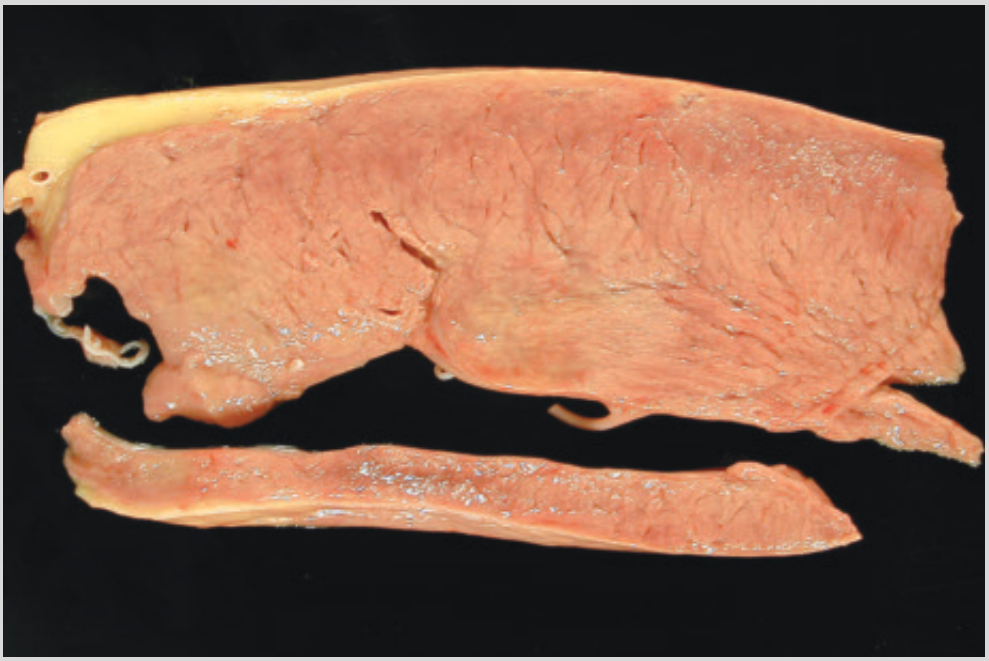
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4.35



Animal species/Organ	Cattle/Heart
Lesion	Lipomatosis
Scoring	Partial condemnation
Comments	Excessive amounts of fatty tissue are seen in the heart

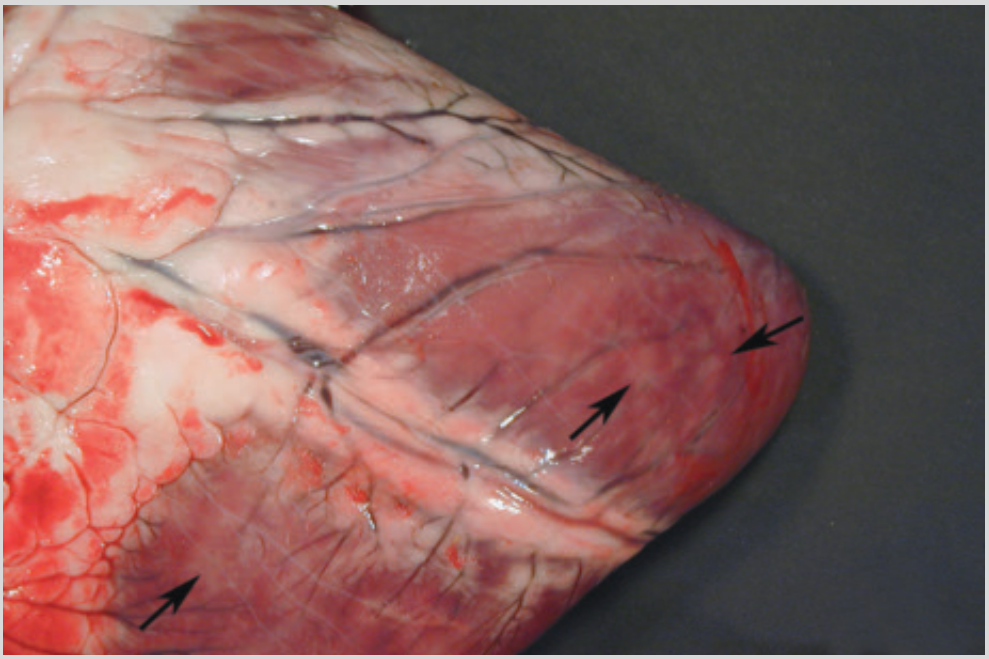
4.36



Animal species/Organ	Cattle/Heart
Lesion	Steatosis
Scoring	Partial condemnation
Comments	Metabolic disorders or intoxications necessitate total condemnation

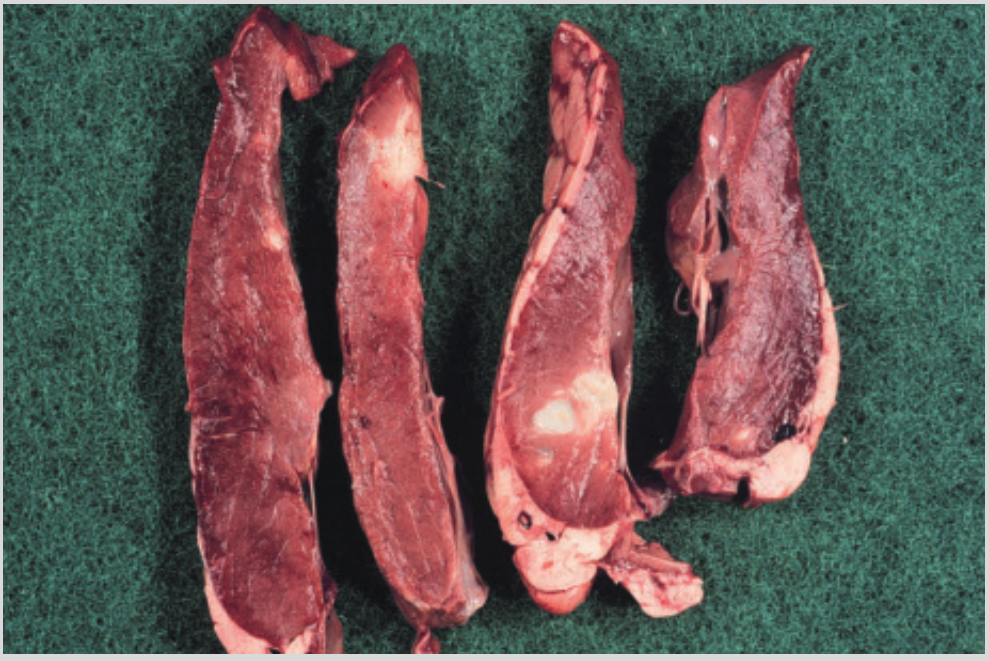
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4.37



Animal species/Organ	Cattle/Heart
Lesion	Chronic, non-purulent myocarditis
Scoring	Partial condemnation
Comments	Pale infiltrations in the myocardium (→)

4.38



Animal species/Organ	Cattle/Heart
Lesion	Chronic, embolic, myocarditis with abscess formation
Scoring	Approved for deboning
Comments	Presence of acute lesions necessitates total condemnation

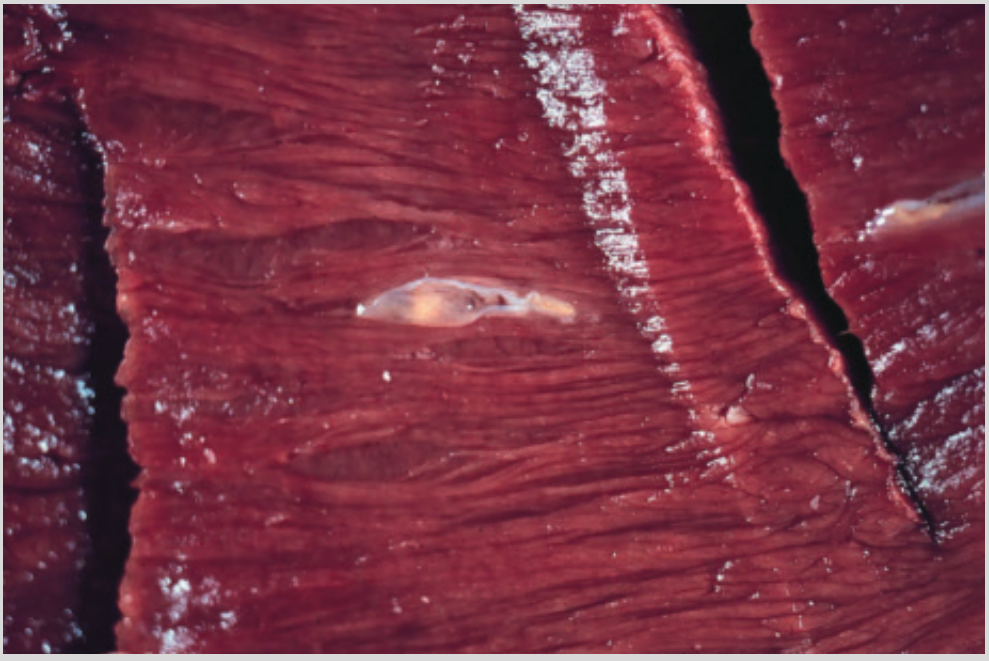
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4.39



Animal species/Organ	Cattle/Heart
Lesion	Chronic, eosinophilic, parasitic myocarditis
Scoring	Partial condemnation
Comments	The changes are probably due to sarcosporidia

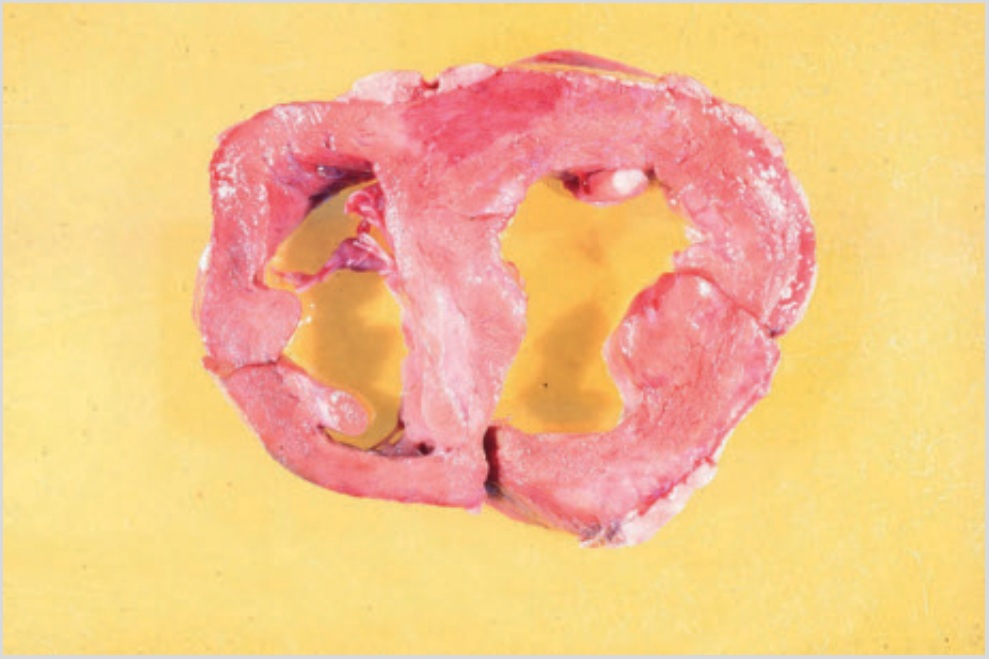
4.40



Animal species/Organ	Cattle/Heart
Lesion	Cysticercosis (viable *Cysticercus bovis*)
Scoring	Conditional approval of carcase and organs
Comments	Findings of more than 10 cysticerci necessitate total condemnation

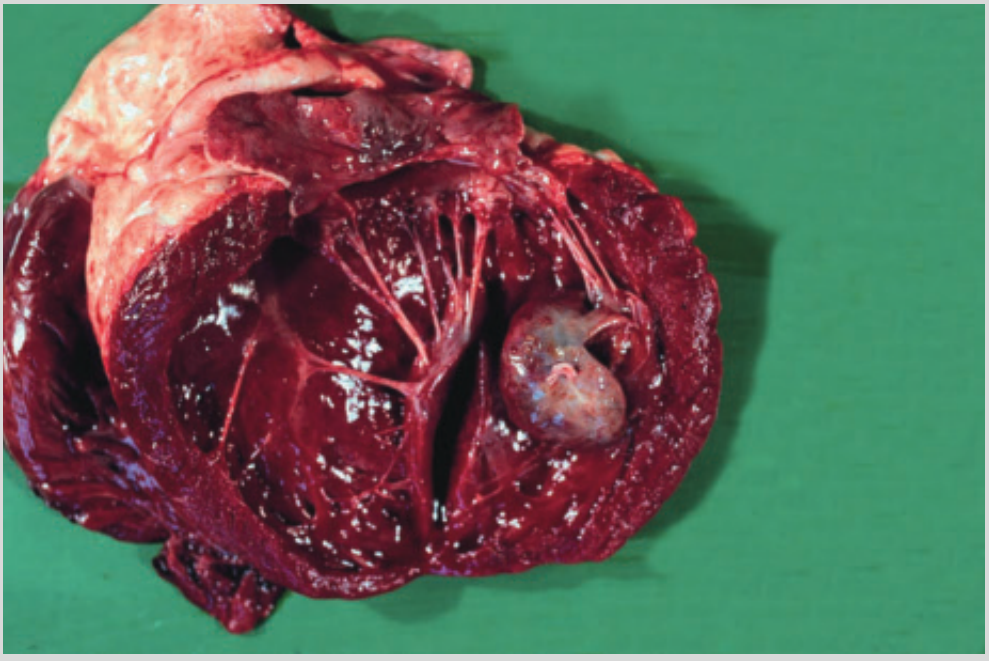
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4.41



Animal species/Organ	Cattle/Heart
Lesion	Nutritional muscle degeneration
Scoring	Partial condemnation
Comments	Widespread changes in the skeletal muscles necessitate total condemnation

4.42



Animal species/Organ	Cattle/Heart
Lesion	Rhabdomyoma
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

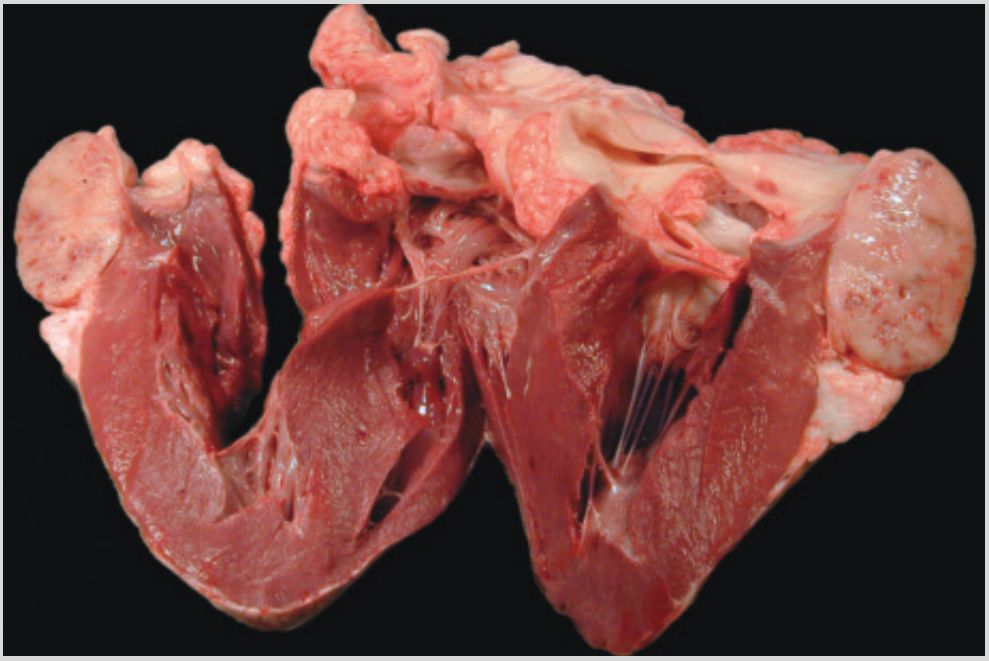
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4.43



Animal species/Organ	Cattle/Heart
Lesion	Angioleiomyoma
Scoring	Partial condemnation
Comments	Note the characteristic structure with white connective tissue and dark blood-filled vascular spaces

4.44



Animal species/Organ	Cattle/Heart
Lesion	Benign heart base tumour
Scoring	Partial condemnation
Comments	Originates in the aortic body

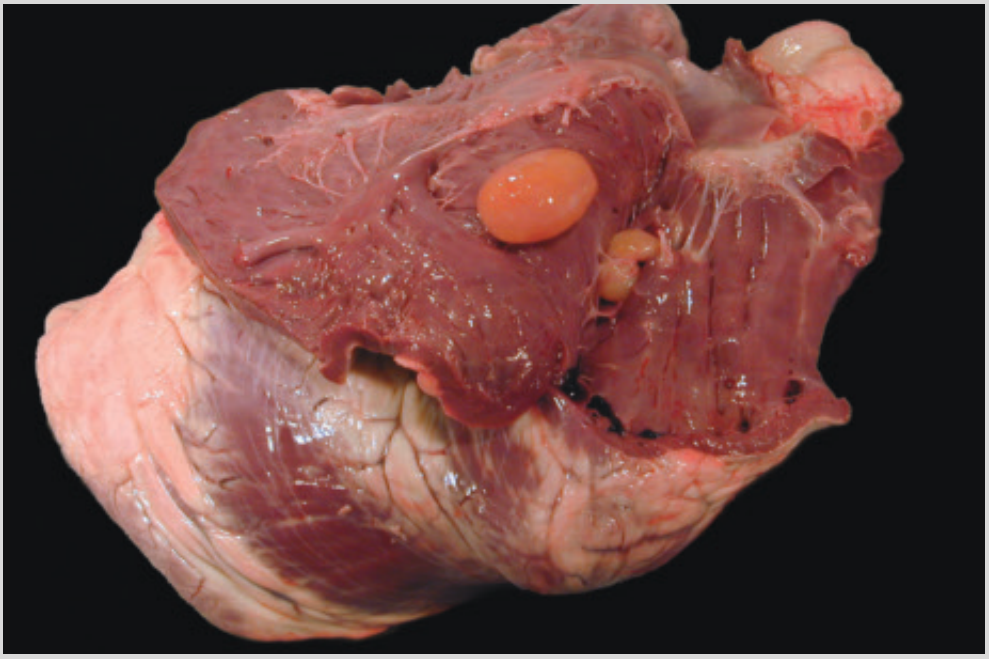
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4.45



Animal species/Organ	Cattle/Heart and lungs
Lesion	Malignant heart base tumour
Scoring	Total condemnation
Comments	The heart is surrounded by the tumour mass. Metastases in the regional lymph nodes (→)

4.46



Animal species/Organ	Cattle/Heart
Lesion	Multiple soft fibromas
Scoring	Partial condemnation
Comments	A soft fibroma (fibroma molle) is typically well-defined and gelatinous

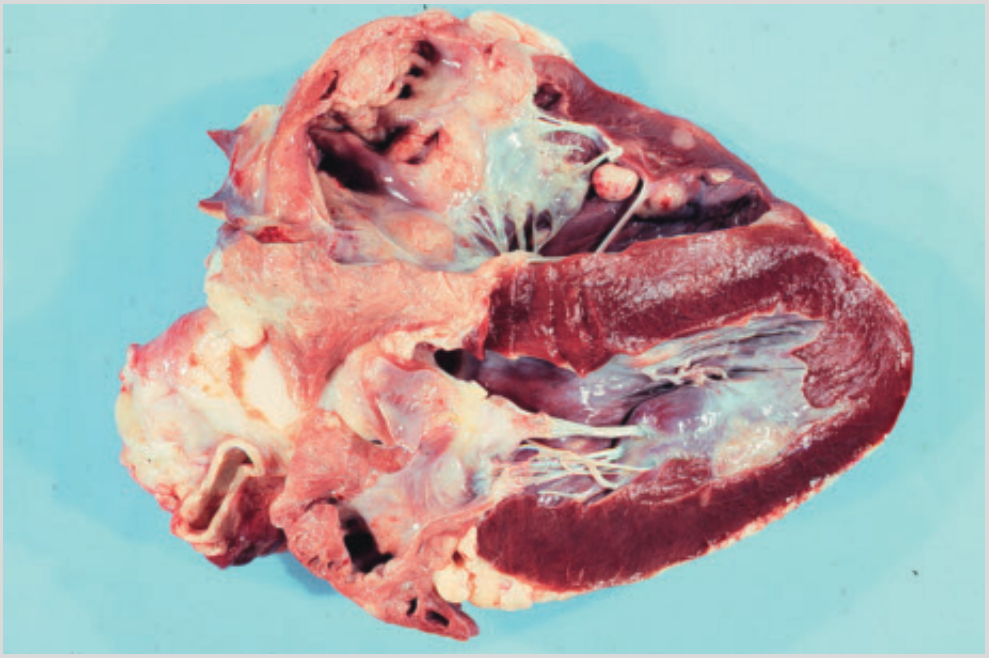
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4.47



Animal species/Organ	Cattle/Heart
Lesion	Schwannomas
Scoring	Partial condemnation
Comments	Schwannomas originate particularly in the thoracic nerves

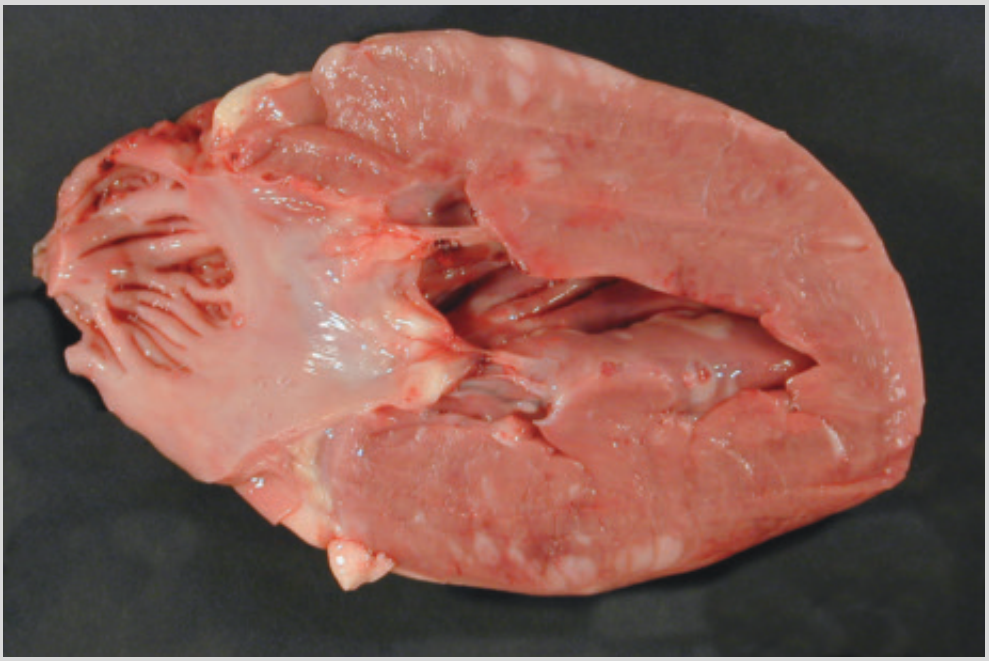
4.48



Animal species/Organ	Cattle/Heart
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Tumour tissue is particularly localised to the right atrium

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4.49



Animal species/Organ	Pig/Heart
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Multiple lesions are observed in the myocardium

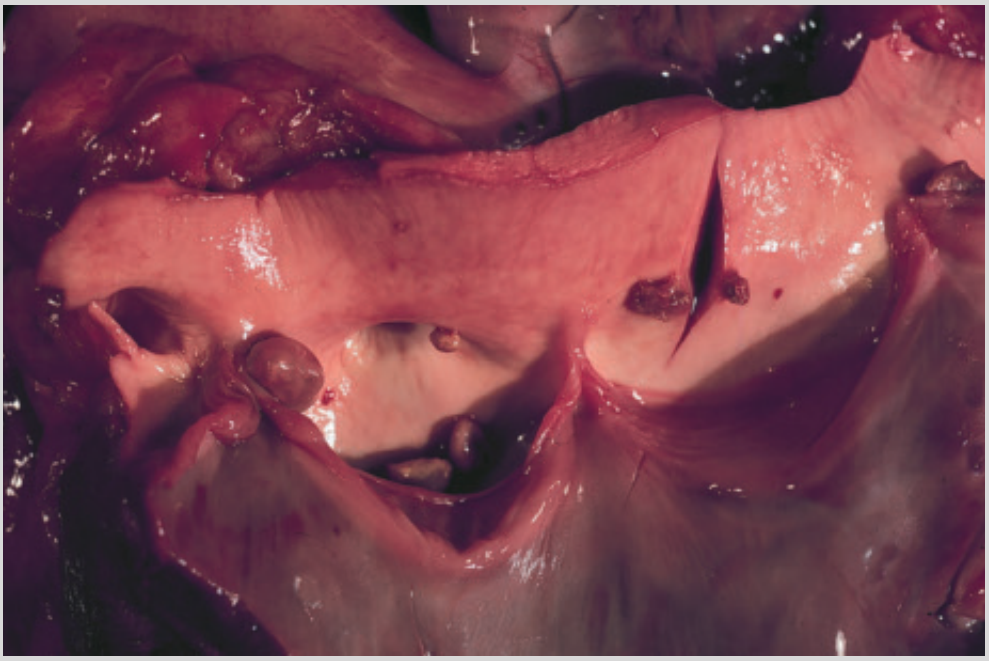
4.50



Animal species/Organ	Cattle/Thoracic aorta
Lesion	Endothelial mineralisation
Scoring	Partial condemnation
Comments	Mineralisation is seen particularly in Johne's disease

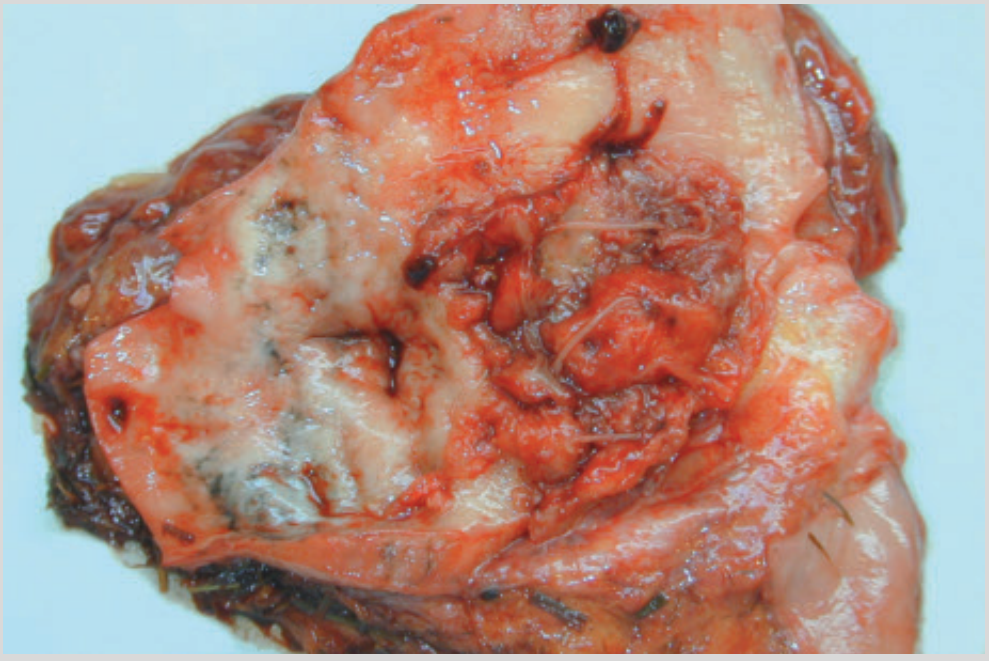
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4.51



Animal species/Organ	Horse/Thoracic aorta
Lesion	Focal mineralisations
Scoring	Partial condemnation
Comments	Probably due to previous site of *Strongylus vulgaris* larvae

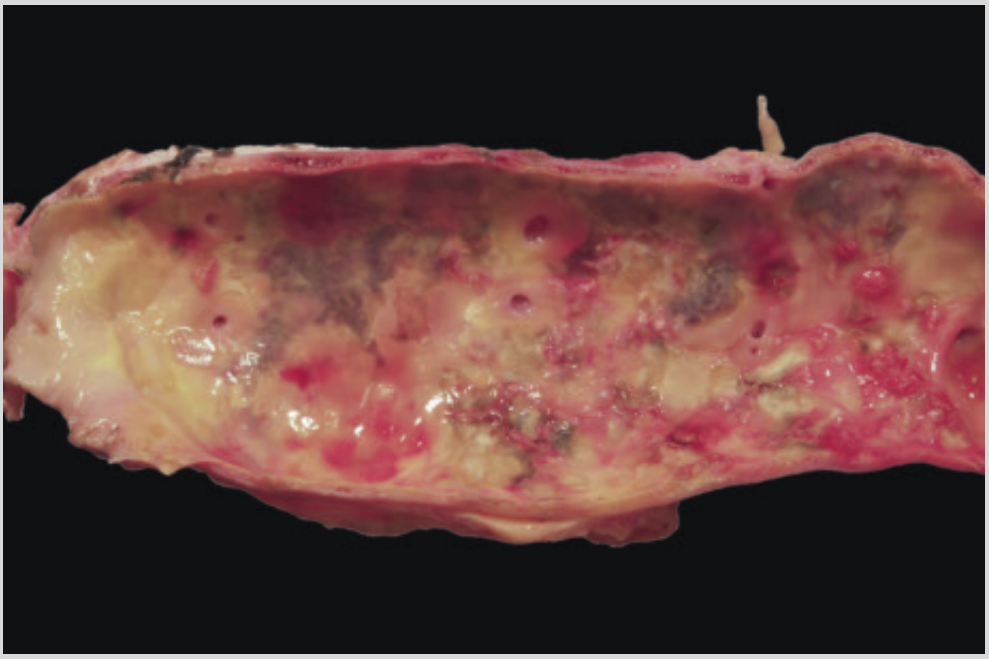
4.52



Animal species/Organ	Horse/Cranial mesenteric artery
Lesion	Chronic, thrombotic, verminous endarteritis with aneurysm formation
Scoring	Partial condemnation
Comments	*Strongylus vulgaris* larvae are seen in the thrombus

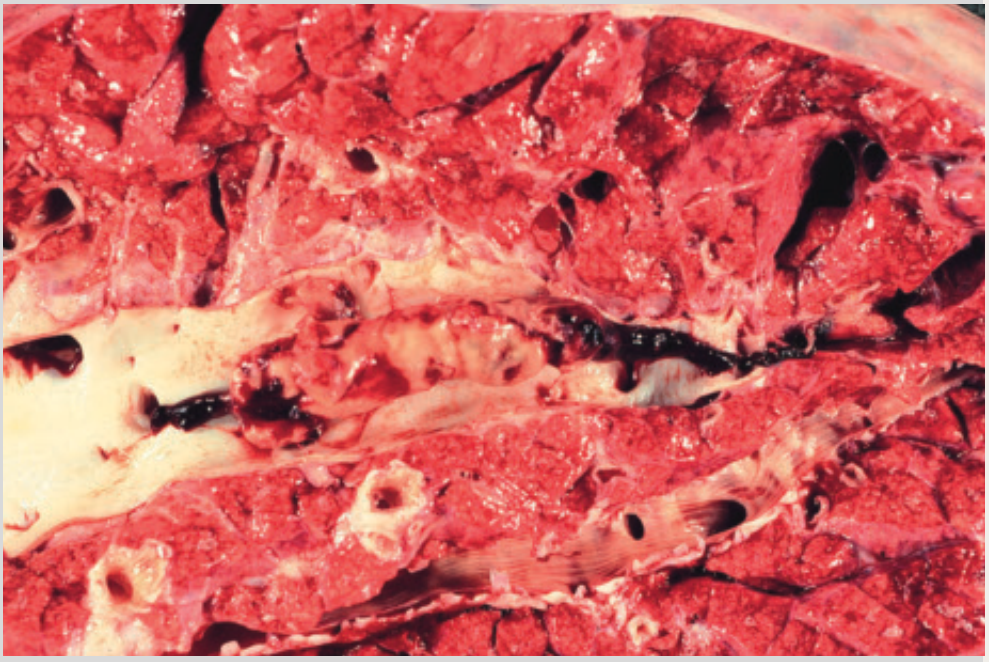
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4.53



Animal species/Organ	Horse/Aortic arch
Lesion	Chronic, eosinophilic arteritis with aneurysm formation and ossification
Scoring	Partial condemnation
Comments	Probably due to *Strongylus vulgaris* larvae

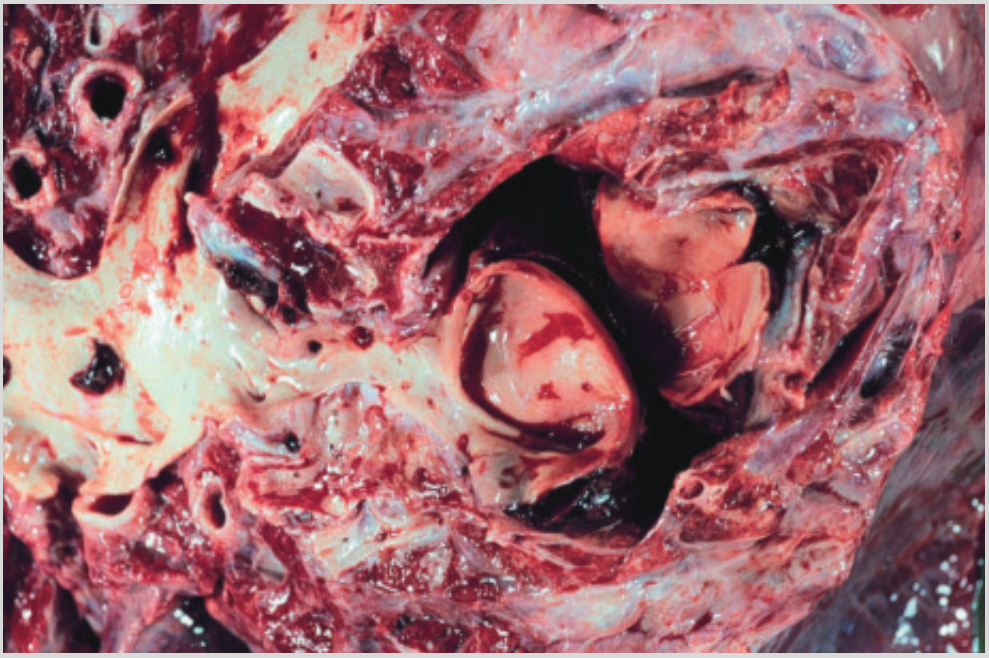
4.54



Animal species/Organ	Cattle/Lung (pulmonary artery)
Lesion	Chronic, thrombotic, purulent endarteritis
Scoring	Total condemnation
Comments	A relatively frequent finding in cases of pyaemia

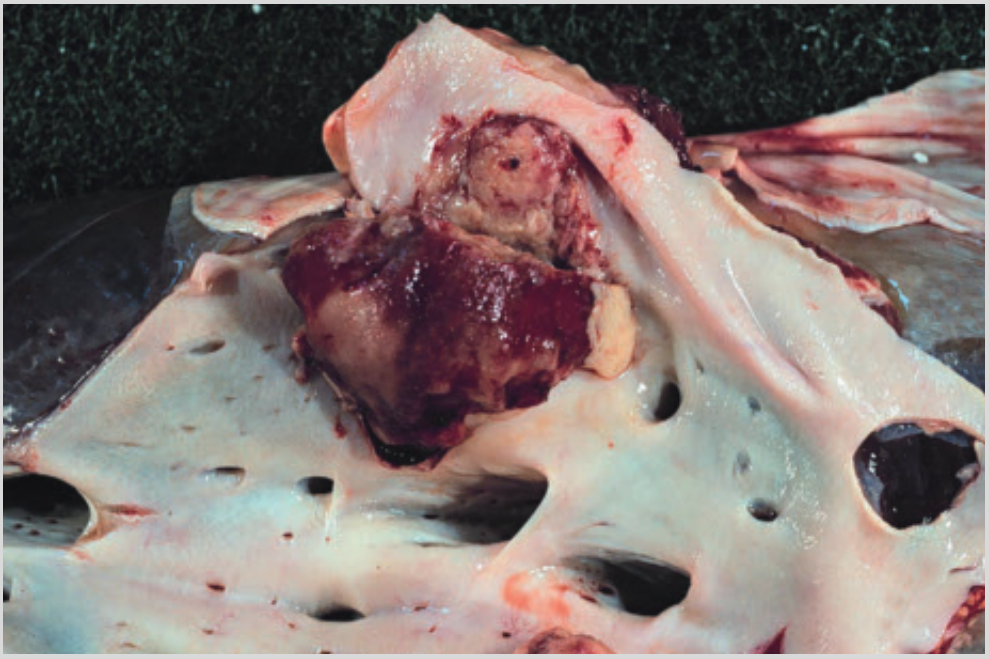
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4.55



Animal species/Organ	Cattle/Lung
Lesion	Aneurysm in the pulmonary artery
Scoring	Partial condemnation
Comments	Presence in connection with pyaemia necessitates total condemnation

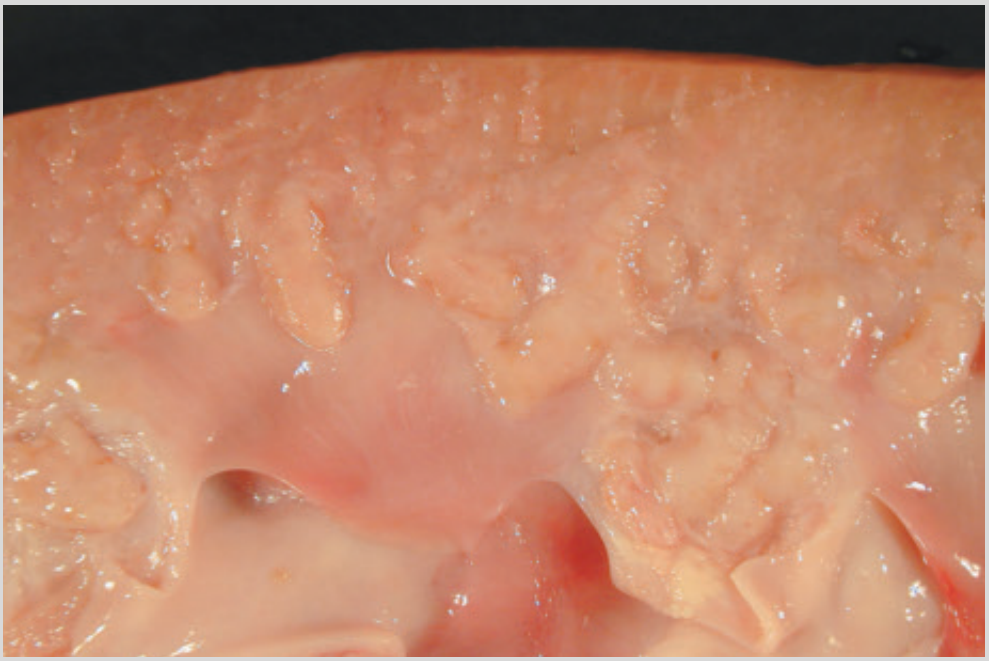
4.56



Animal species/Organ	Cattle/Liver with opened caudal vena cava
Lesion	Chronic, thrombotic endophlebitis
Scoring	Total condemnation
Comments	Typically due to rupture of a subphrenic or hepatic abscess

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4.57



Animal species/Organ	Pig/Kidney
Lesion	Polyarteritis nodosa
Scoring	Partial condemnation
Comments	Similar changes occur especially in the heart and spleen

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5 Respiratory System and Pleura

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Tracheitis and bronchitis p. 118
Circulatory disorders and mineralisation in the lungs p. 119
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Chronic bronchopneumonia p. 124
Fibrinonecrotic bronchopneumonia (porcine contagious pleuropneumonia) in pigs p. 124
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Encapsulated aerogenous necroses and abscesses p. 126
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Introduction

Pneumonia is one of the disease groups that incurs most losses in livestock. Lung lesions are therefore seen frequently at slaughter. At meat inspection of the lungs it is essential, as it is for the other organs, to be able to classify the various types of lesions. In particular, disseminated lesions can cause problems as they can lead to incorrect scoring of the animal. This chapter therefore suggests a slight change to the current classification of pneumonias and introduces a new class – focal pneumonia.

Sinusitis and rhinitis [5.01 – 5.08]

Most viral rhinitides cause catarrhal inflammation and only necessitate partial condemnation. However, the infections can have greater importance if they spread to the lower airways or if a secondary, often purulent, bacterial infection occurs. Fever may be present as a complication depending on the time of infection in relation to slaughter, the extent of the lesions and spread (rhinitis, sinusitis, tracheitis, and bronchopneumonia), and secondary infections. Cattle and horses occasionally exhibit chronic purulent sinusitis, rhinitis and guttural pouch inflammation (horses) with development of empyema in the sinuses and guttural pouches. If the lesions are chronic, deformation of the adjacent bony tissue may also occur. Spread of infection to the regional lymph nodes (lymphadenitis) can occur, as can spread by contiguous inoculation to the adjacent tissue (e.g. bone and brain). In general, in the absence of complications such as fever,

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rhinitis and sinusitis necessitate partial condemnation of the head with removal of the regional lymph nodes. However, in atrophic rhinitis (see below) with uncomplicated conchal atrophy, the head and lymph nodes can be approved.

Rhinitis and tracheitis occur in cattle with infectious bovine rhinotracheitis (IBR). This disease is caused by bovine herpes virus type 1 and is notifiable. Diphtheritic inflammation is often seen at secondary bacterial infection. Previously, atrophic rhinitis was common in Danish pigs, but now appears to be on the decline. Central to the pathogenesis is infection in the nasal cavity with *Bordetella bronchiseptica* and the toxin-producing *Pasteurella multocida*. Lesions include 1) deformation of the bones surrounding the nasal cavity (deviation of the snout towards the most affected side of the nasal cavity or concave nasal bridge), 2) obliteration of the nasolacrimal duct causing overflow of lacrimal fluid and accumulation of dried fluid and dust from the surroundings in the medial canthus of the eye, 3) atrophy of the conchae, 4) deviation of the nasal septum towards the most affected side, and 5) mucopurulent rhinitis.

Strangles in horses (and other equids) is caused by infection with *Streptococcus equi* subsp. *equi*. The infection causes purulent rhinitis, pharyngitis, laryngitis, and lymphadenitis with abscess formation in the draining lymph nodes. The infection can abate, and the lesions heal, or the infection can attack the guttural pouch, sinuses and lungs (bronchopneumonia). Finally, pyaemia can occur (bastard strangles). Acute strangles necessitates total condemnation (fever is always present). In contrast, chronic lymphadenitis with abscess formation necessitates partial condemnation of the head and stripping of the regional lymph nodes. Bastard strangles is scored in the same way as pyaemia (see Chapter 19).

Glanders is caused by *Burkholderia mallei* and can affect horses as well as other equids. Other animals and humans can also become infected. Focal, pyogranulomatous rhinitis develops in the nasal cavity and can heal to leave a typical, star-shaped scar. Lesions can also occur in the lower parts of the respiratory tract. Generalised infection can develop with metastatic lesions in various organs and affection of the skin in the form of lymphangitis. This infection is notifiable. Glanders always necessitates total condemnation.

Tracheitis and bronchitis [5.09 – 5.11]

Calf diphtheria is caused by an infection in the oral cavity, tongue, pharynx or larynx with *Fusobacterium necrophorum*. Similar infections are also seen in sheep. The infection often occurs in weakened animals, frequently with complications such as fever, emaciation, etc. For more detail see Chapter 8. Verminous bronchitis in cattle, sheep, and goats involves the bronchi of the caudal lobes in particular. Copious, mainly mucous-rich exudate is present in the bronchi (and trachea). Closer inspection in cattle can reveal numerous, 1 mm thick and 6-8 cm long, adult nematodes (*Dictyocaulus viviparus*). Similar lesions are seen in sheep and goats; however, the adult *Dictyocaulus filaria*, which is of approximately the same size as *D. viviparus*, and adult *Protostrongylus rufescens*, which is between 1.5 and 3.5 cm long, occur in smaller numbers, and can therefore be difficult to identify. Atelectasis and granulomatous bronchopneumonia occur secondary

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to verminous bronchitis. The bronchopneumonia is caused by aspiration of the eggs and larvae laid by the adult worm into the distal lung sections, permitting development of grey, 2-4 mm lesions localised in dark-red to grey discoloured lobules. Occasionally in cattle, extensive emphysema and oedema occur. Prior to establishment of the adult nematode in the bronchi, larvae have migrated through the lungs infected by larval emboli. These lesions are discussed later (p. 127).

Verminous bronchiolitis and bronchitis in pigs is caused by *Metastrongylus* spp. The intermediate host is the earthworm and, in particular, pigs that are raised outdoors and thus have access to earthworms can be infected. In addition to bronchitis, grey, focal lesions, 1-3 mm in diameter are observed along the ventrocaudal border of the caudal lobes. These lesions represent for the most part accumulated lymphocytes arranged in follicular structures.

Verminous bronchitis and associated lesions necessitate in the first instance partial condemnation of the lungs, with subsequent unconditional approval.

Smoke from fires can affect the trachea, bronchi and lung tissue causing extensive, acute fibrinopurulent and haemorrhagic inflammation. This necessitates total condemnation.

Circulatory disorders and mineralisation in the lungs

[5.12 – 5.20]

Circulatory lesions in the lungs are most frequently seen in finisher pigs as acute haemorrhages occurring in connection with slaughter, so-called blood splash. Blood splash gives unremarkable findings at palpation. Embolic pneumonias always present with a firm centre (necrosis or inflammation), as do parasitic scars (fibroplasias) with secondary peripheral bleeding. These regularly occur in pigs. Blood splash, parasitic scars and other embolic lesions are described in detail in later sections (p. 126–129). Chronic pulmonary congestion occurs in pigs, occasionally secondary to subaortic stenosis. Pulmonary oedema, haemorrhage and hydrothorax are present. The haemorrhages contribute to the red-brown or brick-red discolouration of the lungs. Scoring is based on the primary condition; however, the lungs are always condemned.

Infarctions occur most frequently in cattle with generalised infections, including pyaemia. The lesions are caused by thrombosis in the pulmonary arteries. In the acute stage they present as red, often lobular delineated lesions with a preference for the caudal lobes. Lesions lying adjacent to the surface of the lungs may have a pleural fibrin exudate. Acute pulmonary infarctions always necessitate total condemnation.

Mineralisation of the lungs is most frequently observed in cattle secondary to Johne's disease (paratuberculosis) (see Chapter 20). Mineralised lung tissue protrudes above the adjacent normal tissue, is pale to white, has firm to hard texture, and crackles when squeezed or cut. Scoring is based on the primary condition; however, the lungs are always condemned.

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Classification of pneumonias [5.21 – 5.36]

Pneumonias have been classified based on various criteria. These have included aetiology (pasteurella pneumonia, verminous pneumonia, mycoplasma pneumonia, etc.), type of exudate (purulent, fibrinous, etc.) and epidemiology (contagious bovine pleuropneumonia, enzootic pneumonia, etc.). Thus, mycoplasma pneumonia and enzootic pneumonia in pigs is the same disease. However, none of these classification systems are ideal, and frequently different classifications and their associated terminology are combined in an attempt to obtain an optimal result. Classification of pneumonias as described here is based on macroscopic assessment of the lesions' distribution and appearance (shape etc.) i.e. the lungs are subject to a macroscopic pattern analysis. This provides accurate indications of aetiology and pathogenesis (entry point and the lung structures targeted), which are essential for scoring at meat inspection.

Pneumonia is inflammation of the lungs i.e. inflammation with primary affection of the tissue that undertakes respiration, i.e. the tissue that is bordered in the proximal direction by the bronchioles. Primary involvement of the bronchioles and bronchi is called bronchiolitis and bronchitis, respectively. In pneumonia, the lung tissue texture is firm. At palpation it feels consolidated (dense), because the volume of air in the tissue is reduced due to the inflammatory processes (exudation into the lumen of the respiratory sections of the lungs; accumulation of inflammatory cells in the alveolar septa; acquired atelectasis, etc.). In the flotation test in water, the lung tissue floats barely or sinks. There is hyperplasia of the regional lymph nodes. Pneumonias can be divided into three main types. These are bronchopneumonias (locally extensive), interstitial pneumonias (in general diffuse lesions), and focal pneumonias. Focal pneumonia is suggested here as a new class. It includes the current class of embolic pneumonia. However, as not all "spotted lungs" emerge from embolism, it seems usefull first to recognize the focal appearance of the lesions and then, given the limitations of macroscopic assessment, consider the pathogenesis.

Bronchopneumonias

Bronchopneumonias cause locally extensive, either lobular or lobar lesions and are by definition aerogenous infections. The lesions are seen primarily, but not always, localised to the lung's cranioventral sections, where they occur either unilaterally or bilaterally. Bronchopneumonias are often caused by bacteria, including mycoplasms, and the infection is established in the transition between the distal bronchioles and the alveolar system. From here, the infection spreads distally to the alveoli and proximally to the bronchi, and the pathogenesis is characterised by exudation into the lung air spaces. This causes marking of the bronchioalveolar system's branches (the respiratory system), which can make them macroscopically visible. These macroscopic changes are called cloverleaf markings or bronchopneumonic markings and manifest as areas with several, juxtaposed, greyish circular lesions up to to 1 mm in diameter. Inflammatory reactions peripheral for the bronchioalveolar system's branches can also result in cloverleaf markings. The lesions can be seen both on the surface and cut surfaces of the lung and appear, with a little imagination, to resemble clover with the circular lesions

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representing the leaves. The structure can be seen in both the acute and chronic stages of bronchopneumonia, but does not occur in all cases.

The lobular (often muco-purulent) bronchopneumonias are confined within lobules and the transition zone between the pneumonic and normal areas has a distinct outline which follows the interlobular connective tissue. Lobar (often fibrinous) bronchopneumonias are particularly aggressive due to a highly virulent microorganism spreading explosively in the lung tissue and/or causing development of vasculitis and thrombosis. The boundary between the pneumonic and normal areas becomes fuzzy and the lesion may involve entire lobes. Fibrinous exudation to the pleura is a characteristic feature of this type of pneumonia. The infection can also be characterised by haemorrhage, necrosis, or putrefaction.

Interstitial pneumonias

In general, interstitial pneumonias give rise to diffuse lesions often with extensive involvement of the dorsocaudal lung sections. The lesions occur bilaterally. Interstitial pneumonias can be aerogenous or haematogenic, but not embolic. It can be difficult to recognise this type of pneumonia at macroscopic examination; partly because there is absence of exudate to the lung air spaces, and partly because there is no transition between changed areas and normal areas (the lesion is diffuse). However, the lungs feel heavy and have increased texture (fleshy). They are also often larger than normal, so much so that the ribs can have made an impression in the lungs. The inflammatory process originates in the alveolar septa (alveolar epithelium, basal membranes, endothelium) and/or the bronchiolar interstitium, which gives characteristic histologic changes. Mild exudate into the lung air spaces may also be seen in the acute stage. However, interstitial pneumonia is characterised in particular by hyperplasia of alveolar type II pneumocytes, septal and interstitial infiltration, and fibrosis (chronic stage). Interstitial pneumonia can be caused by viruses, antigen-antibody complexes, toxic gasses, endotoxins, sepsis, etc.

Many aerogenous viral infections (e.g. infection with influenza virus in pigs, and infection with bovine respiratory syncytial virus) result in bronchointerstitial pneumonia. Macroscopically, the lesions resemble lobular bronchopneumonia (affection of the cranioventral lung sections, unilateral or bilateral). However, exudate to the airways ceases rapidly, and the changes assume the character of interstitial pneumonia with hyperplasia of type II pneumocytes and interstitial infiltration dominated by lymphocytes.

Interstitial pneumonias are not common in animals that have attained slaughter weight, but have nevertheless been reported in sheep older than 2 years (maedi) (notifiable) and in adult horses (equine multinodular pulmonary fibrosis or according to old Danish litterature pneumonia lardea). However, the pneumonias do occur occasionally in younger animals. Thus, interstitial pneumonia can be seen in PMWS (postweaning multisystemic wasting syndrome) in weaning pigs, and this type of pneumonia can also occur in PRRS (porcine reproductive and respiratory syndrome) (notifiable).

Focal pneumonias

Focal pneumonias are characterised by the presence of one or more "small", discrete lesions. It is important to note that as all three types of pneumonia demonstrate char-

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acteristic macroscopic patterns (on which classification is based), bronchopneumonias and interstitial pneumonias also have a clear relationship to lung anatomy (lung air spaces and interstitial spaces, respectively).

Focal pneumonias are in contrast a pathogenetically heterogeneous group because the relationship between distribution and appearance of the lesions (macroscopic pattern analysis) and pathogenesis is not always clear. As a general assumption, all pneumonias with disseminated lesions are embolic, but this assumption does not always hold true. In some cases these pneumonias are aerogenous and could therefore also have been classified as bronchopneumonias (see p. 120). To complete the confusion, cattle with valvular endocarditis can have embolic lung lesions concentrated in the cranioventral lung section. Furthermore, the appearance of the lesions varies considerably, and can for example vary with the agent (see section on parasitic infections in the lungs p. 127). If possible, the diagnosis should be supplemented with pathogenesis terms. In some cases, there can thus be a focal, embolic pneumonia. In other cases, the correct diagnosis is focal, aerogenous pneumonia. Most focal pneumonias are caused by bacteria or parasites.

The lesions will be unifocal (solitary), bifocal or multifocal. That a pneumonia is focal does not necessarily mean that there is only one lesion – which is otherwise the usual meaning of focal. If the lesions are numerous and uniformly distributed in the lung lobes, subpleurally and in depth, and of course bilaterally, i.e. the lesions are disseminated – the pathogenesis is considered to be embolic. The pneumonia has occurred after emboli i.e. particulate matter have been trapped in vessels (often capillaries in the alveolar septa). As noted, the appearance of the lesions varies considerably, but the initial changes often comprise small (1-2 mm in diameter) haemorrhagic lesions which can easily be overlooked. A firm centre is always found at palpation. This represents cell infiltration or necrosis, which may be recognisable as a grey to white spot. A centre characterised by pus or necrosis (necrosis can turn quickly into pus), signifies a focal, embolic, abscess-forming pneumonia, or a focal, embolic, necrotizing pneumonia.

In cattle, disseminated lesions can have a lobular appearance. Pattern analysis indicates both embolic and aerogenous pathogenesis. A tentative diagnosis could therefore be focal, aerogenous pneumonia if the lobular appearance is stressed. On closer examination however, the basis of the lesions is often found to be abscesses that occur centrally or peripherally in the affected lobules. Thus, this is a focal, abscess forming, embolic pneumonia with secondary local aerogenous spread.

If unifocal or few unilateral or bilateral lesions are present, dissemination has by definition not occured and the pathogenesis cannot reasonably be determined as embolic. Notwithstanding this, findings of few, scattered and bilateral lesions are considered often to be focal, embolic pneumonia. An obvious entry point, for example tail bite in pigs or presence of valvular endocarditis, will always be considered to be an aggravating finding supporting the embolic pathogenesis. However, a primarily cranioventral distribution of the lesions indicates a need to re-examine the appearance of the lesions and thus the pathogenesis. This could be a primary lobular bronchopneumonia in which the lobular and local extensive appearance is less obvious, for example when chronic abscesses have occurred as sequelae. If this is the case and as the focal appearance

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dominates, i.e. discrete lesions (abscesses) are observed, then this is a chronic, focal, aerogenous pneumonia with abscess formation. It is of course also possible to change the classification and thus make the diagnosis chronic, lobular bronchopneumonia with chronic abscesses. The abscesses must not be confused with bronchiectasis, i.e. the diagnoses must not be confused with chronic, lobular bronchopneumonia with bronchiectasis.

Granulomatous and pyogranulomatous pneumonias are generally focal pneumonias regardless of whether several of them are aerogenous and thus should present local extensive lesions. This non-adherence with the consensus of the relationship between class (distribution and appearance) and pathogenesis applies not only to bacteria that induce these types of inflammations but is also seen in aerogenous infection in pigs with *Staphylococcus aureus*, where in some cases, a focal, aerogenous pneumonia develops that even can have disseminated lesions. Other examples of non-adherence to the consensus between class and pathogenesis are listed in Table 5-1.

Table 5-1. Pneumonias with atypical localisation and appearance

Cattle Focal embolic pneumonias: lesions should be disseminated – Distomal abscesses: the lesions are primarily seen peripherally in the dorsocaudal sections – Lungworm (*Dictyocaulus viviparus*), larval migration stage: lesions are primarily localised in the subpleura Bronchopneumonias: lesions should be locally extensive and localised to the cranioventral sections – Contagious bovine pleuropneumonia (*Mycoplasma mycoides* subsp. *mycoides*) (notifiable): lesions are primarily found in the caudal sections – Tuberculosis (human and bovine types are notifiable), early stages: focal lesions which are primarily seen in the subpleura in dorsocaudal sections
Sheep Focal embolic pneumonias: lesions should be disseminated – Lungworm (*Dictyocaulus filaria, Protostrongylus rufescens*), larval migration stage: lesions are primarily localized in the subpleura – Lungworm (*Muellerius capillaris*): lesions are seen primarily in the subpleura in the dorsocaudal sections Bronchopneumonias: lesions should be locally extensive and localised to the cranioventral sections – Tuberculosis (human and bovine types are notifiable): focal lesions
Pigs Bronchopneumonias: lesions should be locally extensive and localised to the cranioventral sections – *Actinobacillus pleuropneumoniae*: lesions are seen primarily dorsocaudally; the infection can also give rise to lesions in the cranioventral sections or to focal, even disseminated, lesions – *Chlamydophilia psittaci*: lesions are found primarily dorsocaudally – *Pasteurella* spp. or *Staphylococcus aureus*: can give focal, even disseminated, lesions
Horses Bronchopneumonias: lesions should be locally extensive and localised to the cranioventral sections – *Rhodococcus equi*, rapid progression: focal lesions, cranioventrally

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Chronic bronchopneumonia [5.37 – 5.42]

This often involves lobular lesions positioned cranioventrally (lobular bronchopneumonia), which is further characterised by a catarrhal (mucous), mucopurulent or purulent exudate that can be expressed from cut surfaces of the lung tissue (from the bronchi). The lesions are highly prevalent in slaughter animals. With regard to cattle, the origin of bronchopneumonia is often viral (including bovine respiratory syncytial virus), and is followed by secondary bacterial infection (often *P. multocida*, *Trueperella pyogenes,* and *Histophilus somni*), i.e. so-called enzootic pneumonia. In pigs too, the origin may be viral infection with subsequent bacterial infection. However, the bronchopneumonia is often related to infection with *Mycoplasma hyopneumoniae* (enzootic pneumonia), which gives a catarrhal exudate that becomes purulent at secondary bacterial infection (often *P. multocida*, *Streptococcus* spp. or *S. aureus*).

Chronic lesions are identified by 1) the colour of the infected lung tissue, which is red-brown, grey-brown or grey (like fish meat), 2) the surface of the lesional lung tissue which is located in or below the level of the surrounding normal tissue, 3) the presence of atelectasis, 4) the presence of bronchiectasis (cattle), 5) the presence of chronic abscesses as sequelae, 6) the presence of fibrosis including mild, fibrous or adhesive pleurisy. Uncomplicated cases necessitate partial condemnation of the affected areas with subsequent unconditional approval.

Fibrinonecrotic bronchopneumonia (porcine contagious pleuropneumonia) in pigs [5.43 – 5.55]

Porcine contagious pleuropneumonia (pleuropneumonia) is caused by *Actinobacillus pleuropneumoniae*. These are bronchopneumonias that are often lobar, and in which the lesion is frequently localised to the caudal lobe. However, porcine contagious pleuropneumonia can manifest as focal pneumonia, with possible occurrence of disseminated lesions (Table 5-1). One key characteristic is affection of the pleura situated immediately above the lung lesions. Peracute cases are characterised by oedematous and haemorrhagic lesions which are slightly firm and prominent. There is also slight fibrin exudation and necrosis in the lung tissue. However, the lesions cannot readily be identified macroscopically at this timepoint. Comparable lesions are seen in acute cases, but with concomitant considerable necrosis and fibrin exudate. In these cases the lesion cut surface now appears predominantly fibrinonecrotic (red and slightly dry). Fibrin exudate on the overlying pleura and in the interlobular and other interstitia is similarly manifest. Due to the similar texture with that of the liver, the inflammatory processes in the acute stage are called red hepatisation. Towards the end of the acute phase, grey hepatisation becomes manifest, in which the necrosis becomes even more obvious (cut surface of the lesion becomes paler and more dry and the original structure of the lung becomes visible). There is onset of demarcation with neutrophilic granulocytes, and there is also infiltration into the interlobular and other interstitia. Even later in disease, granulation tissue/fibrous tissue start forming and the necrotic lung tissue becomes encapsulated. It can be difficult to characterise the dilated interstitial spaces and the

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lesions in the pleura. The fibrinopurulent exudate, particularly in the interstitia, can easily be misdiagnosed as granulation tissue. The presence of granulation tissue/fibrous tissue is most easily detected on a cut surface of a pleural lesion. Here, granulation tissue/fibrous tissue is formed from the pleura and will therefore be located between the fibrin on the surface and lung in the depth. Peracute lesions or acute lesions in which more than 25% of the lungs are affected necessitate total condemnation of the pig. In pigs, each caudal lobe comprises about 1/3 of the lung tissue. The remaining lobes (cranial, middle, and accessory lobes) on the right side comprise in total about 1/6 and on the left side similarly about 1/6 of the lung tissue. The presence of complications necessitates total condemnation. The remaining cases necessitate partial condemnation of lungs and pleura, with subsequent unconditional approval.

Acute and subacute pneumonia [5.56 – 5.65]

Acute and subacute pneumonias are characterised by 1) red or brown-red colours (hyperaemia or bleeding) of lesional lung tissue, 2) the surface of the lesional lung tissue which protrudes above or is at a level with the surrounding normal tissue, 3) reactive hyperplasia of the regional lymph nodes (occurs in all forms of pneumonia, but acute pneumonia can be difficult to diagnose in which case the hyperplasia becomes important), 4) absence of signs of chronicity (no granulation tissue/fibrosis, etc.). The absence of signs of chronicity is in particular important in determining the age. If the changes comprise less than 25%, the animal is approved after partial condemnation of the lungs. Changes comprising more than 25% of the lung tissue, or the presence of complications, necessitates total condemnation.

In fibrinous pneumonias, which are often lobar bronchopneumonias, the lung tissue appears slightly dry and, in the acute or subacute stage, red to brown-red. Fibrin exudation to lung tissue is reflected by a similar lesion of interlobular connective tissue. These can be filled with fibrin and oedema such that the lobules are pushed apart. In the subacute stage, the red/brown-red colour starts to change to brown and grey due to concomitant infiltration of neutrophilic granulocytes into the interstitia, for example. In this type of pneumonia, there is always concomitant involvement of those parts of the pleura that lie above the areas with pneumonic changes due to exudation of fibrin here. In pigs, pneumonia due to *P. multocida* is generally lobular and purulent, but can be fibrinous. Acute, necrotizing to purulent, focal or disseminated, aerogenous pneumonia, caused by *S. aureus* occurs in pigs (see next section). *P. multocida* and *Mannheimia haemolytica* can be cultivated from cases of lobar, fibrinous bronchopneumonias in cattle (shipping fever) and sheep. In cattle, *H. somni* can occasionally be cultivated from similar lesions. Aspiration often causes severe lobar bronchopneumonia, characterised by necrosis, fibrin exudation, haemorrhage and/or putrefaction. A mixed flora can be cultivated from these cases. In traumatic reticuloperitonitis in cattle, foreign bodies can penetrate into the chest cavity (and heart) causing traumatic pleurisy and traumatic pneumonia. This is often necrotic and putrid, and is caused by a mixed flora from the forestomachs. However, the lesions here are often chronic. Thus, regardless of how much lung tissue is affected,

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and unless complications are present, this necessitates partial condemnation with subsequent unconditional approval.

Encapsulated aerogenous necroses and abscesses [5.66 – 5.68]

In general, focal pneumonias have an aerogenous origin if the lesions are not disseminated. The lesions can occur as sequelae to bronchopneumonias and will thus frequently be localised to the cranioventral lung sections. However, lesions after *A. pleuropneumoniae* infections in pigs (porcine contagious pleuropneumonia) often occur in the caudal lobes. In some cases, aerogenous lesions occur with disseminated distribution. This is seen in few cases of porcine contagious pleuropneumonia and the aerogenous entry can only be detected at close inspection of the lesions or by cultivation. Similarly, in some cases of aerogenous infection with *S. aureus* in pigs, a focal, necrotizing to purulent, aerogenous pneumonia is seen, in which cavitation (air-filled spaces) is found together with the lesions. The lesions which are situated immediately below the pleura, give rise to an overlying, necrotizing and mild fibrinous pleuritis. The lesions can be disseminated. Findings of these chronic changes necessitate partial condemnation with subsequent unconditional approval.

Pyaemic necroses and abscesses [5.69- 5.74]

In general, focal pneumonias with disseminated distribution, are considered to be embolic. If the condition is caused by pyogenic bacteria, this is a pyaemia. Both acute and chronic lesions can be present at the same time, because intermittent spread can occur via blood from the primary focus. At palpation, peracute, acute and chronic lesions feel firm. This change in the normal texture is due to necrosis or inflammation in the lesions. Furthermore, in peracute and acute cases, the lesions will be characterised by hyperaemia or haemorrhage. At incision of the acute lesions, a grey to white centre will be observed which represents necrosis or pus. In peracute cases, the central grey to white area is absent and the centre is not distinguishable from the periphery (hyperaemia or haemorrhage). In chronic cases, the peripheral hyperaemia or haemorrhage will be less obvious, and in a cut section of the lesions they can be seen to represent abscesses with peripheral encapsulation (chronic abscesses) or equivalent necroses. Secondary local aerogenous spread is often found in cattle, and the lesions assume a lobular disseminated appearance. At closer examination, the origin of the lobular lesions is however a central or peripheral necrosis or abscess. In pigs, *S. aureus*, *Actinomyces hyovaginalis* and *T. pyogenes* can often be cultivated from the lesions. In cattle, the most prevalent are *T. pyogenes* and *F. necrophorum*. Acute cases always necessitate total condemnation. If only encapsulated, chronic lesions and no complications are found, the carcase can be approved for deboning.

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Parasitic infections in the lungs [5.75 – 5.85]

Dictyocaulus viviparus (cattle), *D. filaria* and *P. rufescens* (sheep and goats) give rise to verminous bronchitis (see p. 118–119). Prior to the localisaton of adult worms in the bronchi, larval emboli have infected the lungs, and this and the following migratory stage gives rise to focal, embolic, verminous pneumonia. The lesions are a few mm in size, dark-red, greenish, grey and often deposited in relation to the pleura (see Table 5-1). In cattle, infection with species-alien nematodes (e.g. *Ascaris suum* and *Toxocara* spp.) can similarly give rise to focal, embolic, verminous pneumonia, which is difficult to distinguish from that caused by *D. viviparus*. The larvae do not develop to the adult stage, and verminous bronchitis is absent. Mineralisation can be observed in all types of parasitic lung diseases.

Another lung worm is found in sheep and goats, *Muellerius capillaris*. The larvae of this parasite arrive at the lungs as emboli, bore their way through the capillaries, and remain in the interstitial spaces where they develop into the adult worm. Verminous bronchitis is not observed, but instead a focal, embolic, verminous pneumonia at moderate infection. In the acute stages, the lesions are characterised by haemorrhage. Later, these lesions become grey-green and can become mineralised. The animals do not achieve immunity, but are otherwise generally unaffected by the infection, which subsequently assumes the character of an interstitial pneumonia, primarily of the dorsocaudal lung sections. This is conditional on continued assimilation of the larvae such that the focal lesions can become confluent (diffuse). The affected lung section has firm texture. Grey to green almost neoplasm-like formations are seen which can subsequently fill large areas of the caudal lobes.

Verminous bronchiolitis and bronchitis in pigs is caused by *Metastrongylus* spp. In addition to bronchitis, grey, focal lesions, 1-3 mm in diameter are observed along the ventrocaudal edge of the caudal lobes. These lesions represent for the most part accumulated lymphocytes arranged in follicular structures.

In pigs, *A. suum*, and possibly infection with species-alien nematodes (e.g. *Toxocara* spp.), cause disseminated lesions because of the embolic pathogenesis and subsequent migration through the lungs. In the acute stage, hyperaemic or haemorrhagic, palpable (due to inflammation) lesions can be found, which at macroscopic examination are impossible to distinguish from cases of acute, focal, embolic, bacterial pneumonia. Two different types of lesions, lymphadenopathies and parasitic scars (fibroplasias) with secondary peripheral haemorrhage, are seen as sequelae to nematode migration in pigs. Lymphadenopathies are disseminated, greyish, spheric, semi-transparent lesions a few mm in size. They are comprised of lymphocytes. Mineralisation is never observed. Comparable lesions with the same aetiology occur in the liver. The lesions must be differentiated from those caused by *Mycobacterium avium* subsp. *avium* (avian tuberculosis), which are discussed on p. 128. Parasitic scars (fibroplasias) with peripheral secondary haemorrhage are disseminated, red lesions up to 1 cm in diameter, with a grey to white star-shaped or irregular centre comprised of fibrous tissue. This peripheral haemorrhage has probably arisen from weak vessels at slaughter. Parasitic scars must be differentiated from bacterial acute, focal, embolic pneumonias.

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Mineralised, focal, or serpiginous lesions are occasionally seen in horses. Similar lesions can be seen in the aortic intima (see Chapter 4). The lesions are ascribed to the migration of nematodes.

All cases of parasitic pneumonia, including so-called lung strongylosis, necessitate partial condemnation of the lungs (and liver) with subsequent unconditional approval.

In pulmonary echinococcosis/hydatidosis (notifiable), which can occur in all slaughter animals, the lungs are infected with echinococci (hydatid cysts). These are larval stages of the tapeworm *Echinococcus granulosus*, which is found in dogs and foxes. Hydatid cysts manifest in the lung tissue as 3-5 cm (even up to 15 cm), distended fluctuating cysts which peripherally are defined by a gelatinous parasite wall. This is relatively easy to loosen from the host capsule. Fertile cysts contain brood capsules with protoscolices (hydatid sand when capsules and protoscolices are floating freely) and occasionally daughter cysts. Degenerated cysts contain a caseous, or mineralised, mass and can thus mimic tuberculosis. However, the degenerated cysts are relatively easy to loosen from the host capsule. Hydatid cysts as described here also occur in the liver. The scoring is condemnation of the lungs (and liver) with subsequent unconditional approval.

In cattle, so-called pulmonary distomal abscesses, or chronic, focal, embolic, verminous pneumonia with abscess formation are seen sporadically. This is a granulomatous and purulent pneumonia caused by aberrant migration of juvenile stages of the liver fluke, *Fasciola hepatica*, in the blood to the lungs. In the lungs, one or more, possibly multichambered abscesses or cavities up to 10 cm in size develop, often with some calcification of the wall and containing a brown, often fluid exudate. Occasionally, apparently adult flukes can be seen in the lesions. The lesions are most frequently located in the dorsocaudal (peripheral) sections of the lungs (Table 5-1). The scoring is condemnation of the lungs with subsequent unconditional approval.

Granulomatous and pyogranulomatous inflammations

[5.86 – 5.97]

As described previously, granulomatous and pyogranulomatous pneumonias are generally focal pneumonias even though several of them are aerogenous and thus should present local extensive lesions. Tuberculosis caused by *Mycobacterium tuberculosis* and *Mycobacterium bovis* (notifiable) occurs only very rarely in Denmark (see Chapter 20). Avian tuberculosis is caused by *M. avium* subsp. *avium* and occurs occasionally among pigs. This is primarily a digestive tract infection with spread to the liver, lungs, etc. Grey, semi-transparent, disseminated lesions a few mm in size (chronic, focal, embolic, granulomatous pneumonia), which can be misdiagnosed as lymphadenopathies, are seen in the lungs and liver. However, avian tuberculosis is associated with local lymphogenic spread (lymphangitis), whereby the lesions after becoming confluent assume a more irregular, often angular appearance. These lesions can also be up to several centimetres in size. Mineralisation is seen in the lesions in the majority of pigs with avian tuberculosis. In all cases, tuberculous lymphadenitis is seen in the regional lymph nodes where the appearance of the lesions corresponds to that in the lungs. From a meat inspection

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viewpoint, the presence of avian tuberculosis in the lungs is considered to be equivalent to generalised tuberculosis and necessitates total condemnation.

In addition to mycobacteria, *Actinomyces bovis*, *Actinobacillus lignieresii, Rhodococcus equi* and various fungi can give rise to granulomatous and pyogranulomatous pneumonia. The lesions are often focal (focal pneumonia) and generally have a proliferative appearance which means that they can easily be misdiagnosed as neoplasms (see Chapter 20). If embolic lesions caused by these agents are present, the condition is scored in the same way as pyaemia.

Non-inflammatory changes [5.98 – 5.105]

Atelectasis (collapse of lung tissue) occurs most frequently secondary to compression of lung tissue or secondary to obstruction of the airways with exudate. Emphysema is similarly a secondary phenomenon to inflammation but, particularly in cattle, also occurs as a result of forced respiration in connection with slaughter. Circulatory disorders in the lungs are most frequently seen in slaughtered pigs in the form of acute haemorrhage occurring in connection with slaughter, blood splash. The lesions are unremarkable at palpation. If the blood gains access to the lungs' air spaces, these can fill with so much blood that the smallest branches become macroscopically visible. During sticking of slaughter animals, the trachea and the most cranial parts of the lungs are occasionally injured. Blood can then get access to the lungs' air spaces (blood aspiration), which manifests as described above. At meat inspection, atelectasis, emphysema, haemorrhage and aspiration of blood necessitate partial condemnation of the lungs.

Black pigmentation in the lungs (congenital melanosis, melanosis maculosa) occurs sporadically in cattle and pigs. The lesions comprise black spots that are unremarkable at palpation, and which can occur in other tissues and organs (including meninges, aortic intima, liver, and cardiac muscle). Aspiration of scalding water and feed during slaughter occurs relatively frequently. This necessitates partial condemnation of the lungs and other affected organs and tissues.

Pleura [5.106 – 5.109]

Pleuritis is the most frequently occurring lesion in the pleura, often secondary to pneumonia. Lesions in the pleura occur generally secondary to lesions in the tissues and organs that form or fill the thoracic cavity. However, they can also be part of a generalised condition (e.g. polyserositis or sepsis).

In hydrothorax, fluid accumulates in the thoracic cavity. The condition is usually present bilaterally. In haemothorax, blood is present in the thoracic cavity. Hydrothorax is frequently observed in generalised oedema. The lesions can thus occur in connection with hypoproteinaemia (e.g. caused by functional disorder in the intestines or insufficient feed) and at impaired cardiac function (e.g. in subaortic stenosis). Hydrothorax may be observed in connection with pulmonary oedema and the causes of this, and can also be caused by impaired lymph drainage caused by pressure from neoplasms etc. on afferent lymph vessels. Chronic hydrothorax causes reactive hyperplasia of the

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mesothelium and fibrous thickening of underlying tissue. This means the pleura becomes macroscopically unclear visually. At meat inspection, scoring of hydrothorax is based on the primary changes and fluid accumulation in the thoracic cavity is considered to be an aggravating finding. Generalised oedema always necessitates total condemnation.

Petecchiae in the visceral pleural can be observed at slaughter (blood splash) and has been discussed previously. Comparable haemorrhage in the parietal pleura can be the result of shock, e.g. caused by sepsis.

Infections with bacteria, including mycoplasms, are the most common cause of pleuritis. As noted above, this condition occurs most commonly secondary to pneumonia, because lobar bronchopneumonias are characterised by development of pleuritis. The infection attacks the lung and visceral pleura, and spread by contiguous inoculation to the parietal pleura. However, the agent can also reach the pleura by invasion from the oesophagus, or haematogenic spread, for example.

Pleuritis always occurs in connection with traumatic pneumonia, and the inflammation in this case is often putrid. However, in principle, all types of pneumonia can give rise to local spread to the pleura. Thus, abscesses occurring in connection with purulent bronchopneumonia can rupture and spread their content into the thoracic cavity and cause diffuse, purulent pleuritis (pleural empyema or pyothorax). Also, all focal or locally extensive pleuritides, regardless of their pathogenesis have this characteristic of local spread. Chronic stages of pleuritis are characterised by fibrosis, possibly with adherence, and formation of chronic abscesses. Pleuritis is scored separately on the surface of the lungs (visceral pleura) and the surface of the thoracic wall (parietal pleura). Acute fibrinous, serofibrinous, suppurative or putrid pleuritis covering > 25% of either of the surfaces necessitates total condemnation; if < 25% is affected and there are no complications, the scoring is partial condemnation of the affected areas with subsequent unconditional approval. Chronic fibrous pleuritis necessitates partial condemnation with subsequent unconditional approval.

Pleuritis caused by haematogenically spread agents results in bilateral lesions. Sepsis is often seen in very young or younger animals and is caused, for example, by *Streptococcus suis* (pigs, fibrinopurulent inflammation), *Haemophilus parasuis* (pigs, fibrinous inflammation), *Escherichia coli* (pigs and cattle, fibrinopurulent inflammation), *Streptococcus equi* subsp. *zooepidemicus* (horses, purulent inflammation). Pleuritis may occur during the course of these infections, but other lesions may also be observed such as peritonitis, polyarthritis, meningitis, etc. In pigs younger than about 10 weeks, infections with *Mycoplasma hyorhinis* may occur which cause fibrinous polyarthritis and polyserositis, including pleuritis.

Neoplasms and other proliferations [5.110 – 5.119]

Generally, neoplasms and other growths rarely occur in the airways of slaughter animals. Nevertheless, nasal and paranasal sinus cysts are observed in horses. The cysts are connective (bony) tissue formations which contain yellow to haemorrhagic fluid. The cysts grow expansively causing compression and finally destruction of the surrounding structures. Ethmoid carcinomas can occur in all slaughter animals. Nasal polyps

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can occur in connection with chronic inflammation of the nasal cavity, particularly in horses. The polyps are sessile or pedunculated nodular growths comprised of an epithelium-coated, oedematous and inflamed connective tissue. Similarly, progressive ethmoid haematomas or haemorrhagic nasal polyps also occur in horses. These are unilateral, connective tissue limited, dissecting haemorrhages. True neoplasms in the nasal cavity are often malignant. Viral papillomatosis can occur in the larynx in cattle, for example. At meat inspection, the scoring is partial condemnation with subsequent unconditional approval. However, the presence of malignant neoplasms or complications necessitates total condemnation.

Primary neoplasms in the lungs occur rarely in slaughter animals. On the other hand, metastatic neoplasms are more common. In general, the presence of a single large neoplasm, and perhaps a few smaller peripherally located satellite neoplasms, indicate the presence of a primary lung neoplasm. The presence of uniform-sized neoplasms disseminated throughout the lungs indicates the presence of metastases. Nevertheless, primary lung neoplasms can be spread within the lungs giving an impression of metastatic lesions. At meat inspection, the presence of more than one neoplasm will be indicative of malignancy and therefore total condemnation; the same applies if metastases are found in the regional lymph nodes. Please refer in addition to Chapter 21 on neoplasms. Granulomatous and pyogranulomatous pneumonias as well as verminous pneumonias, in particular *M. capillaris* induced verminous pneumonia in sheep, are the most important differential diagnoses for lung neoplasms.

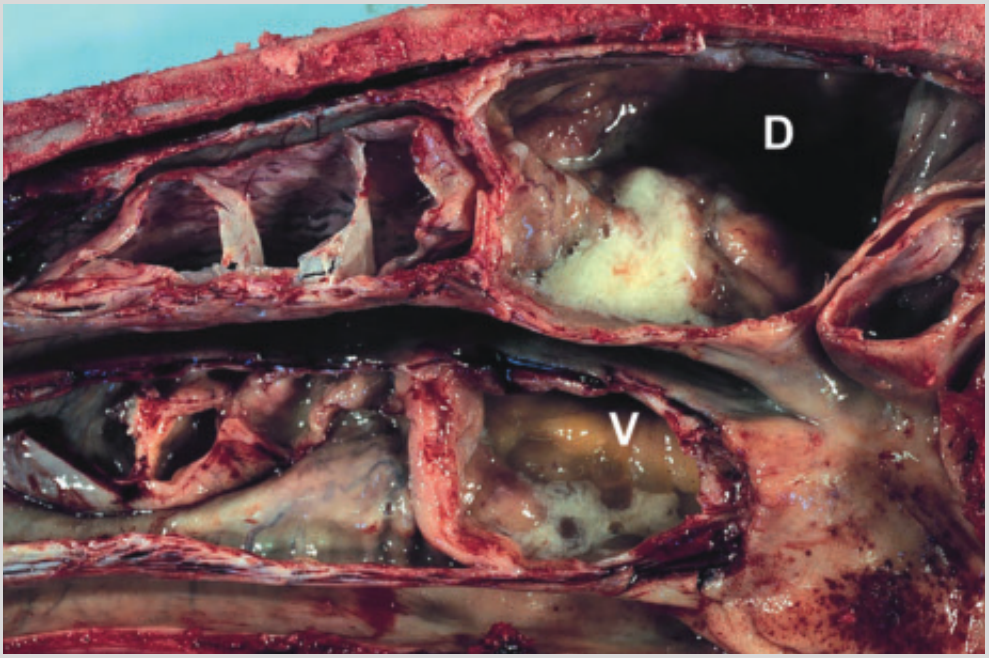
Pulmonary adenocarcinoma (adenomatosis) occurs in older sheep and is caused by a retrovirus. It is considered to be a primary malignant lung neoplasm. Initially, multicentric, grey to white lesions are observed which in advanced cases can become confluent. In cattle metastatic uterine carcinoma occurs quite frequently in the lungs. The lesions are white, with characteristic areas of yellow, orange or red. The lesions are firm due to fibrosis, and the fibrous characteristic appears to mimic the lung's lobular structure. The primary neoplasm in the uterus is often overlooked. It is described under the chapter on reproductive organs (see Chapter 12). In horses, in particular in whites, greys or dapple greys, and pigs (including the Duroc breed) metastatic malignant melanoma occurs sporadically.

Mesothelioma originates in the mesothelium and can occur in the pleura and peritoneum. In slaughter animals, this type of neoplasm occurs particularly in cattle, horses and goats. Other types of neoplasms occur in the thoracic cavity such as schwannomas in cattle and lymphosarcomas in cattle, pigs and horses (see Chapter 21).

Fibrous and filamentous formations on the visceral pleura in livestock occur commonly in older animals and can be seen in particular along the caudal lobes' basal (i.e. ventral) border. Similar changes can occur on the epicardium. These are not considered to be a pathological condition, but if the lesions are widespread they necessitate partial condemnation.

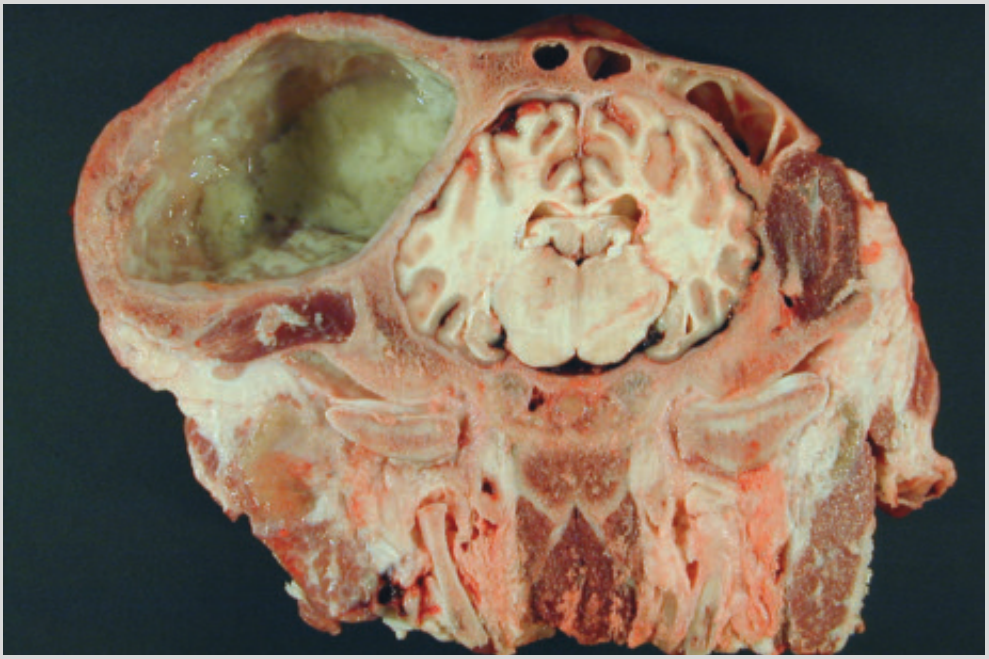
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5.01



Animal species/Organ	Horse/Head; right nasal cavity, and dorsal (D) and ventral (V) conchal sinuses
Lesion	Chronic, purulent sinusitis of dorsal and ventral conchae with pus retention (empyema)
Scoring	Partial condemnation
Comments	Sinuses in the bones of the head (frontal bone, maxilla, etc.) are connected

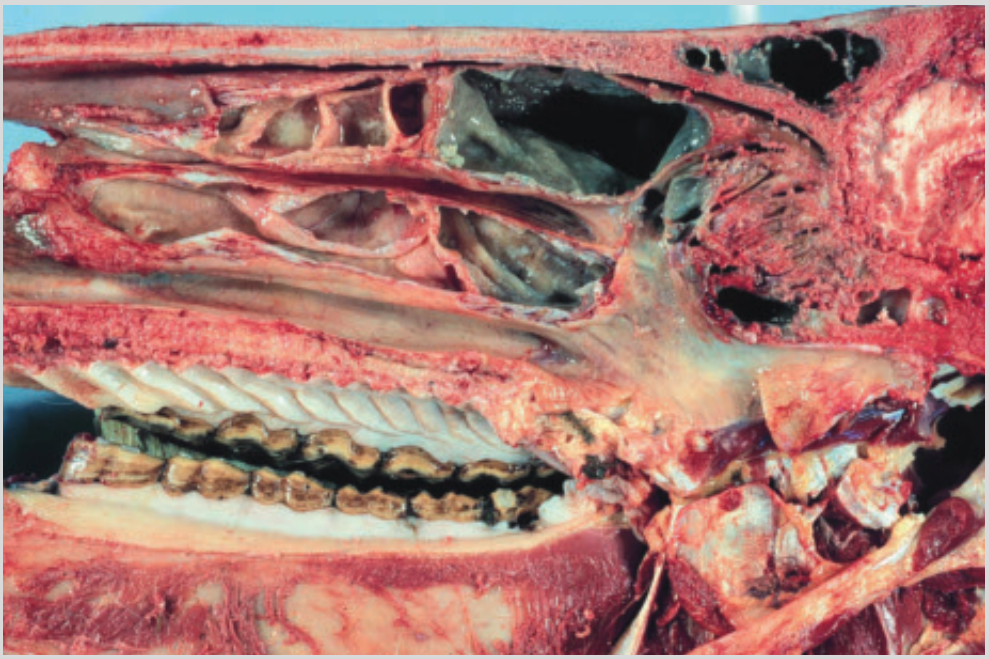
5.02



Animal species/Organ	Cattle/Head; frontal sinus, brain, etc.
Lesion	Chronic, purulent, deforming frontal sinusitis with pus retention (empyema)
Scoring	Partial condemnation
Comments	Severe dorsolateral and mild medial dilatation of the frontal sinus

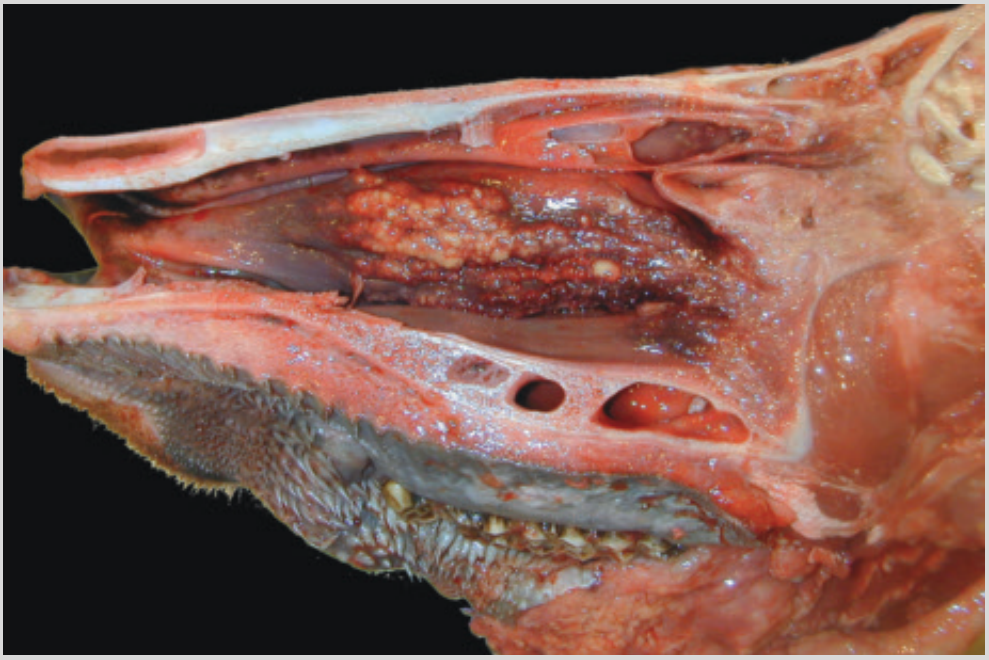
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5.03



Animal species/Organ	Horse/Head; right nasal cavity, frontal sinus, and dorsal and ventral conchal sinuses
Lesion	Chronic, putrid frontal sinusitis and dorsal and ventral conchal sinusitis
Scoring	Partial condemnation
Comments	Black colouring (pseudomelanosis) indicates a mixed bacterial infection

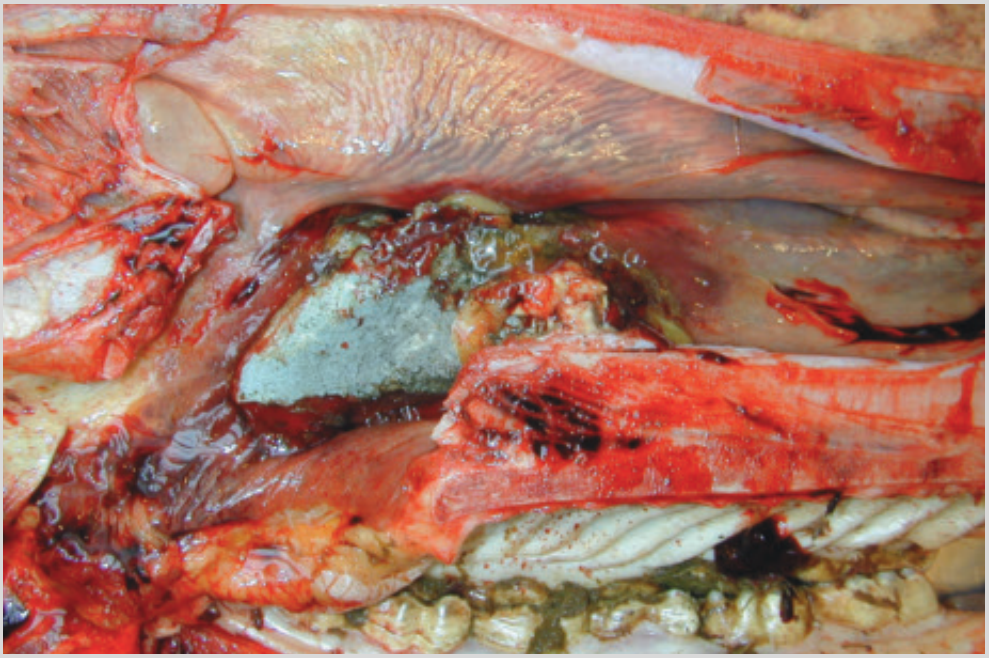
5.04



Animal species/Organ	Cattle/Head; cut section of the right nasal cavity
Lesion	Chronic, pyogranulomatous rhinitis
Scoring	Partial condemnation
Comments	*Actinobacillus lignieresii* isolated from the lesion

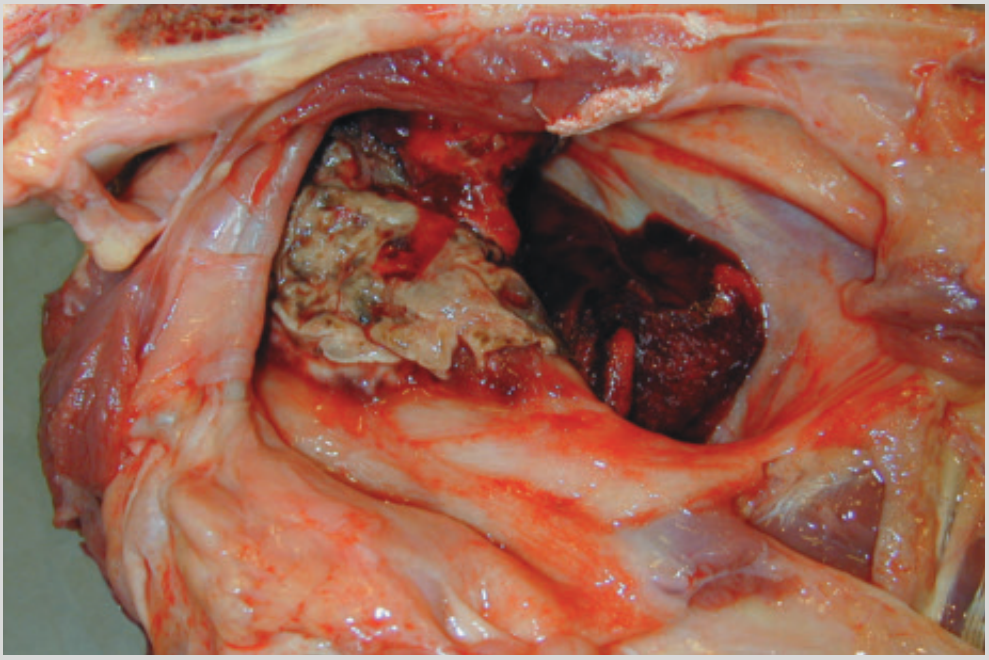
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5.05



Animal species/Organ	Horse/Head; cut section of the left nasal cavity
Lesion	Chronic, purulent and haemorrhagic rhinitis
Scoring	Partial condemnation
Comments	Caused by fungal infection (green discolouration of the ventral concha)

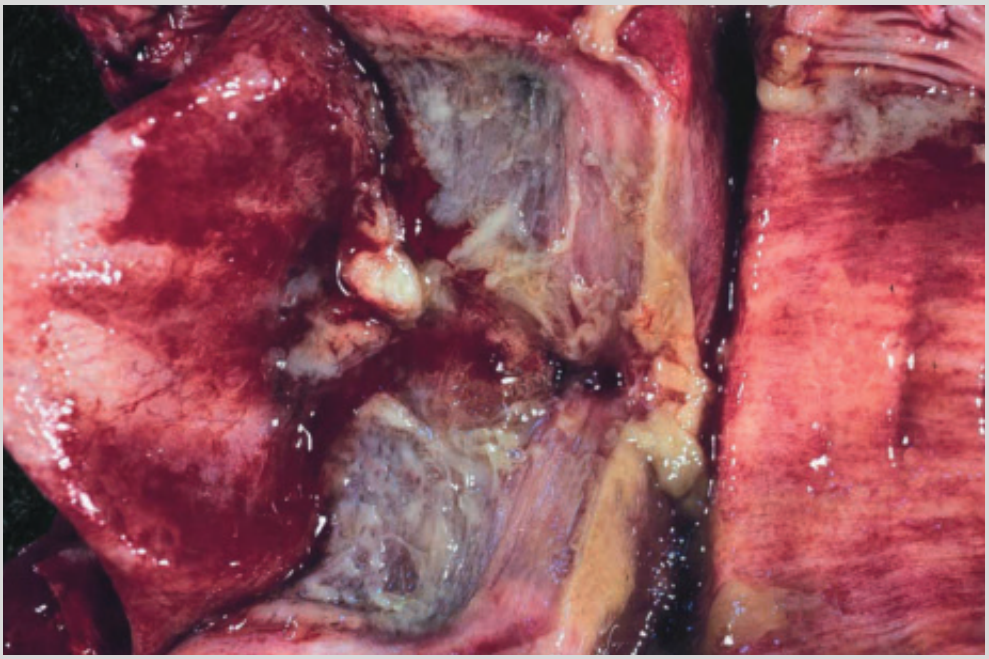
5.06



Animal species/Organ	Horse/Head; presentation of left guttural pouch
Lesion	Chronic, purulent and haemorrhagic guttural pouch inflammation
Scoring	Partial condemnation
Comments	Caused by fungal infection

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5.07



Animal species/Organ	Cattle/Larynx and trachea
Lesion	Acute, fibrinous and haemorrhagic laryngitis and tracheitis
Scoring	Partial condemnation; however, if complications total condemnation
Comments	The lesion can be seen in infectious bovine rhinotracheitis (IBR) with secondary bacterial infection (viraemia necessitates total condemnation)

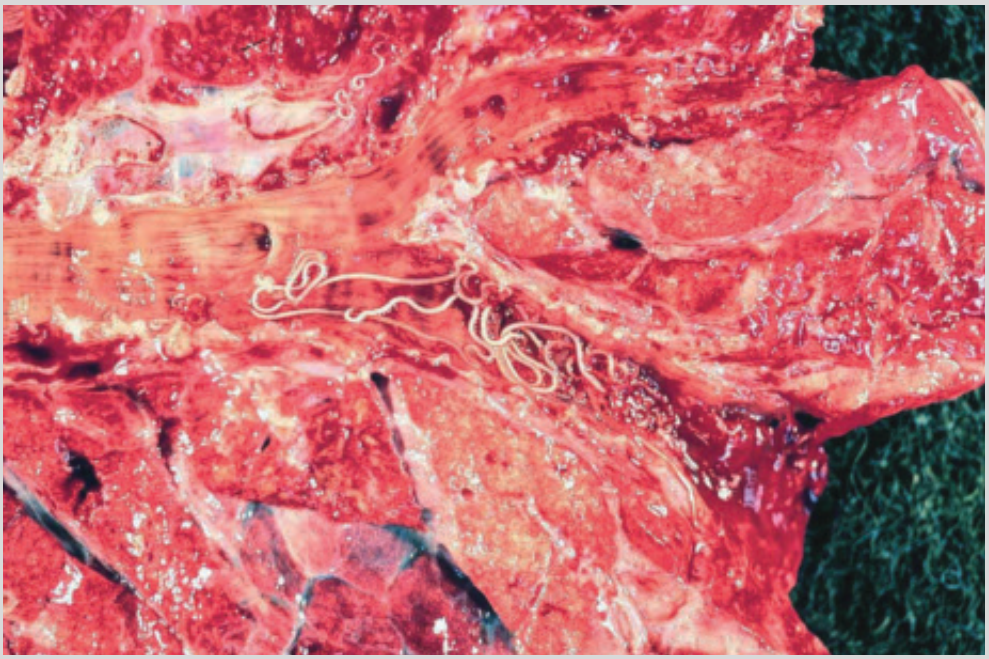
5.08



Animal species/Organ	Pig/Head; cut section of the right nasal cavity
Lesion	Atrophic rhinitis (chronic, atrophic and deforming rhinitis)
Scoring	Partial condemnation (unconditional approval at uncomplicated conchal atrophy)
Comments	In addition to conchal atrophy, atrophy of the snout is evident by the underhung bite and folding of the skin dorsally across the bridge of the nose

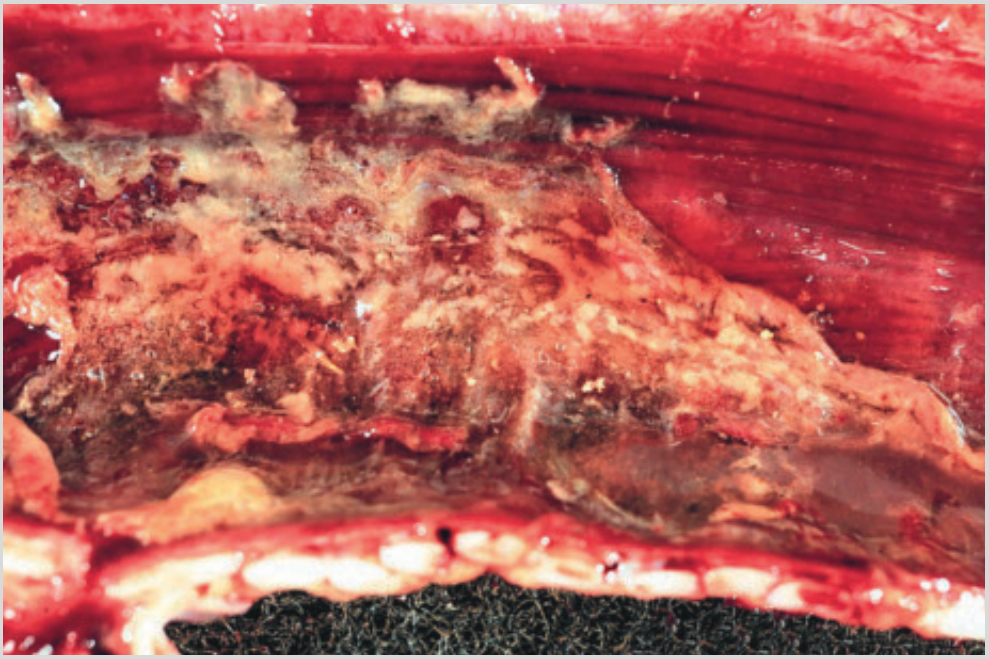
Vet-ebooks.com

5.09



Animal species/Organ	Cattle/Lung; cut section of the bronchi
Lesion	Chronic, verminous bronchitis
Scoring	Partial condemnation
Comments	Caused by *Dictyocaulus viviparus*

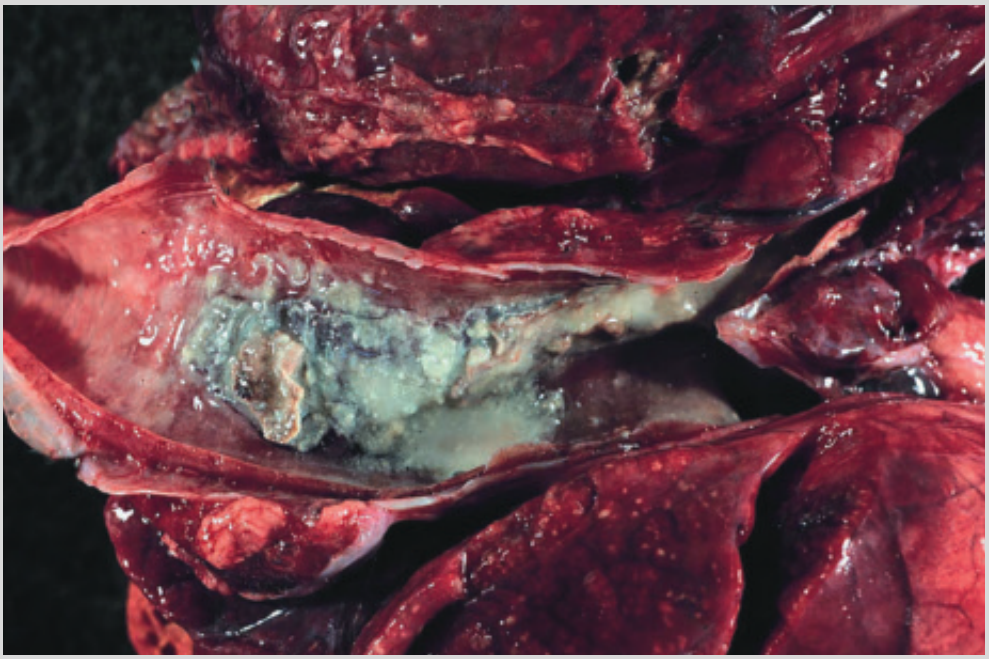
5.10



Animal species/Organ	Cattle/Trachea
Lesion	Acute, fibrinopurulent tracheitis
Scoring	Partial condemnation; however, complications are probable and would necessitate total condemnation
Comments	The lesion can be caused by fire smoke (total condemnation)

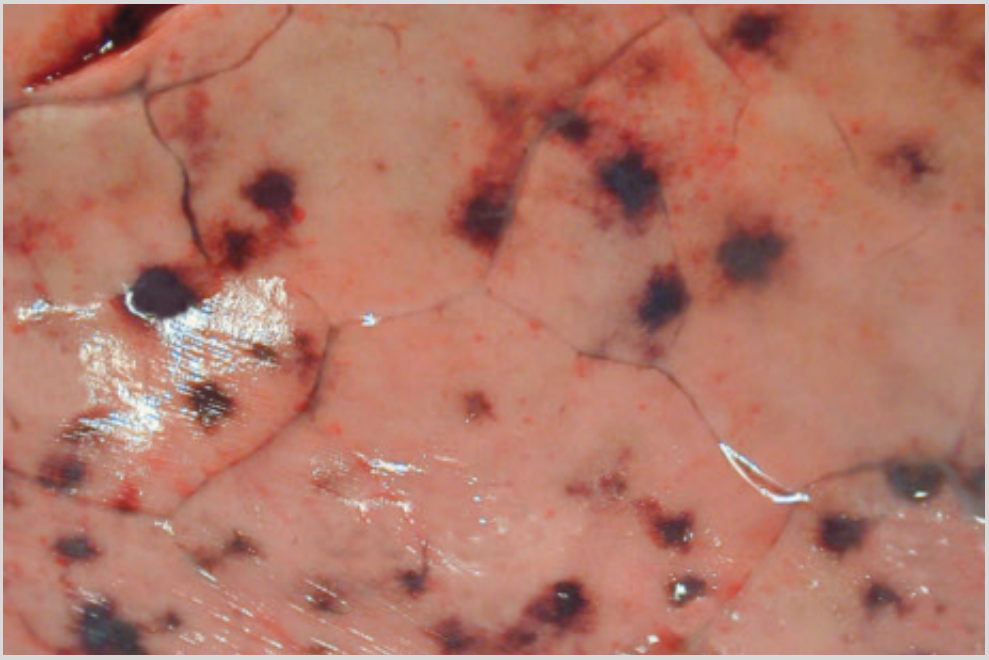
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5.11



Animal species/Organ	Pig/Lungs; cut section of trachea
Lesion	Chronic, purulent, necrotizing tracheitis with sequestration
Scoring	Partial condemnation
Comments	Can be caused by aspiration of gastric content

5.12



Animal species/Organ	Pig/Lung
Lesion	Blood splash (acute haemorrhages occurring at slaughter)
Scoring	Partial condemnation
Comments	The lesions are unremarkable at palpation

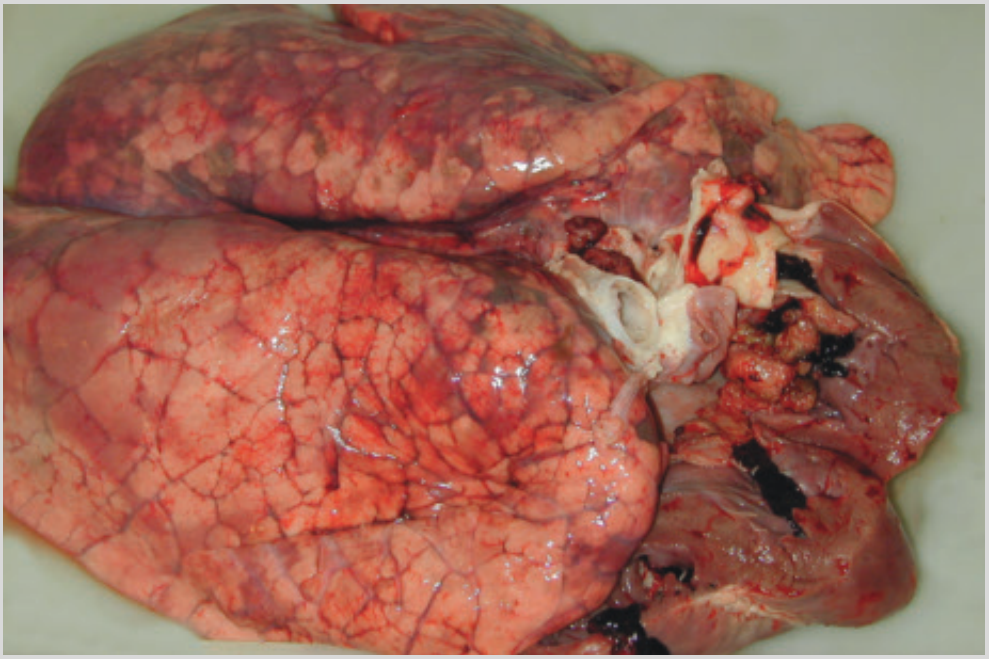
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5.13



Animal species/Organ	Pig/Left tracheobronchial lymph nodes
Lesion	Blood resorption
Scoring	Partial condemnation conditional on the underlying condition not necessitating other scoring
Comments	Blood splash and sticking lesions can cause blood resorption

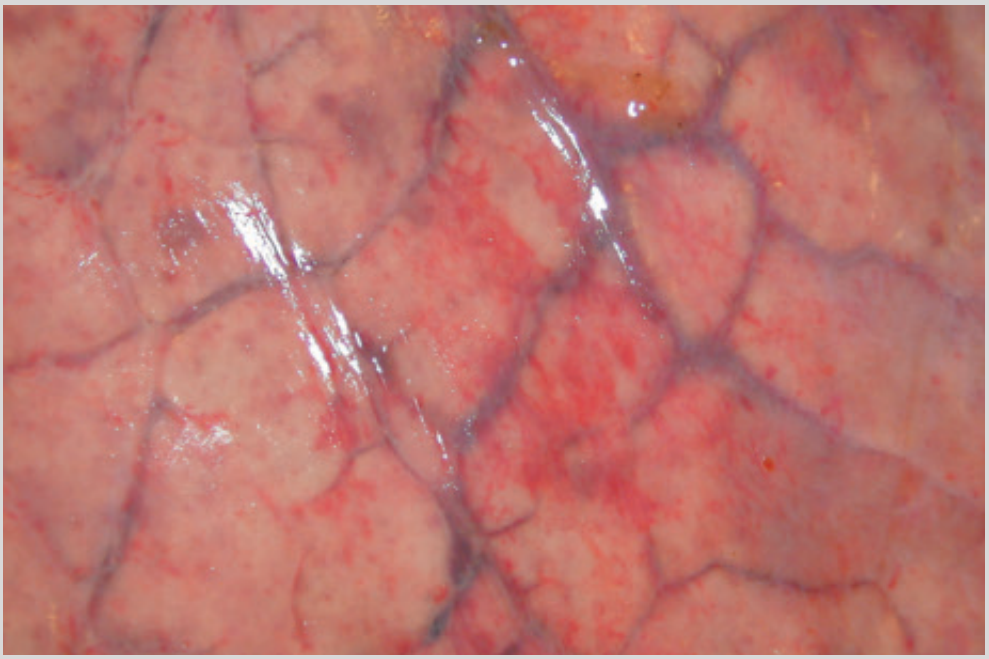
5.14



Animal species/Organ	Pig/Lungs and heart
Lesion	Chronic pulmonary congestion: thrombotic, valvular endocarditis of the mitral valve
Scoring	Total condemnation
Comments	Uncomplicated thrombotic endocarditis in finisher pigs necessitates partial condemnation; however, at complications as here (pulmonary congestion) total condemnation

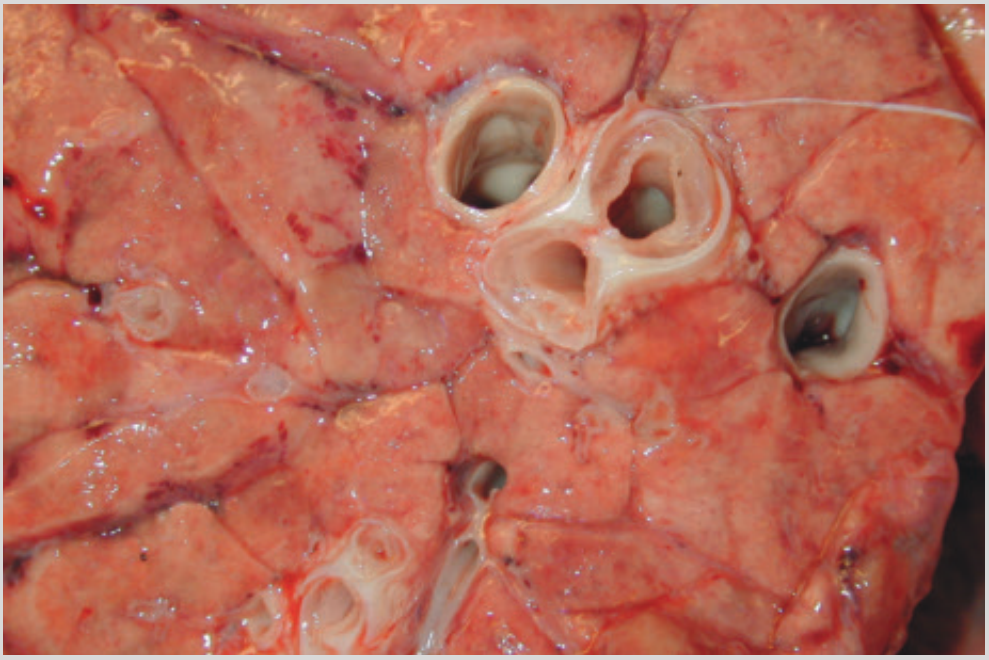
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5.15



Animal species/Organ	Pig/Lung; the same pig as in 5.16
Lesion	Chronic pulmonary congestion
Scoring	Total condemnation if present together with thrombotic endocarditis, for example
Comments	Acute haemorrhages, chronic haemorrhages (red-brown discolouration) and oedema

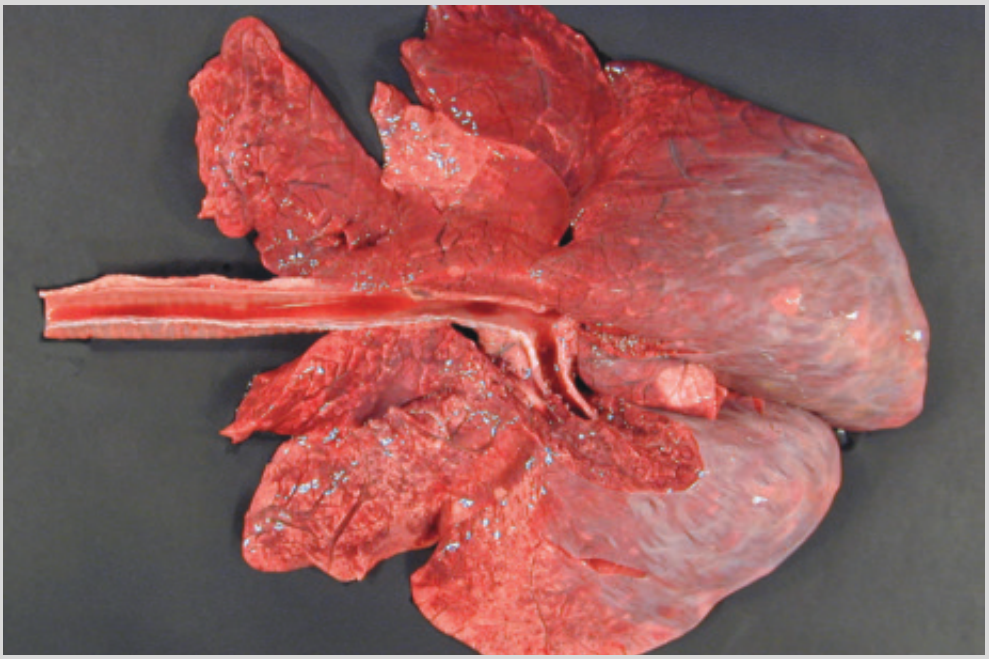
5.16



Animal species/Organ	Pig/Lung; cut section of lung shown in 5.15
Lesion	Chronic pulmonary congestion
Scoring	Total condemnation if present together with thrombotic endocarditis, for example
Comments	The chronic haemorrhages cause the red-brown or brick-red discolouration

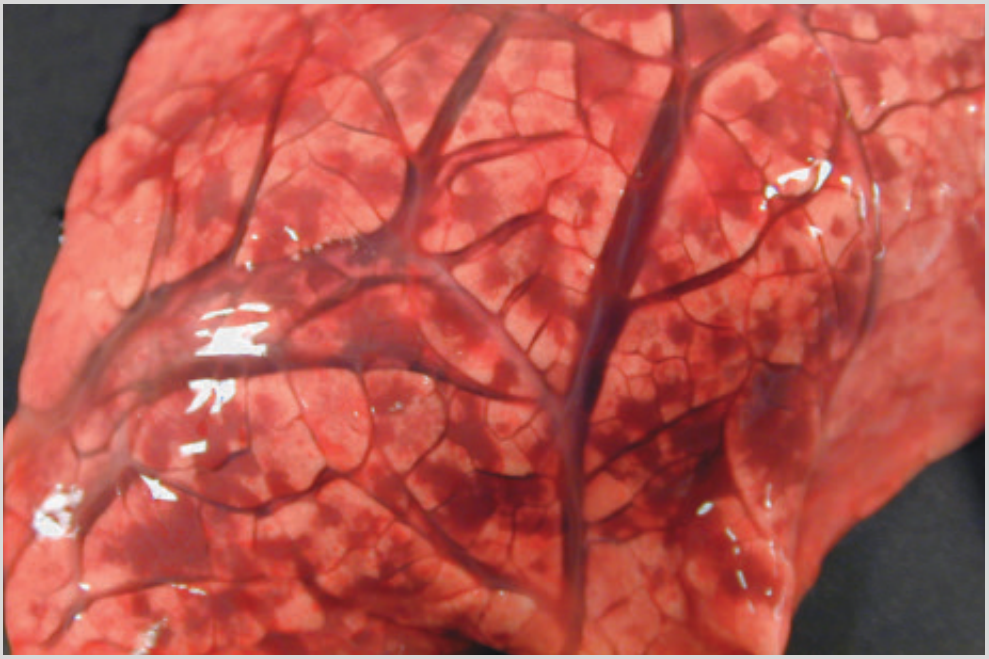
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5.17



Animal species/Organ	Cattle/Lungs; the same lesion as in 5.18
Lesion	Pulmonary oedema; oedema fluid has collected in the trachea and main bronchi
Scoring	Total condemnation because the lungs are from a calf with sepsis (*Escherichia coli*)
Comments	There are only minimal amounts of foam in the trachea

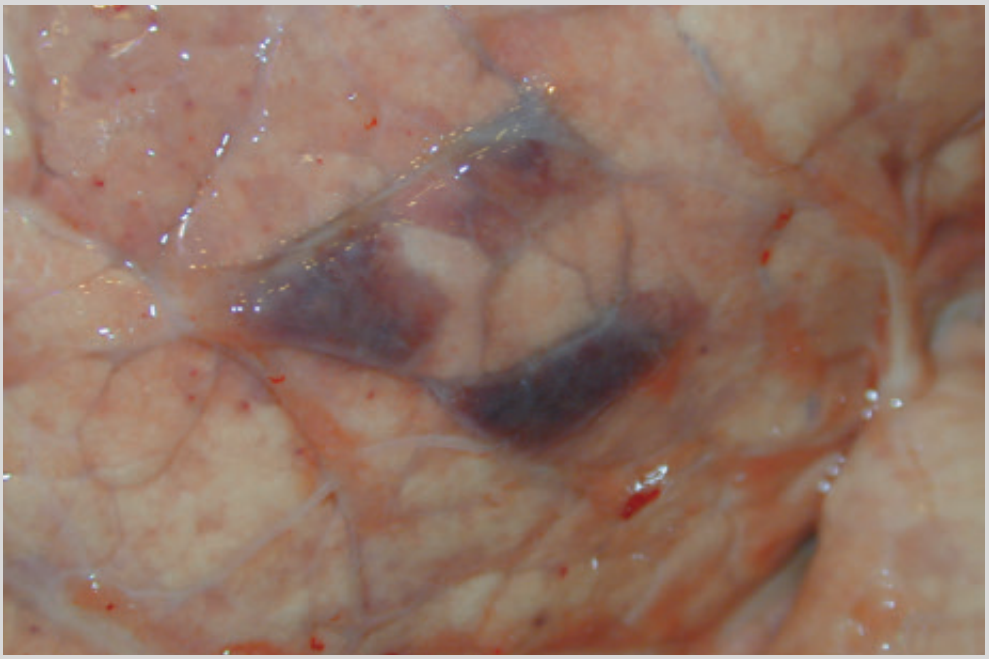
5.18



Animal species/Organ	Cattle/Lung; detail of the lungs (visceral pleura) in 5.17
Lesion	Pulmonary oedema and acute haemorrhages; oedema fluid in the interlobular connective tissue
Scoring	Total condemnation because the lungs are from a calf with sepsis (*E. coli*)
Comments	In principle, the lesion can be primary (partial condemnation) or secondary, when the scoring will be decided by the underlying condition

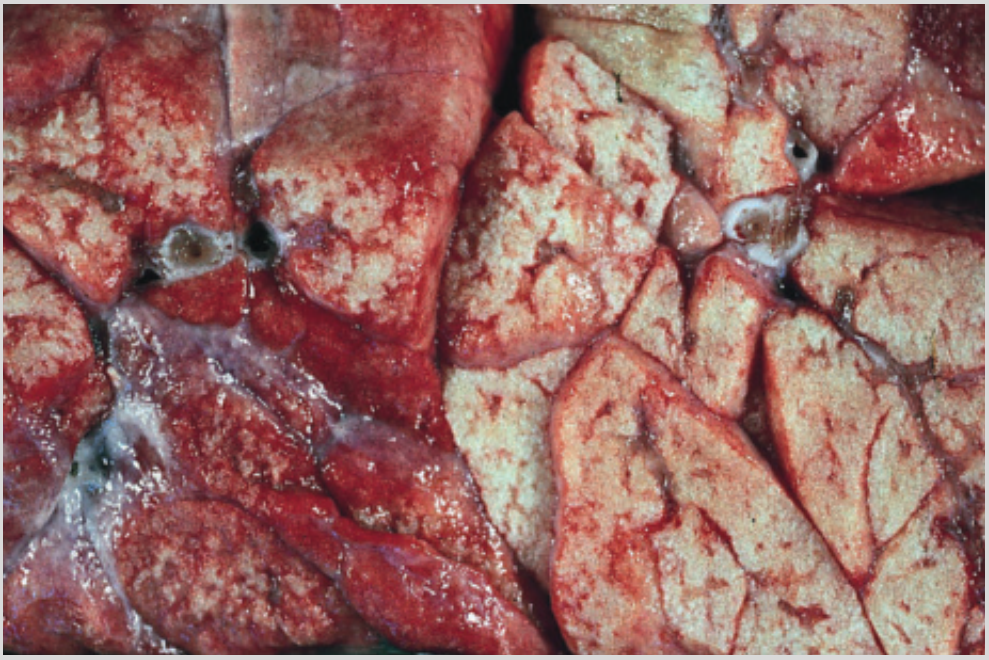
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5.19



Animal species/Organ	Cattle/Lung
Lesion	Acute, haemorrhagic pulmonary infarctions
Scoring	Total condemnation
Comments	Note the lobular appearance of the lesions

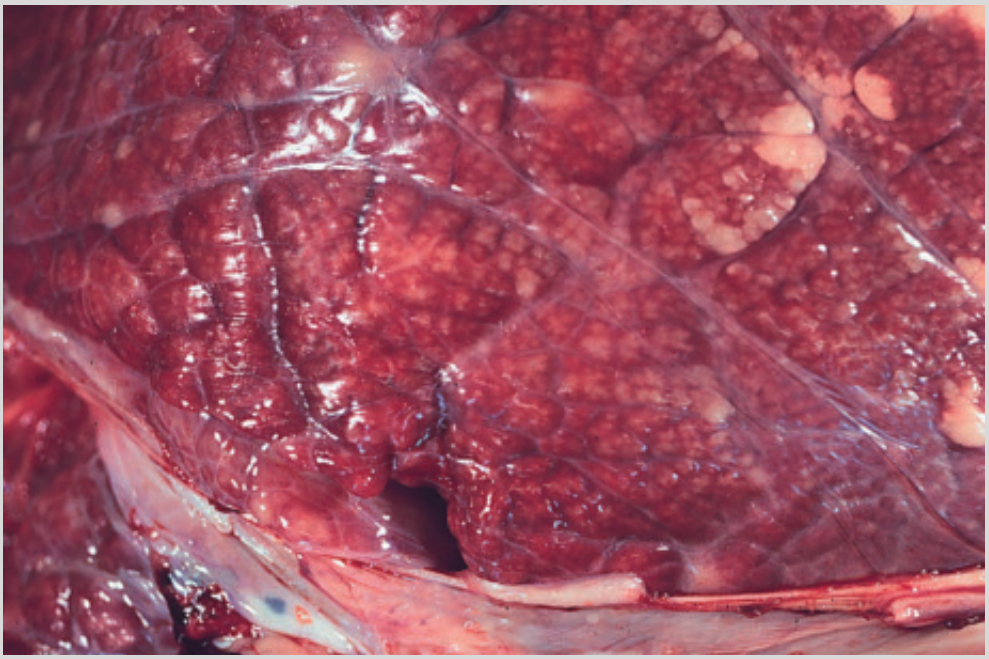
5.20



Animal species/Organ	Cattle/Lung
Lesion	Mineralisation
Scoring	Partial condemnation conditional on the underlying condition not necessitating other scoring
Comments	Is sometimes seen secondary to granulomatous inflammations, in this case Johne's disease (paratuberculosis)

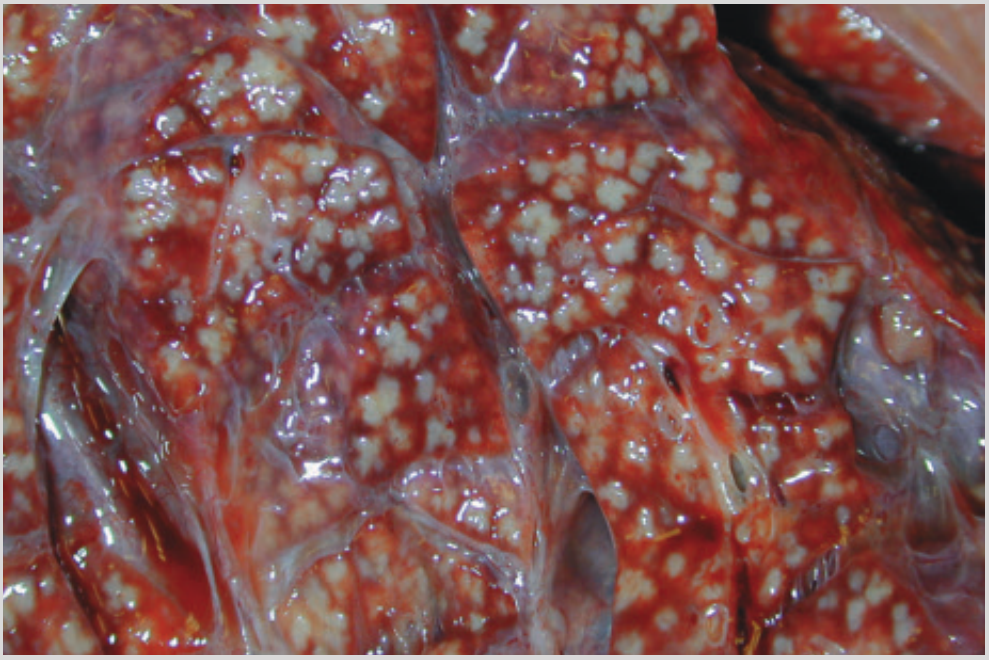
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5.21



Animal species/Organ	Cattle/Lung; surface (visceral pleura; the same lesion as in 5.22)
Lesion	Subacute, purulent bronchopneumonia with cloverleaf markings (bronchopneumonic markings)
Scoring	Partial condemnation
Comments	On the right side of the photo can be seen parts of lobules (yellowish) without changes

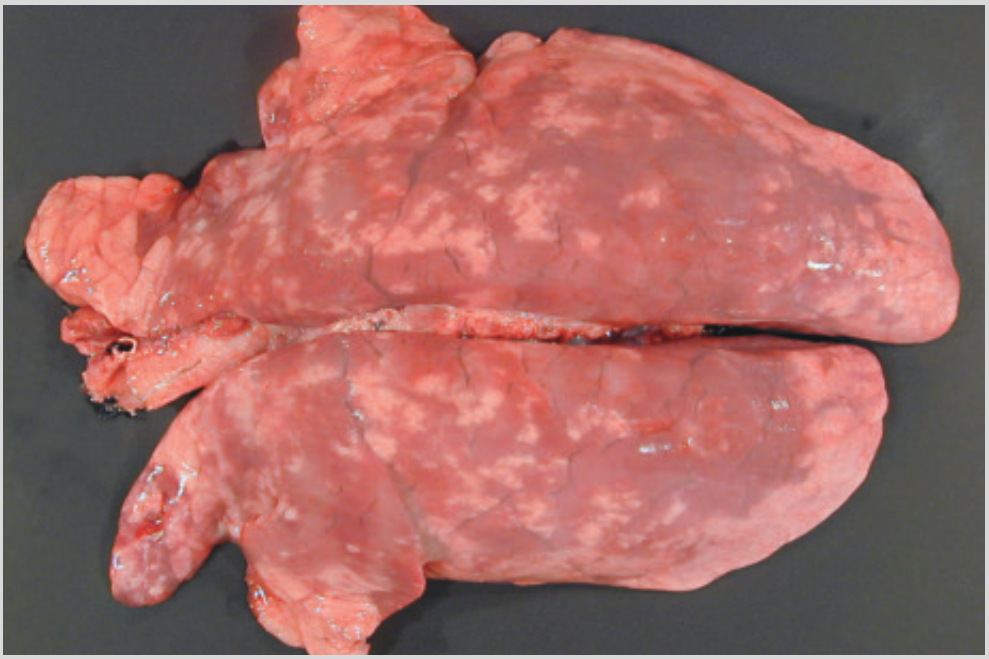
5.22



Animal species/Organ	Cattle/Lung; cut section of lung shown in 5.21
Lesion	Subacute, purulent bronchopneumonia with cloverleaf markings
Scoring	Partial condemnation
Comments	Cloverleaf markings (bronchopneumonic markings) are characteristic for bronchopneumonia, but do not occur in all cases of bronchopneumonia

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5.23



Animal species/Organ	Pig/Lungs
Lesion	Chronic, interstitial pneumonia; same lungs as in 5.24, 5.25 and 5.26
Scoring	Partial condemnation
Comments	At palpation, note the firm texture

5.24



Animal species/Organ	Pig/Lungs
Lesion	Chronic, interstitial pneumonia; same lungs as in 5.23, 5.25 and 5.26
Scoring	Partial condemnation
Comments	Note that the lungs have not collapsed normally

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5.25



Animal species/Organ	Pig/Lungs
Lesion	Chronic, interstitial pneumonia; same lungs as in 5.23, 5.24 and 5.26
Scoring	Partial condemnation
Comments	The edge of the right caudal lobe does not meet the table as normal

5.26



Animal species/Organ	Pig/Lung
Lesion	Chronic, interstitial pneumonia; same lungs as in 5.23, 5.24 and 5.25
Scoring	Partial condemnation
Comments	It can be seen in particular in the subpleura on the left side of the preparation that the lung tissue is homogenous and does not contain air

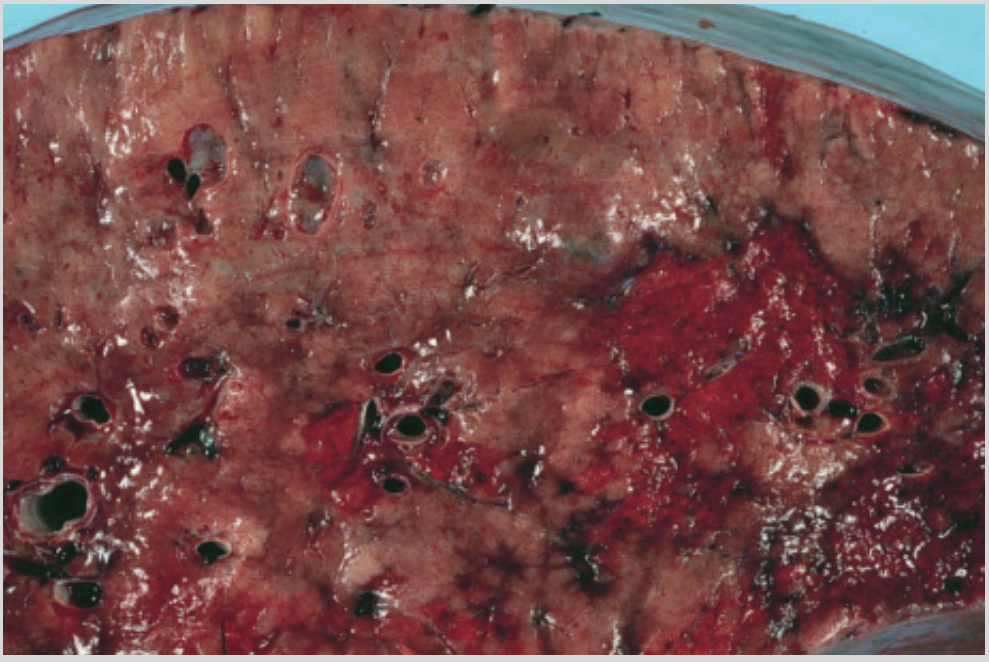
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5.27



Animal species/Organ	Cattle/Lung
Lesion	Acute, interstitial pneumonia ("fog fever")
Scoring	Total condemnation
Comments	Caused by a metabolite of L-tryptophan; characterised by oedema and hyperaemia

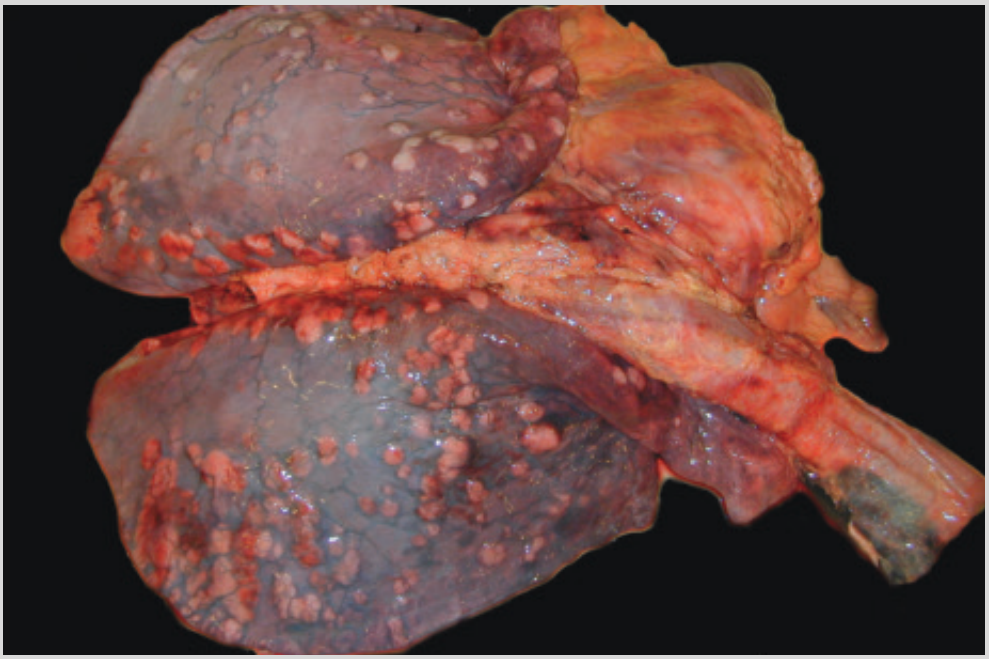
5.28



Animal species/Organ	Horse/Lung
Lesion	Chronic, interstitial pneumonia (equine multinodular pulmonary fibrosis or according to old Danish litterature pneumonia lardea)
Scoring	Partial condemnation
Comments	Lesional areas resemble liver tissue and have firm texture

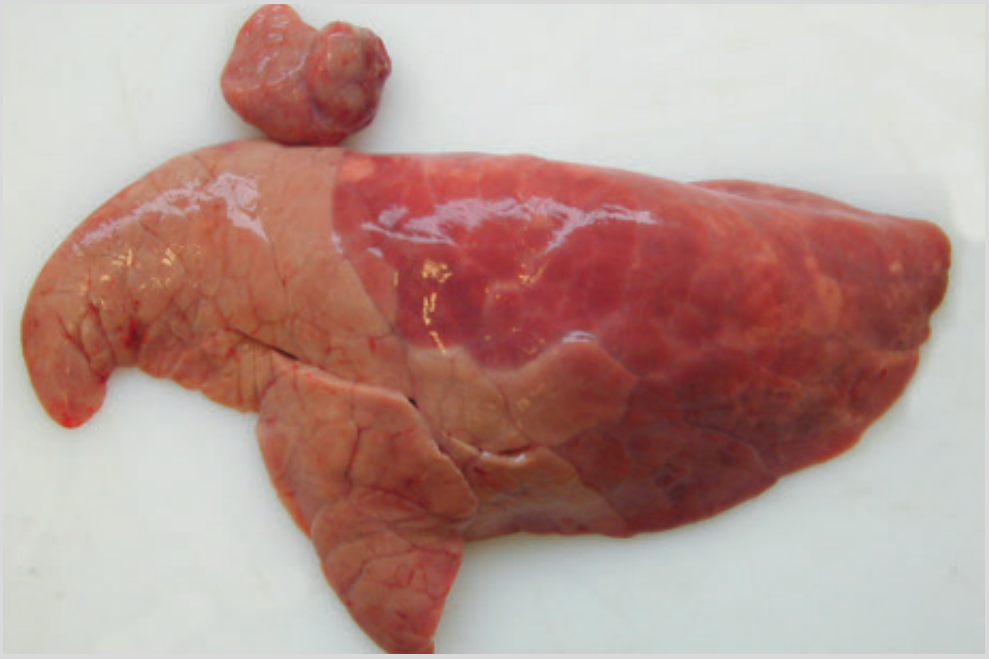
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5.29



Animal species/Organ	Horse/Lung
Lesion	Chronic, interstitial pneumonia (equine multinodular pulmonary fibrosis)
Scoring	Partial condemnation
Comments	The differential diagnosis is metastatic neoplasms

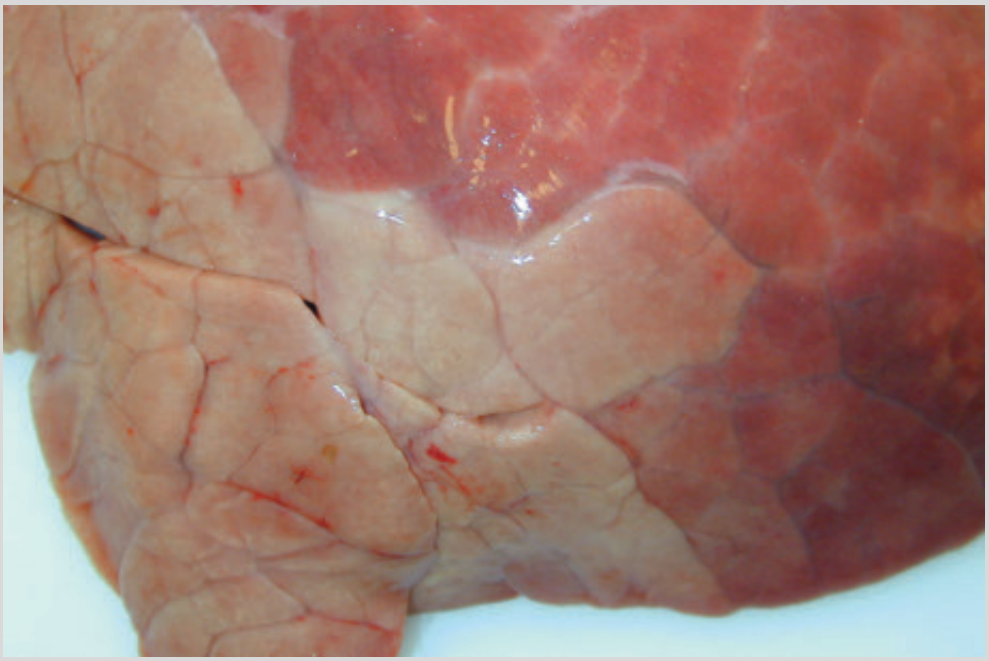
5.30



Animal species/Organ	Pig/Lung
Lesion	Chronic, bronchointerstitial pneumonia; same lungs as in 5.31 and 5.32
Scoring	Partial condemnation
Comments	Cranioventrally, a pale, locally extensive lesion with lobular appearance can be seen; hyperplasia of regional lymph nodes

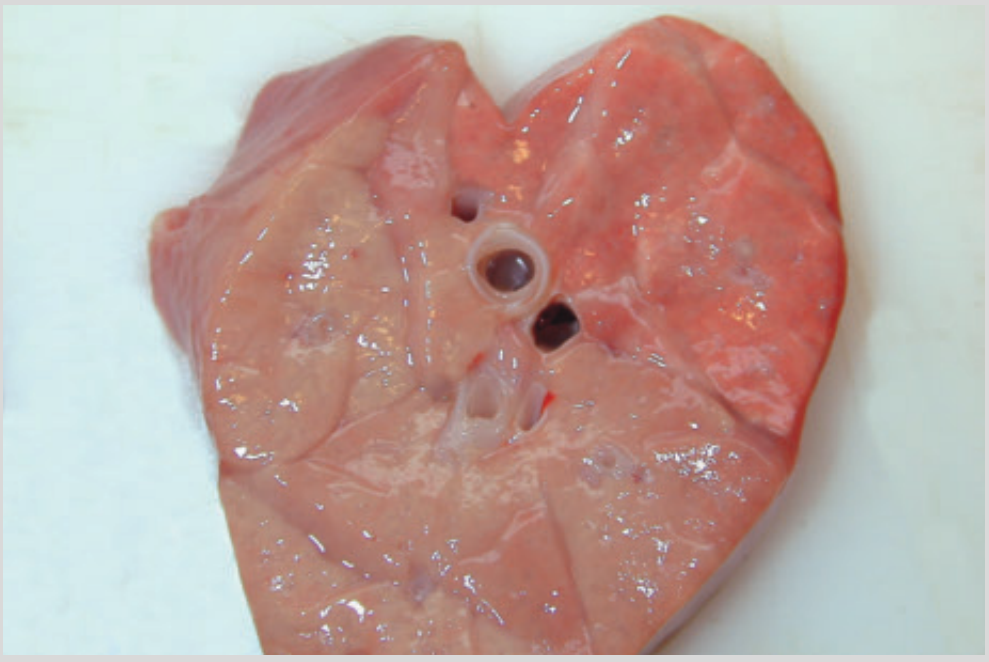
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5.31



Animal species/Organ	Pig/Lung
Lesion	Chronic, bronchointerstitial pneumonia; same lungs as in 5.30 and 5.32
Scoring	Partial condemnation
Comments	Lesional lung tissue protrudes above the adjacent normal lung tissue

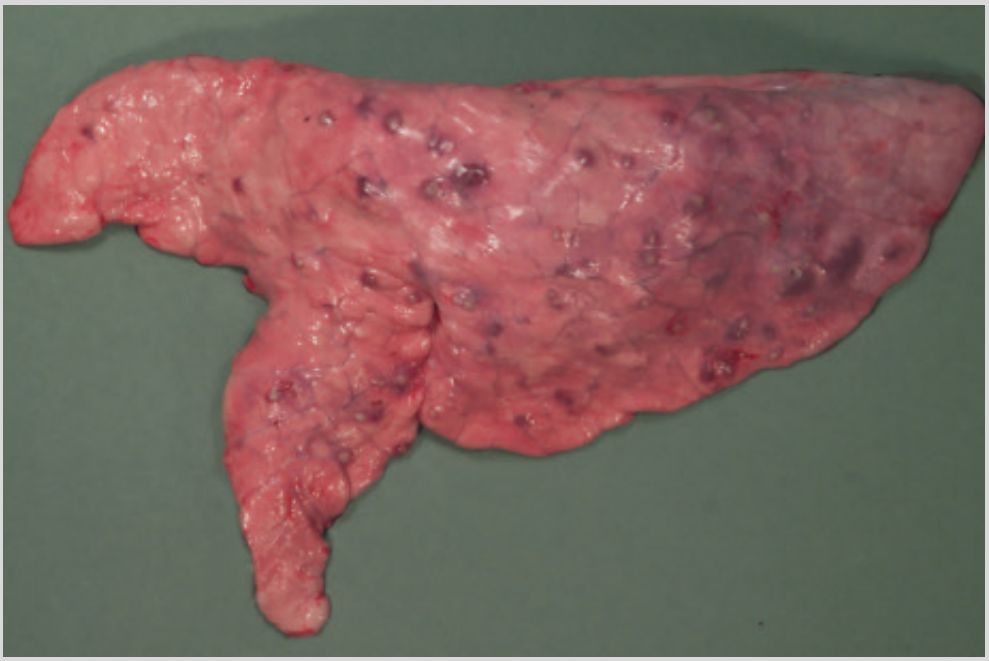
5.32



Animal species/Organ	Pig/Lung
Lesion	Chronic, bronchointerstitial pneumonia; same lungs as in 5.30 and 5.31
Scoring	Partial condemnation
Comments	Cross-section of the transition between lesional and normal lung tissue

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5.33



Animal species/Organ	Pig/Lung
Lesion	Acute, focal, abscess-forming, embolic pneumonia
Scoring	Total condemnation
Comments	Determination of age is performed on cut sections of the lesions; the other lung had similar lesions

5.34



Animal species/Organ	Pig/Lung; transverse incision on the caudal lobe
Lesion	Chronic, focal, necrotizing (with sequestration), embolic pneumonia
Scoring	Approved for deboning
Comments	Although the section represents only a small part of the total lung tissue, it is nevertheless evidence for the presence of disseminated lesions

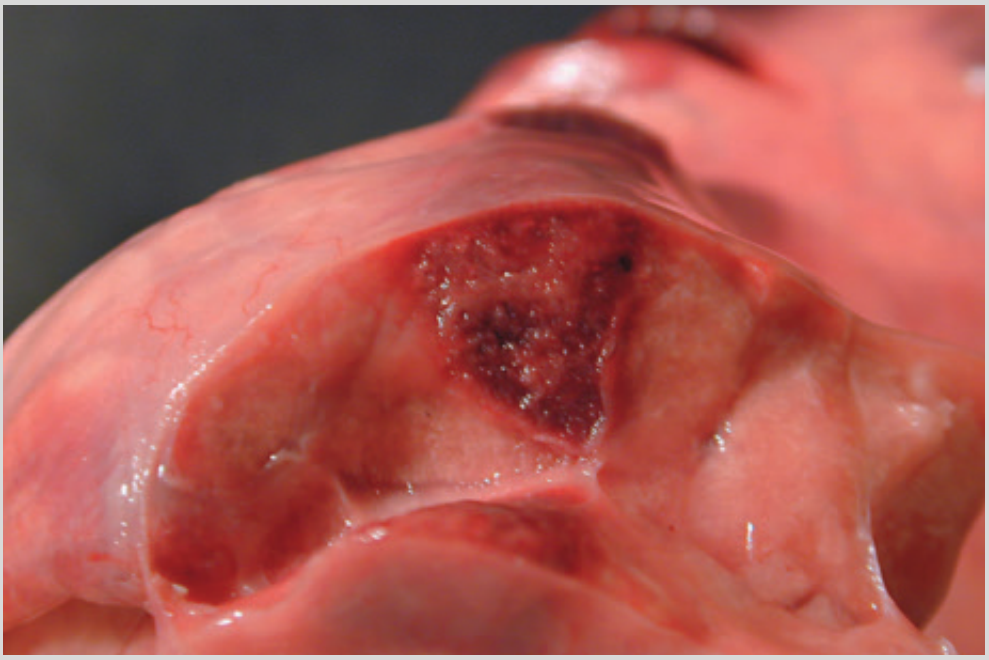
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5.35



Animal species/Organ	Pig/Lung; the same pig as in 5.36
Lesion	Peracute, focal, haemorrhagic, aerogenous pneumonia
Scoring	Total condemnation
Comments	Porcine contagious pleuropneumonia (*Actinobacillus pleuropneumoniae*) with disseminated lesions

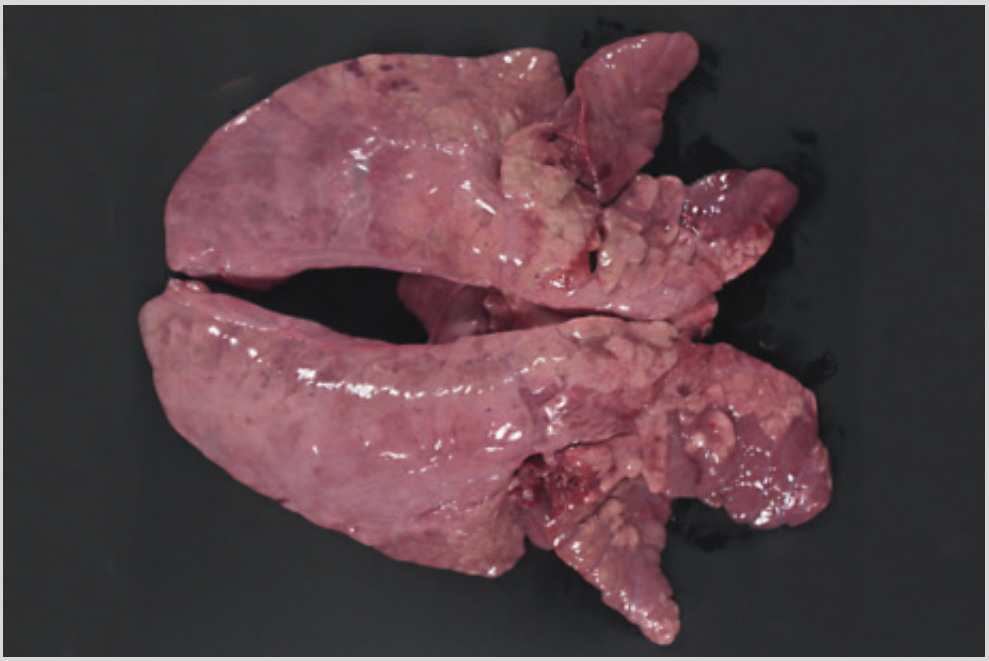
5.36



Animal species/Organ	Pig/Lung; detail of 5.35
Lesion	Peracute, focal, haemorrhagic, aerogenous pneumonia
Scoring	Total condemnation
Comments	The lobular appearance of the lesions reveals the pathogenesis as aerogenous; an alternative classification is peracute, haemorrhagic, lobular bronchopneumonia

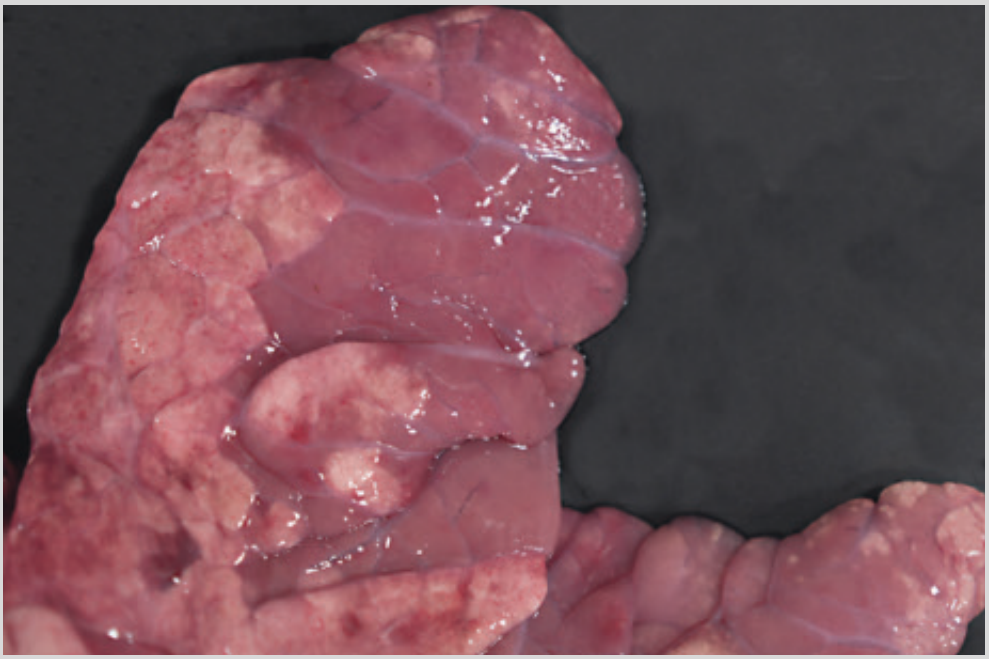
Vet-ebooks.com

5.37



Animal species/Organ	Pig/Lung; the same pig as in 5.38
Lesion	Chronic, lobular bronchopneumonia; bilateral lesions
Scoring	Partial condemnation
Comments	The cranioventral localisation is characteristic

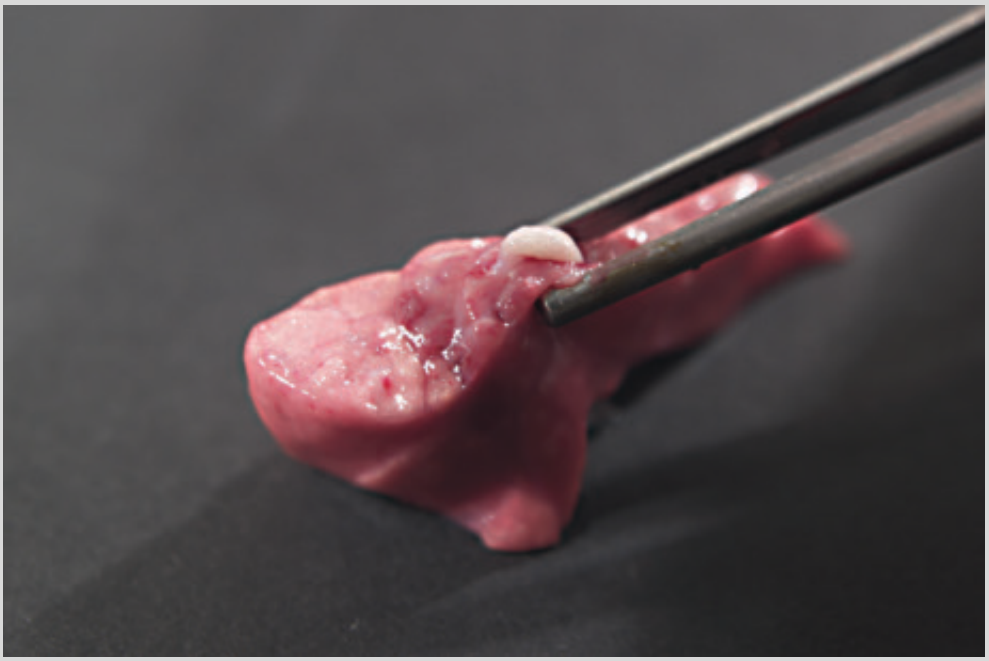
5.38



Animal species/Organ	Pig/Lung; detail of 5.37
Lesion	Chronic, lobular bronchopneumonia
Scoring	Partial condemnation
Comments	Red-brown, lobular lesions below the level of the adjacent normal lung tissue indicates chronicity

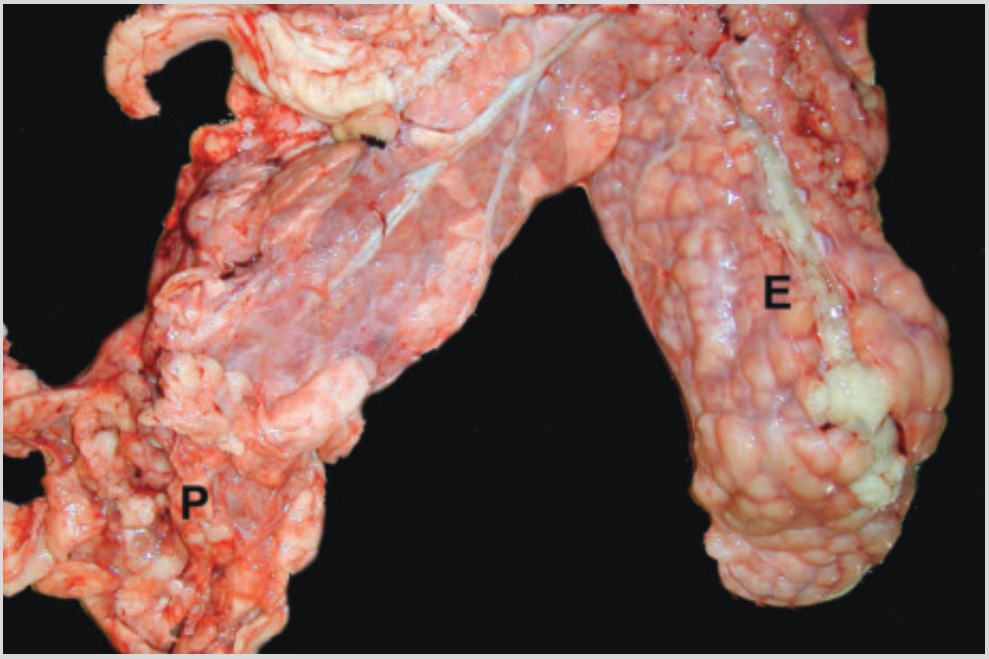
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5.39



Animal species/Organ	Pig/Lung
Lesion	Chronic, lobular, purulent bronchopneumonia
Scoring	Partial condemnation
Comments	Catarrhal exudate (*Mycoplasma hyopneumoniae*); purulent exudate (secondary bacterial infection)

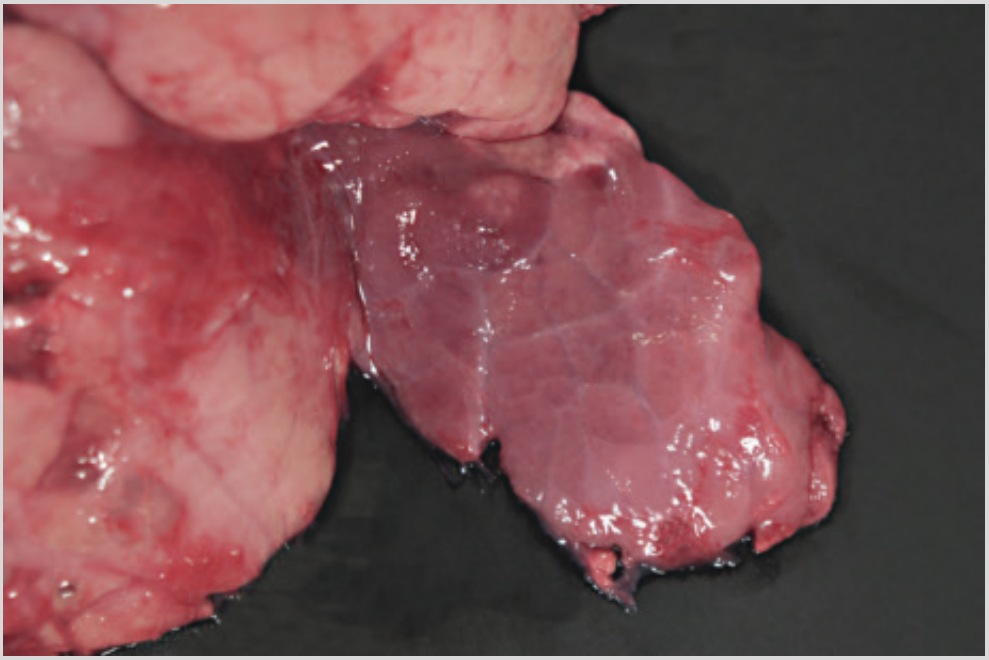
5.40



Animal species/Organ	Cattle/Lung; cut section of bronchi
Lesion	Chronic, lobular, purulent bronchopneumonia with bronchiectasis (E)
Scoring	Partial condemnation
Comments	Chronic, lobular bronchopneumonia with chronic, fibrous, adhesive pleuritis (P)

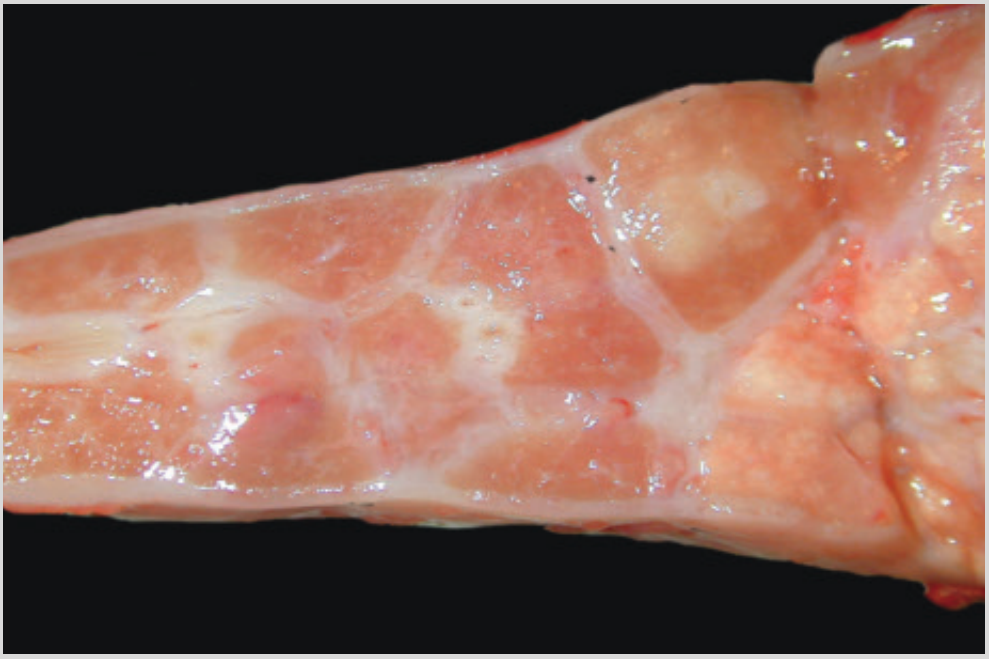
Vet-ebooks.com

5.41



Animal species/Organ	Pig/Lung
Lesion	Chronic, lobular bronchopneumonia
Scoring	Partial condemnation
Comments	Overlying, mild inflammation in pleura (chronic, fibrous pleuritis) often occurs in lobular bronchopneumonia

5.42



Animal species/Organ	Pig/Lung
Lesion	Chronic, lobular, fibrous bronchopneumonia with overlying, chronic, fibrous pleuritis
Scoring	Partial condemnation
Comments	Lesional lobules are also characterised by atelectasis

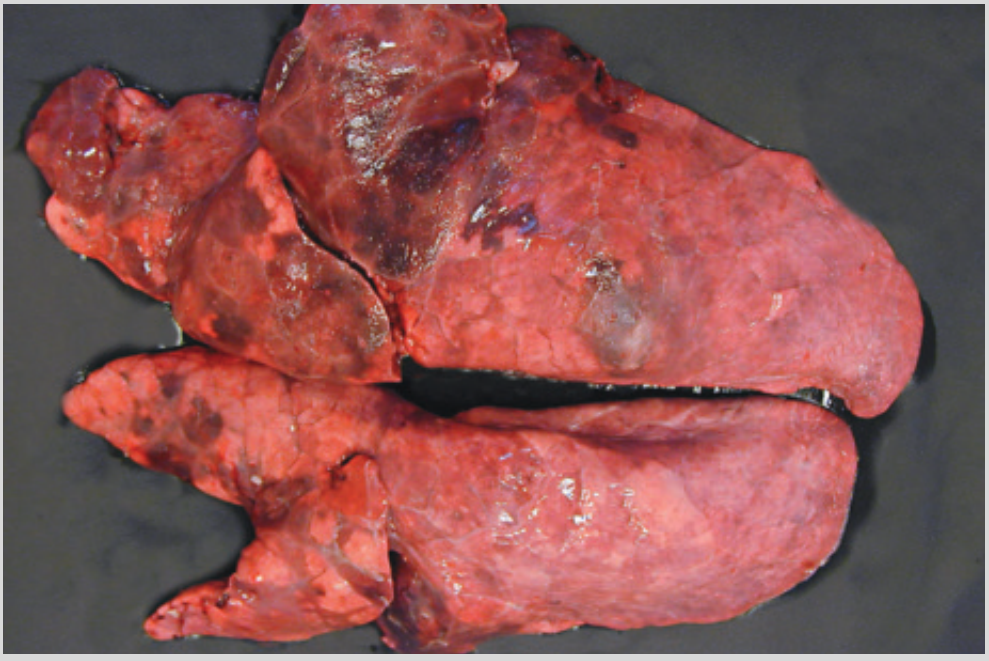
Vet-ebooks.com

5.43



Animal species/Organ	Pig/Lung
Lesion	Peracute and acute, focal, haemorrhagic, aerogenous pneumonia; with overlying, acute, fibrinous pleuritis
Scoring	Total condemnation
Comments	Porcine contagious pleuropneumonia with focal, lobular appearing lesions

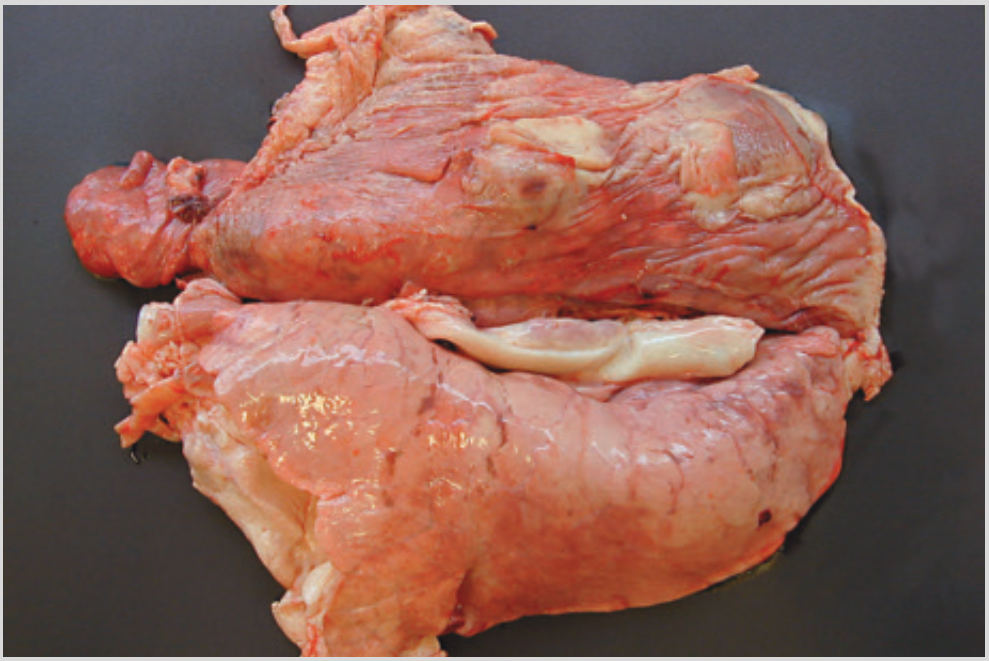
5.44



Animal species/Organ	Pig/Lung
Lesion	Peracute and acute, lobular to lobar, haemorrhagic, bronchopneumonia; the acute lesion (right caudal lobe) has overlying, acute, fibrinous pleuritis
Scoring	Total condemnation
Comments	Porcine contagious pleuropneumonia with cranioventral localisation

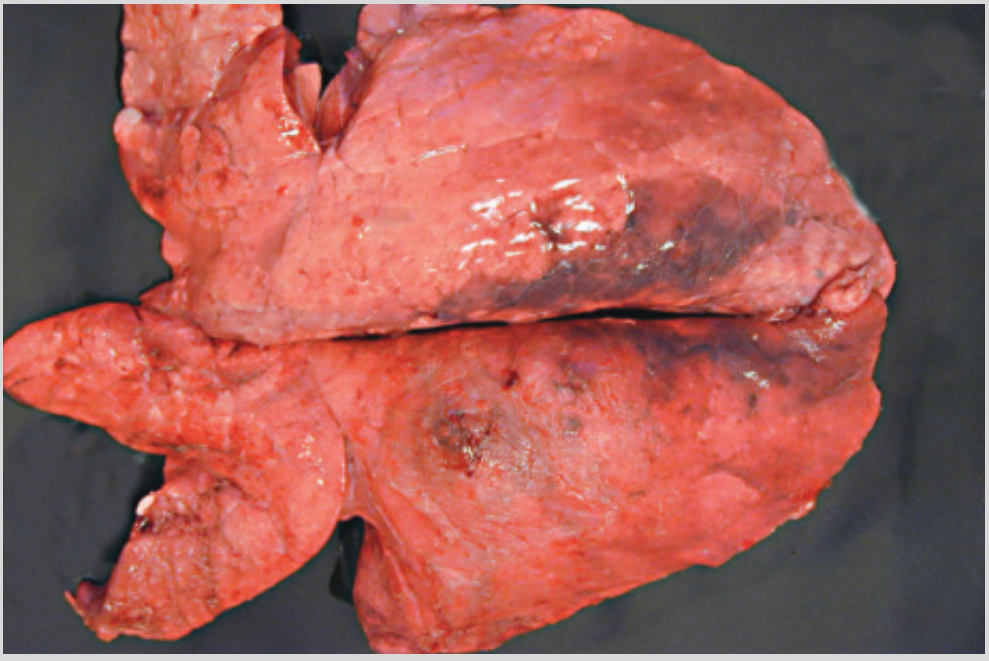
Vet-ebooks.com

5.45



Animal species/Organ	Pig/Lung
Lesion	Acute, lobar bronchopneumonia with acute, fibrinous pleuritis
Scoring	Total condemnation
Comments	Porcine contagious pleuropneumonia; pneumonia affects < 25% of lung tissue (partial condemnation), pleuritis affects > 25% of the lungs' surface (total condemnation)

5.46



Animal species/Organ	Pig/Lung
Lesion	Acute, lobar bronchopneumonia (left caudal lobe) with overlying acute, fibrinous pleuritis
Scoring	Partial condemnation because < 25% of lung tissue and pleura is affected
Comments	Porcine contagious pleuropneumonia; typical localisation

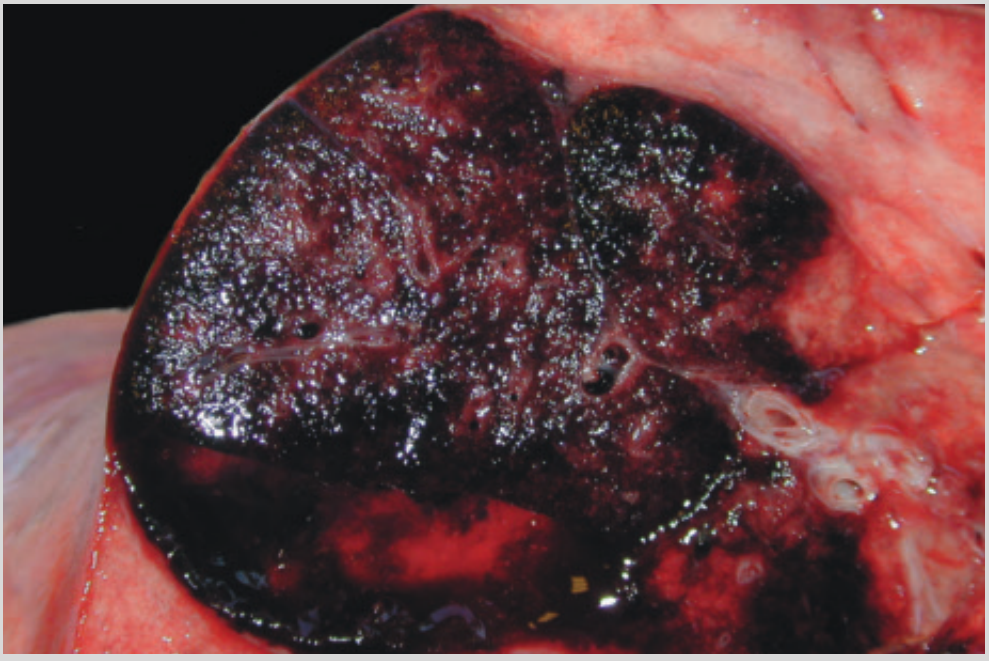
Vet-ebooks.com

5.47



Animal species/Organ	Pig/Lung
Lesion	Acute, lobar bronchopneumonia with acute, fibrinous pleuritis
Scoring	Partial condemnation because < 25% of lung tissue and pleura is affected
Comments	Porcine contagious pleuropneumonia; detail of fibrin exudate

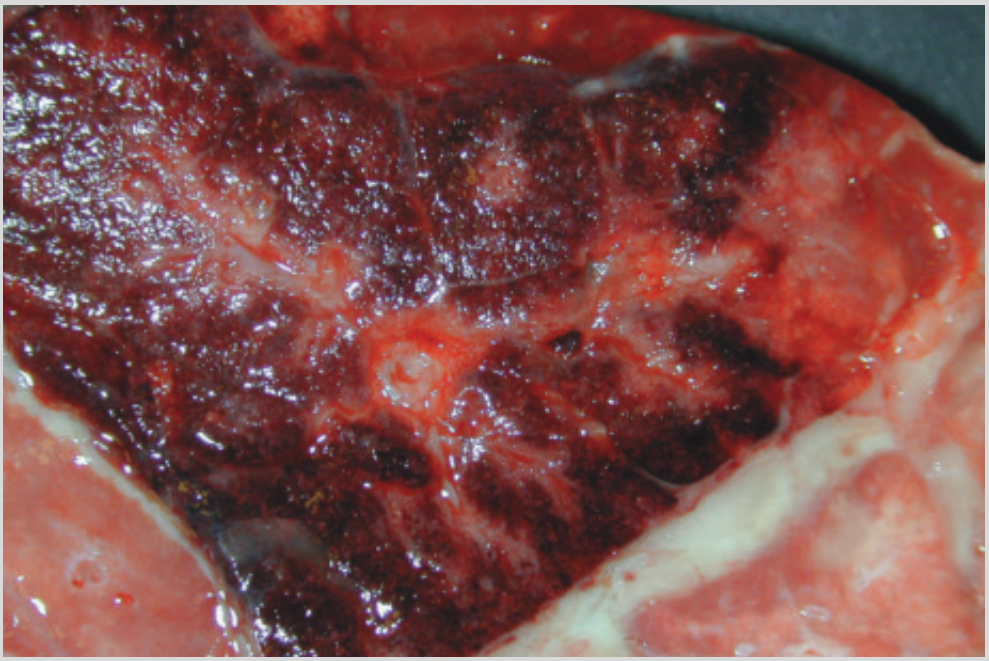
5.48



Animal species/Organ	Pig/Lung
Lesion	Peracute, lobar, haemorrhagic bronchopneumonia; red hepatisation
Scoring	Total condemnation
Comments	Porcine contagious pleuropneumonia; peracute lesions are oedematous and haemorrhagic, but fibrin exudate and necrosis cannot yet be identified macroscopically

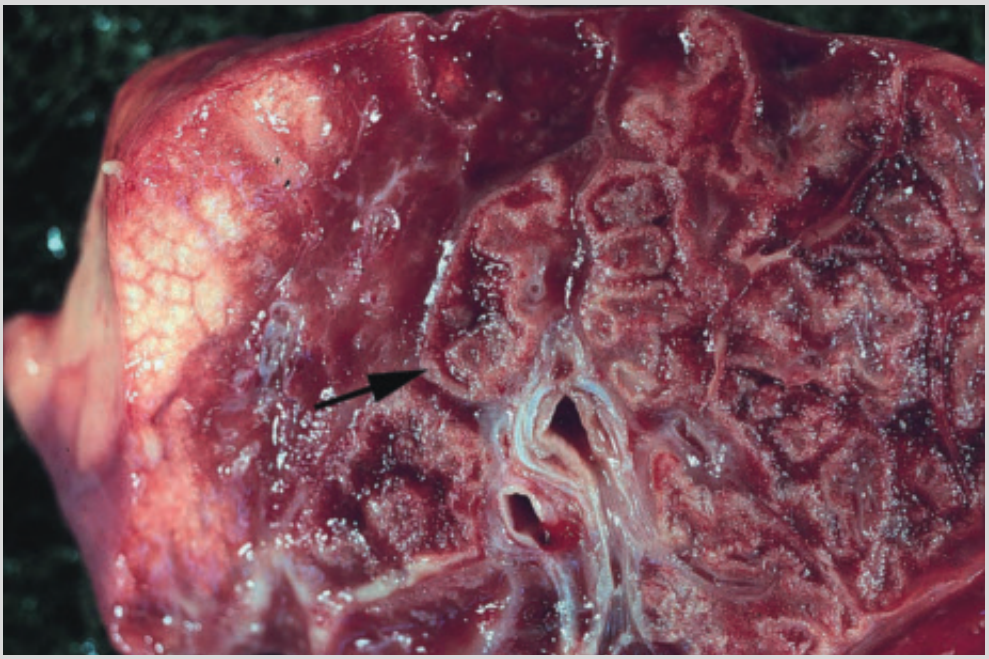
Vet-ebooks.com

5.49



Animal species/Organ	Pig/Lung
Lesion	Acute, lobular, fibrinous, necrotizing and haemorrhagic bronchopneumonia; red/grey hepatisation
Scoring	Partial condemnation; the lesion comprises < 25% of the lung tissue
Comments	Porcine contagious pleuropneumonia; fibrin can be seen in the interstitial spaces

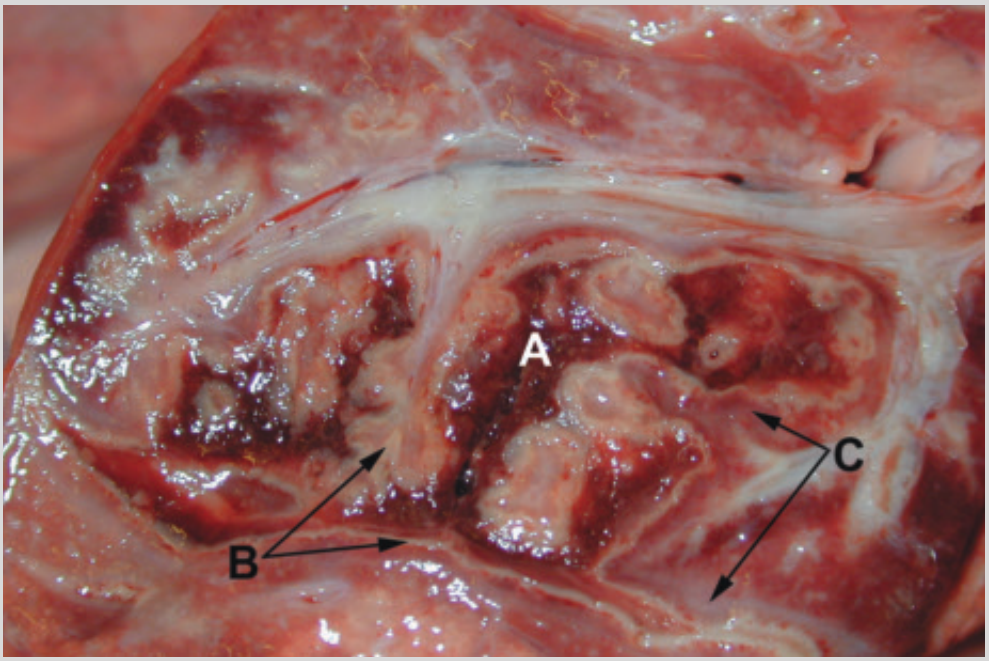
5.50



Animal species/Organ	Pig/Lung
Lesion	Subacute, lobar, fibrinous, necrotizing and haemorrhagic bronchopneumonia; grey hepatisation
Scoring	Partial condemnation; the lesion comprises < 25% of the lung tissue
Comments	Porcine contagious pleuropneumonia; demarcation (→)

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5.51



Animal species/Organ	Pig/Lung
Lesion	Chronic, lobular, fibrinous, necrotizing and haemorrhagic bronchopneumonia; overlying, chronic, fibrinous pleuritis; porcine contagious pleuropneumonia
Scoring	Partial condemnation
Comments	Necrotic tissue (A), demarcation (B), granulation tissue (C)

5.52



Animal species/Organ	Pig/Lung
Lesion	Chronic, lobular, fibrinous, bronchopneumonia with sequestration; overlying, chronic, fibrinous pleuritis; porcine contagious pleuropneumonia
Scoring	Partial condemnation
Comments	Necrosis, demarcation, sequestration and granulation tissue

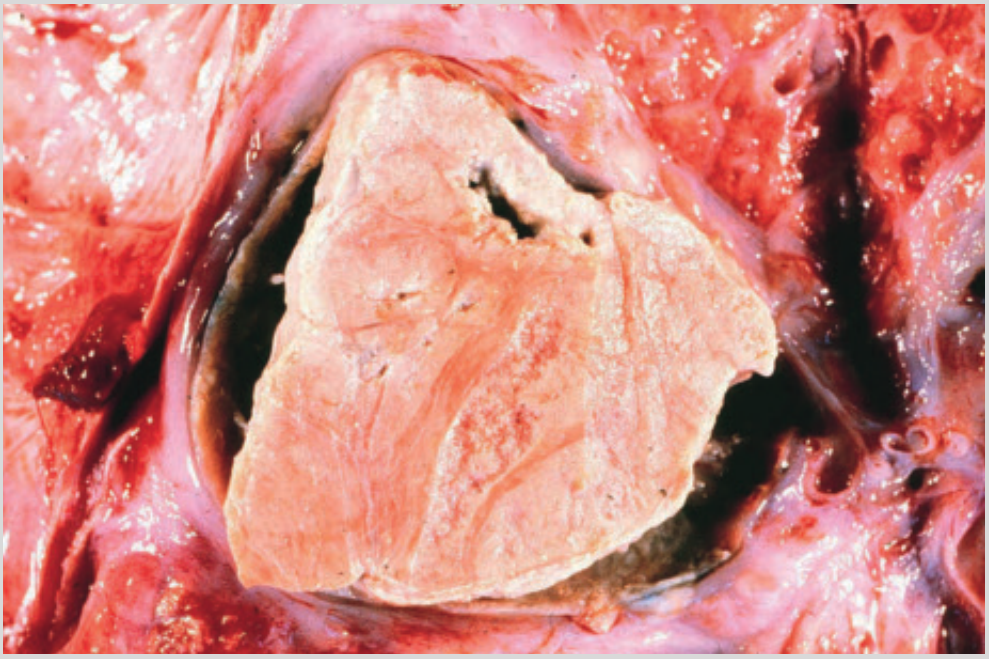
Vet-ebooks.com

5.53



Animal species/Organ	Pig/Lung
Lesion	Chronic, lobar, fibrinous and necrotizing bronchopneumonia; overlying, chronic, fibrinous pleuritis
Scoring	Partial condemnation
Comments	Porcine contagious pleuropneumonia; fibrosis is evident

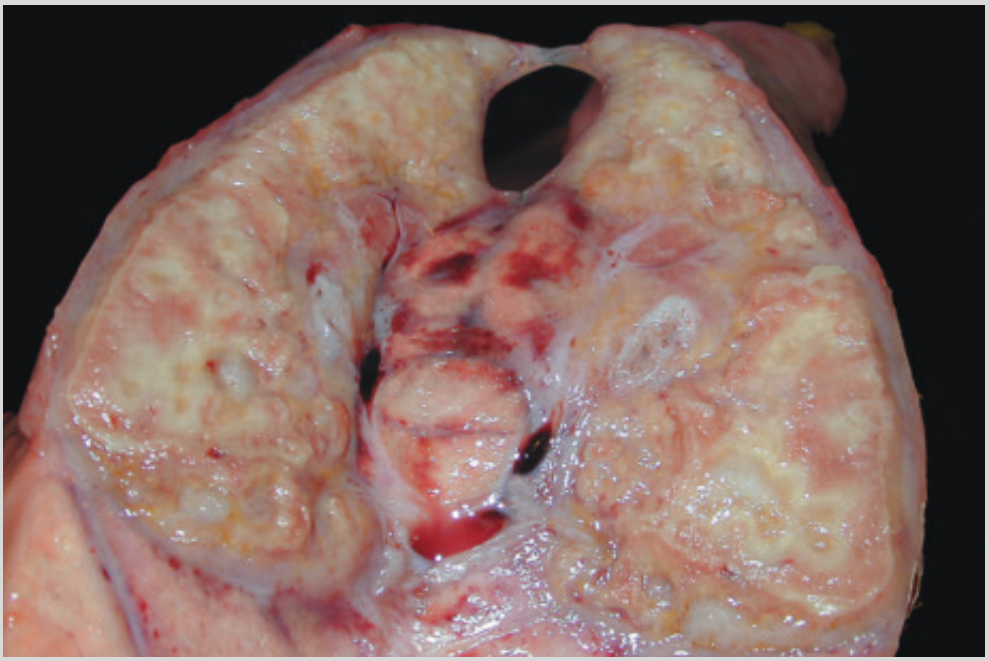
5.54



Animal species/Organ	Pig/Lung
Lesion	Chronic, lobar, bronchopneumonia with sequestration
Scoring	Partial condemnation
Comments	Porcine contagious pleuropneumonia; original lung structures are visible in the sequestered tissue

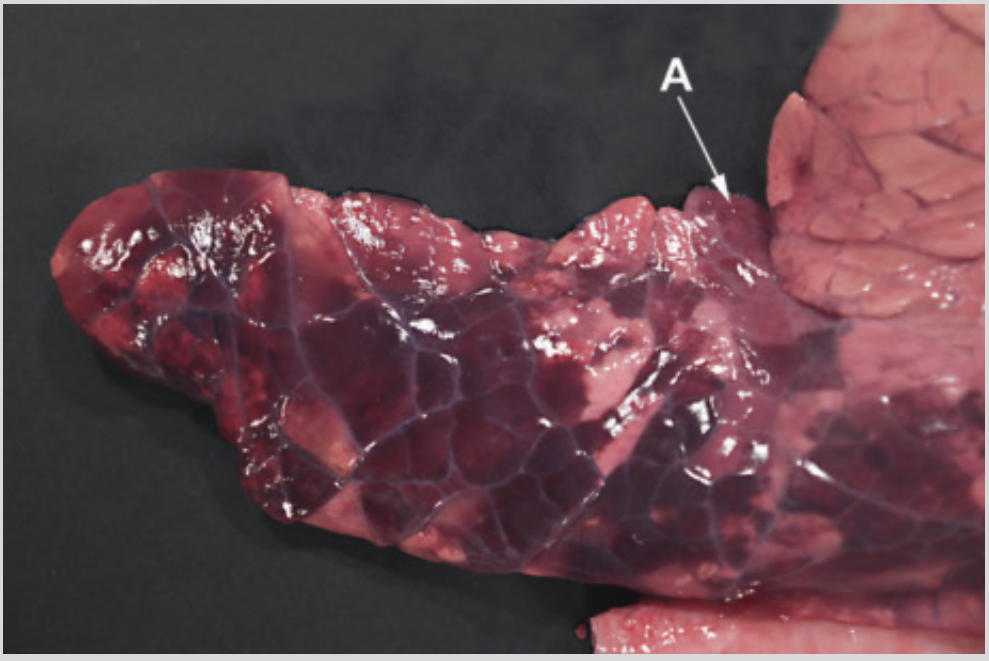
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5.55



Animal species/Organ	Pig/Lung
Lesion	Chronic, lobular, fibrinous, necrotizing and purulent bronchopneumonia; overlying, chronic, fibrinous pleuritis
Scoring	Partial condemnation
Comments	Secondary infection with pyogenic bacteria in porcine contagious pleuropneumonia

5.56



Animal species/Organ	Pig/Lung
Lesion	Acute, lobular bronchopneumonia
Scoring	Total condemnation if > 25% of the tissue is changed or if there are complications
Comments	The red colour is due to hyperaemia; chronic, lobular bronchopneumonia (A)

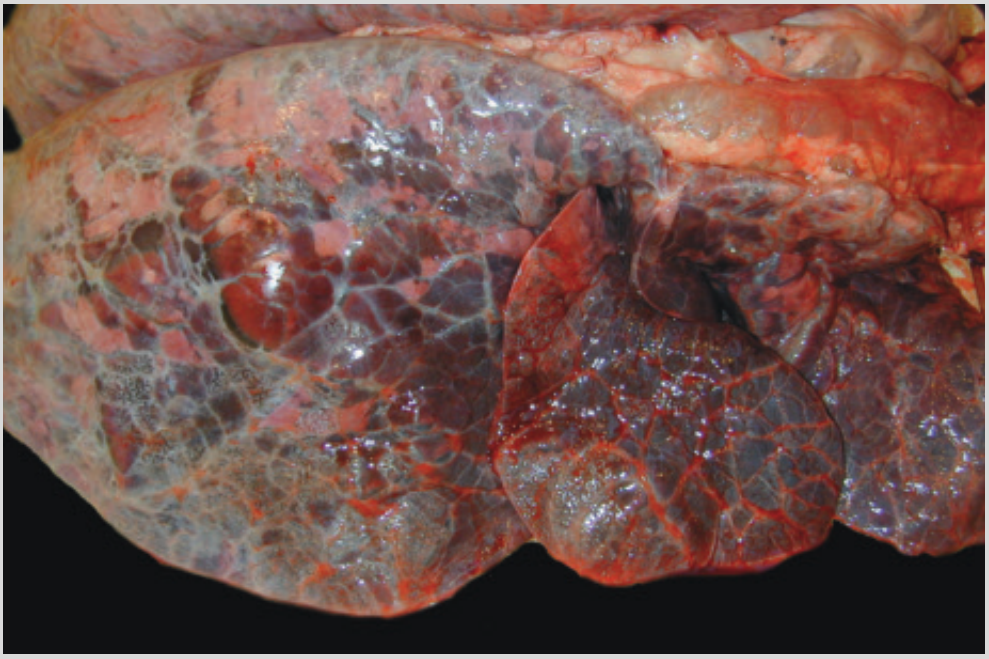
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5.57



Animal species/Organ	Pig/Lung; detail of 5.56
Lesion	Acute, lobular bronchopneumonia
Scoring	Total condemnation if > 25% of the tissue is changed or if there are complications
Comments	The lung tissue is raised, distended, hyperaemic and oedematous

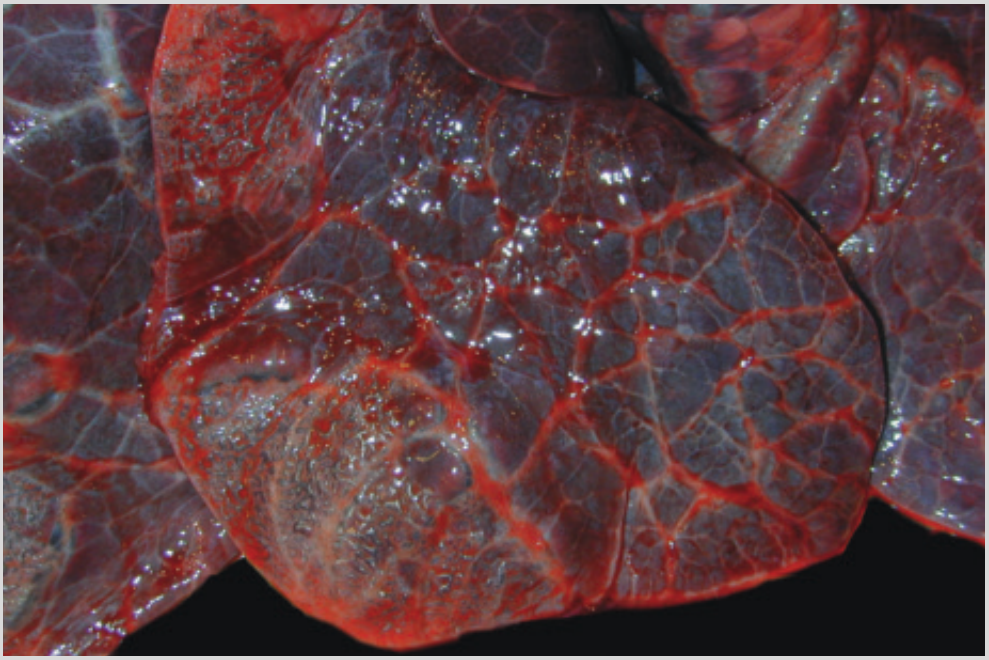
5.58



Animal species/Organ	Cattle/Lung
Lesion	Acute, lobular bronchopneumonia
Scoring	Total condemnation, because > 25% of lung tissue is affected
Comments	Interstitial emphysema is present, and particularly in the caudal lobes there are several normal lobules

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5.59



Animal species/Organ	Cattle/Lung; detail of 5.58
Lesion	Acute, lobular bronchopneumonia
Scoring	Total condemnation, because > 25% of lung tissue is affected
Comments	The lesion is characterised by hyperaemia

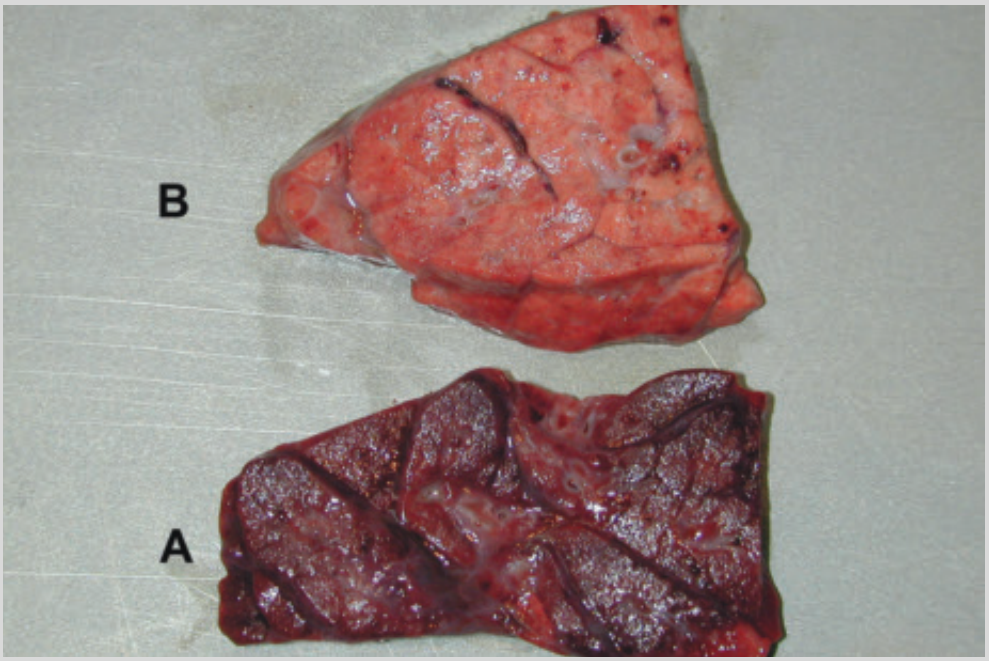
5.60



Animal species/Organ	Cattle/Lung
Lesion	Acute, lobar, haemorrhagic, fibrinous and necrotizing bronchopneumonia; overlying, acute, fibrinous and necrotizing pleuritis
Scoring	Partial condemnation, because < 25% of the tissue is affected
Comments	Complications, e.g. fever, necessitate total condemnation

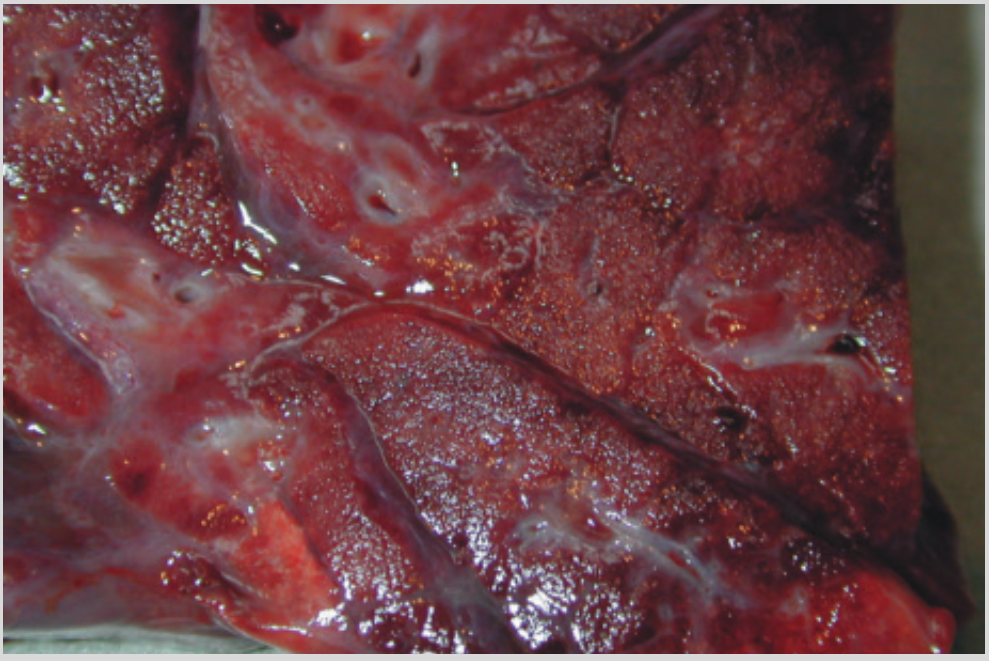
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5.61



Animal species/Organ	Cattle/Lung
Lesion	Acute, lobar, haemorrhagic, fibrinous and necrotizing bronchopneumonia (A)
Scoring	Partial condemnation if < 25% of the tissue is affected
Comments	Lesional lung tissue (A) and normal lung tissue (B)

5.62



Animal species/Organ	Cattle/Lung; detail of 5.61 A
Lesion	Acute, lobar, haemorrhagic, fibrinous and necrotizing bronchopneumonia
Scoring	Partial condemnation if < 25% of the tissue is affected
Comments	Haemorrhage, hyperaemia, oedema, fibrin exudate and necrosis are seen

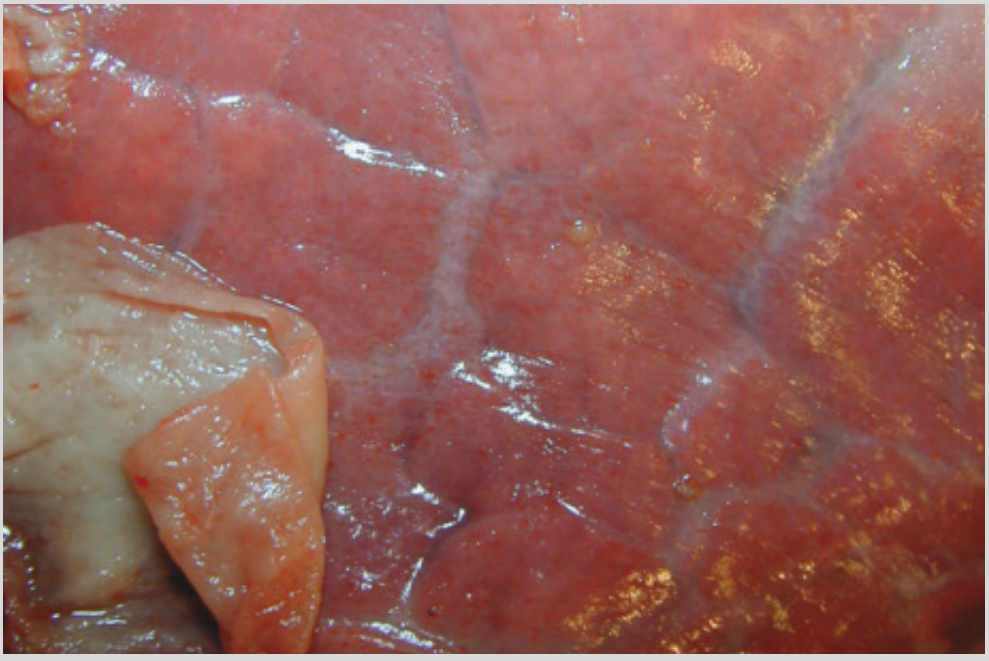
Vet-ebooks.com

5.63



Animal species/Organ	Pig/Lung
Lesion	Acute, lobar bronchopneumonia with overlying, acute, fibrinous pleuritis
Scoring	Partial condemnation; there were no lesions in the other lung which means that about 1/6, i.e. < 25%, of lung tissue is affected
Comments	The transition between lesional and normal tissue is fuzzy and does not have a distinct outline which follows the interlobular connective tissue

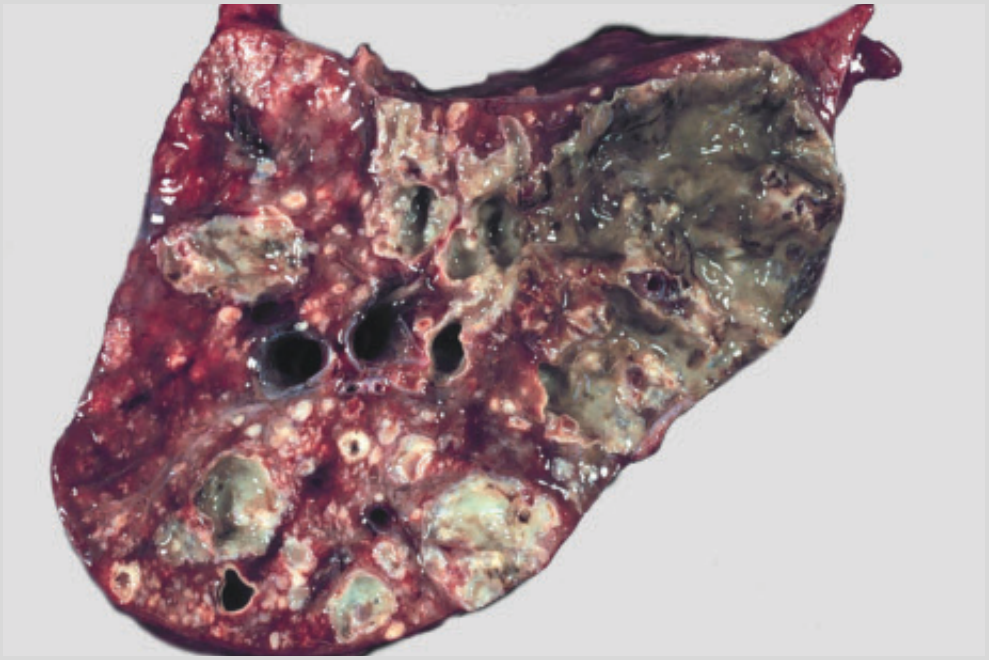
5.64



Animal species/Organ	Pig/Lung; detail of 5.63
Lesion	Acute, lobar bronchopneumonia with overlying, acute, fibrinous pleuritis
Scoring	Partial condemnation
Comments	Absence of signs of chronicity (no granulation tissue in pleura) means that the lesion is acute

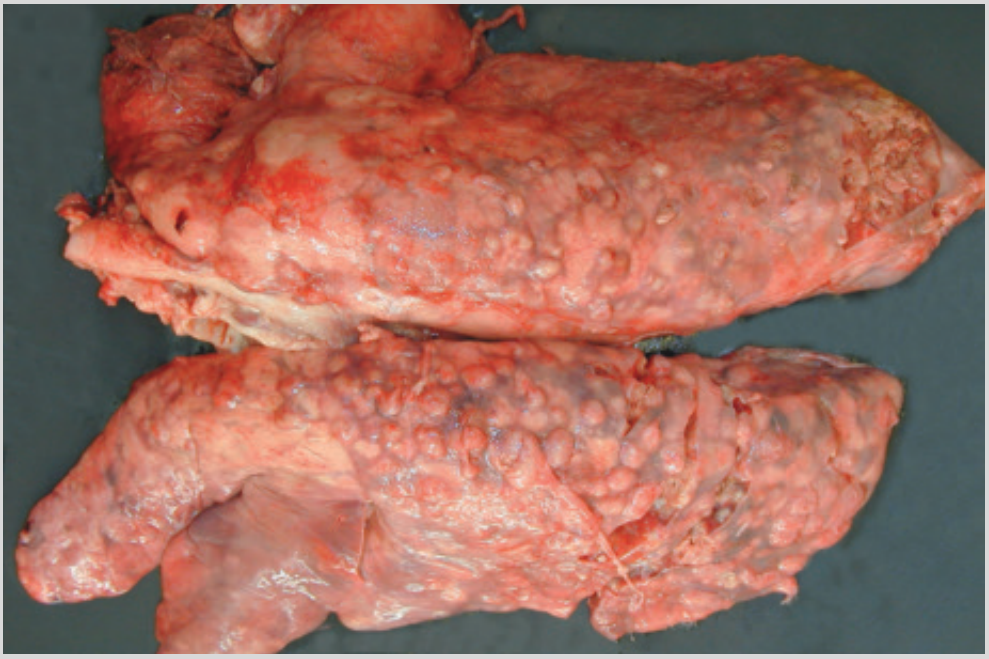
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5.65



Animal species/Organ	Cattle/Lung
Lesion	Chronic, lobar, purulent, putrid and cavitating bronchopneumonia
Scoring	Partial condemnation
Comments	Aspiration where a mixed bacterial infection has resulted in putrefaction

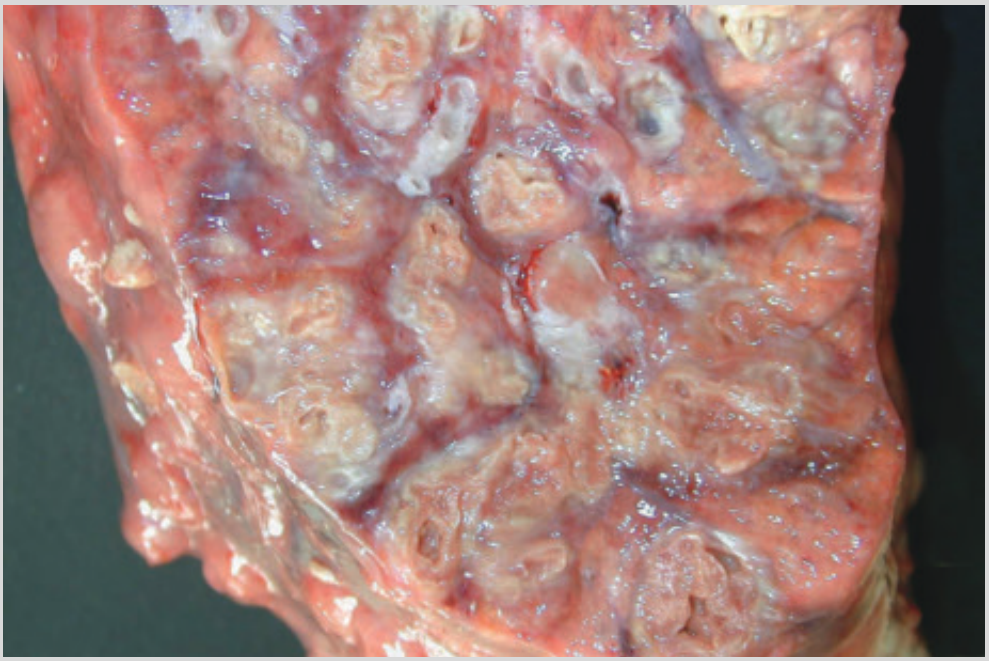
5.66



Animal species/Organ	Pig/Lung; same lung as in 5.67 and 5.68
Lesion	Chronic, focal, necrotizing and purulent, aerogenous pneumonia; several foci with overlying, chronic, fibrous, adhesive pleuritis
Scoring	Partial condemnation
Comments	*Staphylococcus aureus*; non-disseminated lesions

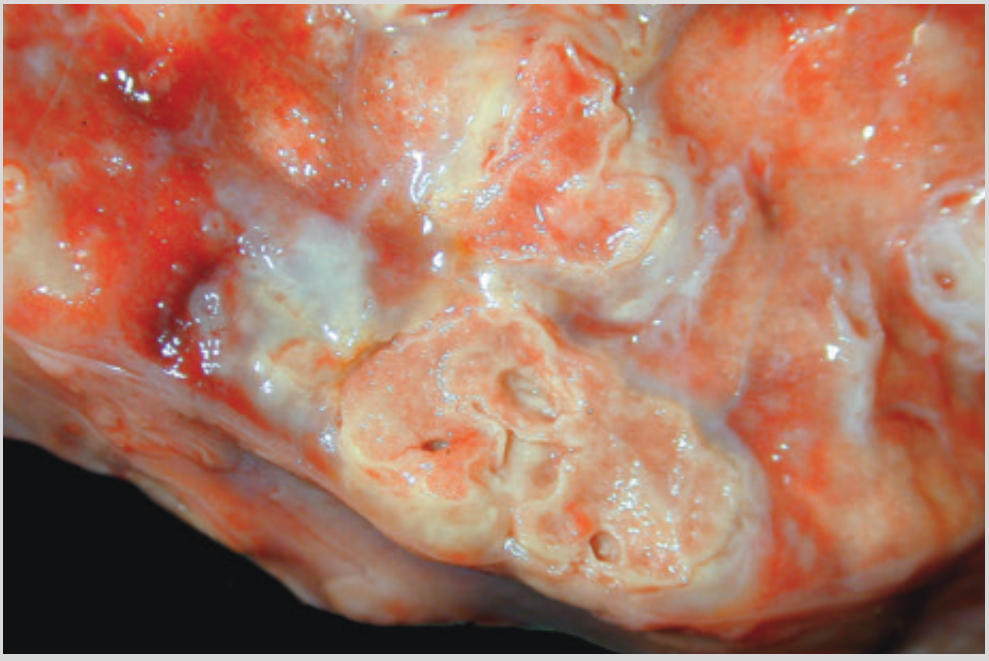
Vet-ebooks.com

5.67



Animal species/Organ	Pig/Lung; same lung as in 5.66 and 5.68
Lesion	Chronic, focal, necrotizing and purulent, aerogenous pneumonia
Scoring	Partial condemnation
Comments	Formation of cavities can be seen

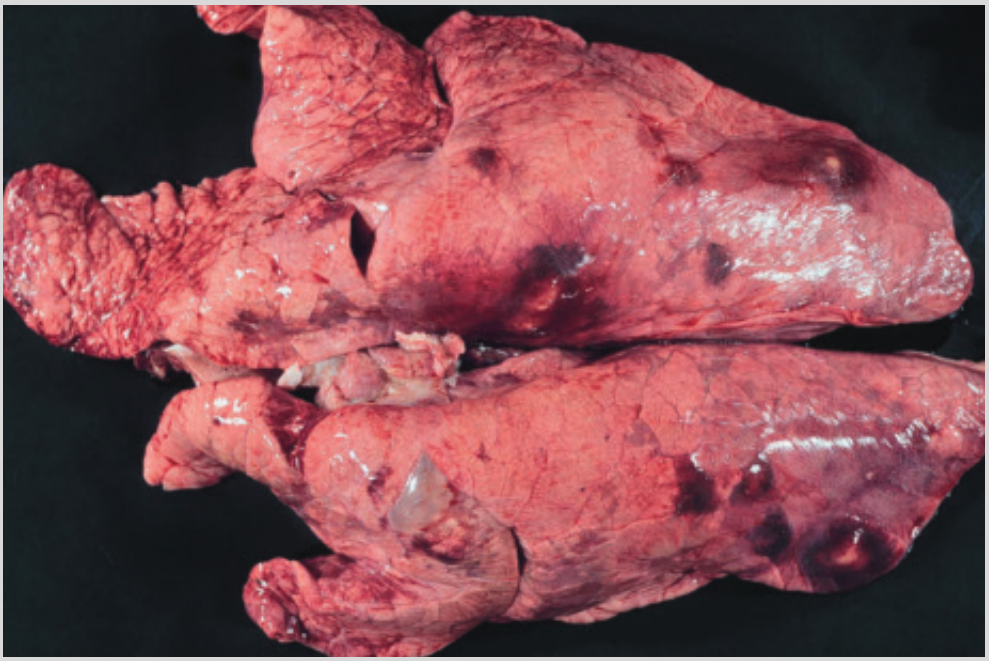
5.68



Animal species/Organ	Pig/Lung; same lung as in 5.66 and 5.67
Lesion	Chronic, focal, necrotizing and purulent, aerogenous pneumonia
Scoring	Partial condemnation
Comments	Cavity formation and start of sequestration

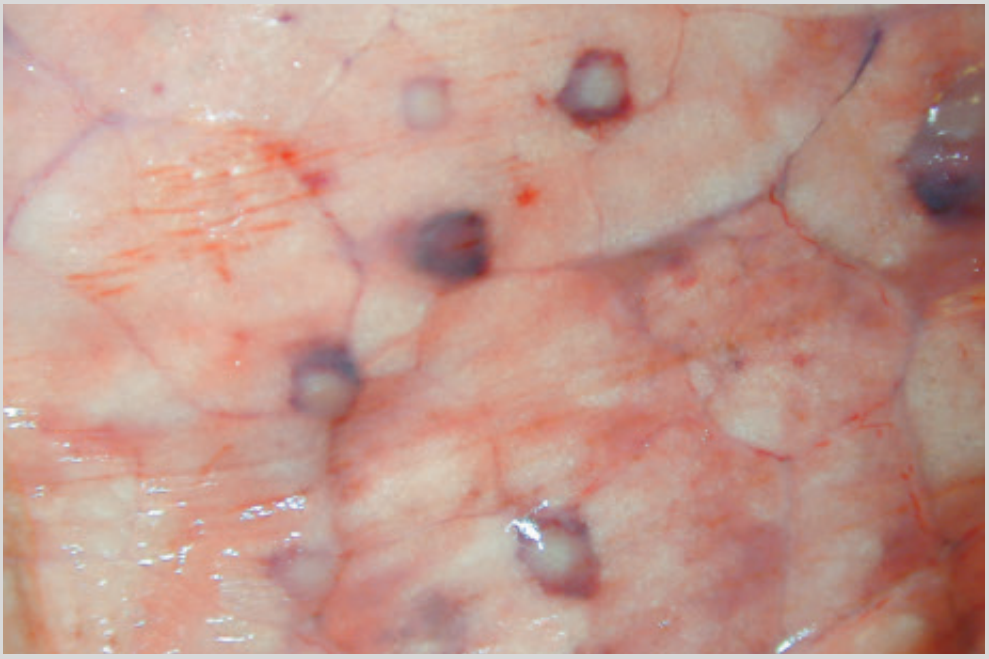
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5.69



Animal species/Organ	Pig/Lungs
Lesion	Acute, focal, necrotizing, embolic pneumonia
Scoring	Total condemnation
Comments	The lesions are not disseminated, but the pig had suffered tail bite; macroscopically detectable granulation- and fibrous tissue encapsulation was absent on cut surfaces of the lesions

5.70



Animal species/Organ	Pig/Lung
Lesion	Acute and chronic, focal, abscess forming, embolic pneumonia
Scoring	Total condemnation, because the lesions were disseminated (embolic) and some were acute
Comments	An accurate age determination requires examination of the lesions' cut surfaces

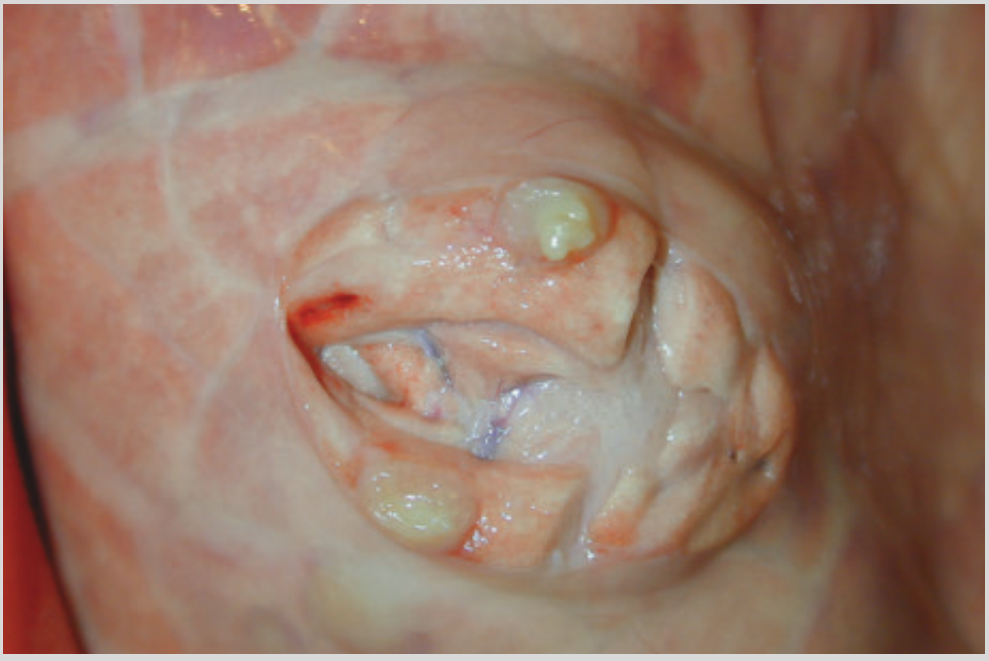
Vet-ebooks.com

5.71



Animal species/Organ	Pig/Lung
Lesion	Chronic, focal, necrotizing, embolic pneumonia
Scoring	Approved for deboning
Comments	Disseminated lesions; the lesions are encapsulated

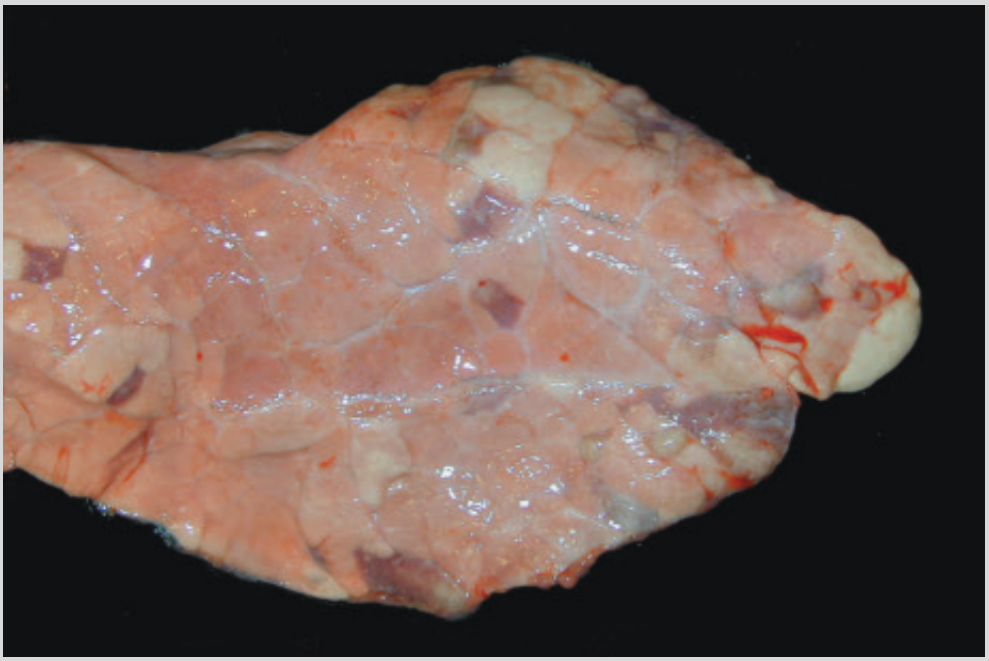
5.72



Animal species/Organ	Cattle/Lung
Lesion	Chronic, focal, abscess forming, embolic pneumonia
Scoring	Approved for deboning
Comments	Disseminated, encapsulated lesions

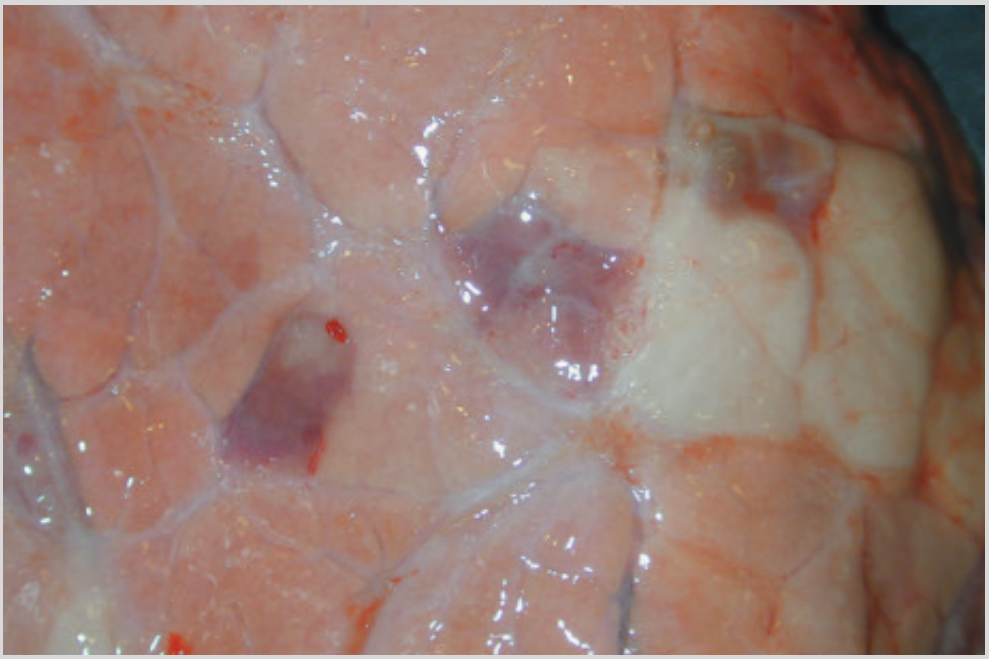
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5.73



Animal species/Organ	Cattle/Lung; the same lung as in 5.74
Lesion	Chronic, focal, purulent, embolic pneumonia; secondary local aerogenous spread
Scoring	Partial condemnation assessed on the lung lesions alone; nevertheless in this case total condemnation due to the presence of thrombotic, valvular endocarditis
Comments	Some lobules are pale due to trapping of air which occurred during slaughter

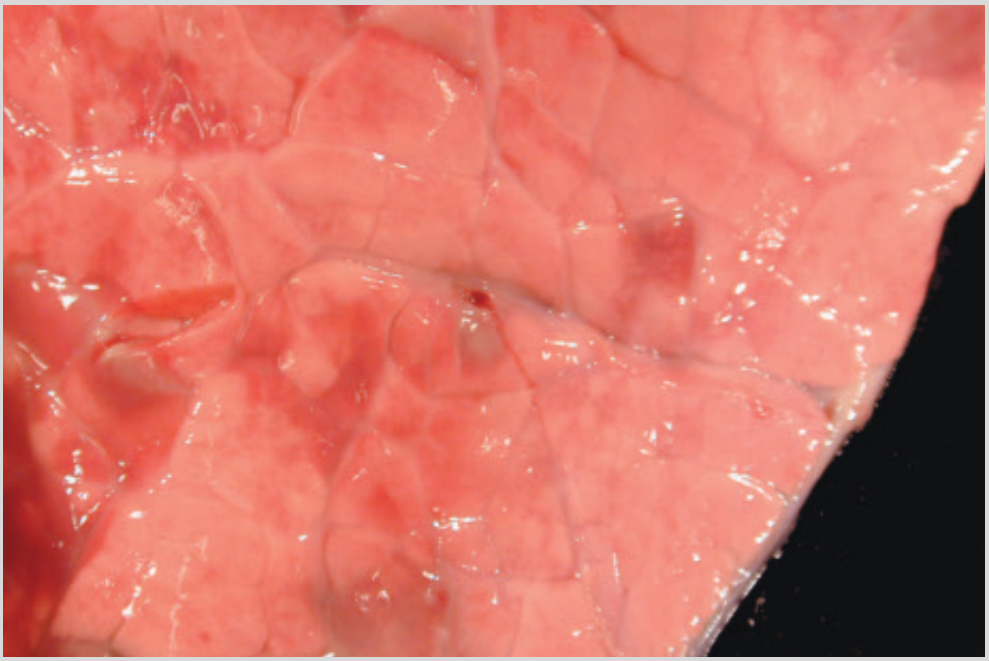
5.74



Animal species/Organ	Cattle/Lung; detail of 5.73
Lesion	Chronic, focal, purulent, embolic pneumonia; secondary local aerogenous spread
Scoring	Partial condemnation assessed on the lung lesions alone; nevertheless in this case total condemnation due to concomitant occurrence of thrombotic, valvular endocarditis
Comments	Lobules with trapped air (contraction of bronchioles, etc.) on the right

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5.75



Animal species/Organ	Cattle/Lung
Lesion	Chronic, focal, embolic verminous pneumonia
Scoring	Partial condemnation
Comments	Disseminated lesions with a grey-green hue

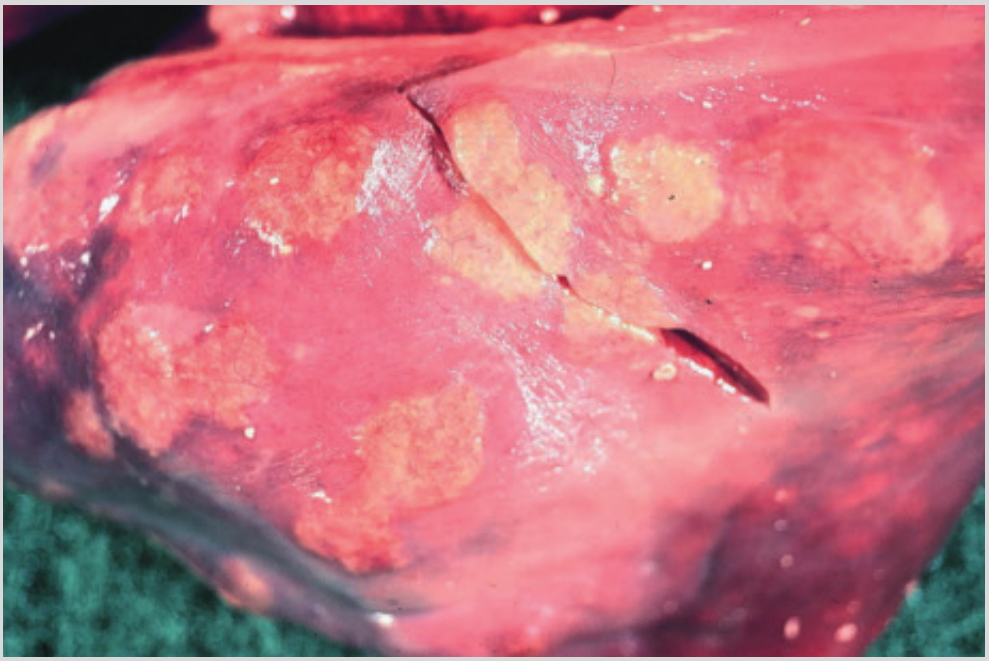
5.76



Animal species/Organ	Cattle/Lung
Lesion	Chronic, focal, embolic verminous pneumonia
Scoring	Partial condemnation
Comments	Disseminated lesions with a greenish hue

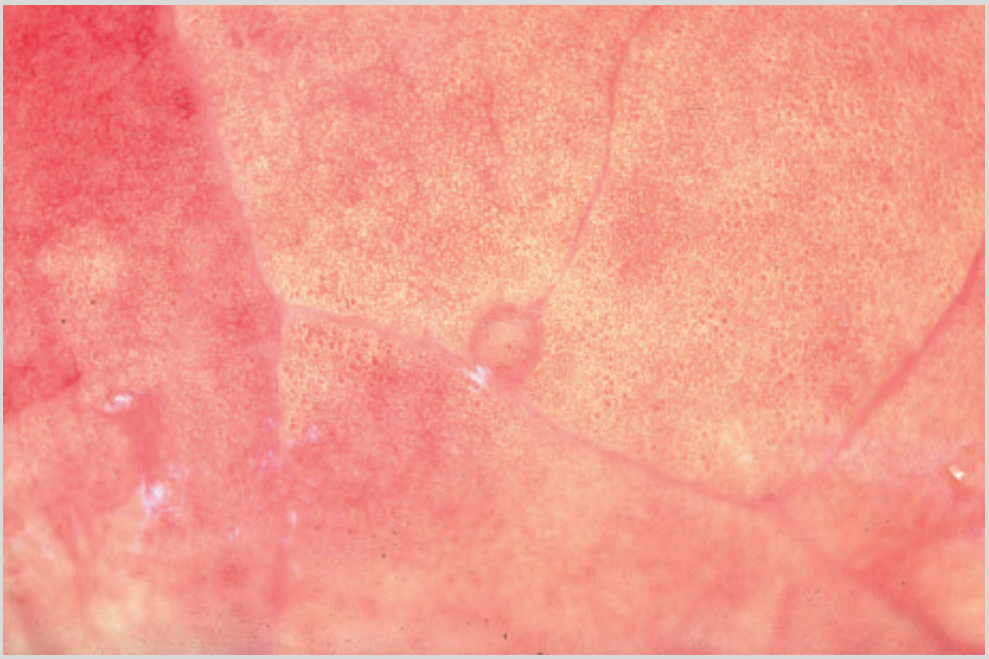
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5.77



Animal species/Organ	Sheep/Lung
Lesion	Chronic, interstitial, verminous pneumonia
Scoring	Partial condemnation
Comments	The lesions resemble neoplasms; are observed mostly in the caudal lobes and are caused by *Muellerius capillaris*

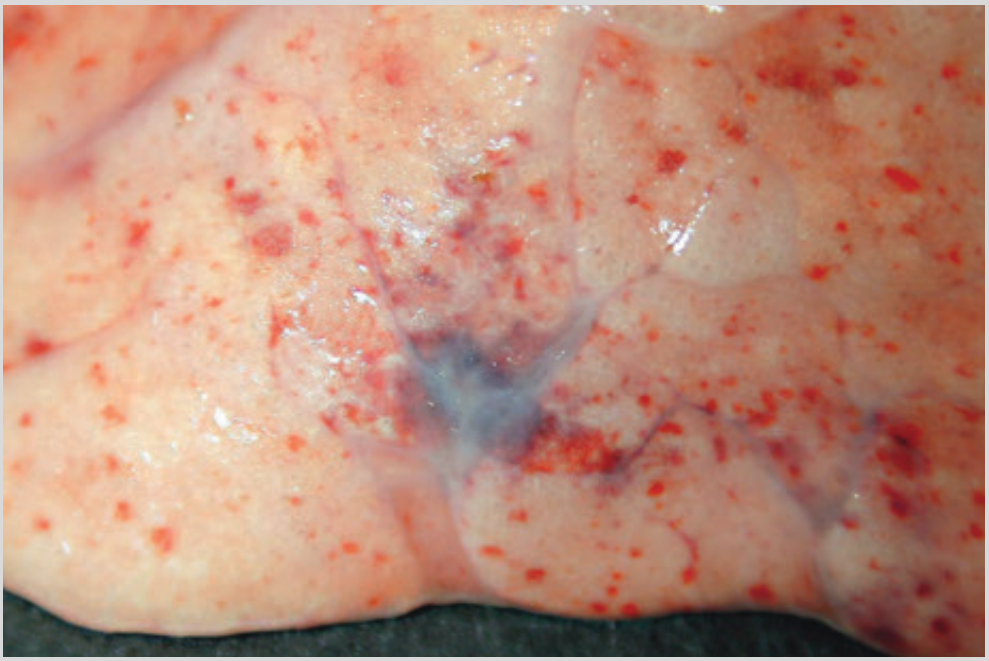
5.78



Animal species/Organ	Pig/Lung
Lesion	Lymphadenopathy
Scoring	Partial condemnation
Comments	Spheric, semitransparent lesion; sequelae from *A. suum* migration

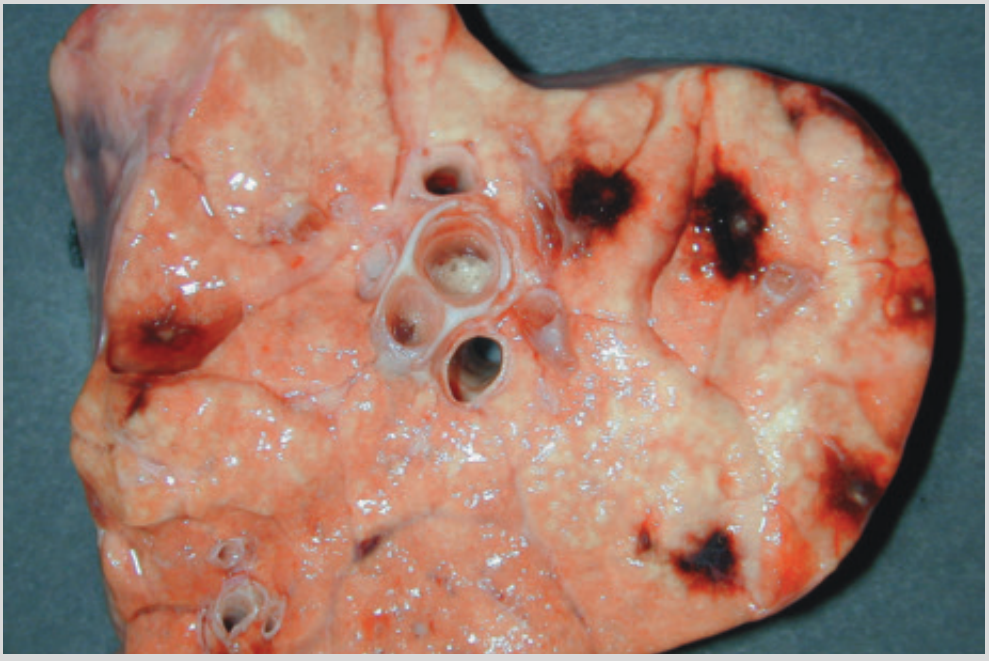
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5.79



Animal species/Organ	Pig/Lung
Lesion	Parasitic scar with secondary, peripheral haemorrhage
Scoring	Partial condemnation
Comments	An indistinct scar is seen together with an acute haemorrhage; sequelae from *A. suum* migration

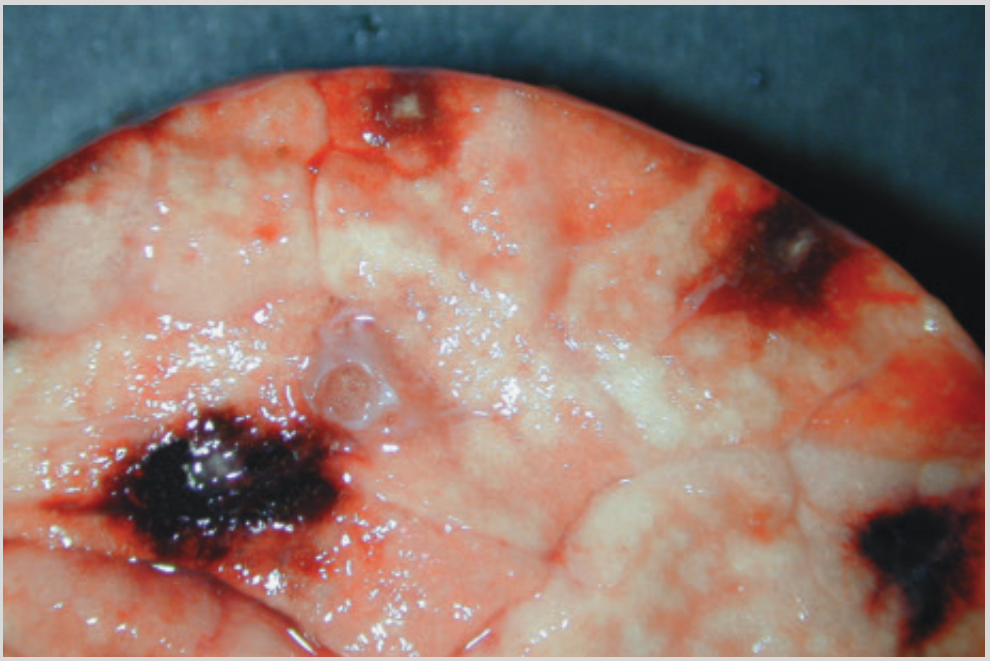
5.80



Animal species/Organ	Pig/Lung; the same lung as in 5.81
Lesion	Parasitic scar with secondary, peripheral haemorrhage
Scoring	Partial condemnation
Comments	Sequelae from *A. suum* migration

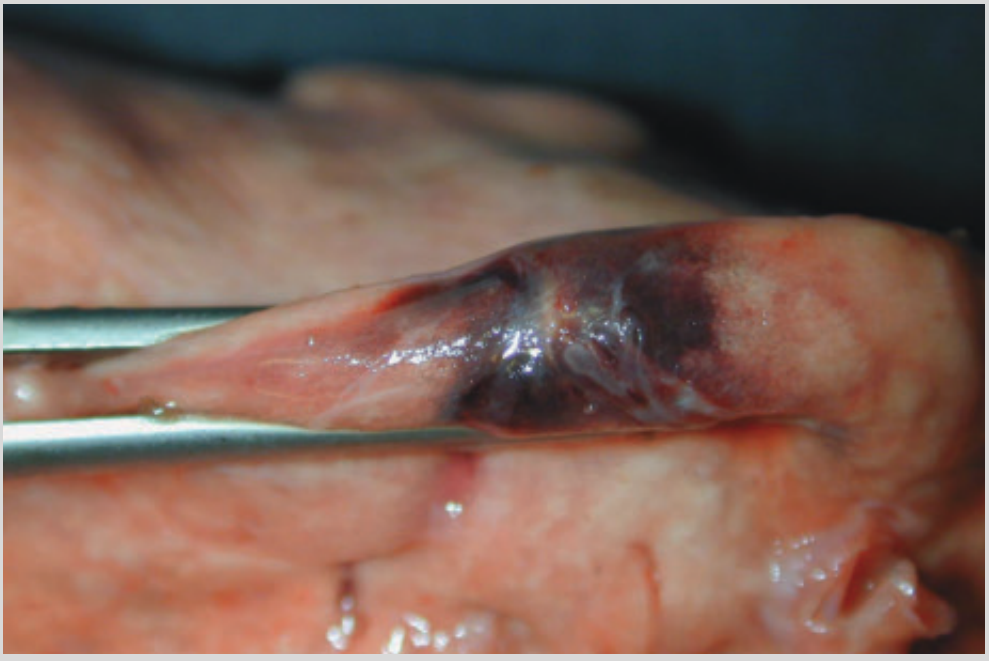
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5.81



Animal species/Organ	Pig/Lung; detail of 5.80
Lesion	Parasitic scar with secondary, peripheral haemorrhage
Scoring	Partial condemnation
Comments	The centrally-located scars are indistinct and irregular; the parasitic scars are also called fibroplasias

5.82



Animal species/Organ	Pig/Lung
Lesion	Parasitic scar with secondary, peripheral haemorrhage
Scoring	Partial condemnation
Comments	No contents can be expressed at the cut surface

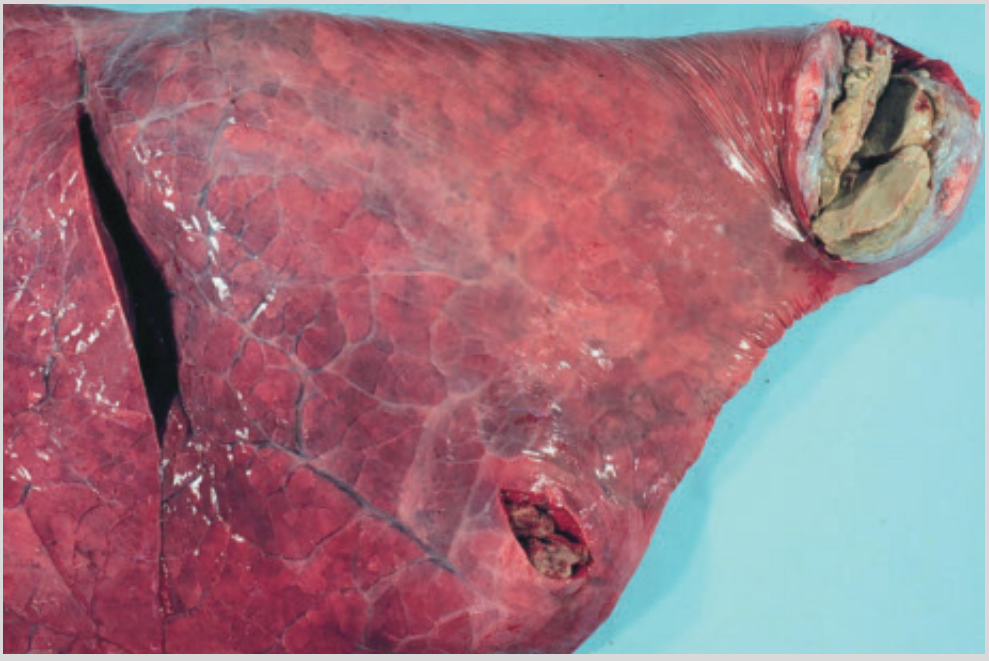
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5.83



Animal species/Organ	Horse/Lung
Lesion	Chronic, focal, verminous, embolic pneumonia
Scoring	Partial condemnation
Comments	The lesion is serpiginous and mineralised as a result of nematode migration

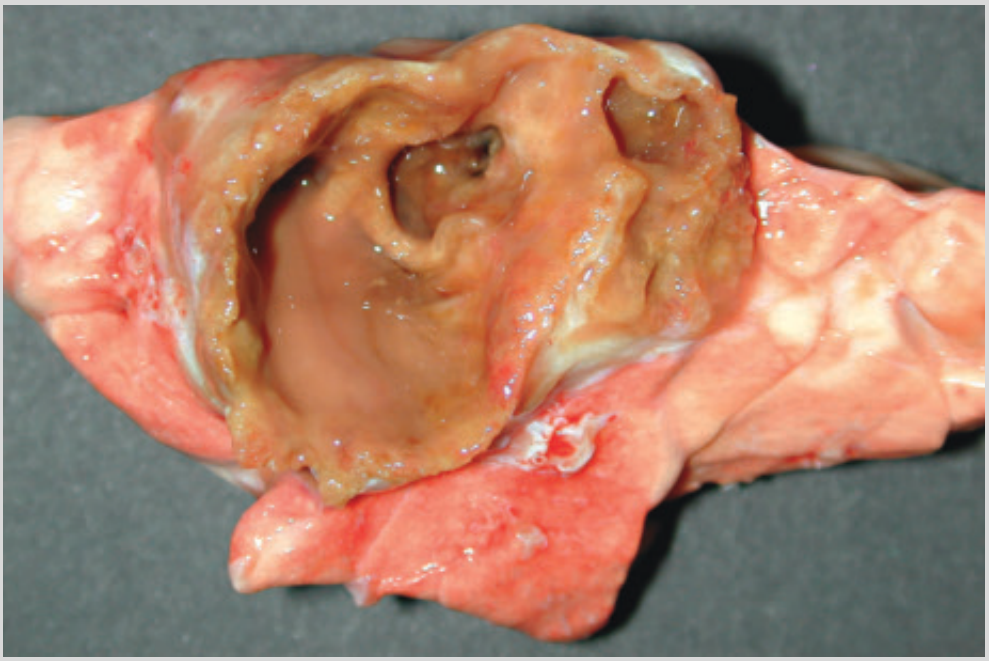
5.84



Animal species/Organ	Cattle/Lung
Lesion	Chronic, focal, verminous, embolic pneumonia (pulmonary distomal abscesses)
Scoring	Partial condemnation
Comments	The lesions are necrotic in character and caused by aberrant migration of *Fasciola hepatica*

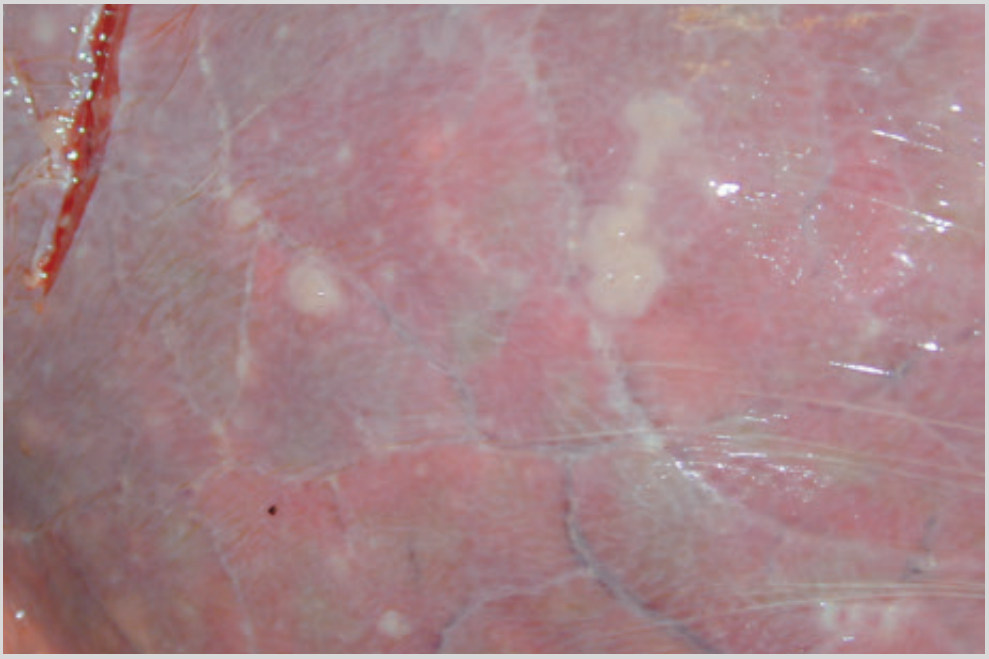
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5.85



Animal species/Organ	Cattle/Lung
Lesion	Chronic, focal, abscess-forming, verminous, embolic pneumonia (pulmonary distomal abscess)
Scoring	Partial condemnation
Comments	This lesion is characterised by brown pus, and the abscess capsule is mineralised

5.86



Animal species/Organ	Pig/Lung
Lesion	Chronic, focal, granulomatous, embolic pneumonia
Scoring	Total condemnation
Comments	*Mycobacterium avium* subsp. *avium*; local lymphogenic spread (lymphangitis) causes the lesions to acquire an irregular appearance

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5.87



Animal species/Organ	Pig/Lung; the same lung as in 5.88
Lesion	Chronic, focal, granulomatous, embolic pneumonia (pulmonary avian tuberculosis)
Scoring	Total condemnation
Comments	Disseminated lesions

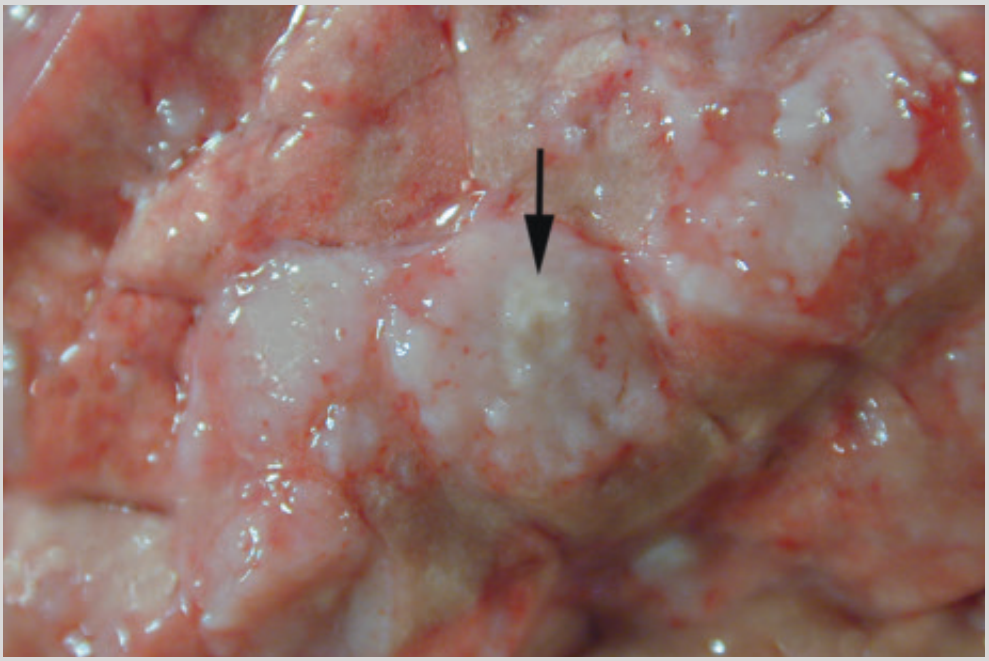
5.88



Animal species/Organ	Pig/Lung; detail of 5.87
Lesion	Chronic, focal, granulomatous, embolic pneumonia (pulmonary avian tuberculosis)
Scoring	Total condemnation
Comments	The lesions have a proliferative, almost neoplastic appearance

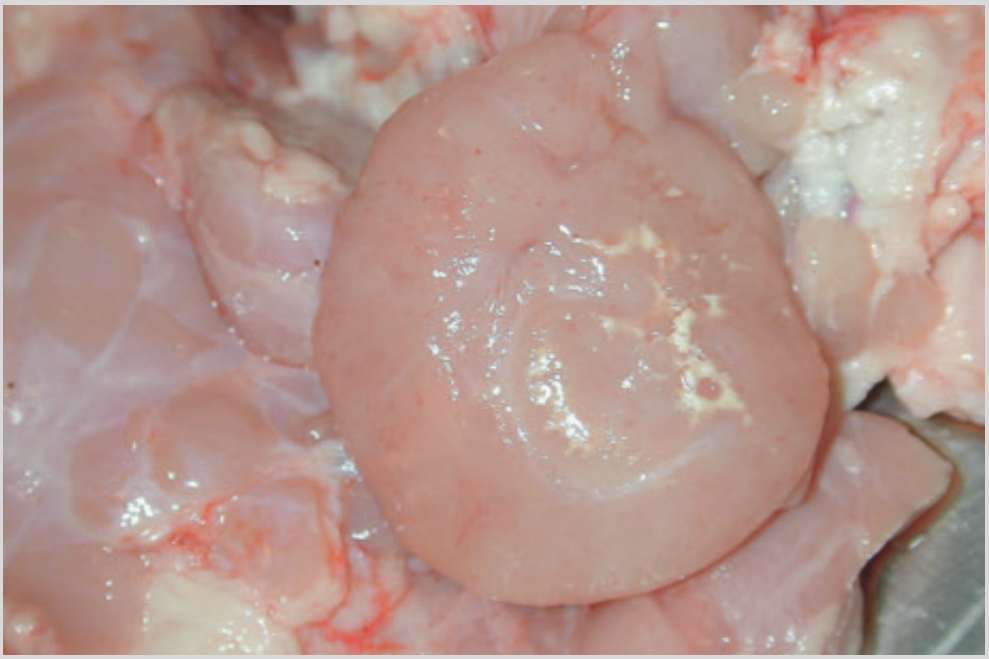
Vet-ebooks.com

5.89



Animal species/Organ	Pig/Lung
Lesion	Chronic, focal, granulomatous, embolic pneumonia (pulmonary avian tuberculosis)
Scoring	Total condemnation
Comments	Lesions with mineralisation (→)

5.90



Animal species/Organ	Pig/Tracheobronchial lymph node
Lesion	Chronic, granulomatous lymphadenitis (spread of pulmonary avian tuberculosis)
Scoring	Total condemnation
Comments	Lesion with mineralisation

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5.91



Animal species/Organ	Cattle/Lung; the same lung as in 5.92
Lesion	Chronic, focal, pyogranulomatous, aerogenous pneumonia
Scoring	Partial condemnation
Comments	The lesions may be interpreted to have an aerogenous origin because they are located mostly cranioventrally and have a lobular appearance; *Actinobacillus lignieresii*

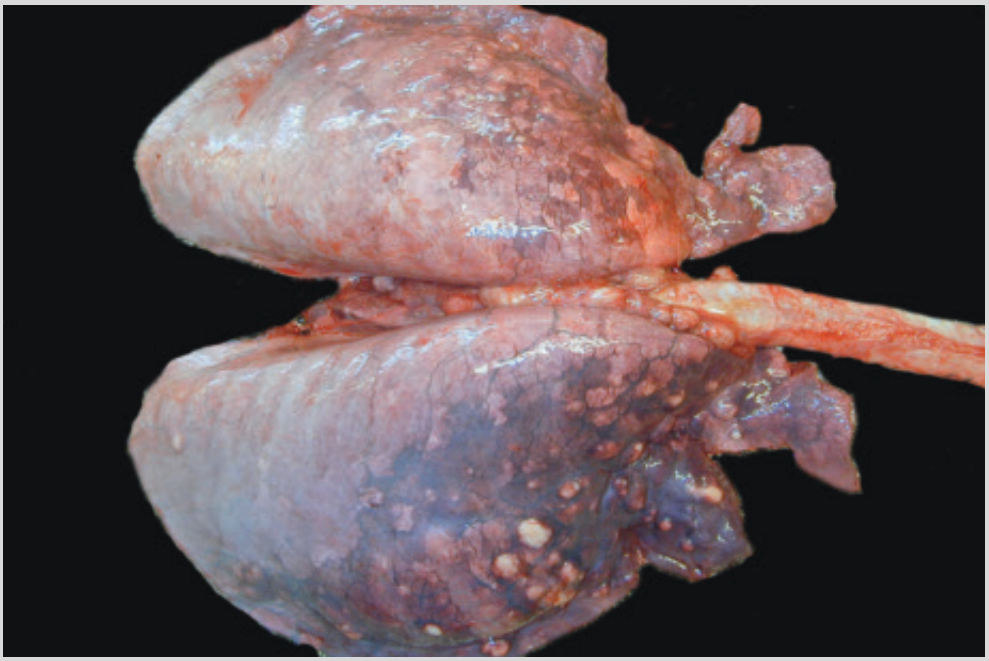
5.92



Animal species/Organ	Cattle/Lung; detail of 5.91
Lesion	Chronic, focal, pyogranulomatous, aerogenous pneumonia
Scoring	Partial condemnation
Comments	The proliferative character of the inflammation must be distinguished from neoplasia

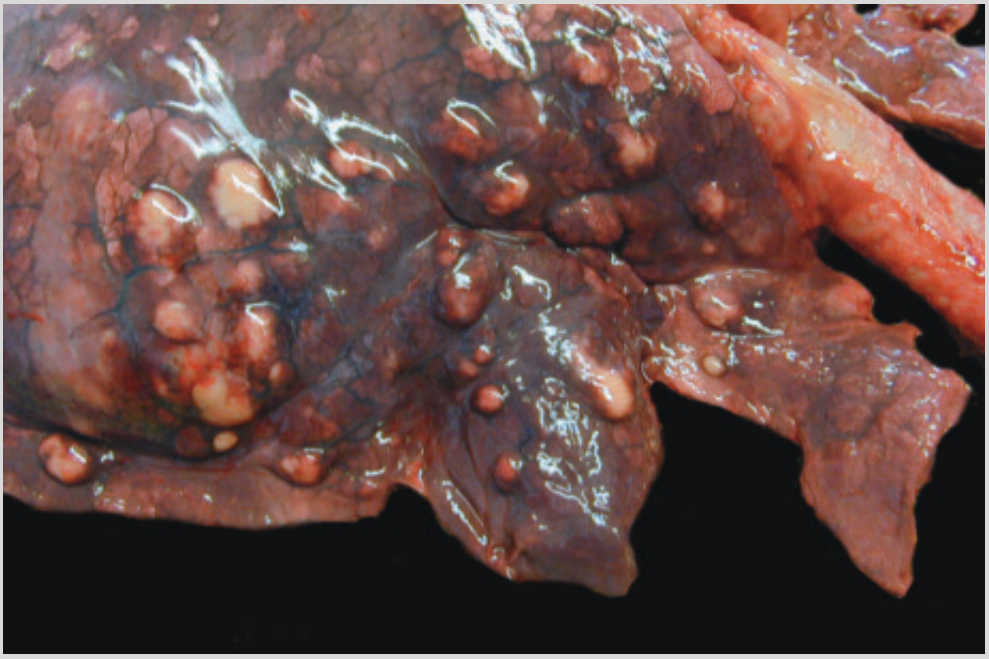
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5.93



Animal species/Organ	Horse/Lungs; the same lung as in 5.94
Lesion	Chronic, focal, pyogranulomatous, aerogenous pneumonia
Scoring	Partial condemnation
Comments	The cranioventral distribution implies the aerogenous pathogenesis; caused by *Rhodococcus equi*

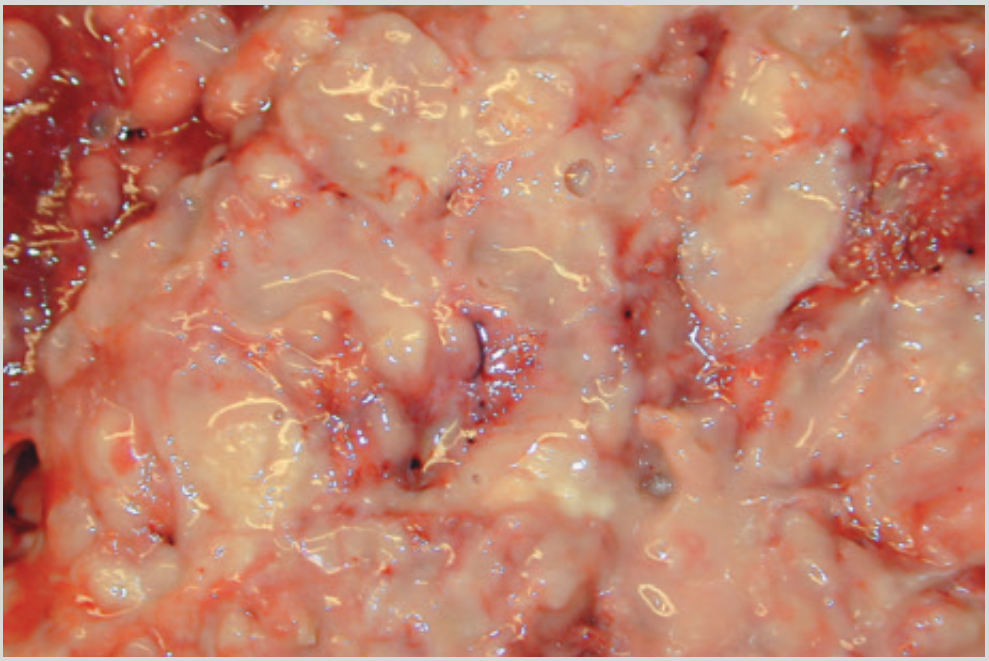
5.94



Animal species/Organ	Horse/Lung; detail of 5.93
Lesion	Chronic, focal, pyogranulomatous, aerogenous pneumonia
Scoring	Partial condemnation
Comments	The focal character is dominant; *Rhodococcus equi* infection in the lungs can however also give more traditional, cranioventral, lobular lesions

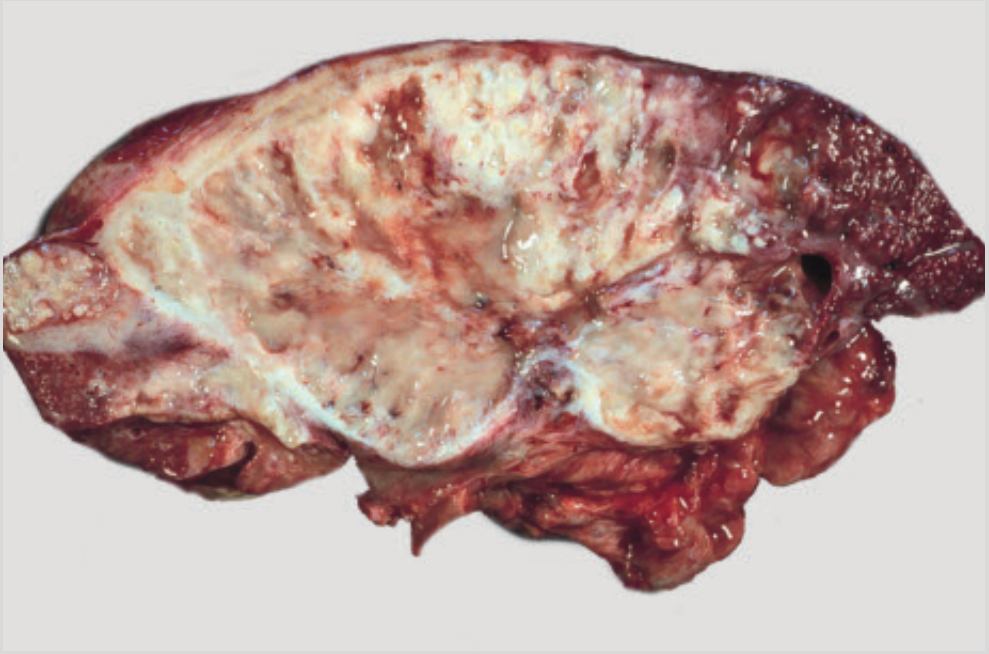
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5.95



Animal species/Organ	Horse/Lung
Lesion	Chronic, focal, pyogranulomatous, aerogenous pneumonia
Scoring	Partial condemnation
Comments	The lesion is characterised to a greater extent by suppurative than granulomatous inflammation; *Rhodococcus equi*

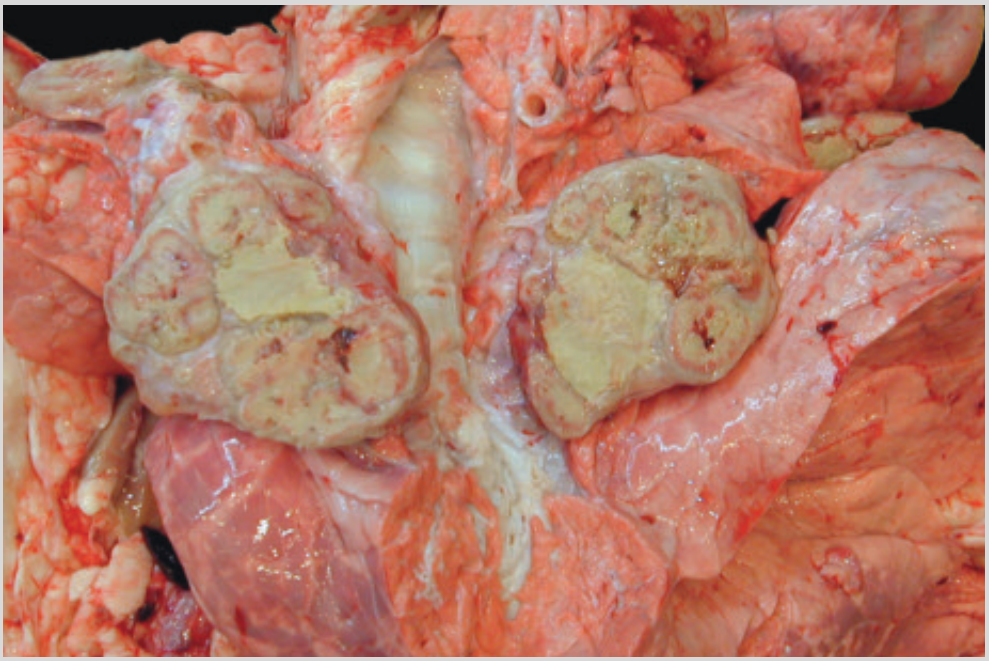
5.96



Animal species/Organ	Horse/Lung
Lesion	Chronic, focal, pyogranulomatous, aerogenous pneumonia
Scoring	Partial condemnation
Comments	Equal parts suppurative and granulomatous inflammation; only horses younger than about 6 months can be infected; *Rhodococcus equi*

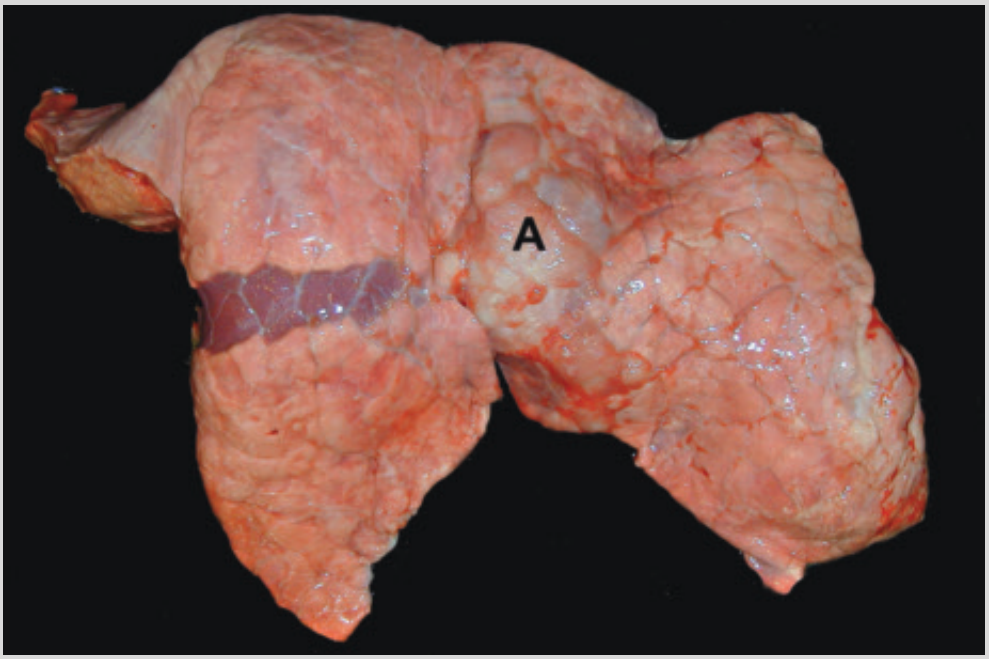
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5.97



Animal species/Organ	Cattle/Tracheobronchial lymph node
Lesion	Chronic, pyogranulomatous, necrotizing lymphadenitis; comparable lesions are found disseminated in the lungs
Scoring	Approved for deboning
Comments	Scored as pyaemia; the lesions are caused by fungal infection

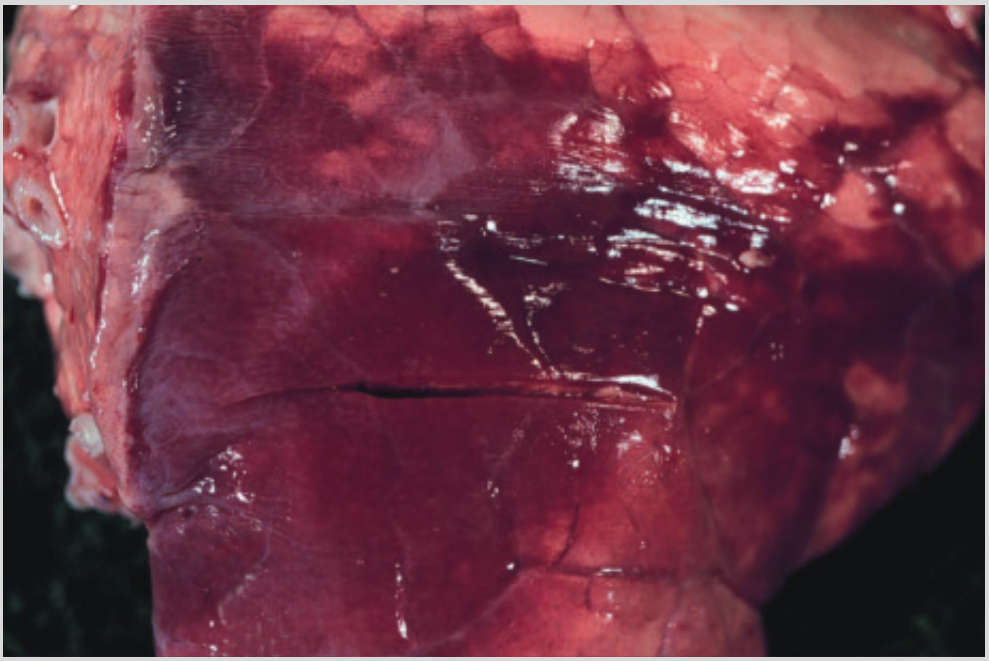
5.98



Animal species/Organ	Cattle/Lung
Lesion	Chronic, focal, abscess-forming, aerogenous pneumonia and atelectasis
Scoring	Partial condemnation; at embolic pathogenesis approval for deboning
Comments	The chronic abscess (A) has probably resulted in development of obstructive atelectasis

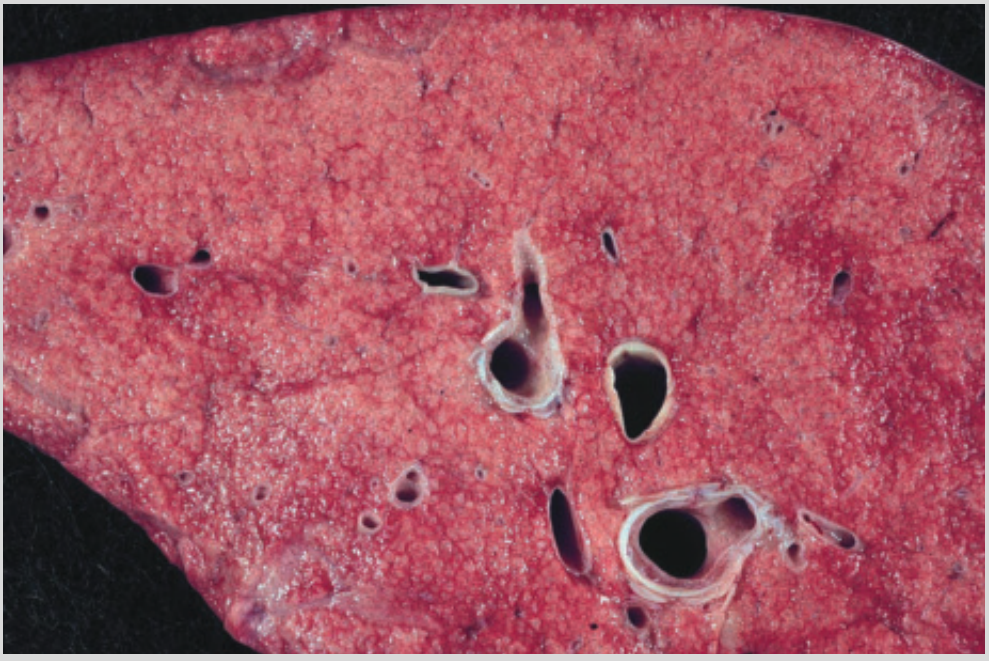
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5.99



Animal species/Organ	Pig/Lung
Lesion	Subpleural atelectasis
Scoring	Postmortem change without consequences for meat inspection
Comments	Below the pleura there is surface atelectasis; immediately below this there is normal tissue

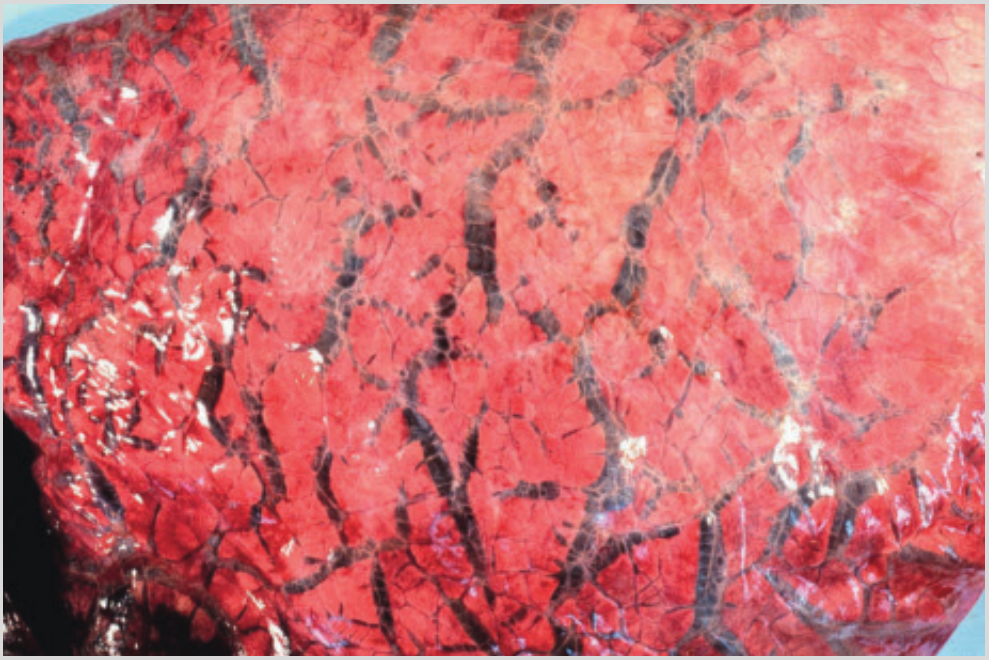
5.100



Animal species/Organ	Horse/Lung
Lesion	Alveolar emphysema
Scoring	Partial condemnation conditional on the underlying condition not necessitating other scoring
Comments	Often due to chronic bronchiolitis (partial condemnation)

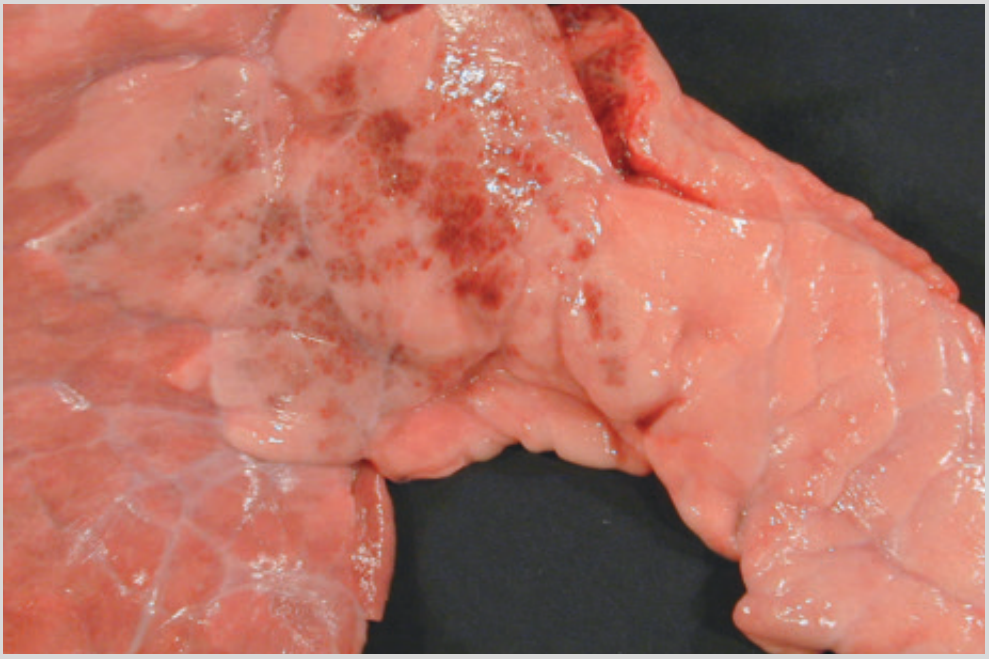
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5.101



Animal species/Organ	Cattle/Lung
Lesion	Interstitial emphysema
Scoring	Partial condemnation
Comments	Can occur through forced respiration at slaughter

5.102



Animal species/Organ	Pig/Lung; the same lung as in 5.103
Lesion	Aspiration of blood
Scoring	Partial condemnation
Comments	Incurred at sticking

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5.103



Animal species/Organ	Pig/Lung; detail of 5.102
Lesion	Aspiration of blood
Scoring	Partial condemnation
Comments	The lesion resembles cloverleaf markings

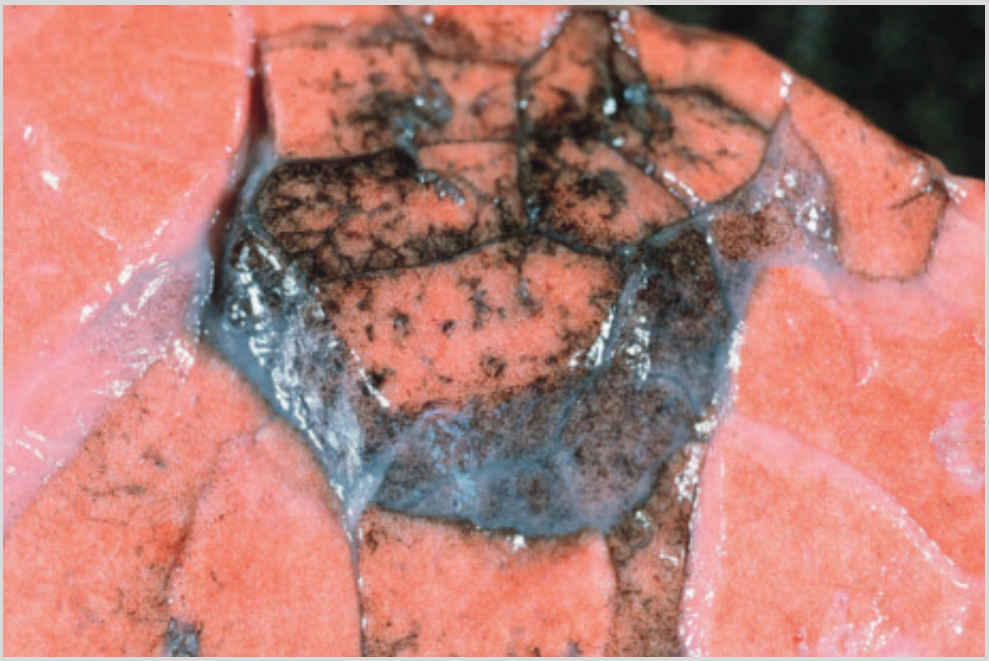
5.104



Animal species/Organ	Cattle/Lung
Lesion	Pulmonary congenital melanosis (melanosis maculosa)
Scoring	Partial condemnation
Comments	The liver and heart are often affected at the same time; rarely present in older animals

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5.105



Animal species/Organ	Cattle/Lung
Lesion	Pulmonary melanosis maculosa (Pulmonary congenital melanosis)
Scoring	Partial condemnation
Comments	The lesion is not characterised by proliferation (is not neoplastic) but only by pigmentation

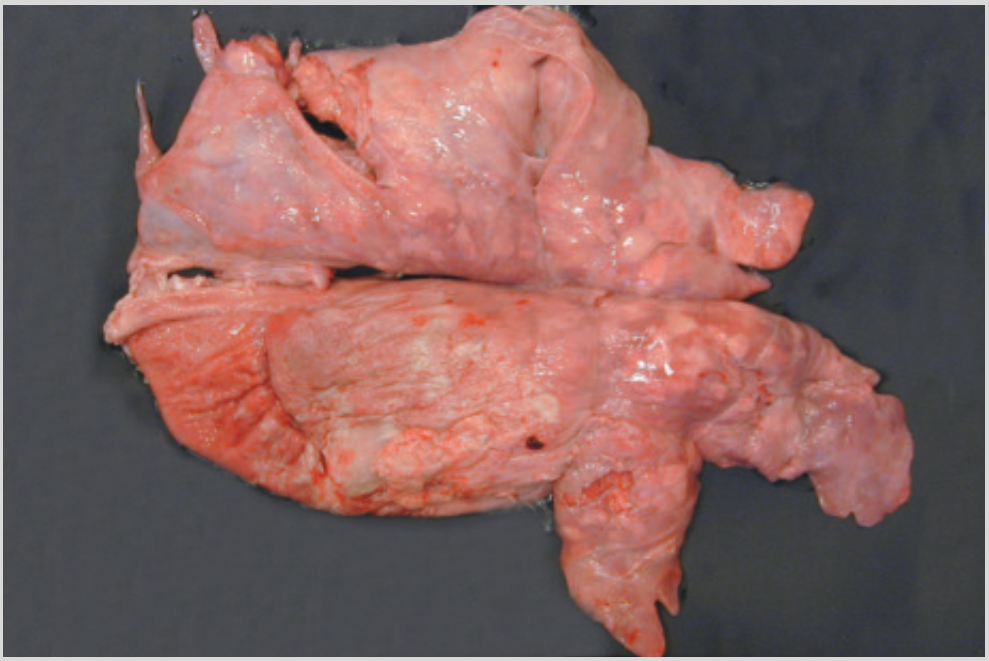
5.106



Animal species/Organ	Pig/Left thoracic wall with parietal pleura
Lesion	Local pleuritis (the type of exudate cannot be determined)
Scoring	Pleuritis is scored based on the age and extent of the lesion
Comments	Partial condemnation of acute lesions which cover <25% of both the lung and thoracic wall surfaces

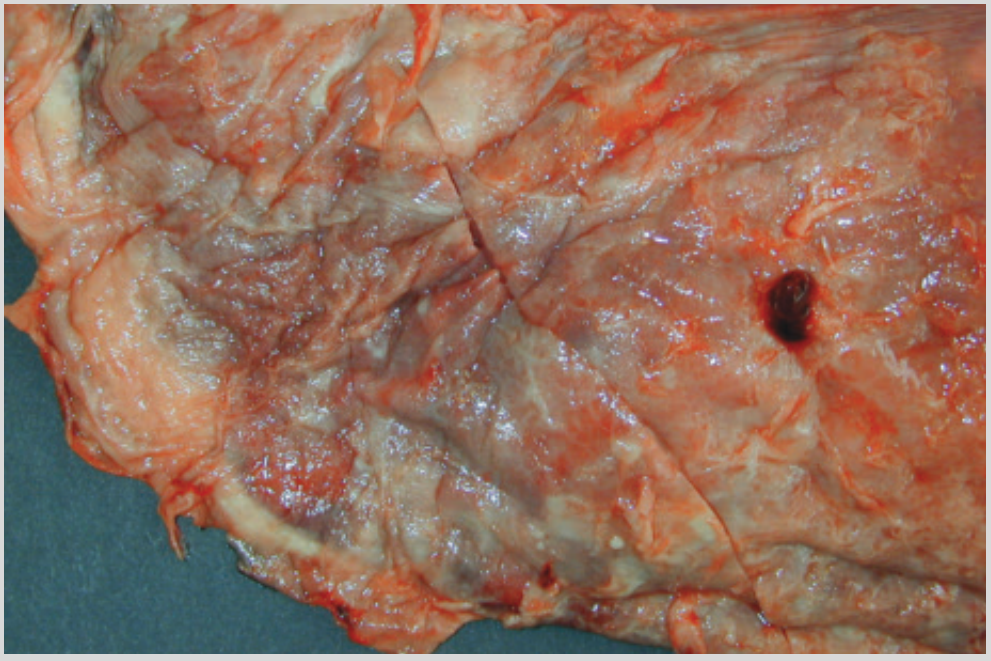
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5.107



Animal species/Organ	Pig/Lung
Lesion	Chronic, fibrous, adhesive pleuritis (left lung); fibrinous pleuritis (right lung)
Scoring	Partial condemnation if an acute pleuritis covers < 25% of the lungs' surface
Comments	All forms of chronic pleuritides result in partial condemnation

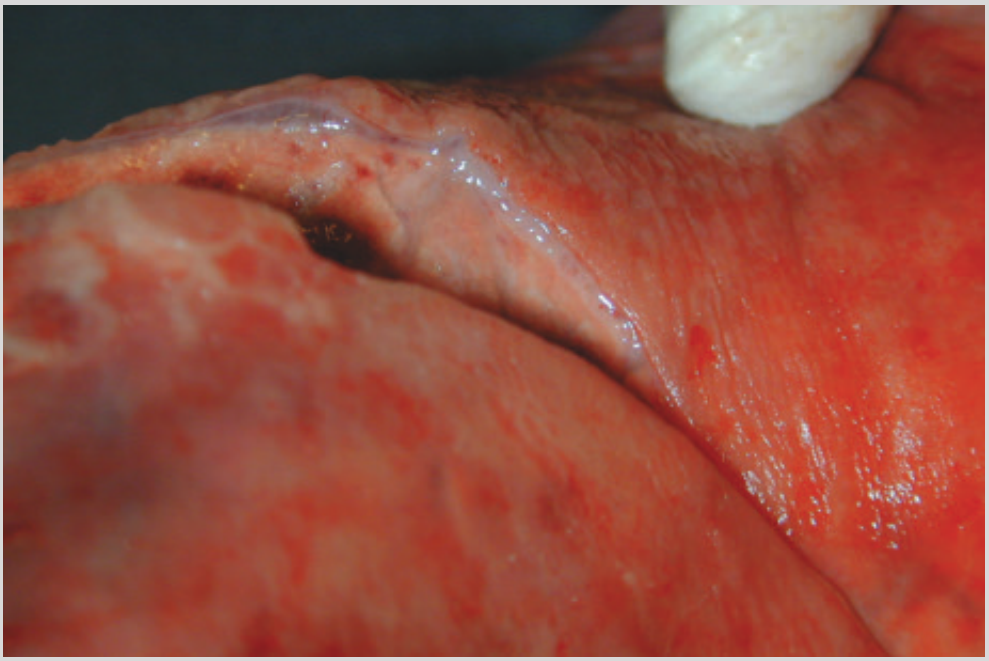
5.108



Animal species/Organ	Pig/Lung
Lesion	Fibrinous pleuritis
Scoring	Partial or total condemnation depending on the age and extent of the lesion
Comments	The age of the lesion is determined on a cross-section

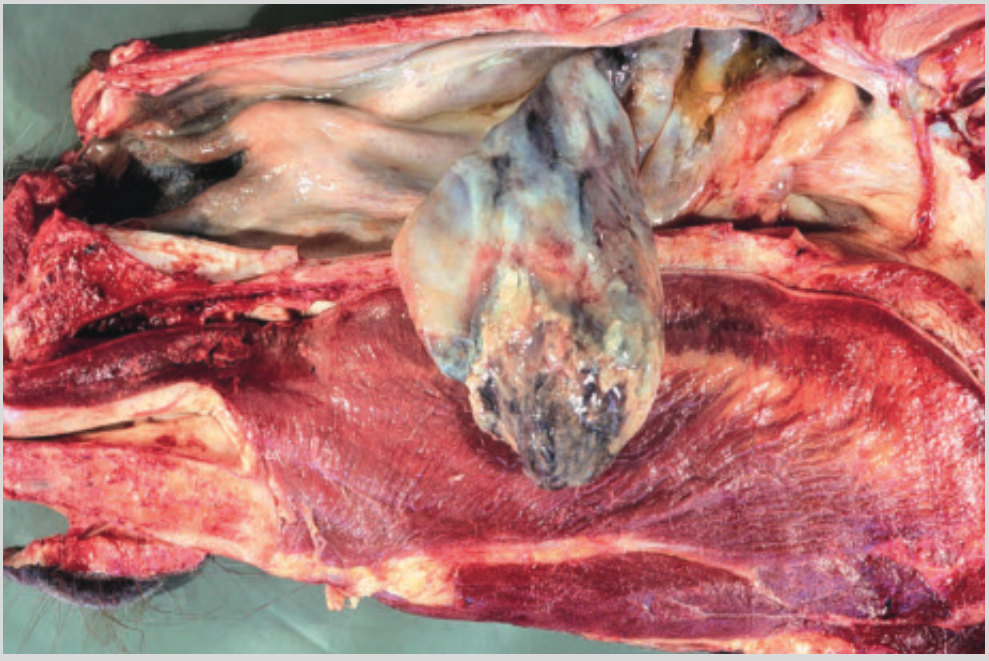
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5.109



Animal species/Organ	Pig/Lung
Lesion	Chronic, fibrinous pleuritis
Scoring	Partial condemnation irrespectively of the extent of spread
Comments	Granulation tissue between the lung tissue and the fibrinous exudate

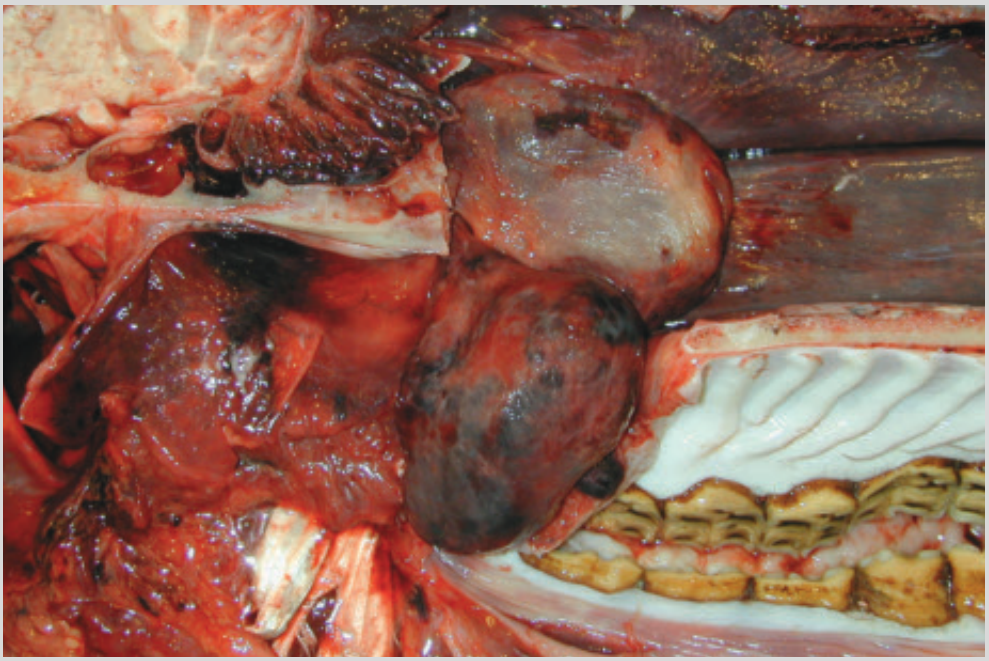
5.110



Animal species/Organ	Horse/Head; right nasal cavity and dorsal and ventral conchae
Lesion	Nasal polyp (chronic polypous rhinitis)
Scoring	Partial condemnation
Comments	The polyp fills the right nasal cavity; the tip is characterised by necrosis and suppuration

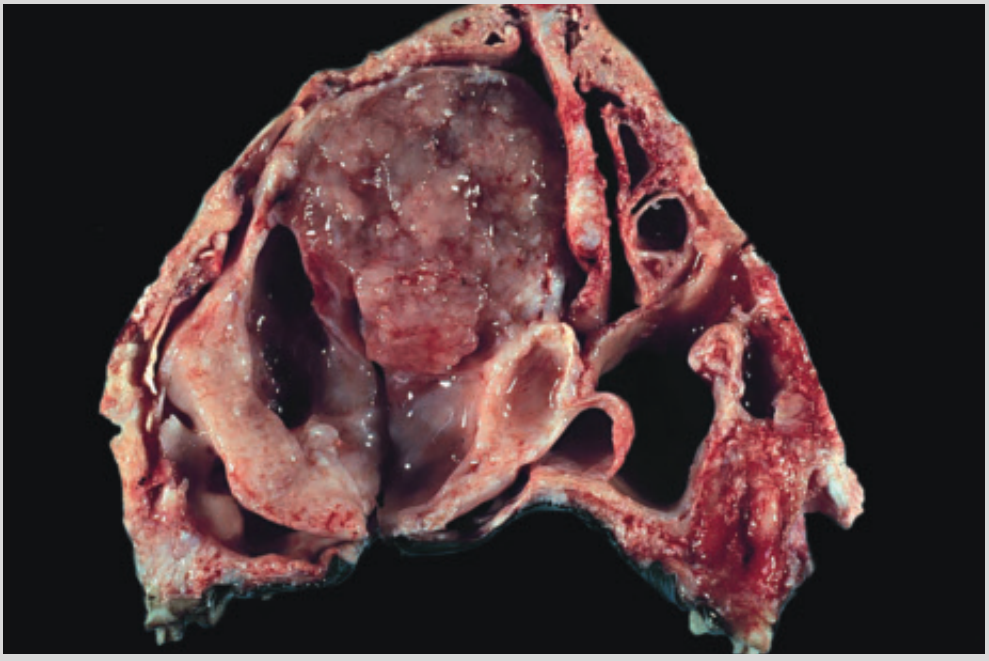
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5.111



Animal species/Organ	Horse/Head; left, caudal section of the nasal cavity and pharynx
Lesion	Malignant neoplasm (cut surface)
Scoring	Total condemnation
Comments	Histologic examination is necessary to make an exact diagnosis

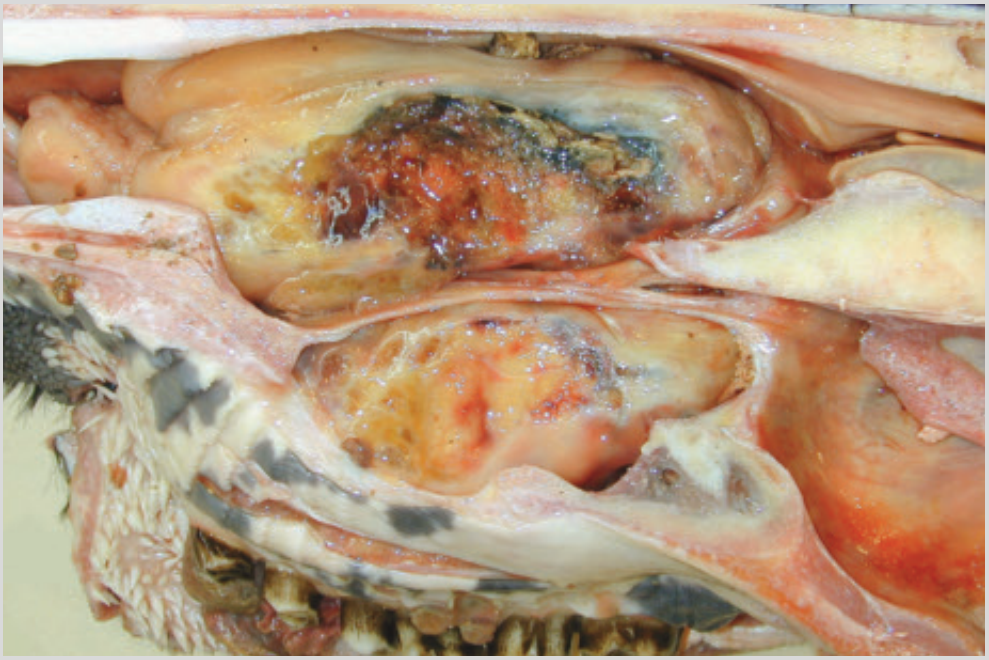
5.112



Animal species/Organ	Horse/Head; nasal cavity, maxillary sinus, etc.
Lesion	Malignant neoplasm localised to the nasal cavity, etc.
Scoring	Total condemnation
Comments	Infiltrative growth and deformation make it difficult to recognise the various anatomic structures

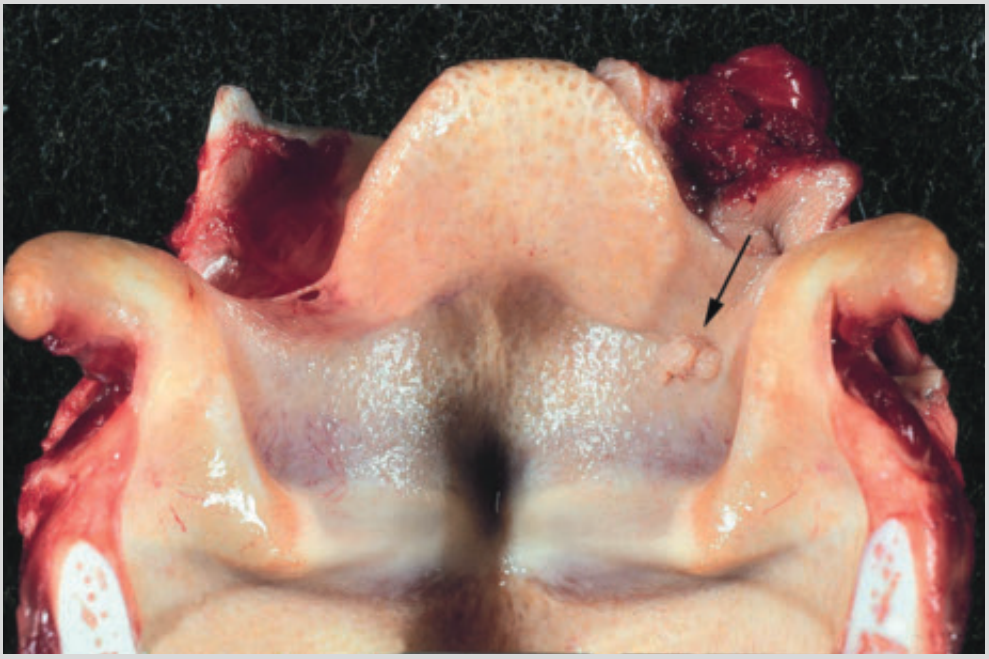
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5.113



Animal species/Organ	Cattle/Head; right nasal cavity, maxillary sinus, etc.
Lesion	Malignant neoplasm localised to the nasal cavity and maxillary sinus
Scoring	Total condemnation
Comments	Pronounced osteolysis has resulted in deformation (dilatation) of the maxillary sinus and loosening of the molars

5.114



Animal species/Organ	Cattle/Larynx
Lesion	Papillomas (papillomatosis) can be seen on the right side (→)
Scoring	Partial condemnation
Comments	Caused by a virus

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5.115



Animal species/Organ	Cattle/Lung; the same lung as in 5.116 and 5.117
Lesion	Metastatic uterine carcinoma (disseminated lesions)
Scoring	Total condemnation
Comments	Malignant neoplasms always necessitate total condemnation

5.116



Animal species/Organ	Cattle/Lung; the same lung as in 5.115 and 5.117
Lesion	Metastatic uterine carcinoma
Scoring	Total condemnation
Comments	The white, yellow to orange (or red) colour is characteristic

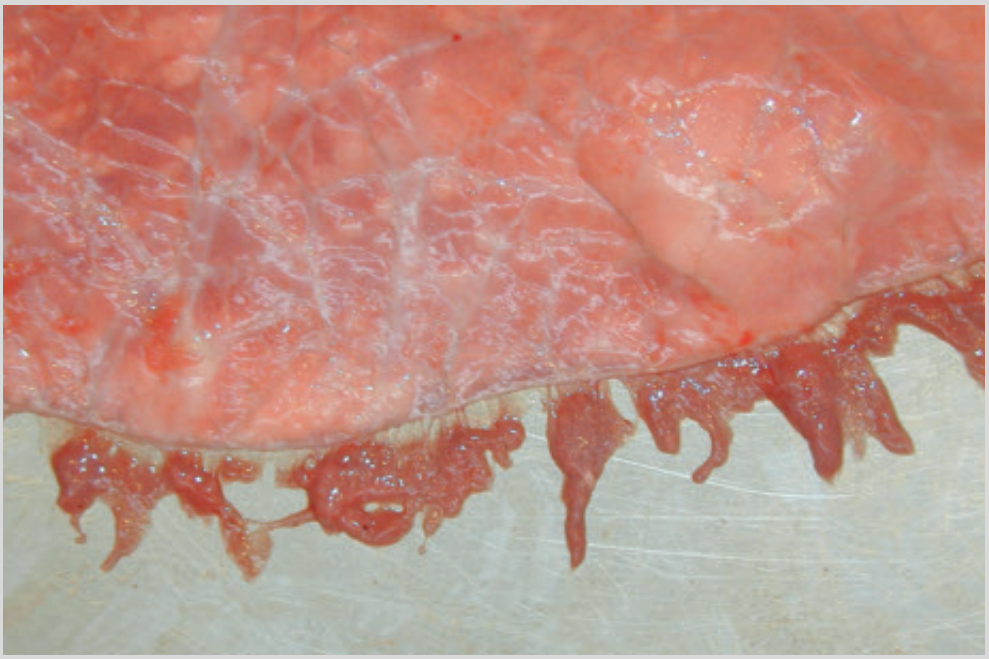
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5.117



Animal species/Organ	Cattle/Lung; the same lung as in 5.115 and 5.116
Lesion	Metastatic uterine carcinoma
Scoring	Total condemnation
Comments	The lesions are characterised by fibrosis (palpation), and often acquire a lobular appearance

5.118



Animal species/Organ	Cattle/Lung; the same lung as in 5.119
Lesion	Fibrous and filamentous formations on the visceral pleura
Scoring	Partial condemnation in widespread lesions
Comments	Occurs particularly in older animals and along the caudal lobes' basal (i.e. ventral) border

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5.119



Animal species/Organ	Cattle/Lung; same lung as in 5.118
Lesion	Fibrous and filamentous formations on the visceral pleura
Scoring	Partial condemnation in widespread lesions
Comments	Comparable lesions can be seen on the epicardium, particularly at the base of the heart

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6 Pancreas

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Pancreatitis p. 194
Vascular disorders p. 194
Foreign bodies, including calculi p. 194
Neoplasms p. 195

Introduction

The pancreas has a large number of functions related to the digestive processes (exocrine pancreas) and the endocrine regulation of the body's organ functions including energy catabolism (endocrine pancreas). The endocrine functions will be discussed in detail in the chapter on endocrine organs. This chapter will discuss lesions in the pancreas and adjacent structures in general.

Functional disorders of the pancreas (hypoactivity and hyperactivity) are difficult to recognise in slaughter animals, but must be borne in mind at findings of abnormal nutritional status of unknown aetiology, or abnormal intestinal contents such as steatorrhoea. In these cases, the pancreas should be inspected. Scoring of carcases with no lesions besides abnormal nutritionel status is based on the general rules.

A number of the lesions found in the pancreas and the adjacent structures occur as a result of unintentional release of potent enzymes from the exocrine component of the pancreas, e.g. lipases. Release of these enzymes can result in necrosis of the adjacent structures (e.g. fatty tissue, connective tissue, and peritoneum) and associated parts of the pancreas, thus initiating a vicious circle of advancing necrosis. Fatty tissue necrosis is discussed separately (see Chapter 7).

At meat inspection, scoring is based partly on the pancreas itself and partly on the generalised findings e.g. presence of fever and debilitated general health which can be associated with severe acute pancreatitis/pancreatic necrosis. It is essential to assess whether the lesion is circumscribed to the pancreas and adjacent structures, or spread throughout the abdomen. Local lesions, including local peritonitis, necessitate partial condemnation, whereas pancreatitis associated with extensive inflammation in the abdomen is scored according to the peritoneal lesion.

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Pancreatitis [6.01]

Pancreatitis can be seen as 1) a circumscribed condition, 2) a consequence of invasion from adjacent structures and 3) part of a generalised condition. At meat inspection it is important to determine which of these conditions are present. In cases 2) and 3), scoring will not be dependent on the pancreatic lesion, but will be determined by the more general findings. Regardless of age, circumscribed pancreatitis necessitates partial condemnation, unless systemic complications are present. In that case, the scoring is total condemnation.

Acute pancreatitis will often be necrotic in character with a secondary suppurative response. Affected parts of the pancreas will appear oedematous and hyperaemic, and necrosis will be associated with haemorrhage. In addition, fibrin exudation is observed with adhesion to the adjacent structures. Depending on the severity of the condition, fatty tissue necrosis and peritonitis may be observed. The chronic stage is often characterised by fibrosis and encapsulation of the lesions as well as chronic fibrous adhesive peripancreatitis. As previously mentioned, pancreatitis can be a progressive lesion in which areas of chronic inflammation and acute inflammation can be seen concomitantly.

Solitary abscesses may be seen in the pancreas; however pancreatitis is often not primarily suppurative. It is therefore important to know whether it is due to spread from a primary focus (pyaemia) or invasion from another organ in the abdomen (e.g. hepatitis with abscess formation or traumatic reticuloperitonitis).

In general, it is difficult to determine the exact cause of pancreatitis and in many cases it is considered to be idiopathic. Pancreatitis is well-known to occur after trauma. In cattle, this can be due either to external trauma or to a direct effect on the pancreas at migration of foreign bodies through the abdomen. Migration of the larval stages of endoparasites can also traumatise the pancreas. Furthermore, ascending infections via the pancreatic duct can cause pancreatitis.

Vascular disorders

Vascular disorders are rarely seen as a primary condition in the pancreas. These would necessitate partial condemnation. Vascular disorders in the pancreas occur most frequently in connection with more generalised vascular disorders which typically result in ascites (abdominal dropsy). Scoring of the carcase will thus depend either on the primary condition or follow the general scoring rules, but in all cases will necessitate condemnation of the affected organs.

Foreign bodies, including calculi [6.02 – 6.04]

Foreign bodies may be seen in the pancreas itself (e.g. migrating parasites and metal pieces) as well as in the pancreatic duct. Foreign bodies in the pancreas are subject to the rules for pancreatitis. Foreign bodies present in the pancreatic duct necessitate partial condemnation of the pancreas.

Calculi (pancreatic stones, pancreatolithiasis) are regularly found in the pancreatic

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duct. These are comprised of phosphate and carbonate compounds and are considered to be an occasional finding without clinical significance. The formation of calculi in the ducts can occur as a result of accumulation of pancreatic secretions or be due to inflammation. On the other hand, accumulation of pancreatic secretions and inflammation can occur as a result of calculi formation. It is therefore often impossible to delineate the pathogenesis. Pancreatic secretions can accumulate due to compression of the pancreatic duct by lesions (e.g. abscesses or neoplasms) located in proximity to the pancreas, and can result in partial pancreatic atrophy.

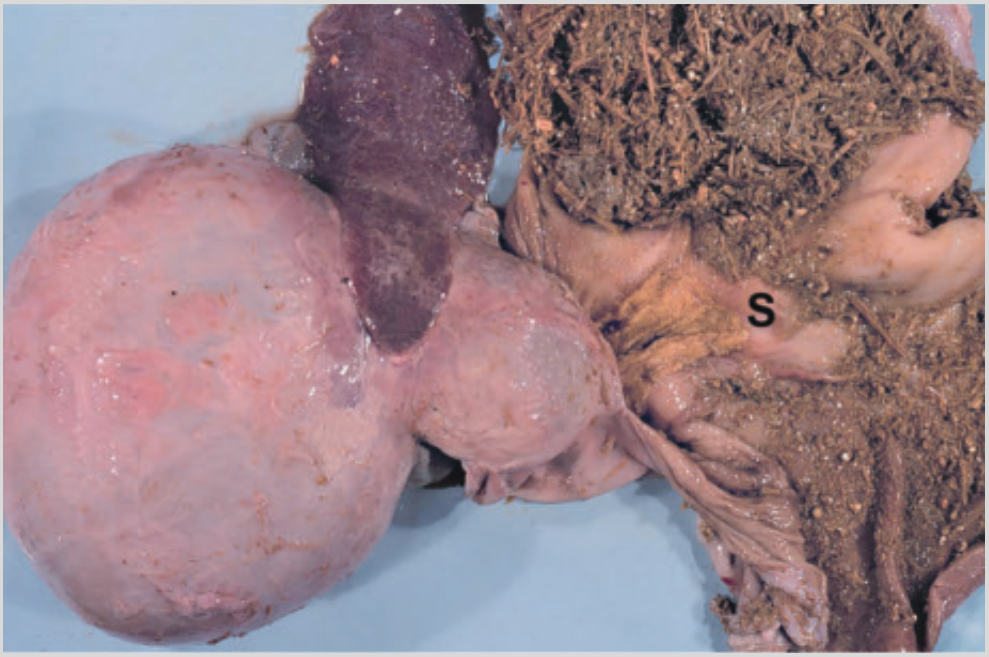
Migration of parasites can be seen in the ducts, particularly in pigs, and is often due to heavy intestinal infestation with *Ascaris suum*. This is often a post-mortem event, but if present when the animal is alive, it is associated with inflammation. Both cases necessitate partial condemnation.

Neoplasms [6.05 – 6.06]

Pancreatic neoplasms occur rarely in slaughter animals. Neoplasms can originate in both the endocrine component (see Chapter 17) and the exocrine component. Neoplasms in the exocrine component comprise in particular adenomas and adenocarcinomas. Adenocarcinomas frequently metastasise to the regional lymph nodes and liver. Neoplasms in the pancreas are judged based on the general rules (see Chapter 21).

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6.01



Animal species/Organ	Pig/Pancreas and stomach (S)
Lesion	Chronic pancreatitis with abscess formation
Scoring	Partial condemnation
Comments	Approved for deboning if the lesion occurs in connection with pyaemia

6.02



Animal species/Organ	Cattle/Pancreas
Lesion	Pancreatolithiasis
Scoring	Partial condemnation
Comments	The condition is rarely associated with symptoms in slaughter animals

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6.03



Animal species/Organ	Cattle/Pancreas
Lesion	Pancreatolithiasis
Scoring	Partial condemnation
Comments	Detail from 6.02

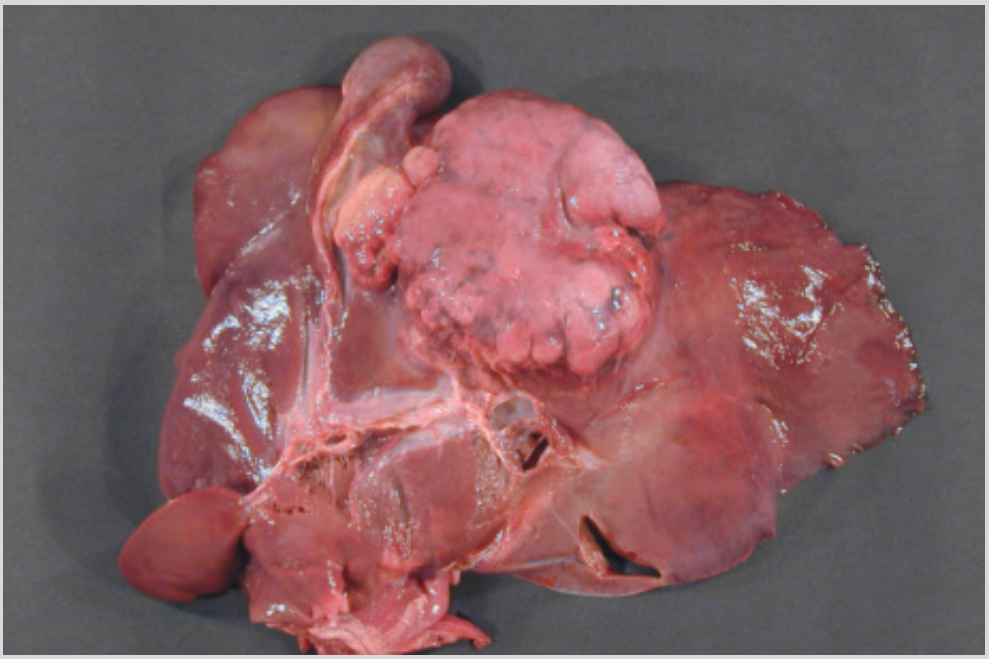
6.04



Animal species/Organ	Cattle/Pancreas
Lesion	Pancreatolithiasis
Scoring	Partial condemnation
Comments	Calculi located in the pancreatic duct

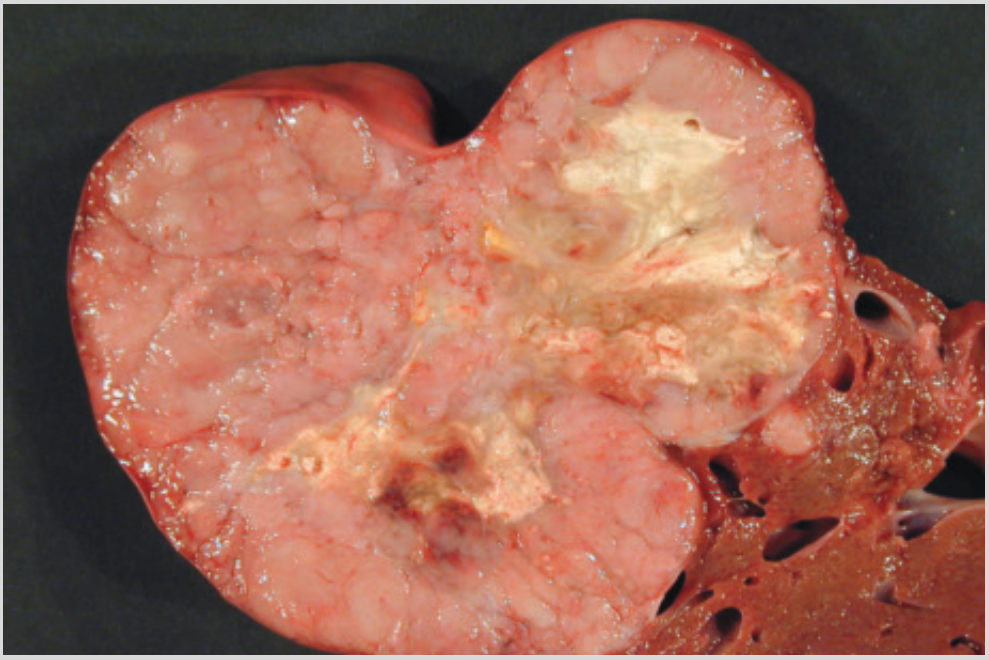
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6.05



Animal species/Organ	Sheep/Liver
Lesion	Metastasis from pancreatic adenocarcinoma
Scoring	Total condemnation
Comments	Malignant neoplasms always necessitate total condemnation

6.06



Animal species/Organ	Sheep/Liver
Lesion	Metastasis from pancreatic adenocarcinoma
Scoring	Total condemnation
Comments	Cut surface from preparation in 6.05

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7 Peritoneum

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Introduction

The peritoneum is comprised of a parietal component which lines the abdominal wall and a visceral component surrounding the abdominal organs. In principle, lesions in the peritoneum deals with both components. However, the overall scoring of lesions that develops due to invasion through the visceral component is based mainly on the nature of the underlying lesions. When scoring lesions in the peritoneum it is therefore often necessary to apply the rules of other organ systems.

It is essential to determine whether lesions in the peritoneum have developed locally or as a result of haematogenous spread. In the latter, it is necessary to differentiate between a circumscribed lesion and a noncircumscribed lesion. Acute peritonitis with diffuse or non-defined distribution necessitates total condemnation, whereas acute peritonitis with local distribution necessitates partial condemnation. However, it is necessary to be aware of the general findings, because peritonitis can result in fever and debilitated general health due to absorption of toxins across the large surface area of the peritoneum. It is also necessary to be aware that acute paralytic ileus can develop as a secondary condition, which necessitates total condemnation. Regardless of the distribution, uncomplicated chronic peritonitis necessitates partial condemnation whereas the presence of complications necessitate total condemnation, as mentioned previously.

Ascites and haemoperitoneum [7.01]

Ascites (hydroperitoneum, abdominal dropsy) develops in association with generalised conditions such as hypoproteinaemia or emaciation or as part of local, often chronic, vascular disorders. Ascites present as part of a generalised condition necessitates total condemnation, whereas ascites present as a local condition necessitates rejection of the oedematous tissue. If ascites is due to local conditions, the cause is often associated

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with the caudal vena cava, the liver, or the right side of the heart. Ascites is occasionally seen in association with prolonged pregnancy, particularly in cattle, with concomitant abnormal fluid accumulation in the uterus (hydramnion, hydrallantois (see Chapter 12)).

Haemoperitoneum, including subperitoneal haemorrhage, occurs with generalised haemorrhagic disorders (haemorrhagic diathesis) and as local lesions. Local haemorrhage is often the result of trauma, possibly caused by migrating parasitic larvae. Generalised conditions, where it is not possible to remove all lesions, or in which the animal is anaemic, necessitate total condemnation. Circumscribed lesions necessitate partial condemnation.

Peritonitis [7.02 – 7.04]

Peritonitis can occur as a result of 1) direct implantation of microorganisms at perforation, 2) haematogenous spread, 3) lymphogenous spread or 4) direct invasion from lesions in the adjacent tissues. The aetiology of peritonitis is almost exclusively bacterial, but chemical peritonitis associated with rupture of the gall bladder or urinary bladder does occur. Furthermore, peritonitis is seen as a complication of pancreatic necrosis or parasite migration.

Direct implantation of microorganisms can occur with perforating lesions in the abdominal wall, such as after butting, or injuries conferred by pointed objects. Perforation of the alimentary system is most frequent, and commonly caused by traumatic reticuloperitonitis (ruminants) or ulcerative gastritis (pigs and horses) or abomasitis (ruminants). Distribution of the lesions will depend on the localisation because close proximity to the omentum or abdominal organs can help demarcate the lesion, while lack of proximity predisposes to spread of infection. Trauma associated with breeding or parturition may result in rupture of the internal reproductive organs, and the bones of a macerated foetus can penetrate the uterus. Inflammation associated with these lesions will often be generated by a mixed bacterial flora as well as foreign bodies (intestinal content, hair, pieces of bone, etc.), and will often be putrid with a fibrinopurulent exudate. Acute non-defined lesions or complications in the form of intoxication, fever, etc. necessitate total condemnation, whereas defined or chronic, uncomplicated lesions necessitate partial condemnation.

Haematogenous spread is often found in calves and pigs, and in the acute stage causes diffuse inflammation of a serous, fibrinous or fibrinopurulent character. In calves, the aetiology is generally *Escherichia coli* (septicaemic colibacillosis), while in pigs the aetiology is often *E. coli*, *Haemophilus parasuis*, *Streptococcus suis* or mycoplasms. Acute cases necessitate total condemnation. The chronic stage characterised by diffuse fibrous adhesive peritonitis is, however, seen most frequently in slaughter animals. This necessitates partial condemnation. Note that in cattle, the presence of multifocal or disseminated granulomatous peritonitis ("pearl disease") could indicate the presence of tuberculosis (see Chapter 20).

Lymphogenous spread can be seen at drainage of fluid from the abdomen through fenestrations in the diaphragm to lymph nodes in the thoracic cavity, which is the most important drainage route. This means that lesions can be present between the liver and

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diaphragm. In cattle, this typically results in formation of a subphrenic abscess (see Chapter 9). Lymphogenous spread may occur in alimentary system infections with spread to the lymph nodes in the mesentery. Most frequently, chronic lymphangitis is seen in the mesentery in association with Johne's disease (paratuberculosis). Local lymphogenous spread necessitates partial condemnation.

Direct invasion from the surrounding tissues is seen if lesions are present in the adjacent structures. Circumscribed or chronic, uncomplicated lesions necessitate partial condemnation, whereas noncircumscribed lesions or generalised conditions necessitate total condemnation. However, it is often the lesion in the adjacent structures that is decisive at scoring. In young animals, focal visceral peritonitis is often seen in association with chronic hepatitis with abscess formation (see Chapter 9). Similarly, local peritonitis can occur after rupture of lesions in the forestomachs and spleen. In pigs particularly, chronic suppurative spondylitis, pyaemia, and local lymphogenous spread after tail bite is associated with secondary, dissecting abscess formation. Such lesions can rupture into the abdominal cavity thus causing peritonitis. Retrograde spread of infection via the oviduct to the abdomen can be seen in pyometra/endometritis, with resultant localised or widespread peritonitis. Chronic, localised peritonitis is also seen in connection with abscesses in the umbilicus (in particular in calves and pigs) as well as in the internal opening of the inguinal canal (castrated pigs).

Parasitic peritonitis can be seen in connection with migration of intestinal parasites, both with the normal migration route and aberrant migration. Certain parasites, e.g. *Fasciola hepatica*, have a definite peritoneal migration phase during which the parasite can induce inflammation, which initially is fibrinous in character. Uncomplicated parasitic peritonitis necessitates partial condemnation. In horses, nematodes can be seen in the retroperitoneum. These are often larval stages of *Strongylus edentatus* or *Strongylus equinus*. Similarly, adult *Setaria equina* several centimetres in length can occasionally be found in the abdominal cavity. Because this is a commonly occurring parasite, the peritoneum must be carefully examined in horses. The presence of parasites necessitates partial condemnation.

A number of tapeworms can form cysticerci in the peritoneum. The most important of these is the *Taenia multiceps* (definitive host: dog and fox; intermediate host: ruminants and pigs), the cysticerci stage of which, *Cysticercus tenuicollis*, can be found subperitoneally in ruminants and pigs. In the liver, the localisation is often subperitoneal, but the cysticerci can also be found in the mesentery, the omentum or in another subperitoneal localisation. The cysticercus, which can attain a diameter of 10 cm, is seen as a fluctuating, non-distended thin-walled cyst. A single scolex on the end of a long, thin neck can be observed inside the cysticercus. With regard to differential diagnosis, the echinococcal cyst (hydatid) of *Echinococcus granulosus* is of particular interest. These are localised in the liver itself and have a thicker capsule containing numerous small cysts (brood capsules). Echinococcosis is discussed in detail in Chapter 9. Cysticercosis and echinococcosis necessitate partial condemnation.

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Abdominal fatty tissue necrosis [7.05 – 7.06]

Abdominal fatty tissue necrosis occurs principally as four types: 1) enzymatic necrosis associated with pancreatic lesions, 2) focal necrosis, 3) massive necrosis and 4) steatitis. While the first three are localised in the abdomen, steatitis occurs as part of a generalised condition (pansteatitis). Steatitis in the subcutaneous fatty tissue (panniculitis) is discussed later (see Chapter 16). The scoring of abdominal fatty tissue necrosis follows the general rules for the peritoneum, such that acute or chronic, uncomplicated, circumscribed lesions necessitate partial condemnation, whereas acute noncircumscribed lesions or complicated acute or chronic lesions necessitate total condemnation.

Enzymatic necrosis develops initially in the fatty tissue surrounding the pancreas and is due to release of pancreatic enzymes mostly in connection with pancreatic necrosis or pancreatitis (see Chapter 6). In the acute stages, foci or confluent areas of yellowish, dry fatty tissue surrounded by hyperaemia and oedema, possibly with free fatty droplets in the peritoneal fluid are found. Chronic lesions are fibrotic. The condition is rare in slaughter animals. Acute pancreatic necrosis/pancreatitis necessitates total condemnation if associated with debilitated general health.

Focal fatty tissue necrosis occurs either as single or as multiple foci in the abdominal and retroperitoneal fatty tissues. The condition mostly occurs in sheep where it may be present as small, dry, calcified areas. The inflammation is not detectable macroscopically. The pathogenesis has not been clarified, but it may be due to ischaemic necrosis resulting from inadequate blood supply.

Massive fatty tissue necrosis occurs in cattle and can include fatty tissue in the omentum, mesentery and retroperitoneum. In the early stages, there is acute inflammation with firm, dry, necrotic areas surrounded by a hyperaemic border zone. The overlying peritoneum may be necrotic. In the later stages, the necrotic areas are surrounded by connective tissue. The pathogenesis is unknown, but much indicates a metabolic cause. The acute stages may be associated with debilitated general health, including anorexia, and the affected animal is totally condemned. Acute, local, and circumscribed lesions without complications necessitate partial condemnation. In the chronic stages the abdominal organs, such as the intestine, uterus and ureters, can be surrounded by massive, firm, necrotic masses and connective tissue which retain and compress the organs. This may result in a number of complications (for example: constipation, bloat, colic, emaciation, urinary congestion, dystocia, etc.), and scoring must be based on these. Uncomplicated cases necessitate partial condemnation with rejection of the abdominal and retroperitoneal fatty tissue with associated organs.

Steatitis is an inflammation of the fatty tissue. The condition occurs mainly in pigs and horses. The underlying cause is nutritional and is due to use of feed containing a high concentration of polyunsaturated fatty acids in conjunction with a low content of antioxidants (vitamin E). The condition occurs as a generalised condition (pansteatitis) and necessitates total condemnation.

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Neoplasms [7.07 – 7.08]

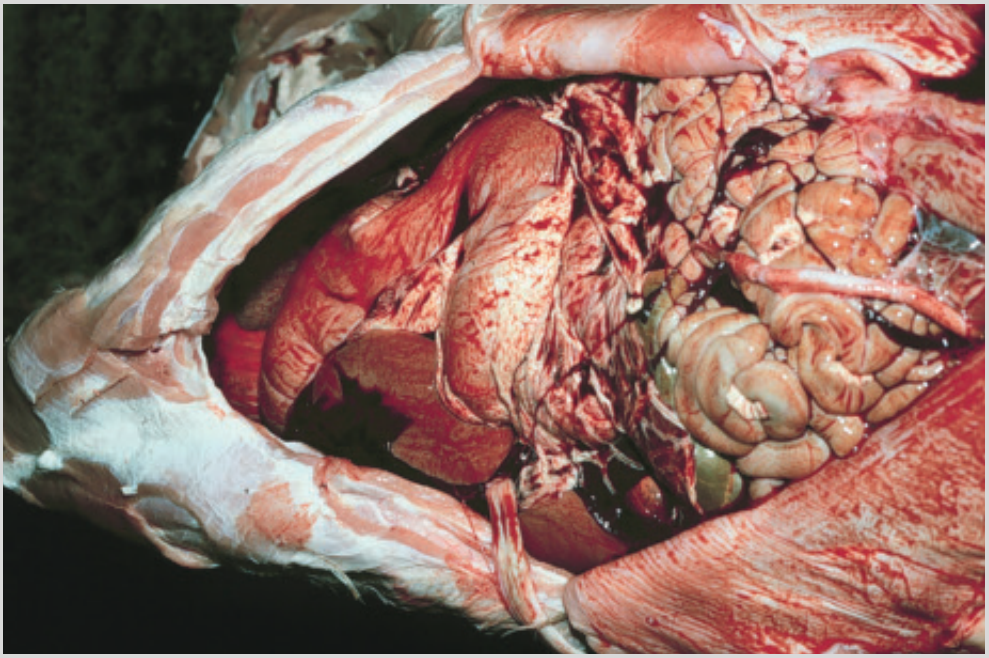
Primary peritoneal neoplasms are relatively rare in slaughter animals. Mesotheliomas are seen particularly in cattle. This is a malignant tumour which originates from the serosal surface. Local implantation metastases occur often in the peritoneum, as does lymphogenous spread to the sternal and mediastinal lymph nodes. This occurs via fenestrations in the diaphragm which must therefore always be inspected. The presence of metastases, including implantation, necessitates total condemnation.

In horses, lipomas are often found in the retroperitoneal fatty tissue. These are benign tumours and necessitate partial condemnation. Because this tumour is often pedunculated, complications such as strangulation, typically of the intestine, can occur. If this complication is present, it must form the basis for the scoring (see Chapter 8).

Tumour metastases or local invasion can develop with all tumours located in or near the abdomen. Metastatic spread to the peritoneum from primary adenocarcinomas in the uterus is often seen in cows with this type of tumour. Invasive growth by pancreatic carcinomas also occurs.

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7.01



Animal species/Organ	Cattle/Peritoneum
Lesion	Haemoperitoneum
Scoring	Partial condemnation
Comments	Complications such as anaemia or shock necessitate total condemnation

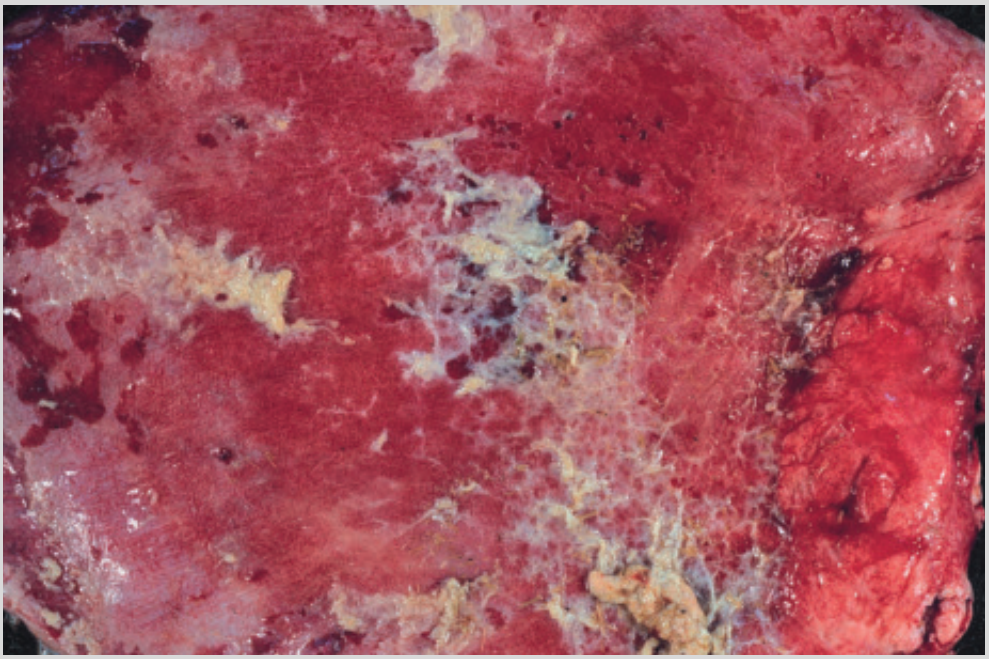
7.02



Animal species/Organ	Cattle/Peritoneum
Lesion	Acute, diffuse, fibrinopurulent peritonitis
Scoring	Total condemnation
Comments	Acute, diffuse, peritonitis always necessitates total condemnation

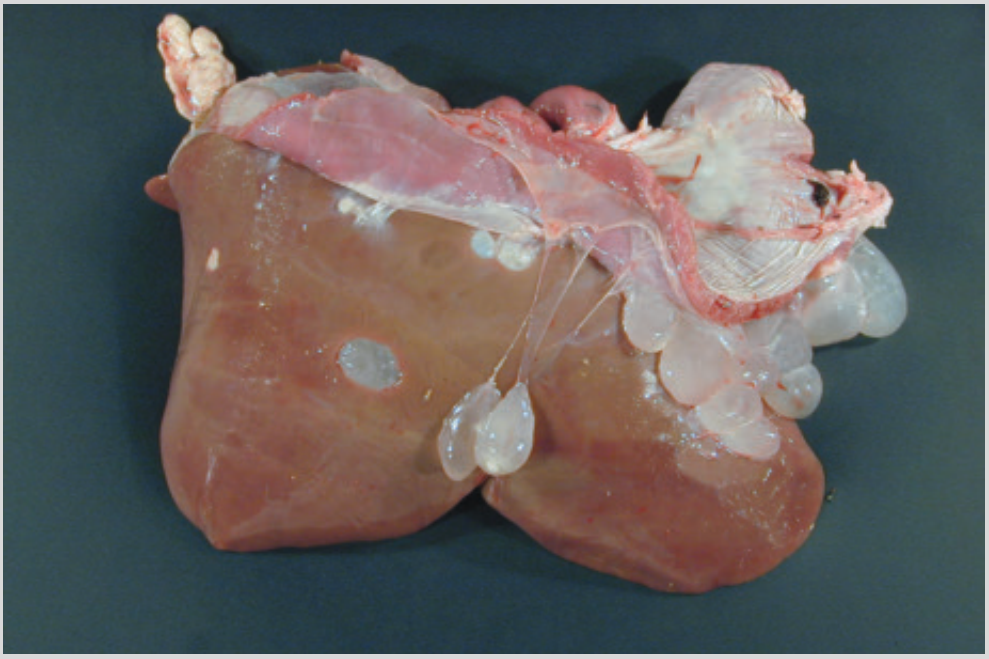
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7.03



Animal species/Organ	Cattle/Peritoneum
Lesion	Acute, locally distributed, fibrinous peritonitis over the reticulum
Scoring	Partial condemnation
Comments	Acute, defined lesions without complications necessitate partial condemnation

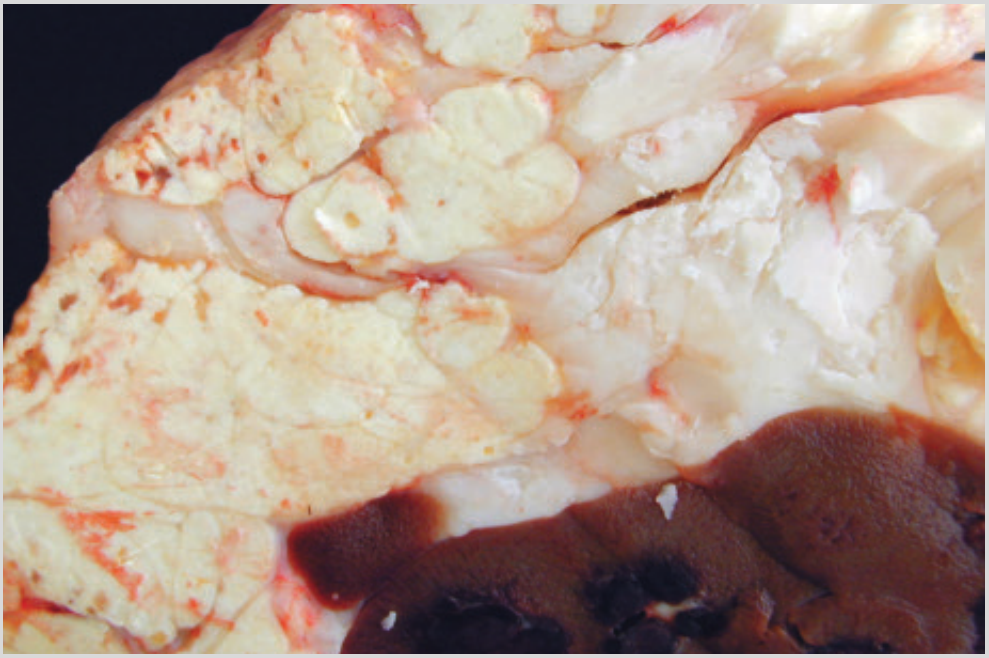
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Animal species/Organ	Sheep/Peritoneum and liver
Lesion	Cysticercosis
Scoring	Partial condemnation
Comments	Multiple cysticerci (*Cysticercus tenuicollis)* located in the peritoneum

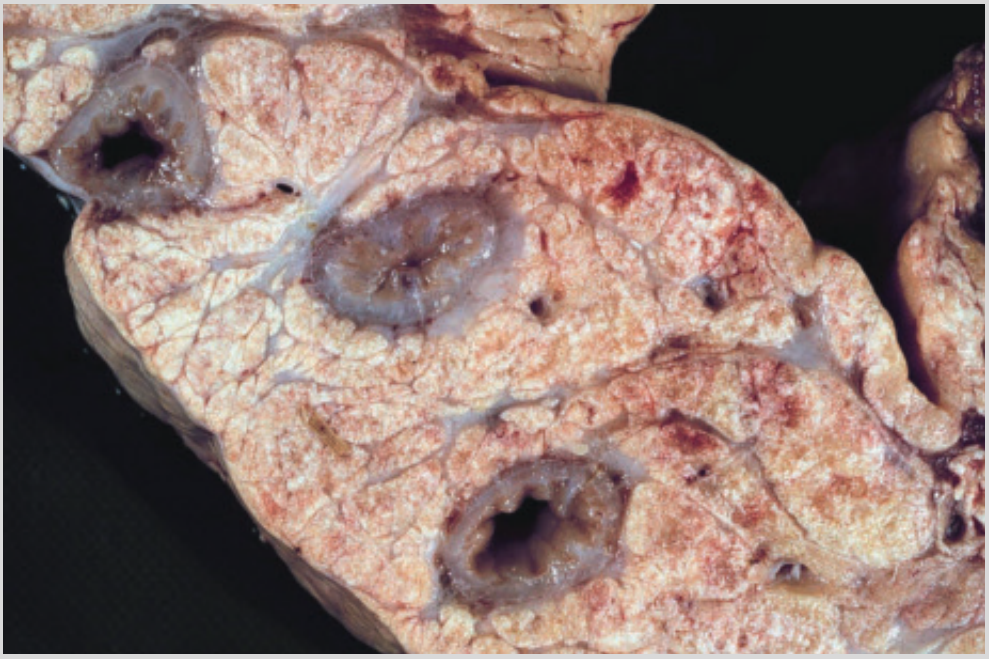
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Animal species/Organ	Cattle/Subperitoneal fatty tissue
Lesion	Chronic, massive, fatty tissue necrosis
Scoring	Partial condemnation
Comments	Necrotic fatty tissue is seen as yellowish areas

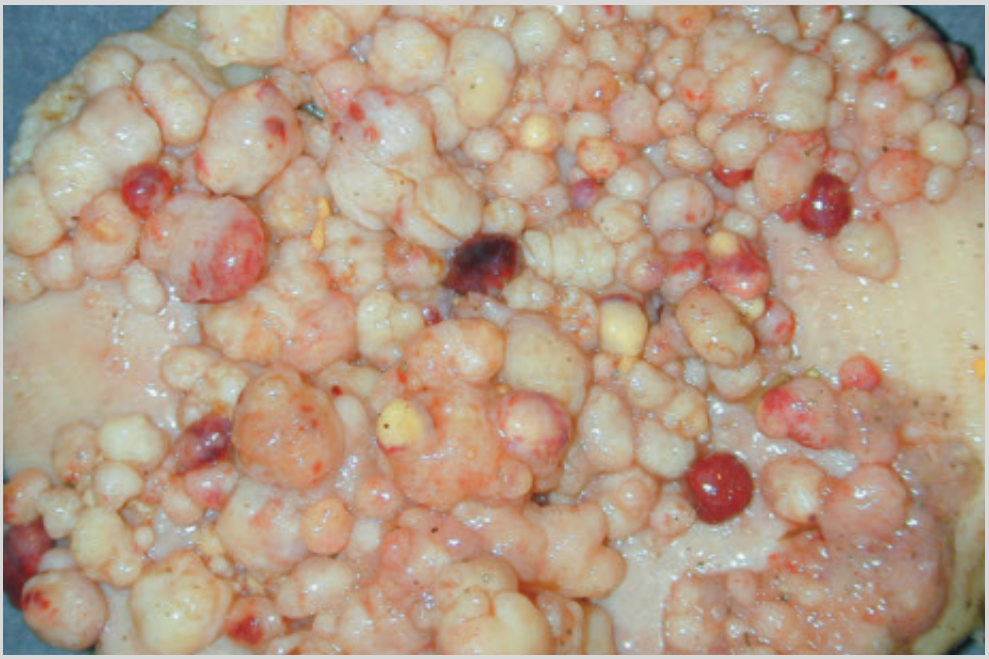
7.06



Animal species/Organ	Cattle/Subperitoneal fatty tissue
Lesion	Chronic, massive, fatty tissue necrosis
Scoring	Partial condemnation
Comments	The intestinal loops are surrounded by massive amounts of necrotic fatty tissue

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7.07



Animal species/Organ	Cattle/Peritoneum
Lesion	Multicentric lymphosarcoma
Scoring	Total condemnation
Comments	Malignant neoplasms always necessitate total condemnation

7.08



Animal species/Organ	Cattle/Peritoneum
Lesion	Malignant mesothelioma
Scoring	Total condemnation
Comments	Neoplasms in the abdomen metastasise to the sternal lymph nodes via the diaphragm

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8 Alimentary System

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Introduction

Not only do the anatomy and physiological functions of the alimentary system vary considerably throughout its length, but there is also considerable inter-species variation. For the purposes of meat inspection, the alimentary system can be categorised into two compartments. Firstly, the non-glandular compartment that includes the oral cavity, pharynx, oesophagus, forestomachs and the oral part of the stomach, and secondly, the glandular compartment that includes the abomasum/the aboral part of the stomach, and the intestines. The non-glandular section is lined with squameous epithelium. Lesions in the non-glandular compartment will often give rise to localised changes and are therefore often judged mildly. Lesions in the glandular compartment will on the other hand more often give rise to generalised complications.

Ante-mortem and post-mortem inspections of the alimentary system are vital for monitoring contagious diseases of livestock. A number of serious viral diseases such as foot-and-mouth disease, swine vesicular disease, and vesicular exanthema, present lesions in the non-glandular compartment, and must therefore always be kept in mind.

Developmental anomalies and idiopathic conditions

[8.01 – 8.05]

Emphysema

Intestinal (mesenteric) emphysema is a condition in pigs characterised by the presence of gas-filled cystic structures of a few mm to several mm in size in the intestinal wall and below the serosa. The condition occurs particularly in the small intestine but can also be found in the large intestine, mesentery, and mesenteric lymph nodes. The cysts

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are comprised of gas-filled dilated lymph vessels. The aetiology and pathogenesis are unknown. Judgement is partial condemnation.

Muscular hypertrophy

Hypertrophy of the tunica muscularis presents as a segmentally diffuse firm thickening of the intestinal wall. The condition is seen primarily in horses and pigs, in which it is typically localised to the aboral section of the oesophagus (horse) or the small intestine, typically the ileum. The condition presents partly as an idiopathic condition, partly as a muscular adaption to stenosis (work hypertrophy) or chronic intestinal infection, e.g. with *Lawsonia intracellularis*. Uncomplicated conditions necessitate partial condemnation. Complicated conditions are judged based on the nature of the complication.

Intestinal diverticulum

Intestinal diverticulum occurs both as an idiopathic condition and in connection with muscular hypertrophy. The condition is characterised by ballooning of the intestinal lumen into the wall. Intestinal diverticula are mucosa-lined and uncomplicated cases necessitate partial condemnation. If complications such as rupture are present judgement is based on the complication. Diverticula are susceptible to both rupture and local inflammation.

Meckel's diverticulum and enterocystoma

Meckel's diverticulum and enterocystoma are congenital malformations which arise due to non-regression of the proximal and distal parts of the intra-abdominal section of the yolk stalk (omphalomesenteric duct), respectively. The conditions occur particularly in pigs. Meckel's diverticulum is comprised of a mucosal-lined diverticulum arising in the ileum, and is judged as for other intestinal diverticula. Enterocystomas are most often comprised of a multicystic structure with serous or serohaemorrhagic content located in the abdomen near the umbilicus, and possibly reaching into the abdominal wall. Uncomplicated conditions necessitate partial condemnation.

Pigmentation

Diffuse brownish pigmentation of teeth is seen in cattle and pigs in association with porphyria, where the bones are also discoloured. Although rare, the condition is seen particularly in the Holstein cattle breed and is due to a genetic enzyme defect. Affected animals can also have skin lesions due to photosensitisation, and varying degrees of anaemia. Uncomplicated conditions are approved for deboning. The condition should be reported to the relevant breeding association to avoid continued spread of the defective gene in the population.

Pigmentation in the intestine can vary in extent. Most frequently presence of pigments is due to local haemorrhage; for example in connection with parasite migration where the discolouration is due to haemoglobin degradation. Haemomelasma ilei occurs in horses (see p. 214). Occasionally melanosis is found which necessitates partial condemnation.

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Haemorrhagic bowel syndrome

Haemorrhagic bowel syndrome is an idiopathic haemorrhagic non-inflammatory intestinal condition in pigs, which presents as a sudden massive haemorrhage into the intestinal lumen. As the name indicates, all sections of the intestine are affected, and the intestine appears dilated and contains almost purely non-coagulated blood. The condition is generally complicated with secondary anaemia or shock, and necessitates total condemnation. Uncomplicated cases necessitate partial condemnation. The condition must be differentiated from porcine intestinal haemorrhagic enteropathy caused by *L. intracellularis*. This condition occurs primarily in gilts and younger sows. It is limited to the aboral part of the small intestine and the oral part of the large intestine. The bloody intestinal content is often coagulated. Haemorrhagic bowel syndrome must also be differentiated from acute enteric salmonellosis. Such animals often have fever and debilitated general health. The intestinal mucous membranes appear inflamed, often necrotic.

Inflammation in the oral cavity, pharynx, oesophagus and forestomachs [8.06 – 8.37]

Defined lesions due to trauma (bite wounds, foreign bodies, including hair penetration in the lingual fossa) occurs frequently in the oral cavity. The lesions are generally uncomplicated and only necessitate partial condemnation. The lesions can be the port of entry for secondary bacterial or mycotic infections. Particularly in young animals, secondary infection with *Fusobacterium necrophorum*, which causes necrotising stomatitis (calf diphtheria) may be present in these lesions, or lesions associated with tooth eruption. Spread from the primary focus is mainly seen in young animals, and the condition therefore always necessitates total condemnation. The condition in older animals without spread necessitates partial condemnation. Similarly, secondary infection with *Actinobacillus lignieresii* may be present, which is particularly localised in the tongue at the lingual fossa (actinobacillosis, "wooden tongue"). The condition is particularly prevalent in cattle, but may also be seen in pigs and small ruminants. Local lymphatic spread to the regional lymph nodes may occur. The condition necessitates partial condemnation with removal of the retropharyngeal and mandibular lymph nodes. Uncomplicated chronic generalisation with circumscribed lesions associated with pyaemia necessitate deboning, whereas the presence of complications necessitates total condemnation.

Occasionally in cattle, superficial circular or oval lesions are found in the epithelium of the tongue. The lesions are caused by infection with fungi or filamentous bacteria in the upper epithelial layer, leading to thinning. This lesion necessitates partial condemnation. The condition is an important differential diagnosis for viral vesicular stomatitis. However, the lesions are superficial, limited to the tongue, and not associated with debilitated general health or fever.

Periodontitis occurs in all slaughter animals, and the lesion is occasionally associated with feed packaging. A putrid pyonecrotising inflammation may develop which spreads to the jaw bones causing osteomyelitis. Uncomplicated cases necessitate partial condemnation. Judgement of complicated lesions is discussed in Chapter 14.

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Trauma to the oral cavity and pharynx can also result from physical or chemical injury. In boars, curved, overgrown canine teeth can penetrate not only soft tissue but also bone. Chemicals can cause widespread injuring of particularly the oral cavity, the pharynx, and the oesophagus. Judgement depends on the age of the lesions, distribution, aetiology, the presence of complications and residual concentrations of chemicals. Inappropriate procedures at application of preparations for prevention of milk fever in cattle can result in accumulation in the pharyngeal soft tissue, with resultant development of an often highly putrid pyonecrotising phlegmon. The condition is often complicated with fever and debilitated general health, which necessitates total condemnation.

Some viral infections cause lesions in the non-glandular compartments of the alimentary system. These lesions may be vesicular (e.g. foot-and-mouth disease, swine vesicular disease, and vesicular exanthema); erosive (e.g. "mucosal disease" and malignant catarrhal fever); or papular (e.g. bovine papular stomatitis and contagious pustular dermatitis in sheep (orf)). It is important to be aware that vesicular lesions can rapidly develop into erosive or ulcerative lesions thus masking the character of the primary lesion. Care must therefore be exercised when inspecting any lesion that could indicate a contagious disease in domestic animals. Judgement of the non-notifiable disease must be based on the general regulations including fever, debilitated general health, and viraemia.

Oesophagitis is seen typically as a result of acid cauterization in connection with reflux oesophagitis. The condition is seen in pigs and horses and is often characterised by chronic epithelial damage in the aboral part of the oesophagus. Partial condemnation is necessary.

Chronic ruminitis occurs typically as a result of ruminal acidosis in fattening calves on intensive feeding. The lesion is characterised partly by brown, club-shaped, clumped papillae and partly by papillae-sparse, epithelialised or granulated areas. Acute cases of ruminal acidosis necessitate total condemnation due to the effect on general health, whereas chronic lesions necessitate partial condemnation.

Lesions in the reticulum are frequently seen associated with ruminal acidosis and are judged together with the ruminal lesion. Traumatic reticulitis is seen as a result of injury by sharp objects. The lesion in the reticulum is of minor importance and generally necessitates partial condemnation. More important are lesions in adjacent tissues (peritoneum, spleen, liver, lungs, and heart) that are the result of penetration and migration of the foreign body. This can necessitate partial condemnation, approval after deboning, or total condemnation depending on the overall assessment of the animal. Please refer to the relevant chapters.

Lesions are frequently observed at inspection of the omasum. These are most often due to chronic fenestrations in the lamellae occurring as a result of bacterial or mycotic necroses. Acute lesions dominated by mostly round or oval necrosis with a haemorrhagic border zone may be observed. Epithelial damage can be seen in cases of reflux omasitis due to acid from the abomasum. This occurs primarily in the aboral part of the omasum. The conditions necessitate partial condemnation regardless of age, unless complications are present.

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Inflammation in the stomach, abomasum, and intestines
[8.38 – 8.57]

At meat inspection, scoring of inflammation in the stomach/abomasum and intestines is based on the risk of generalised infection. Therefore, the following conditions must be considered: 1) the age of the animal, because bacterial intestinal infections are more frequently generalised in younger animals, 2) the age of the lesion, because acute conditions are more often associated with generalisation than chronic conditions and 3) the extent and character of the lesion, because profound lesions more frequently develop generalisation than superficial lesions. Profound lesions are often characterised by fibrin exudation, necrosis, fibrinonecrotising (diphtheritic, croupous) coatings or haemorrhage. In addition, consideration must be given to the presence of complications which, regardless of the scoring of the primary condition can necessitate total condemnation. Gastritis and abomasitis in adult animals necessitate partial condemnation regardless of the age and character of the lesions. Similarly, acute mild enteritis and chronic enteritis, regardless of the character, necessitate partial condemnation in adult animals, whereas acute profound enteritis necessitates total condemnation. In very young animals, gastritis, abomasitis and enteritis always necessitate total condemnation regardless of the age and character of the lesions. However, it is important to be aware that a number of diarrhoetic microorganisms such as rotavirus, coronavirus, and enterotoxigenic *Escherichia coli* do not primarily cause inflammation because the diarrhoea is due to villus atrophy or hypersecretion. In addition, many cases of diarrhoea are due to inappropriate feeding. The presence of diarrhoea does not necessarily necessitate total condemnation. Total condemnation requires the presence of inflammation or complications.

Acute lesions in the abomasum occur frequently in post partum cows, and in cattle after long-term stress such as after prolonged transport. The lesions occur most frequently as smaller, sharply-defined, haemorrhagic ulcerations in the mucosa. Scoring depends on the general rules, but as a minimum necessitates partial condemnation. Chronic ulcerations are seen in all slaughter animals. In pigs and horses, these lesions are typically localised in the non-glandular areas. Uncomplicated lesions necessitate partial condemnation. Scoring of complications depends on their character. Scoring of transmural ulceration depends primarily on whether the peritoneal lesion is circumscribed or not (see Chapter 7). Furthermore, ulcerations can result in a number of other complications which are discussed later.

Parasitic infections occur frequently in the stomach in ruminants and horses. In ruminants, infection with nematodes belonging to *Trichostrongyloidea* (e.g. *Ostertagia ostertagi* and *Haemonchus contortus*) are most frequently observed, while the larval stage of *Gasterophilus* sp. are frequently found adhered to the keratinised area of the stomach in horses. Outdoor pigs can be infected with red stomach worms (*Hyostrongylus rubidus*). Uncomplicated parasitic infections necessitate partial condemnation.

In slaughter animals, acute intestinal infections are found relatively rarely, whereas chronic lesions are more frequent. Acute severe inflammation is typically caused in all slaughter animals by *Salmonella* spp. (acute enteric salmonellosis), and necessitates total

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condemnation, whereas uncomplicated chronic enteric salmonellosis necessitates partial condemnation. Salmonellosis however occurs most frequently as a latent subclinical enteric infection that cannot be recognised macroscopically. In horses, colitis-X is the most important differential diagnose for acute, enteric salmonellosis. These conditions cannot be definitely differentiated morphologically, and both necessitate total condemnation. In cattle, the most important enteric differential diagnose is acute viral enteropathy caused by coronavirus ("winter dysentery"). The acute stage necessitates total condemnation.

Chronic bacterial intestinal infections in cattle are caused particularly by infection with *Mycobacterium avium* subsp. *paratuberculosis*. This infection initially causes a chronic lepromatous hyperplastic enteritis and typhlocolitis. Chronic granulomatous lymphangitis is often present as well as chronic granulomatous mesenteric lymphadenitis. Uncomplicated cases, with only localised occurrence with local lymphatic or portal spread necessitate partial condemnation. Spread to other organs, which occurs as part of a bacteraemia, necessitates total condemnation. In small ruminants the infection manifests as chronic tuberculoid hyperplastic inflammation. Infections with mycobacteria are discussed separately in Chapter 20.

Chronic bacterial intestinal infections in horses are most frequently found in foals with concomitant abscess-forming bronchopneumonia caused by *Rhodococcus equi*. Bacteria are removed from the bronchial system via the mucociliary apparatus and are then swallowed and colonise the intestinal system. Chronic multifocal pyonecrotising ulcerative enteritis can develop, which can be complicated with local lymphatic spread. As a main rule, this is not a case of pyaemia but rather bronchopneumonia and enteritis. This therefore necessitates only partial condemnation, unless the condition is complicated for example by fever.

Chronic intestinal infections occur frequently in pigs. The most frequent are proliferative enteropathy, swine dysentery, and spirochetal diarrhoea. Uncomplicated cases necessitate partial condemnation. The most frequent complication is emaciation. Proliferative enteropathy caused by *L. intracellularis* occurs in four forms: proliferative enteritis, necrotising enteritis and regional ileitis in slaughter animals, as well as haemorrhagic enteropathy in gilts and sows. The underlying condition is segmental proliferation (hyperplasia) of the small intestine's mucosa, which in certain cases undergo necrosis. When healed, the lesion can be dominated by muscular hypertrophy of the ileum. The hyperplastic and necrotising lesions can in certain cases extend into the caecum and colon. Haemorrhagic enteropathy is an acute enterorrhagia. As with haemorragic bowel syndrome, uncomplicated cases necessitate partial condemnation. Swine dysentery and spirochetal diarrhoea are both characterised by chronic hyperplastic and necrotising lesions in the caecum and colon. The conditions are caused by *Brachyspira hyodysenteriae* and *B. pilosicoli*, respectively.

Parasitic infections in the intestines necessitate partial condemnation, unless associated with generalised complications. Particularly in horses, a number of parasites cause macroscopically detectable lesions in the intestines. These include in particular fibrovascular plaques in the ileum (hæmomelasma ilei) caused by migrating *Strongylus edentatus* and cyathostomiasis, which is seen as multiple, few mm sized, often ulcerative

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lesions in the mucous membrane of the large intestine caused by the larval stage of equine small strongyles (cyathostomes). Pigs can be infected with *Oesophagostomum dentatum* and *O. quadrispinulatum*. Infection is apparent as subserosal granulomatous noduli in the large intestine and necessitates partial condemnation.

Stenoses, dilatations, and organ displacements
[8.58 – 8.63]

Oesophageal stenosis
Oesophageal stenosis is seen in association with occlusion of the lumen by foreign bodies or as a result of compression by the surroundings (e.g. by neoplasias or abscesses). Foreign bodies will typically get caught in the oesophagus at the level of the cranial thoracic orifice and cause necrosis of the oesophagus. The condition can be complicated by transmural necrosis and development of a perioesophageal phlegmon. Partial stenosis may cause pre-stenotic ectasia and feed accumulation. Uncomplicated stenosis with ectasia necessitates partial condemnation, whereas the presence of a phlegmon usually necessitates total condemnation due to general debilitation.

Ruminal tympany
Ruminal tympany will, in the acute stages with vascular impairment and general debilitation, necessitate total condemnation. In slaughter cattle, the chronic form is seen most frequently, in which eructation of rumen gas is compromised due to functional causes (chronic secondary ruminal tympany), for example as a result of papillomatosis. Partial condemnation is necessary. These animals occasionally have a rumen trochar inserted. This can cause complications such as peritonitis, which may impact on scoring (see Chapter 7).

Organ displacements
Organ displacements, including rectal prolapse, hernias and intestinal invaginations are scored at meat inspection based on the extent of circulatory changes, age of lesion and complications. Organ position changes resulting in acute infarcts (venous infarct), always necessitate total condemnation. A number of organ displacements particularly in the horse (ileus, torsions, invaginations, and constrictions) necessitate total condemnation. Right-sided and in certain cases left-sided abomasal displacement in cattle will also necessitate total condemnation. Total condemnation also applies in acute venous infarct in the intestines in cases of hernia, prolapse, and invagination.

Uncomplicated cases of constipation, such as caecal and colonic constipation in horses, necessitate partial condemnation.

Hernias, including both eventrations and internal and external hernias, are scored based on the presence of vascular disorders. Infarcts or other acute complications, such as rupture of the intestines, necessitate total condemnation, whereas uncomplicated cases necessitate partial condemnation. Hernias ventral in the abdomen are frequently associated with formation of a hernial sac. This type of hernia is often exposed to

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trauma particularly if it is prominent. A hernial sac necessitates partial condemnation, whereas scoring of a trauma is based on the skin lesion.

Intestinal invaginations are occasionally seen as a post-mortem phenomenon. These conditions are considered to be unimportant and are irrelevant at meat inspection. Post-mortem intestinal invaginations occur without vascular changes or adherences and can be easily straightened. In contrast, intravital lesions are associated with vascular changes and are often also associated with fibrinous or fibrous adherences. Intestinal invaginations can be seen in all species and can occur in all parts of the alimentary system with a sufficiently long mesentery.

Rectal stricture

Rectal stricture is seen most frequently in pigs and is characterised by a permanent constriction (stenosis) in the rectum or the anus (anal stricture) as a result of fibrosis. This is typically a chronic condition where the original cause can no longer be identified. The blood supply to the rectum is characterised by the absence of anastomoses, and therefore ischaemia is more likely to occur in the rectum in connection with thrombosis than in other intestinal segments. This can be seen following necrotising inflammation in the rectum (proctitis) in connection with acute enteric salmonellosis or at healing of rectal prolapse. The orally located segment of the intestine can be dilated depending on the impact of the stenosis on the passage of faeces. A genetic defect in Jersey cattle ("recto-vaginal constriction" (RVC)), is characterised by stenosis in the anus and vestibulum and, in connection with calving, severe udder oedema.

Rectal stricture necessitates partial condemnation.

Neoplasms [8.64 – 8.68]

Papillomatosis in the forestomachs of cattle is probably the most common neoplasm in the alimentary system of slaughter animals. Localisation of the tumour in the region of the oesophageal opening into the rumen can cause functional impairment resulting in secondary ruminal tympany, while localisation in the oesophagus can result in oesophageal stenosis. Uncomplicated cases necessitate partial condemnation. In horses, squamous cell carcinomas are occasionally seen originating in the white part of the stomach. This is a malignant tumour, and necessitates total condemnation. Multicentric lymphoma localised to the stomach/abomasum and intestines are occasionally present and necessitate total condemnation.

Complications

Generalised infection and enterotoxaemia

In connection with infections in the alimentary system, particularly in the glandular part, there is a risk for local haematogenous or lymphatic spread, or generalised spread. Local haematogenous spread most often occurs via the portal blood to the liver, where the further course depends on the liver's capacity to filter the blood and eliminate

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the infection. Scoring is based on the liver lesion and the overall assessment. Local lymphatic spread to the lymph nodes in the mesentery can be seen in many acute and chronic infectious conditions in the alimentary system. This means the lymph nodes should be removed if there is inflammation in the drainage area.

Generalised spread is seen most frequently in very young animals in which infections in the intestinal tract, including the pharyngeal lymphoid ring, pass into the blood and cause sepsis. Swelling of parenchymatous organs, haemorrhage and polyserositis can be seen. These are typically bacterial infections, such as infection with *E. coli*. These generalised infections will in the acute stage give rise to fever and debilitation, and necessitate total condemnation. Chronic stages may present as fibrous peritonitis, pleuritis, or pericarditis, for example. In animals of all ages, it must be assumed that brief subclinical haematogenous spread of bacteria and fungi from the intestinal canal occurs at intervals, resulting for example in localisation in the pregnant uterus. These subclinical conditions cannot be detected at meat inspection.

Enterotoxaemia is seen in association with absorption of toxins formed in the intestine. Several species of bacteria are capable of producing toxins with generalised effects. The most important of these are the verotoxin-producing *E. coli* ("oedema disease" in pigs) and *Clostridium perfringens* type D ("pulpy kidney disease" in small ruminants). A characteristic of the toxins is systemic endothelial damage resulting in haemorrhage, oedema, and reduced tissue perfusion. Enterotoxaemia necessitates total condemnation.

Emaciation and cachetic oedema

Emaciation and cachetic oedema are chronic generalised complications, which occur secondary to functional impairment in the alimentary system or insufficient or inappropriate feed. These conditions which occur concomitantly, are characterised by absence of fat, serous fatty tissue atrophy, systemic atrophy of muscles, and dark pigmentation (lipofuscinosis) of the liver, heart and skeletal muscles. These conditions necessitate total condemnation.

Dehydration

Dehydration occurs in connection with impaired fluid balance regulation across the intestinal barrier or insufficient fluid intake, possibly combined with increased fluid loss. Debilitation is present, and the animal may have sunken eyes and reduced skin elasticity. Ante-mortem inspection is therefore of great importance for judgement because the presence of debilitation necessitates total condemnation. At post-mortem inspection, the carcase may appear dry. Scoring is based on the appearance and texture of the muscles. If dehydration is present in very young animals, it is important to assess whether the underlying cause is inflammation in the stomach/intestinal system. This would necessitate total condemnation.

Peritonitis

With regard to lesions in the stomach/intestine, peritonitis can occur in various ways (see Chapter 7). Peritonitis is a frequent complication at traumatic reticulitis in cattle

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and deep ulcerations in the forestomachs, stomach and abomasum. For scoring refer to Chapter 7.

Anaemia

Anaemia occurs secondary to haemorrhagic conditions in the alimentary system, in particular in the stomach, abomasum and intestines. It is therefore very important to inspect these organs if anaemia is present. Blood loss to the stomach and abomasum is often associated with deep ulcerative lesions. However, infection with haematophagic parasites, such as *H. contortus* can also cause anaemia in small ruminants. Anaemia as a result of blood loss to the small intestine and large intestine is most frequently seen in pigs, often in connection with haemorrhagic bowel syndrome or haemorrhagic enteropathy caused by *L. intracellularis.* Anaemia necessitates total condemnation.

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8.01



Animal species/Organ	Pig/Small intestine and mesentery
Lesion	Intestinal emphysema
Scoring	Partial condemnation
Comments	The cause of this condition is unknown. The cysts are comprised of gas-filled dilated lymph vessels.

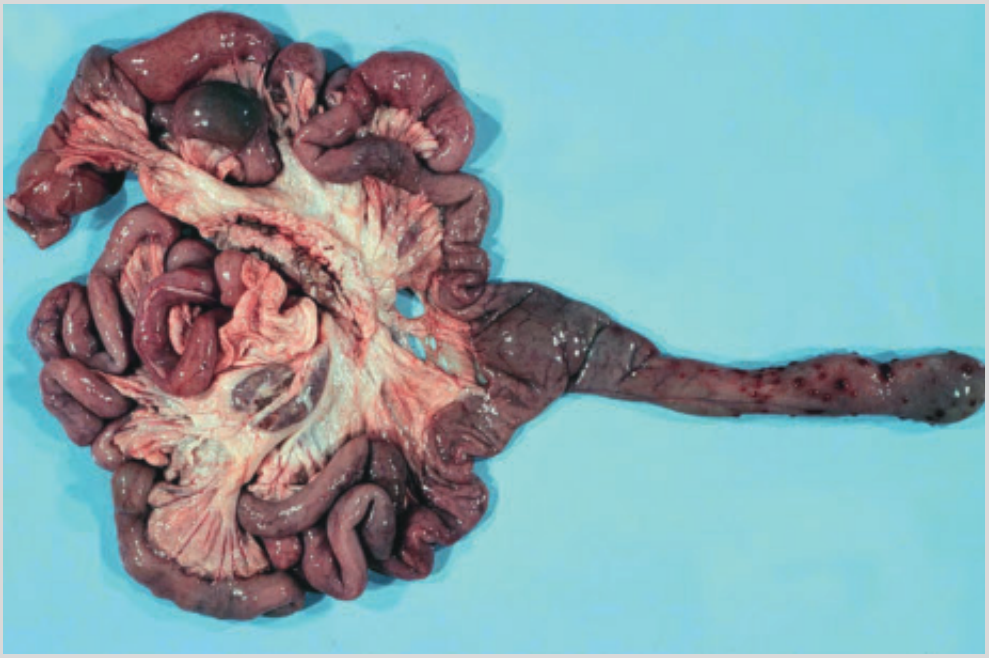
8.02



Animal species/Organ	Cattle/Small intestine
Lesion	Segmental muscular hypertrophy
Scoring	Partial condemnation
Comments	Muscle hypertrophy occurs particularly in the aboral part of oesophagus and in the small intestine, particularly in the ileum. Often the actual cause cannot be demonstrated

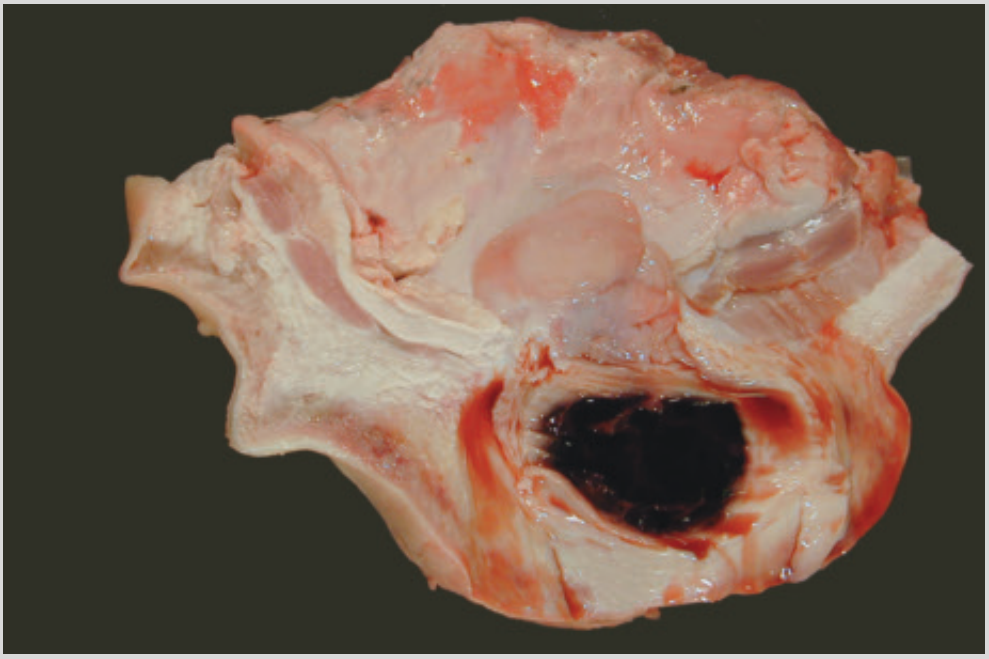
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8.03



Animal species/Organ	Pig/Small intestine
Lesion	Meckel's diverticulum
Scoring	Partial condemnation
Comments	This is a malformation in which the proximal part of the yolk stalk is retained and communicates with the intestinal lumen

8.04



Animal species/Organ	Pig/Abdominal wall
Lesion	Enterocystoma
Scoring	Partial condemnation
Comments	Malformation in which a part of the intra-abdominal section of the yolk stalk persists and is apparent as a cystic structure in the umbilical area

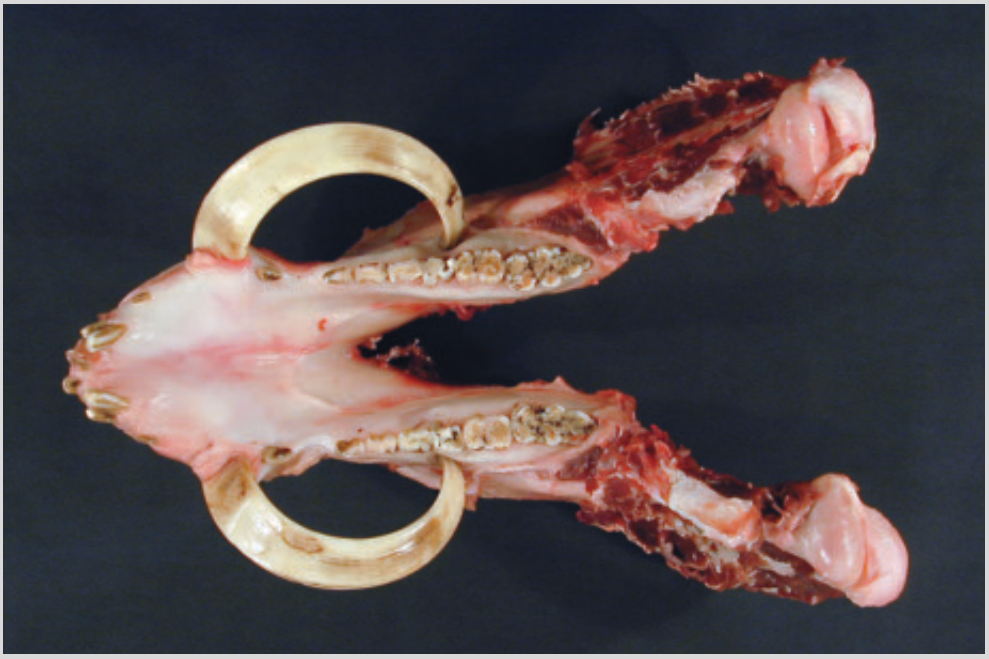
Vet-ebooks.com

8.05



Animal species/Organ	Cattle/Lower jaw
Lesion	Congenital erythropoetic porphyria
Scoring	Approved for deboning
Comments	In this condition the teeth and bones have a diffuse brown pigmentation. The condition is genetic

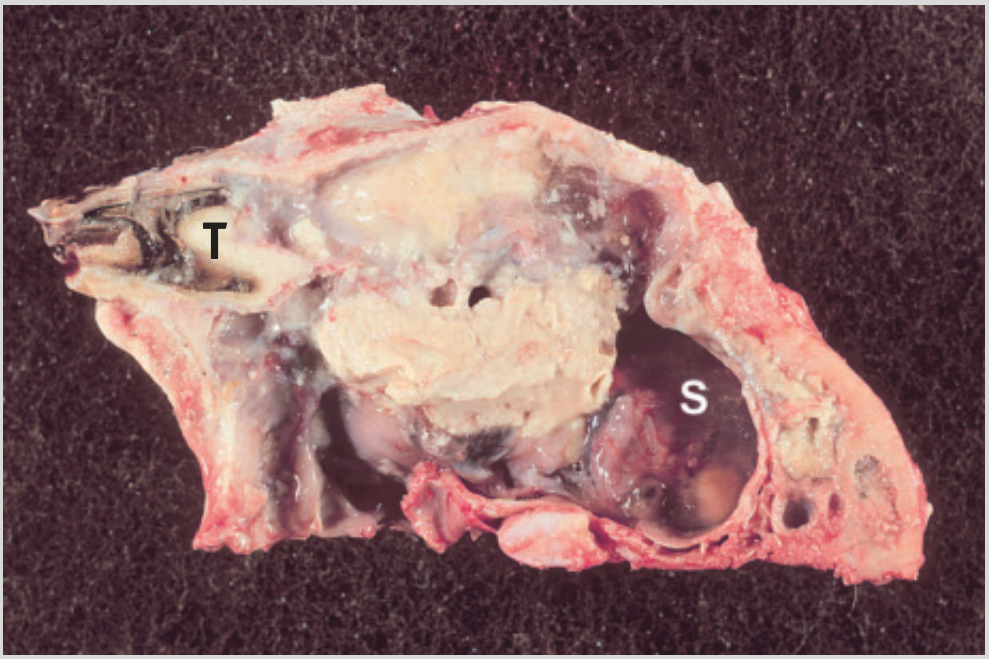
8.06



Animal species/Organ	Pig/Lower jaw
Lesion	Overgrown canines with bilateral compression atrophy of gingiva and mandibular bone
Scoring	Partial condemnation
Comments	The condition is unacceptable from an animal welfare point of view

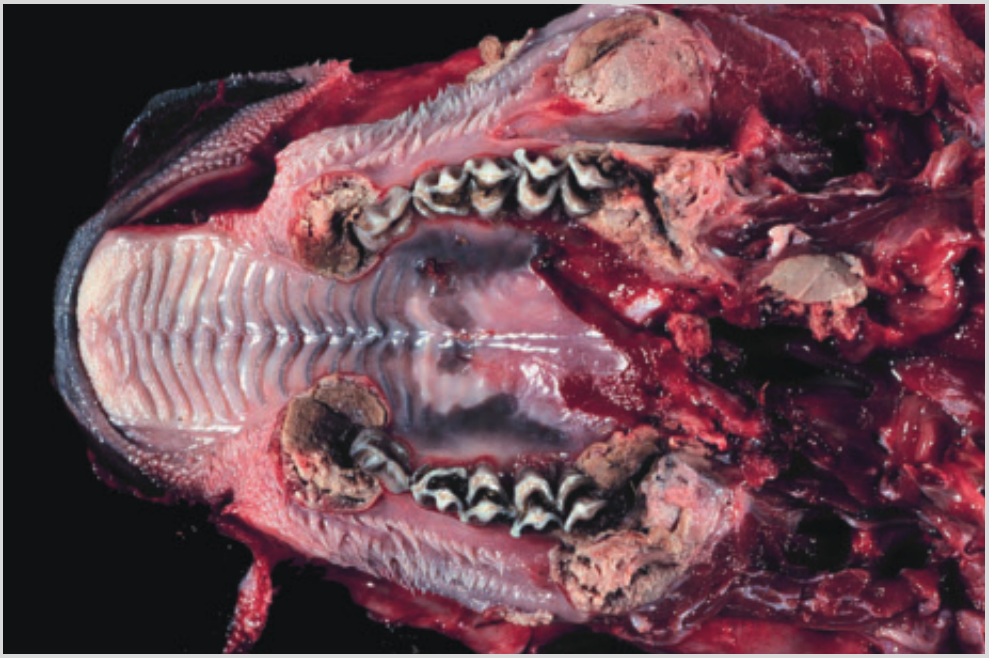
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8.07



Animal species/Organ	Cattle/Upper jaw (transverse section)
Lesion	Chronic, purulent periodontitis and pulpitis with penetration to the maxillary sinus (S). Split tooth (T)
Scoring	Partial condemnation
Comments	The sinus lesion is a secondary lesion

8.08



Animal species/Organ	Cattle/Oral cavity
Lesion	Acute, multifocal, necrotising stomatitis (“calf diphtheria”)
Scoring	Total condemnation
Comments	Necrotising lesions in the alimentary system in very young calves necessitate total condemnation. Lesions in older animals necessitate partial condemnation

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8.09



Animal species/Organ	Cattle/Tongue
Lesion	Focal, acute, necrotising glossitis ("calf diphtheria")
Scoring	Total condemnation
Comments	Necrotising lesions in the alimentary system in very young calves necessitate total condemnation. The lesion is caused by *Fusobacterium necrophorum*

8.10



Animal species/Organ	Cattle/Head
Lesion	Chronic, pyogranulomatous, mandibular osteomyelitis
Scoring	Partial condemnation
Comments	Osteomyelitis in the jaws is seen as a result of infection in or around the teeth

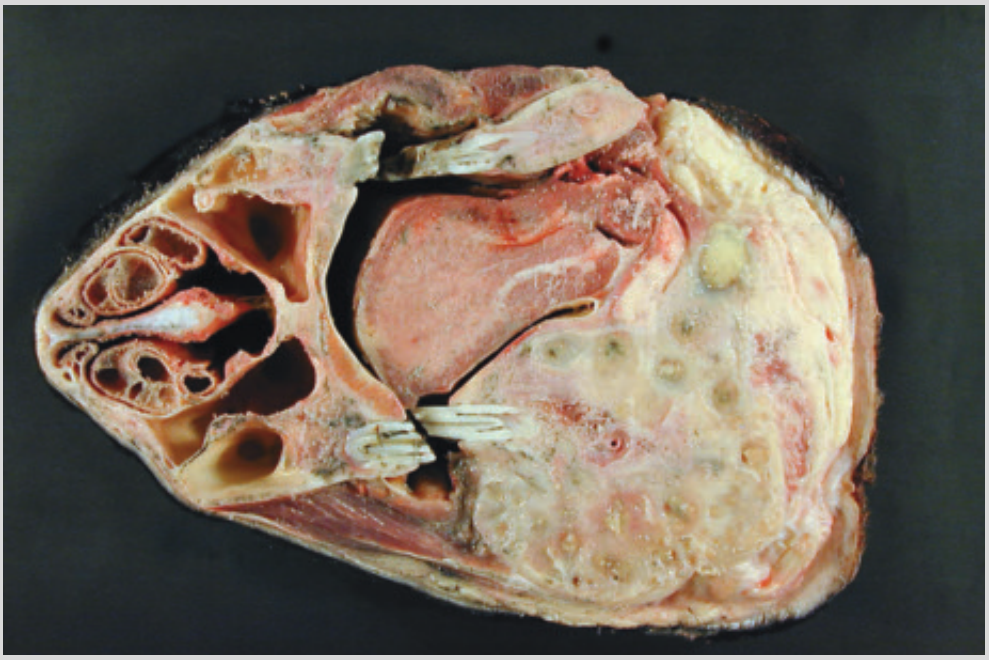
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8.11



Animal species/Organ	Cattle/Head
Lesion	Chronic, pyogranulomatous, mandibular osteomyelitis
Scoring	Partial condemnation
Comments	Cross-section of the preparation presented in 8.10

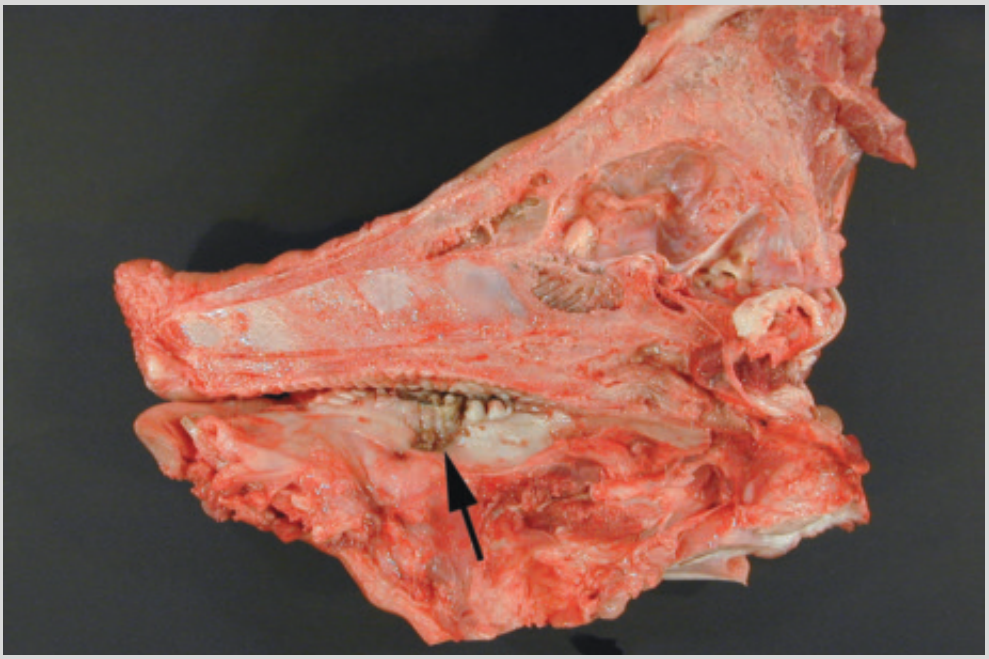
8.12



Animal species/Organ	Cattle/Head
Lesion	Chronic, pyogranulomatous, mandibular osteomyelitis
Scoring	Partial condemnation
Comments	Cross-section of the preparation presented in 8.10

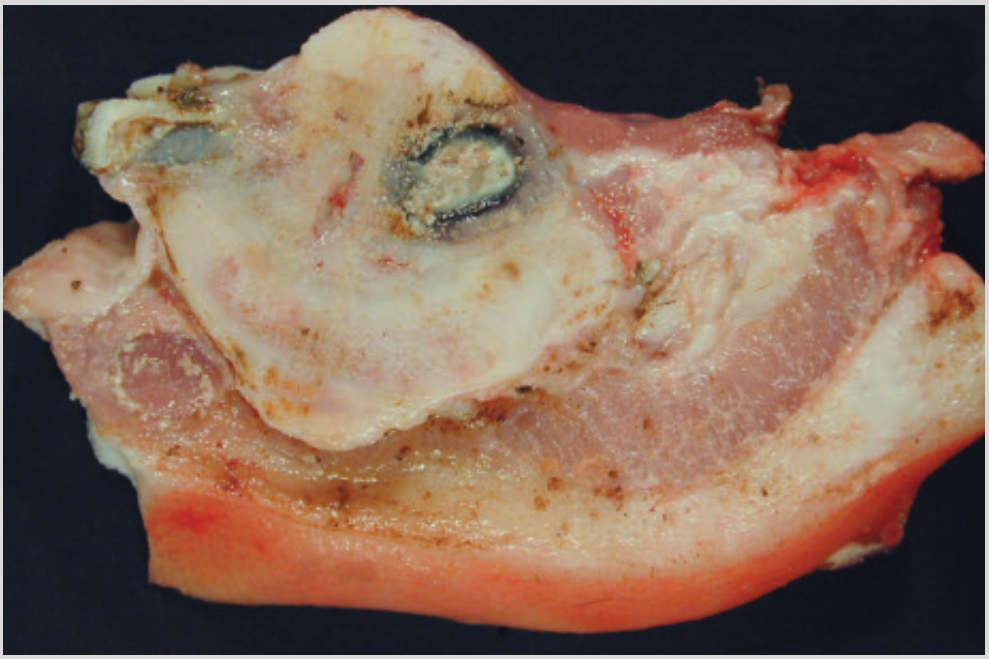
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8.13



Animal species/Organ	Pig/Head
Lesion	Chronic, purulent periodontitis with atrophy of the gingiva (→)
Scoring	Partial condemnation
Comments	The animal should be examined for pyaemia due to the underlying bone lesion (see 8.14)

8.14



Animal species/Organ	Pig/Mandible
Lesion	Chronic, purulent, osteomyelitis with marked bone hyperplasia
Scoring	Partial condemnation
Comments	Associated with periodontitis. Cut surface of the lower jaw from preparation in 8.13

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8.15



Animal species/Organ	Cattle/Tongue
Lesion	Chronic, local, necrotising glossitis with onset of sequestration
Scoring	Partial condemnation
Comments	Lesions laterally on the tongue may have occurred as a result of self inflicted biting wounds

8.16



Animal species/Organ	Cattle/Tongue
Lesion	Chronic, focal, glossitis with abscess formation
Scoring	Partial condemnation
Comments	Bacterial infection

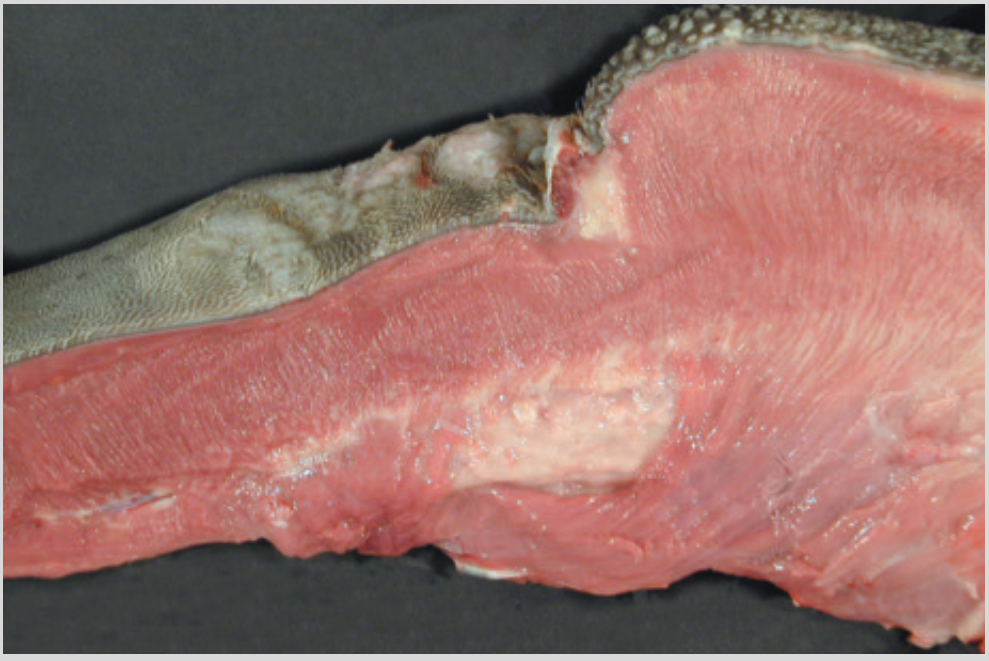
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8.17



Animal species/Organ	Cattle/Tongue
Lesion	Chronic, multifocal, pyogranulomatous glossitis localised particularly on the aboral part of the tongue
Scoring	Partial condemnation
Comments	The condition is caused by *Actinobacillus lignieresii*

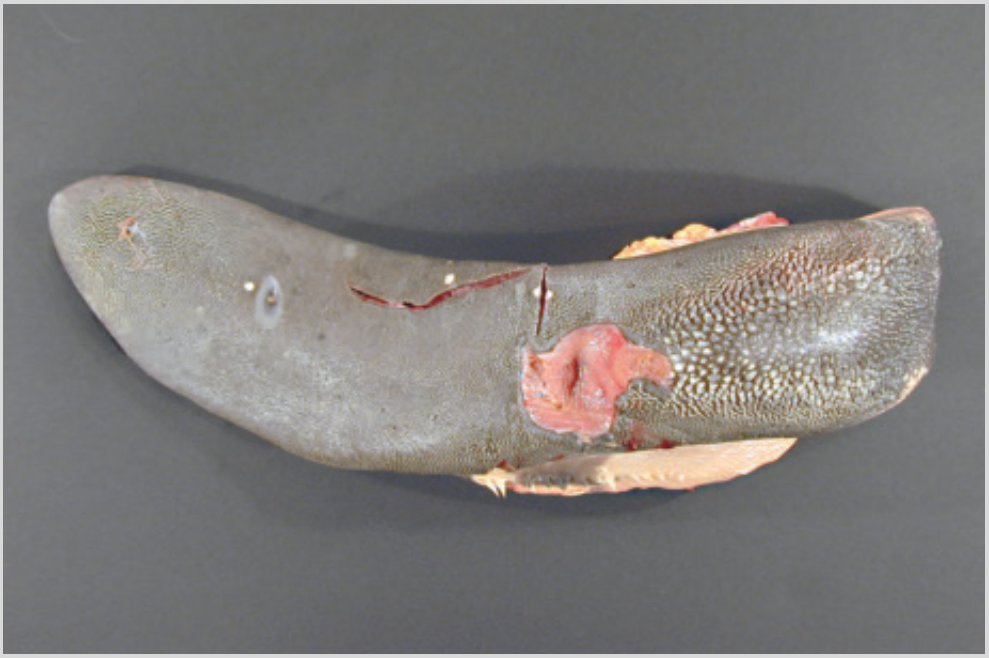
8.18



Animal species/Organ	Cattle/Tongue
Lesion	Chronic, multifocal, pyogranulomatous glossitis in the lingual fossa
Scoring	Partial condemnation
Comments	Longitudinal section of the preparation presented in 8.17

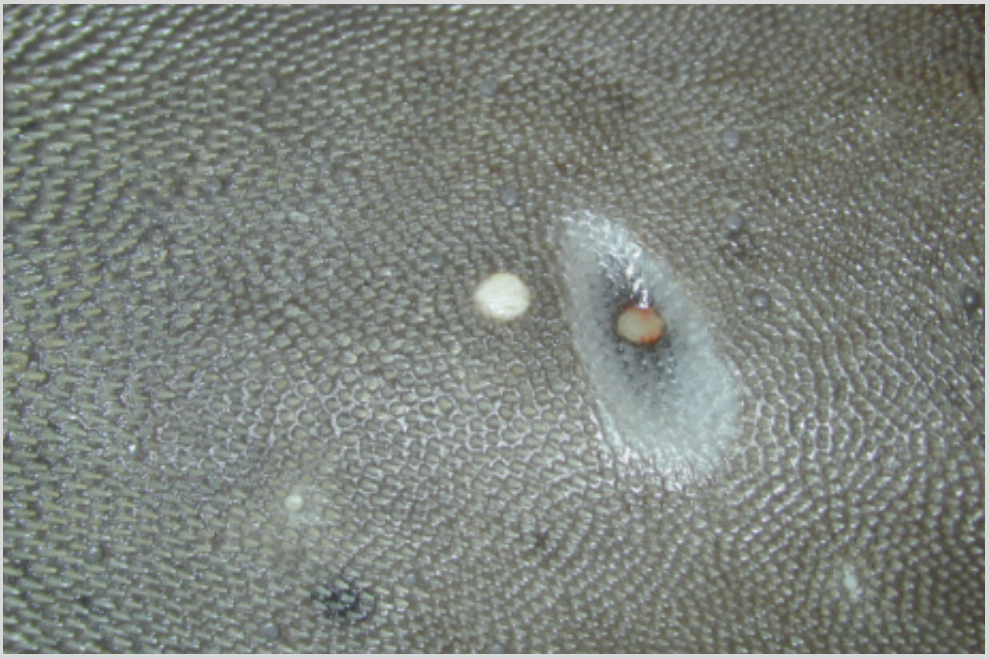
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8.19



Animal species/Organ	Cattle/Tongue
Lesion	Chronic, multifocal, pyogranulomatous glossitis
Scoring	Partial condemnation
Comments	The lingual fossa has been removed. The lesions are caused by *Actinobacillus lignieresii*

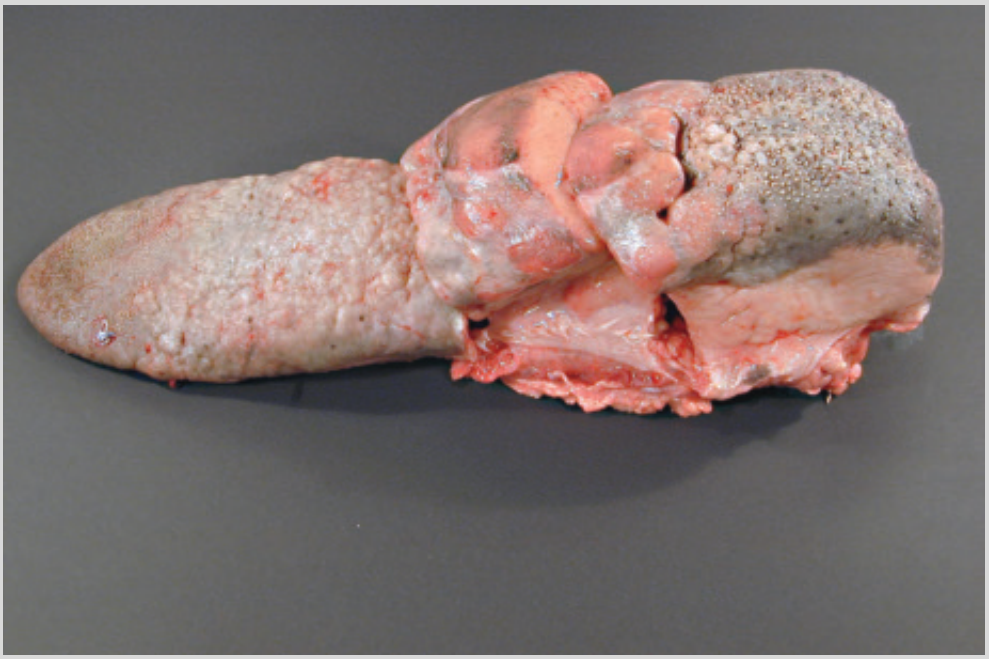
8.20



Animal species/Organ	Cattle/Tongue
Lesion	Chronic, multifocal, pyogranulomatous glossitis
Scoring	Partial condemnation
Comments	Details of the preparation presented in 8.19

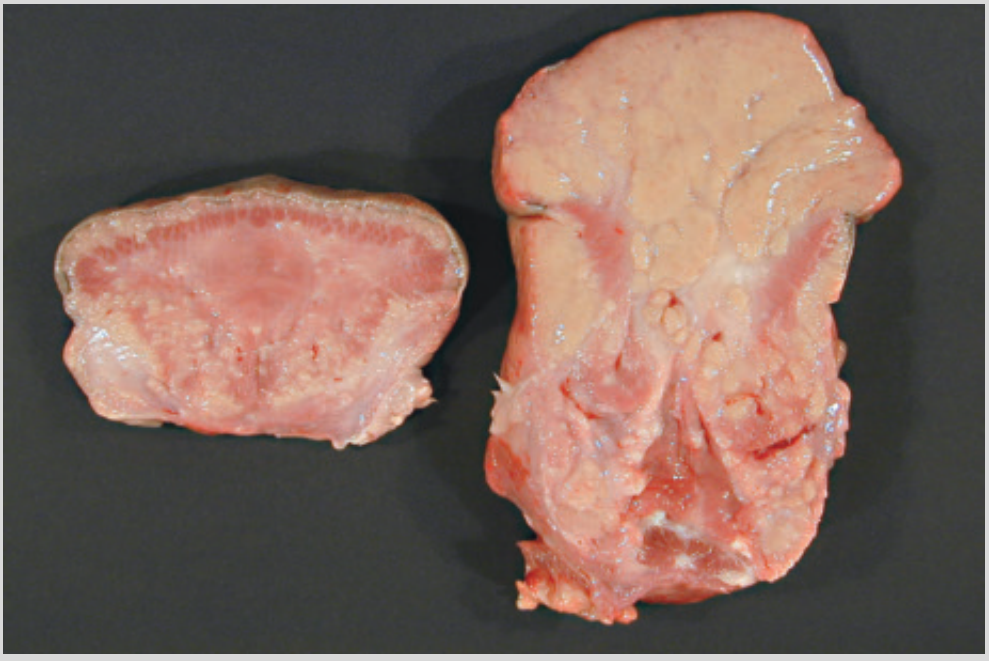
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8.21



Animal species/Organ	Cattle/Tongue
Lesion	Chronic, multifocal, partly diffuse, pyogranulomatous and fibrotic glossitis
Scoring	Partial condemnation
Comments	The lesions are caused by *Actinobacillus lignieresii*

8.22



Animal species/Organ	Cattle/Tongue
Lesion	Chronic, multifocal, partly diffuse, pyogranulomatous and fibrotic glossitis
Scoring	Partial condemnation
Comments	Cross-section in two levels of the preparation presented in 8.21

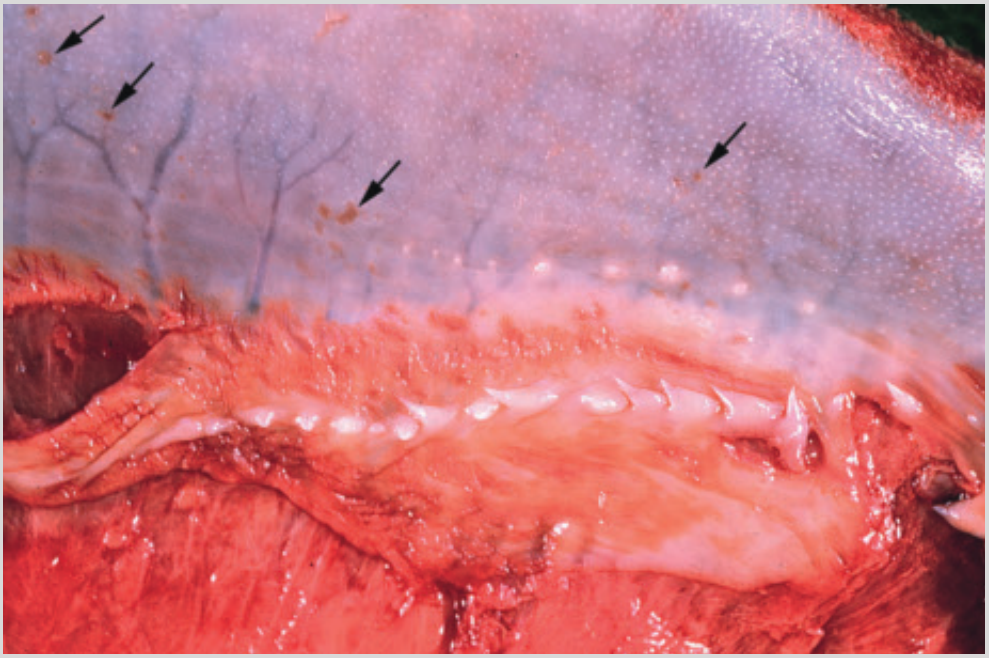
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8.23



Animal species/Organ	Cattle/Tongue
Lesion	Chronic multifocal, pyogranulomatous glossitis in the lingual fossa
Scoring	Partial condemnation
Comments	Accumulation of hair can be seen in the lingual fossa

8.24



Animal species/Organ	Cattle/Tongue
Lesion	Chronic, multifocal, ulcerative glossitis (→)
Scoring	Total condemnation
Comments	Case of "mucosal disease". Affected animals are viraemic necessitating total condemnation

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8.25



Animal species/Organ	Cattle/Tongue
Lesion	Chronic, multifocal, circular glossitis
Scoring	Partial condemnation
Comments	The lesion is caused by fungi or bacteria and only affects the superficial parts of the epithelium

8.26



Animal species/Organ	Cattle (young calf)/Oesophagus
Lesion	Chronic, diphtheritic oesophagitis ("calf diphtheria")
Scoring	Total condemnation
Comments	Necrotising lesions in the alimentary system in young calves necessitate total condemnation.

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8.27



Animal species/Organ	Cattle/Oesophagus
Lesion	Chronic, multifocal, papular oesophagitis
Scoring	Partial condemnation
Comments	The lesion is caused by bovine parapoxvirus

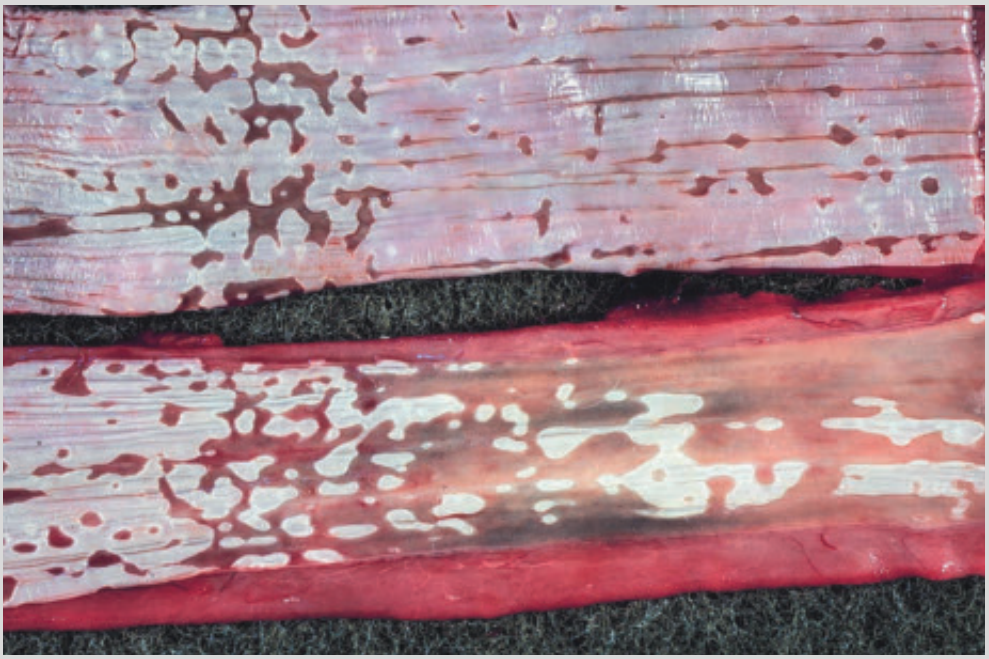
8.28



Animal species/Organ	Cattle/Oesophagus
Lesion	Chronic, multifocal, ulcerative oesophagitis with ectasia
Scoring	Partial condemnation
Comments	Dilatation of the oesophagus is often present as pre-stenotic ectasia

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8.29



Animal species/Organ	Horse/Oesophagus
Lesion	Chronic, confluent, ulcerative oesophagitis
Scoring	Partial condemnation
Comments	Chronic reflux of stomach content to the oesophagus can induce a chemical oesophagitis

8.30



Animal species/Organ	Cattle/Rumen
Lesion	Acute, multifocal, ulcerative ruminitis as part of "mucosal disease"
Scoring	Total condemnation
Comments	Viraemic conditions necessitate total condemnation.

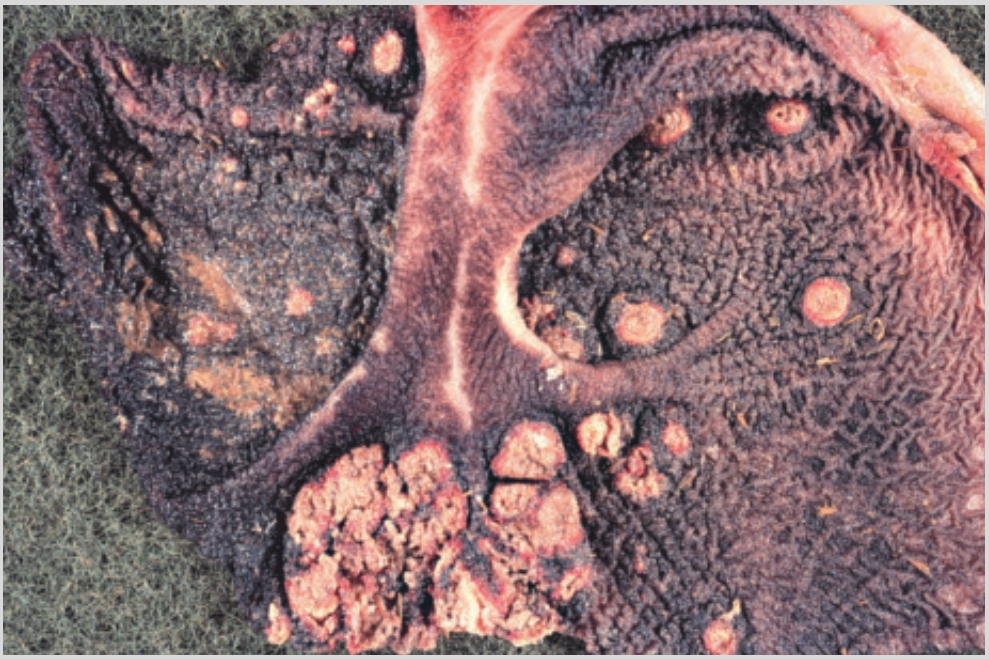
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8.31



Animal species/Organ	Cattle/Rumen
Lesion	Chronic, ulcerative ruminitis with onset of reepithelialisation
Scoring	Partial condemnation
Comments	In most cases, the lesion is the result of a prior ruminal acidosis

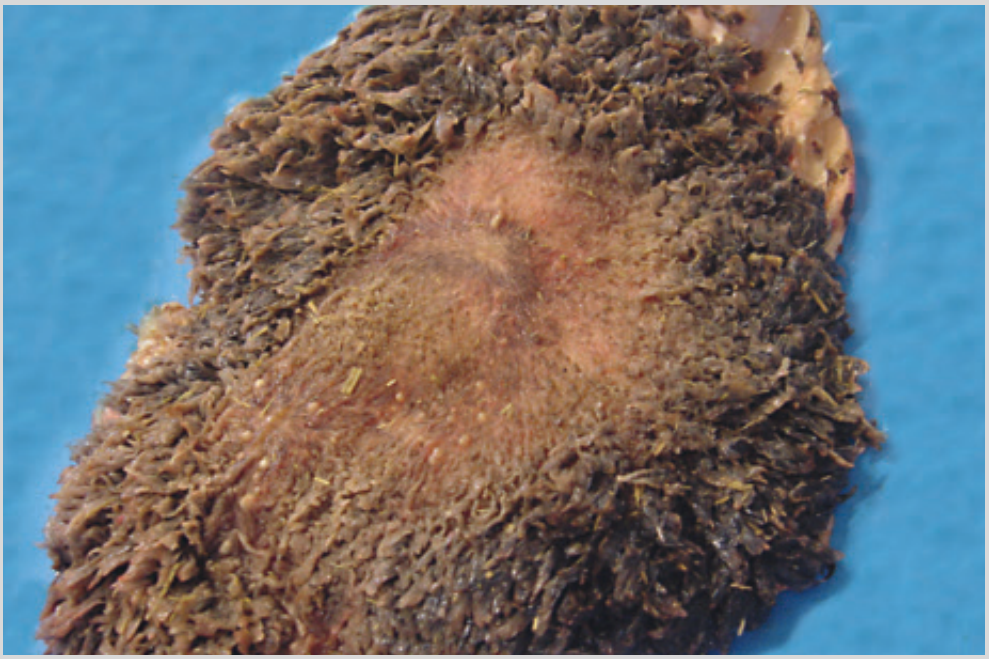
8.32



Animal species/Organ	Cattle/Rumen
Lesion	Subacute, multifocal, necrotising ruminitis
Scoring	Partial condemnation
Comments	The condition may be due to ruminal acidosis with secondary infection

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8.33



Animal species/Organ	Cattle/Rumen
Lesion	Chronic, focal, cicatrising ruminitis
Scoring	Partial condemnation
Comments	The condition may be due to prior acidosis

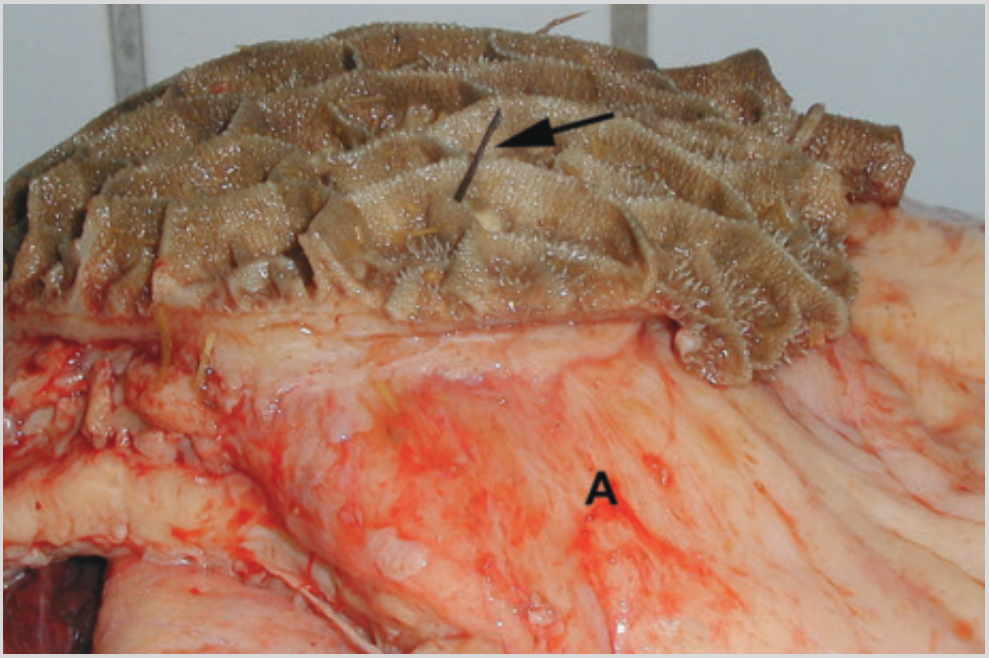
8.34



Animal species/Organ	Cattle/Reticulum
Lesion	Chronic, focal, reticulitis
Scoring	Partial condemnation
Comments	A foreign body can be seen (spike) penetrating the reticular lamel

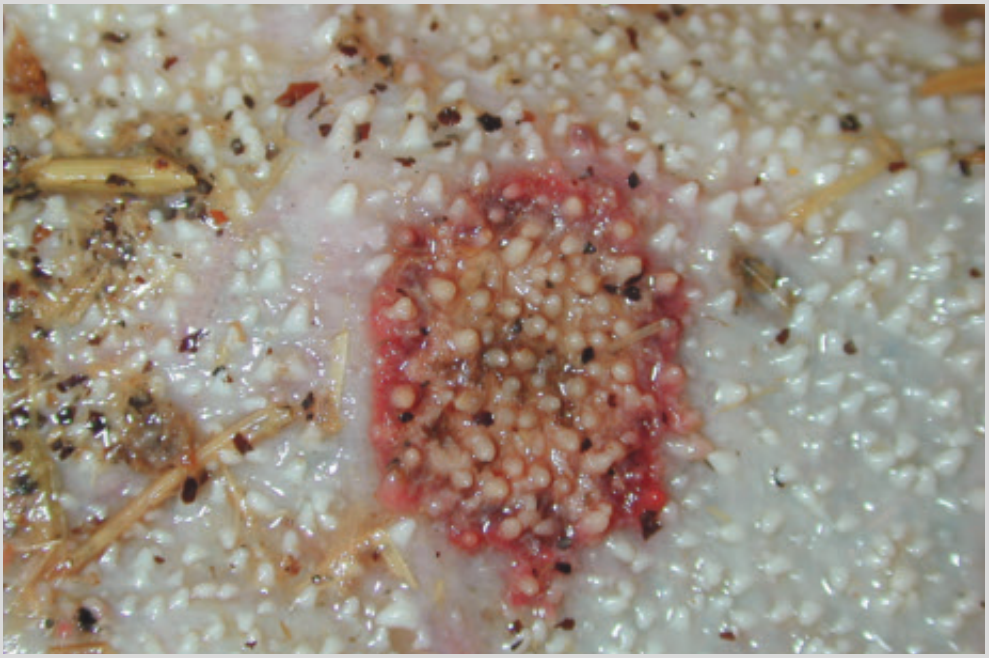
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8.35



Animal species/Organ	Cattle/Reticulum
Lesion	Chronic, focal, reticulitis with abscess formation
Scoring	Partial condemnation
Comments	A penetrating foreign body can be seen (tyre wire) (→) and a non-opened abscess (A)

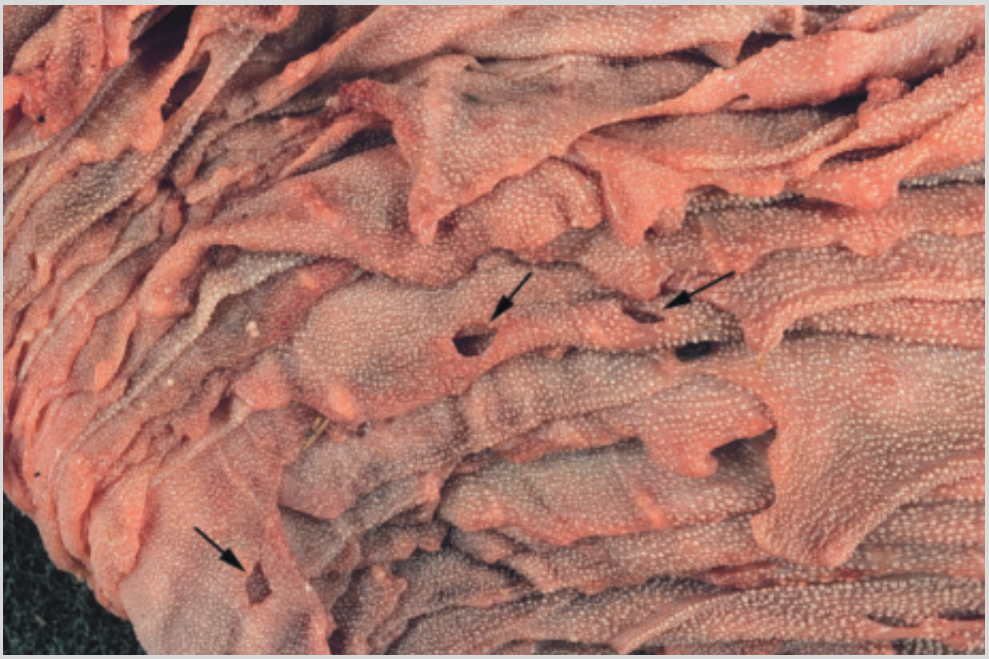
8.36



Animal species/Organ	Cattle/Omasum
Lesion	Acute, focal, necrotising omasitis
Scoring	Partial condemnation
Comments	The lesion is frequently caused by *Fusobacterium necrophorum* or fungi

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8.37



Animal species/Organ	Cattle/Omasum
Lesion	Chronic, multifocal, fenestrating omasitis
Scoring	Partial condemnation
Comments	Multiple fenestrations (→) can be seen in omasal lamella. This is the result of a previous necrotising omasitis (see 8.36)

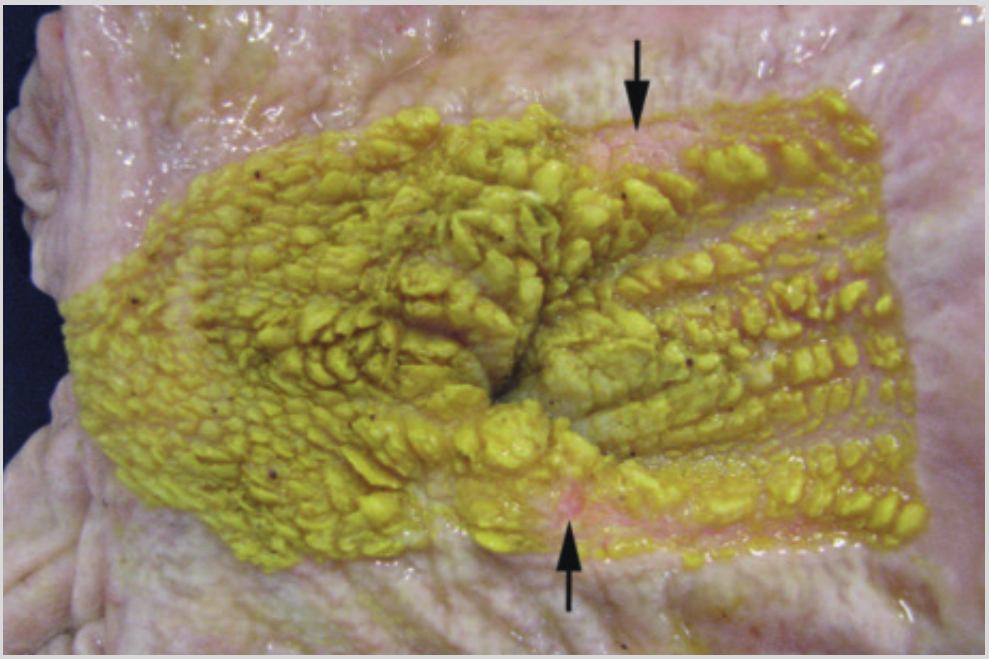
8.38



Animal species/Organ	Pig/Stomach
Lesion	Chronic, multifocal, ulcerative gastritis in the non-glandular part
Scoring	Partial condemnation
Comments	Ventricle ulcerations in pig are generally localised to the non-glandular part

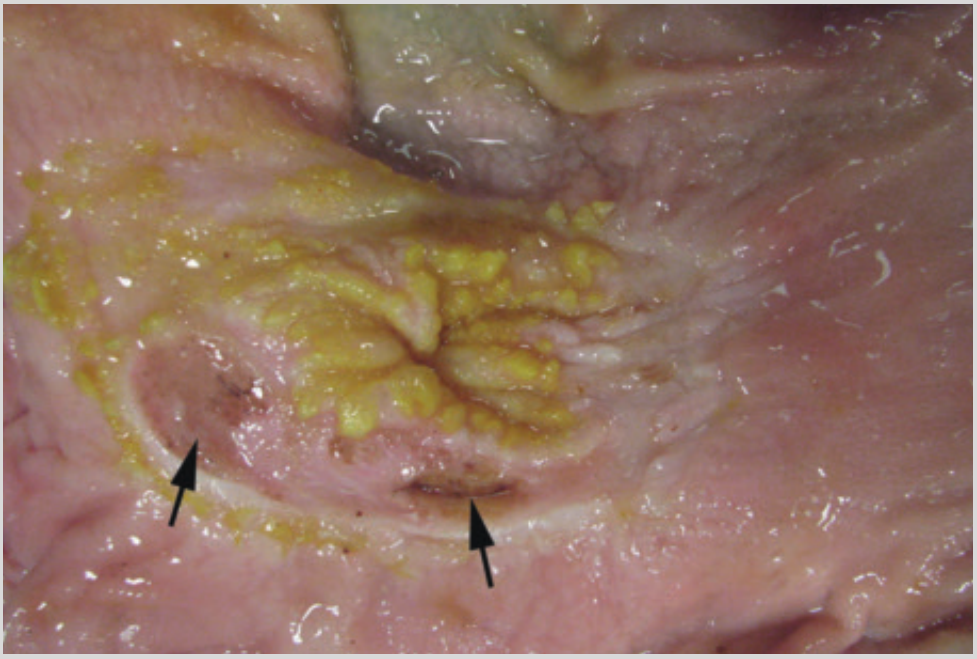
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8.39



Animal species/organ	Pig/Stomach
Lesion	Chronic, erosive, hyperplastic gastritis in the non-glandular part
Scoring	Partial condemnation
Comments	The epithelium is hyperplastic and two erosions are present (→)

8.40



Animal species/organ	Pig/Stomach
Lesion	Chronic, ulcerative, hyperplastic gastritis in the non-glandular part
Scoring	Partial condemnation
Comments	Ulcerations (→) and granulation tissue are present in the periphery of the non-glandular part

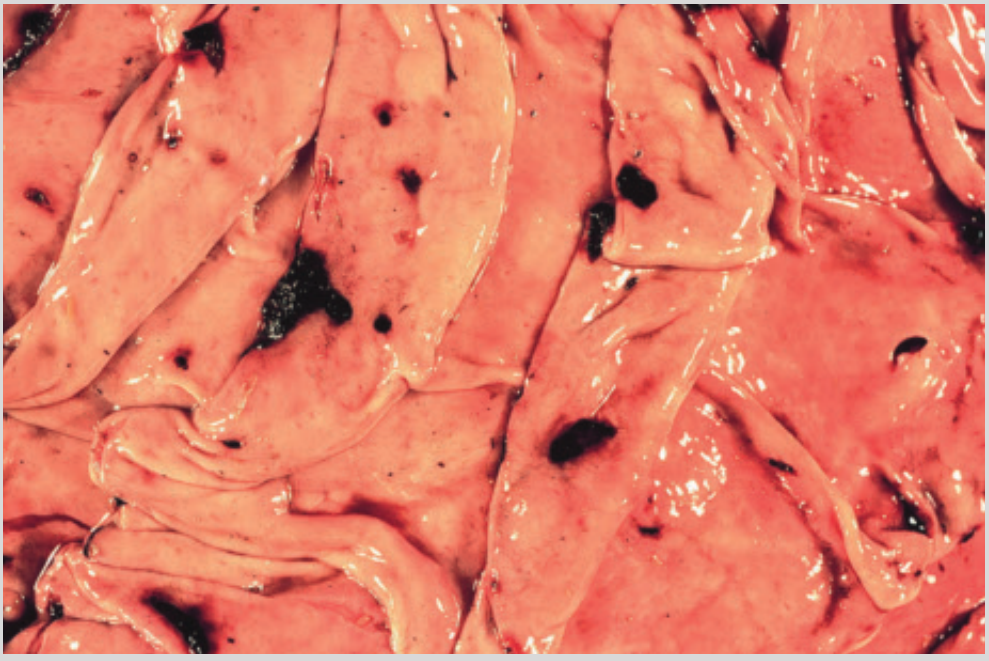
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8.41



Animal species/Organ	Horse/Stomach
Lesion	Chronic, multifocal, parasitic gastritis
Scoring	Partial condemnation
Comments	Several *Gasterophilus* sp. can be seen adhering to the epithelium and mucosa on the transition between the non-glandular and the glandular parts

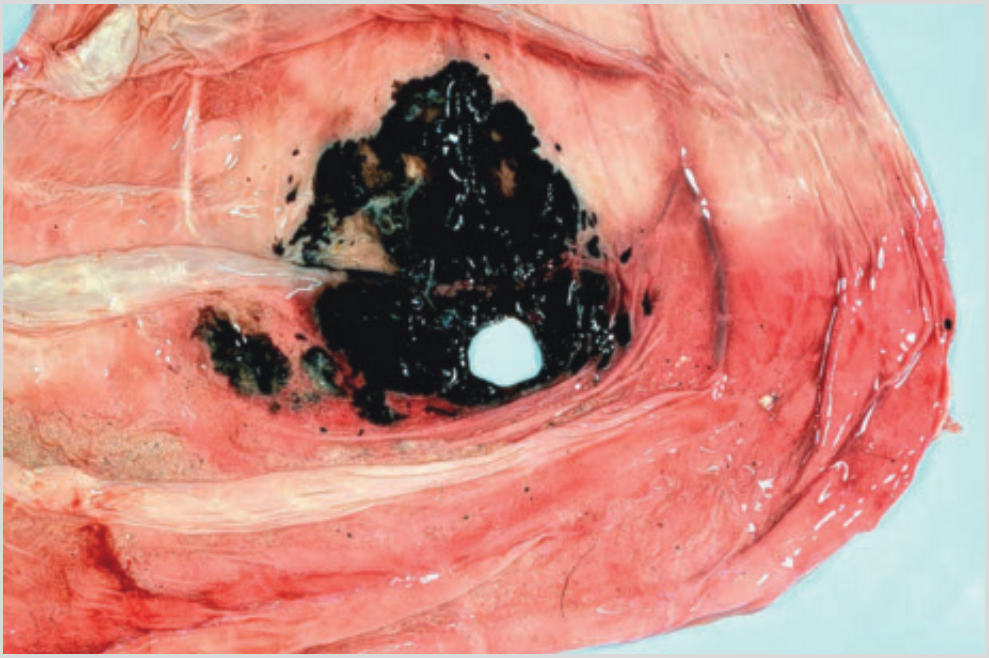
8.42



Animal species/Organ	Cattle/Abomasum
Lesion	Acute, multifocal, ulcerative and haemorrhagic abomasitis
Scoring	Partial condemnation
Comments	Acute, multifocal abomasitis is seen regularly in cattle associated with stress. Presence of complications necessitates total condemnation

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8.43



Animal species/Organ	Cattle/Abomasum
Lesion	Acute, focal, ulcerative, haemorrhagic and perforating abomasitis
Scoring	Partial condemnation
Comments	The presence of acute diffuse peritonitis or complications necessitates total condemnation

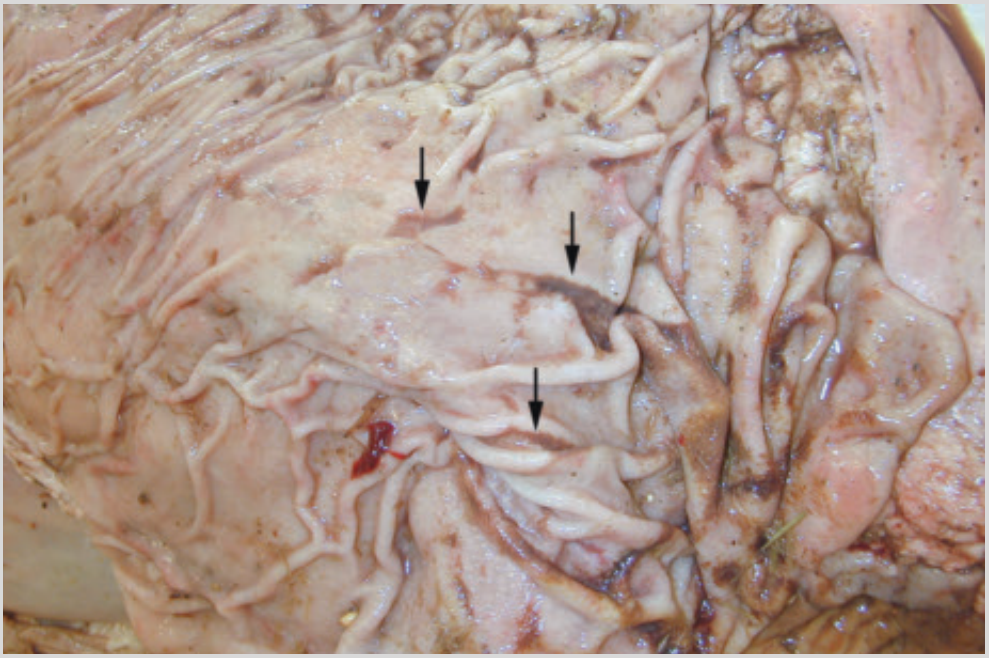
8.44



Animal species/Organ	Cattle/Abomasum
Lesion	Chronic, multifocal, ulcerative abomasitis
Scoring	Partial condemnation
Comments	Acute lesions in the mucous membrane of the abomasum can progress to deep lesions as a result of the effect of acid and pepsin or secondary infections

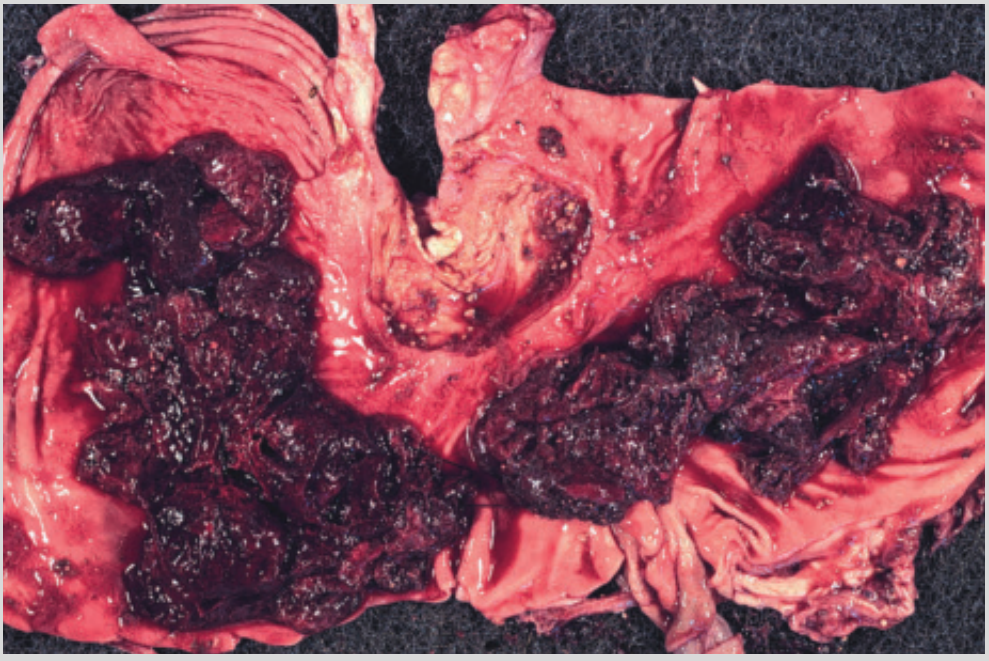
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8.45



Animal species/Organ	Cattle/Abomasum
Lesion	Chronic, multifocal, ulcerative abomasitis (→)
Scoring	Partial condemnation
Comments	The condition occurs for example due to stress

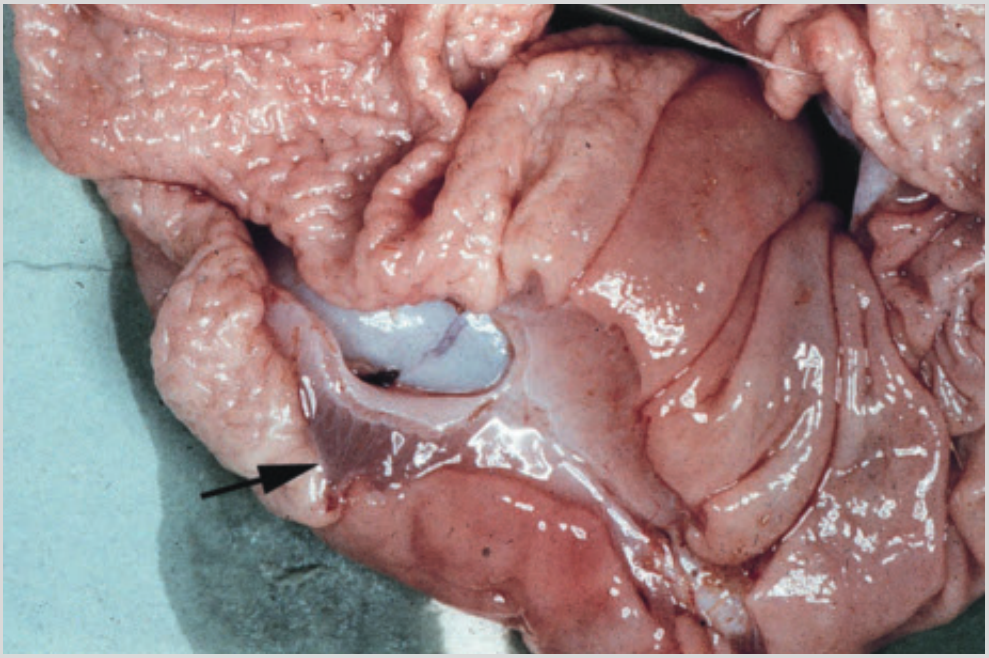
8.46



Animal species/Organ	Pig/Stomach
Lesion	Gastrorrhagia
Scoring	Partial condemnation
Comments	Complications such as anaemia necessitate total condemnation

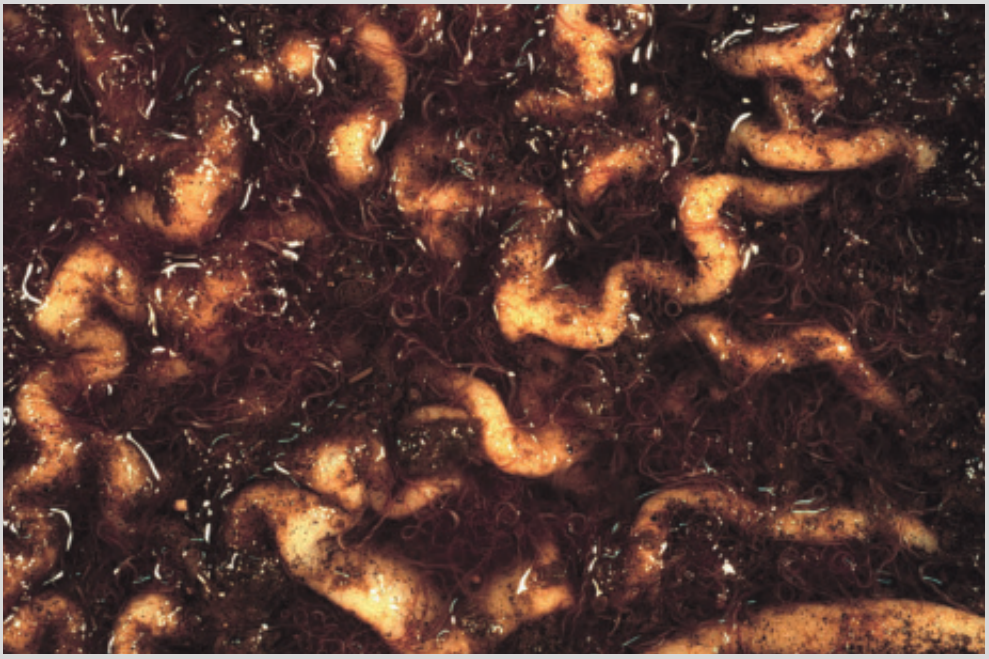
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8.47



Animal species/Organ	Pig/Stomach
Lesion	Diffuse oedema in the ventricle (→) associated with enterotoxaemia
Scoring	Total condemnation
Comments	Enterotoxaemia may cause oedema. At meat inspection, it is important to determine the cause of the oedema as judgement is dependent on this

8.48



Animal species/Organ	Sheep/Abomasum
Lesion	Chronic, disseminated, ulcerative, haemorrhagic, parasitic abomasitis
Scoring	Partial condemnation
Comments	The condition is caused by a massive infection with *Haemonchus contortus*. Concomitant anaemia necessitates total condemnation

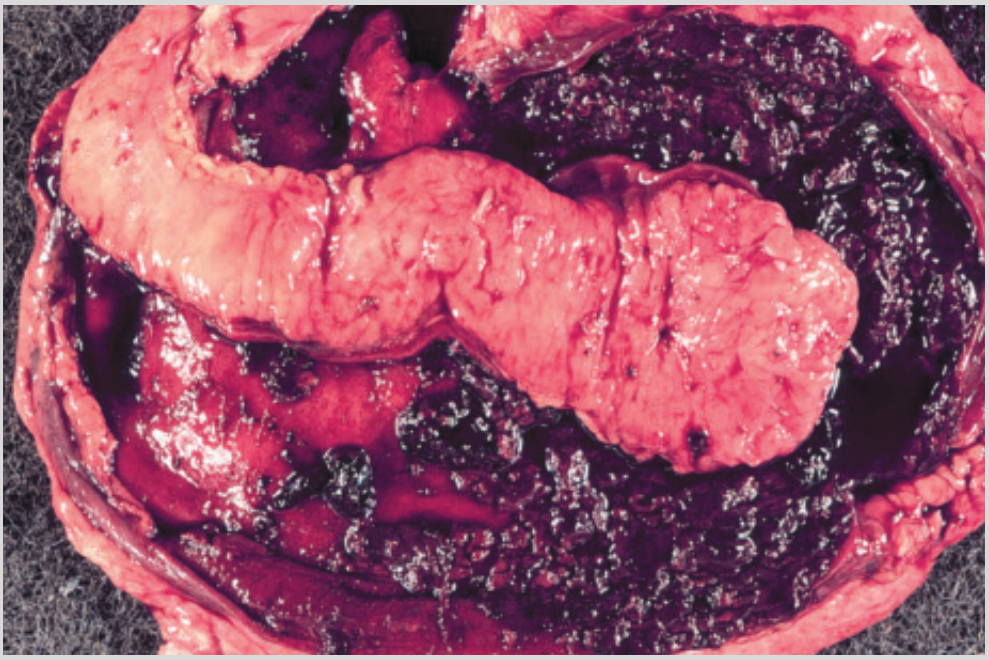
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8.49



Animal species/Organ	Cattle/Abomasum
Lesion	Chronic, multifocal, hyperplastic, parasitic abomasitis
Scoring	Partial condemnation
Comments	The lesion is caused by the larval stage of *Ostertagia ostertagi*

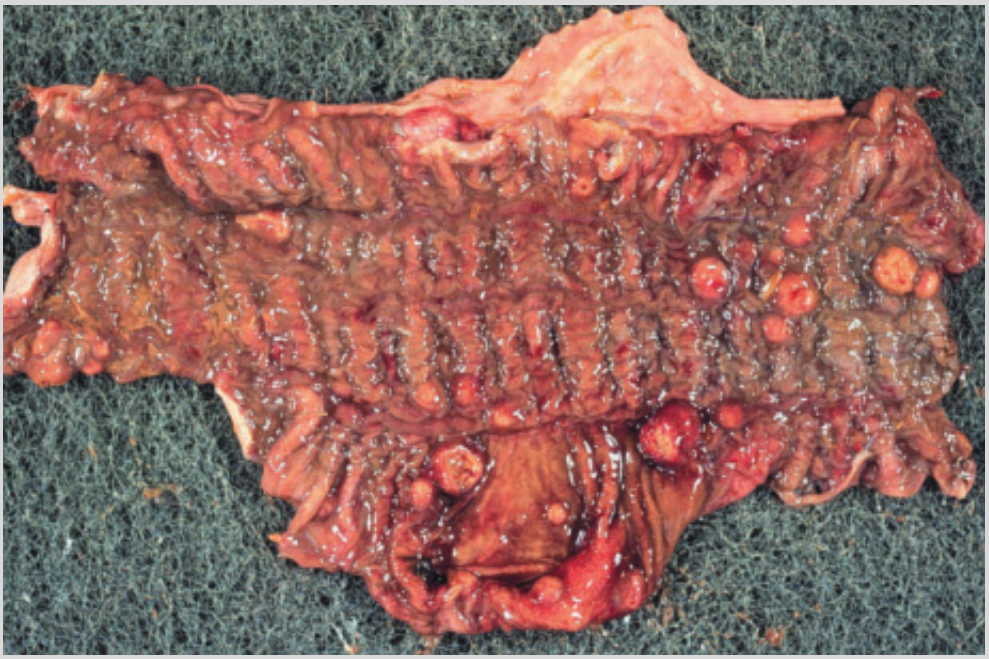
8.50



Animal species/Organ	Cattle/Colon
Lesion	Acute, necrotising and haemorrhagic colitis
Scoring	Total condemnation
Comments	The condition may be due to acute enteric salmonellosis

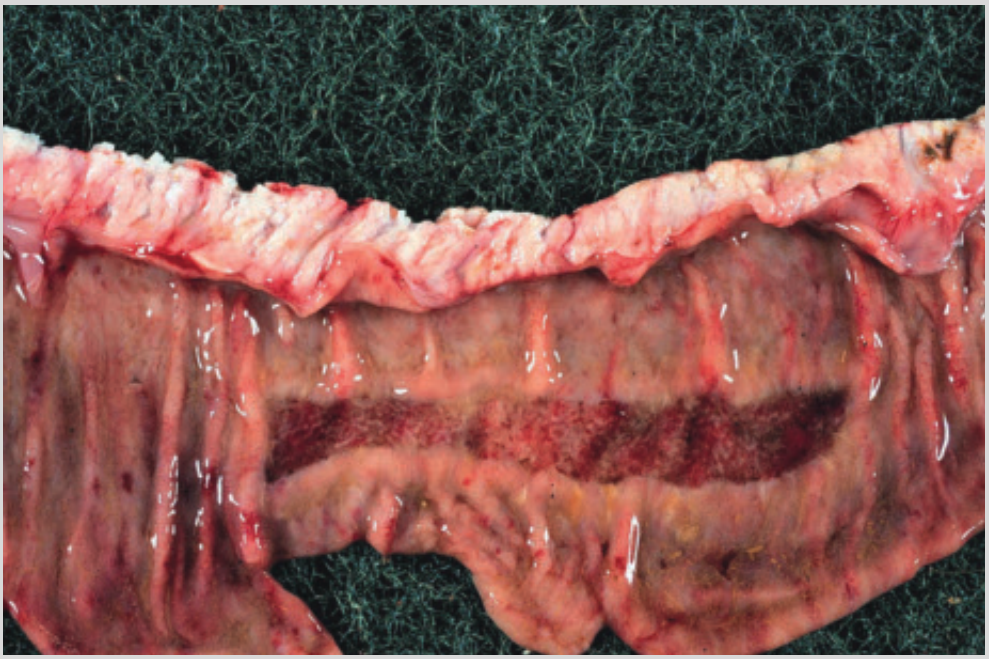
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8.51



Animal species/Organ	Horse/Colon
Lesion	Chronic, multifocal, ulcerative colitis
Scoring	Partial condemnation
Comments	The lesion is caused by *Rhodococcus equi*

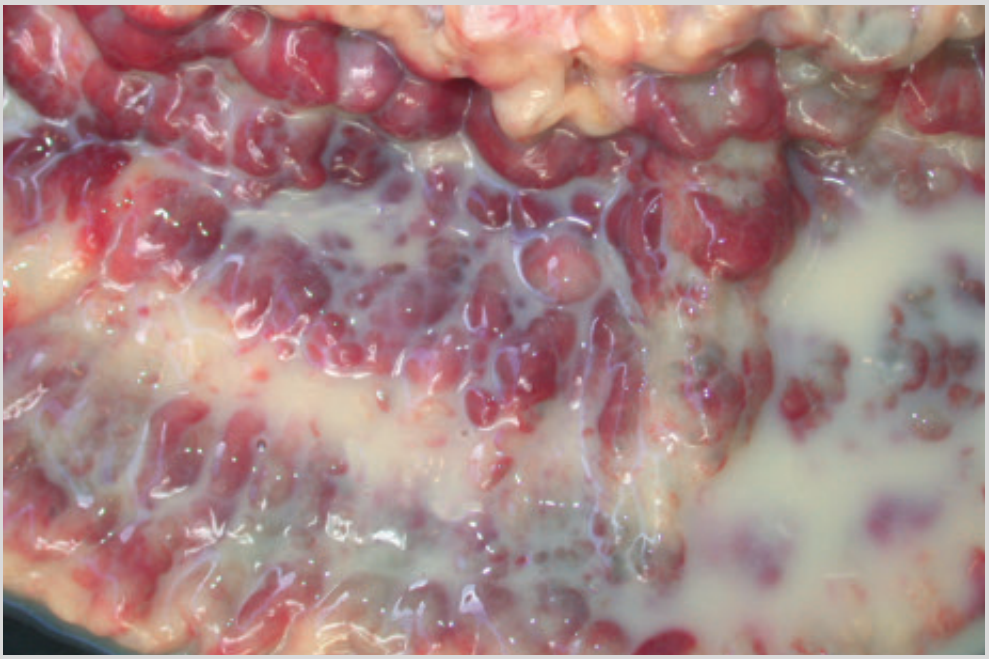
8.52



Animal species/Organ	Cattle/Small intestine
Lesion	Chronic, multifocal, erosive enteritis with atrophy of Peyer patches
Scoring	Total condemnation
Comments	The lesion occurs as part of "mucosal disease" caused by persistent infection with bovine viral diarrhoea virus

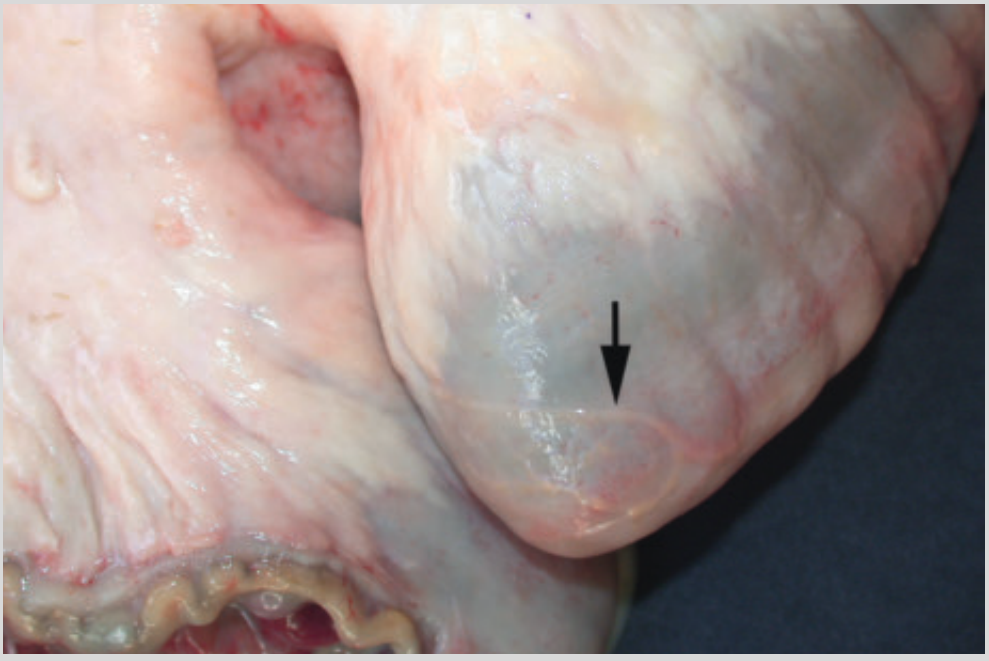
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8.53



Animal species/Organ	Cattle/Small intestine
Lesion	Chronic, diffuse, hyperplastic enteritis
Scoring	Partial condemnation
Comments	The lesion is characteristic for Johne's disease

8.54



Animal species/Organ	Cattle/Small intestine with lymph vessels
Lesion	Chronic, locally spread, diffuse lymphangitis with ectasia (→)
Scoring	Partial condemnation
Comments	In Johne's disease, local lymphatic spread of mycobacteria may occur and cause granulomatous lymphangitis and lymphadenitis

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8.55



Animal species/Organ	Pig/Small intestine
Lesion	Chronic, segmental, hyperplastic and necrotising enteritis
Scoring	Partial condemnation
Comments	The lesion is characteristic for infection with *Lawsonia intracellularis*

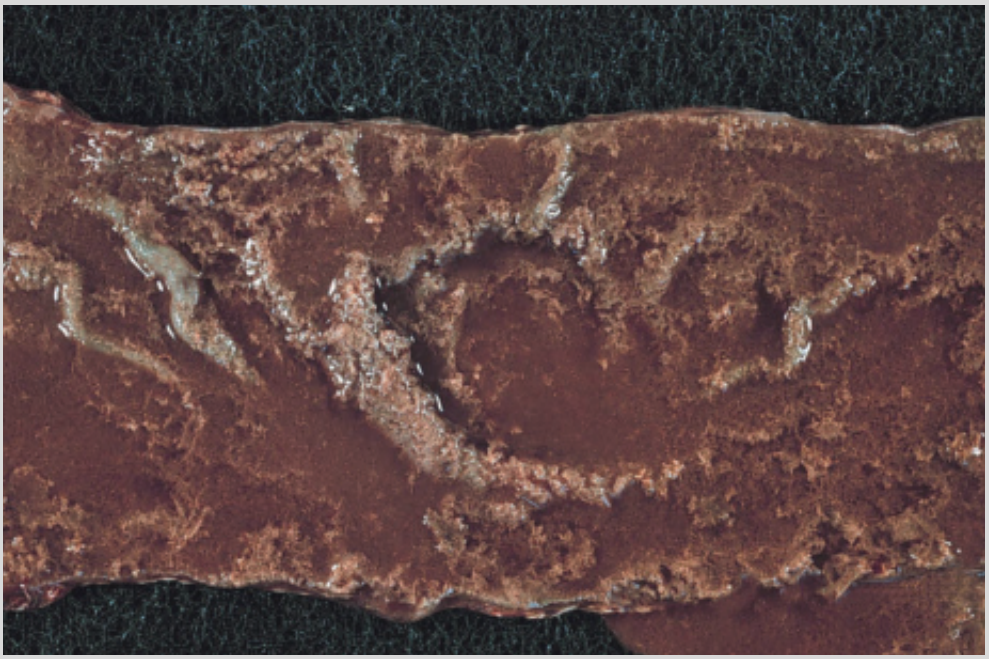
8.56



Animal species/Organ	Pig/Small intestine
Lesion	Chronic, segmental, haemorrhagic enteropathy
Scoring	Partial condemnation
Comments	In gilts and sows infection with *Lawsonia intracellularis* may cause intestinal haemorrhage

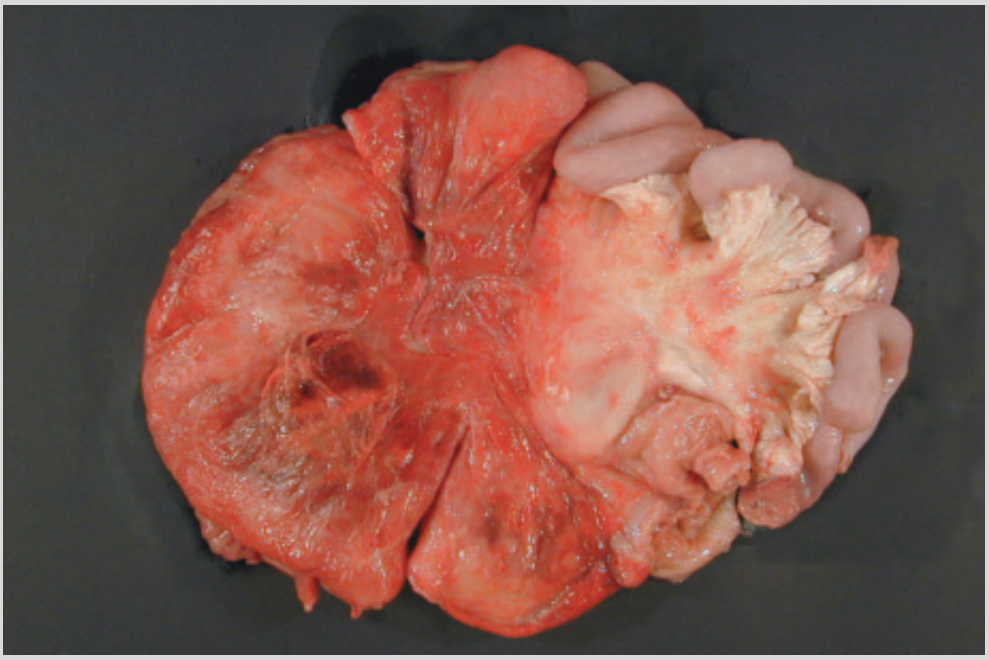
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8.57



Animal species/Organ	Pig/Colon
Lesion	Chronic, diffuse, fibrino-necrotising and haemorrhagic colitis
Scoring	Partial condemnation
Comments	The lesion is caused by *Brachyspira hyodysenteriae*.

8.58



Animal species/Organ	Pig/Small intestine
Lesion	Chronic congestion and fibrous adherences in a herniated segment of the small intestine
Scoring	Partial condemnation
Comments	Herniation can compromise the venous drainage of the segment resulting in congestion (partial condemnation) or ischaemia (total condemnation)

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8.59



Animal species/Organ	Cattle/Small intestine
Lesion	Pre-stenotic dilatation with work-induced muscular hypertrophy associated with chronic herniation
Scoring	Partial condemnation
Comments	Herniation can compromise the passage of the intestinal content

8.60



Animal species/Organ	Sheep/Thoracic and abdominal cavities
Lesion	Eventration of intestinal segments with constriction through a defect in the diaphragm
Scoring	Total condemnation
Comments	Uncomplicated cases without constriction necessitate partial condemnation.

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8.61



Animal species/Organ	Pig/Intestines
Lesion	Chronic, segmental intestinal invagination
Scoring	Partial condemnation
Comments	Presence of acute vascular disorders necessitates total condemnation

8.62



Animal species/Organ	Pig/Rectum
Lesion	Chronic prolapse of the rectum with acute necrosis of the mucous membrane
Scoring	Total condemnation
Comments	Presence of acute inflammation necessitates total condemnation. The pale colour is due to post mortem processing

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8.63



Animal species/Organ	Pig/Rectum
Lesion	Rectal stenosis with pre-stenotic ectasia of the rectum and descending colon
Scoring	Partial condemnation
Comments	Rectal stenosis may develop during healing of inflammatory lesions

8.64



Animal species/Organ	Cattle/Head
Lesion	Ameloblastic fibroma localised in the left maxilla
Scoring	Partial condemnation
Comments	Ameloblastic fibroma is the most frequently occurring odontogenic neoplasm in cattle. The neoplasm is benign

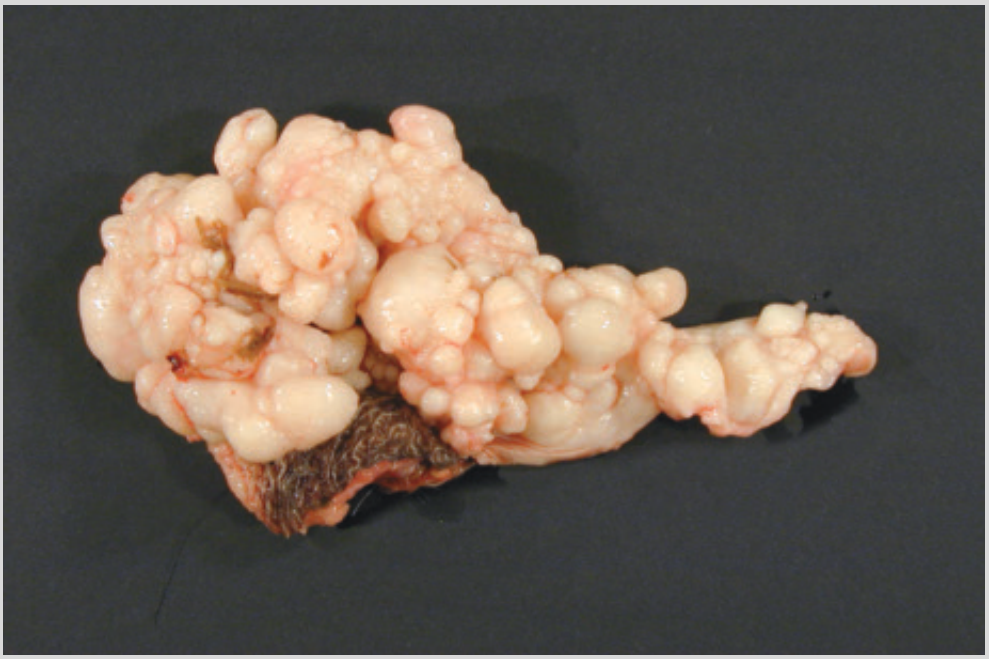
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8.65



Animal species/Organ	Cattle/Head
Lesion	Ameloblastic fibroma with ectasia of the maxillary sinus and compression of the conchae
Scoring	Partial condemnation
Comments	Cross-section of the preparation presented in 8.64

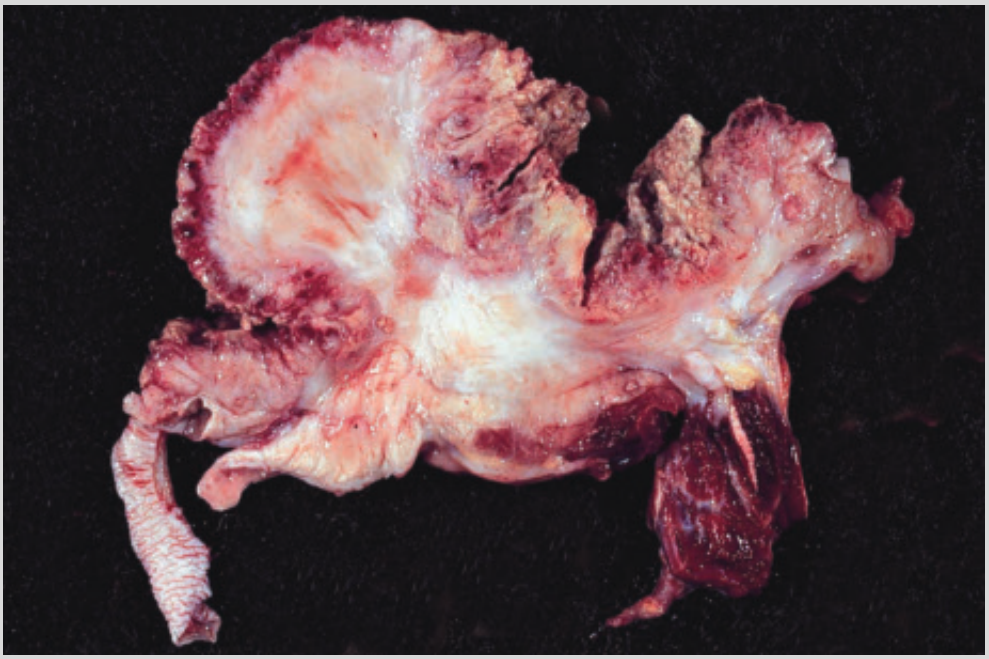
8.66



Animal species/Organ	Cattle/Rumen
Lesion	Ruminal papillomatosis
Scoring	Partial condemnation
Comments	This is a benign, virus-induced, neoplasm caused by the bovine papilloma virus

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8.67



Animal species/Organ	Horse/stomach
Lesion	Sclerosing squamous cell carcinoma with necrotic surface
Scoring	Total condemnation
Comments	Squamous carcinomas in the stomach are a malignant neoplasm originating in the non-glandular part

8.68



Animal species/Organ	Pig/Small intestine
Lesion	Multicentric lymphoma
Scoring	Total condemnation
Comments	Multicentric lymphoma is classified as a malignant neoplasm which necessitates total condemnation.

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9 Liver

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Introduction

Given the liver's diverse and central functions involving so many areas of metabolism (e.g. protein, fat, carbohydrates), detoxification (exogenous and endogenous substances as well as particulate elements), excretion of substances to blood and bile, deposition (e.g. vitamins, minerals, and glycogen), and synthesis of bile and many other substances (e.g. plasmaproteins, acute phase reactants and coagulation factors), it is understandable that liver injury can result in a number of complications. At meat inspection, scoring of liver lesions always focusses on such complications except in the presence of multifocal (disseminated) or diffuse cases of acute or subacute hepatitis or necrosis. The latter, including hepatic necrosis in calves caused by miliary tuberculosis and hepatic lesions with complications, always necessitate total condemnation. For other hepatic lesions, scoring follows the general regulations, for example those relating to pyaemia, malignant neoplasms, and tuberculosis.

Fat infiltration (hepatic steatosis) [9.01 – 9.07]

Diffuse accumulation of visible fat in the form of triglycerides in the hepatocytes (the liver is pale yellow with rounded edges and has reduced consistency ("fatty liver")) may be an expression of a normal physiological situation. However, these changes may also reflect a pathologic condition. Neither macroscopic nor microscopic morphology can be used to determine whether a fatty liver is due to a physiologically normal or pathologic condition. Therefore, at meat inspection of an animal with a fatty liver, it is essential to evaluate all findings, including clinical observations made on the animal. This means that a fatty liver in an animal which does not demonstrate any other changes, neither before nor after slaughter, must be expected to lie within the normal physiological range.

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This applies for example to fatty liver in cows in the puerperal phase (newly-calved), fatty liver in obese animals, animals that have starved (e.g. at long-distance transport), and to fatty liver in young calves and lambs. Cases in which the condition is manifest necessitate partial condemnation. Findings of fatty liver in an animal which, either before or after slaughter, shows pathologic changes such as infectious disease, inflammation, intoxication or metabolic disease must always be deemed to be pathologic. In such cases, the presence of fatty liver must be considered to be an aggravating finding that is possibly the result of a general affection of the animal, and thus normally necessitates total condemnation. Specific causes of fatty liver include 1) overfeeding and obesity, 2) increased mobilisation from depots (starvation and newly-calved), 3) lowered metabolism of carbohydrates (ketosis in cattle and "pregnancy toxaemia" in sheep), 4) reduced fat metabolism in the hepatocytes (compromised fat transport, esterification or apoprotein binding), which can be seen at reduced oxygen supply or as effects of toxic substances (microbial, organic or non-organic toxins), 5) hyperlipaemia particularly in ponies, 6) cobalt deficiency (particularly in sheep), and 7) endocrine disorders such as diabetes mellitus or hypothyroidism.

Accumulation of fat (as triglycerides) in the liver can also be focally localised. Because such local fat accumulations are often found associated with attachment of ligaments, they are called tension steatosis. These local tension steatoses are presumed to be a result of local hypoxia due to obstructed blood circulation resulting from pull on the ligaments. The presence of tension steatoses necessitates partial condemnation of the affected areas, or possibly the entire liver.

As mentioned, hepatic steatosis is an accumulation of triglycerides in the hepatocytes. Accumulation of non-triglycerides, which is only seen extremely rarely, is accumulation of fat due to congenital enzyme defects. In these cases the fat accumulation is called "hepatic lipidosis". A third form of fat accumulation is called "lipomatosis". In these cases, lipocytes invade the tissue.

Hepatitis, including necroses [9.08 – 9.39]

Necroses in the liver can be categorised according to various principles (aetiology, pathogenicity or distribution). Necroses are most frequently categorised according to their distribution which may be focal, zonal or massive.

Focal necroses occur typically in a disseminated pattern. This is because they are most often a result of haematogenous spread of an infectious agent to the liver. Haematogenous spread of microorganisms to the liver can occur via several routes. Haematogenous spread via the umbilical vein is an important route in newborn and young animals, especially calves. This is often a complication of omphalophlebitis (umbilical infection). If microorganisms spread via the umbilical vein, the lesions will typically be located in the left side of the liver where the ductus venosus runs through it. In older animals, the most important route of infection is via the hepatic portal vein which receives blood from the intestinal tract, spleen and pancreas. Around 70-80% of the blood flowing to the liver is received from here. If infection is spread via the general circulation, the microorganisms can also reach the liver via the hepatic artery. Lesions

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caused by infectious material spread via the hepatic portal vein or hepatic artery will normally be disseminated. It must also be noted in connection with this, that the intrahepatic biliary tree has branching similar to the vascular system, and is the reason why ascending bile duct infections can also manifest in a multifocal/disseminated form. Only rarely are solitary intrahepatic liver abscesses seen, and in cattle these must be differentiated from subphrenic abscesses. The latter type of abscess is always located between the liver and the diaphragm.

Acute necroses manifest typically as sharply defined, pale or red-brown, dry areas. The entire liver may be enlarged. If acute to subacute necroses are located towards the surface of the liver, the lesions are often coated with fibrin. At meat inspection, scoring of fibrin coatings and/or fibrosis of the liver surface must follow those for peritonitis.

Depending on the aetiology, focal necroses during the healing phase will convert to abscesses and/or undergo sequestration and eventually become organised. Depending on the extent of the lesions, there may be direct conversion to scar tissue or regeneration may take place.

In cattle, foreign bodies from the forestomachs may occasionally penetrate into the liver directly. In other cases, the spleen may be penetrated giving opportunity for local haematogenous spread of bacteria to the liver via the venous portal system. This is thus not a case of pyaemia, in which spread of bacteria is systemic.

In cattle, abcesses in the liver is a common finding. It is due to bacteria (*Trueperella pyogenes, Fusobacterium necrophorum, Peptostreptococcus indolicus*) from the forestomach reaching the liver via the venous portal system. The most important factor in spread from the forestomach is the presence of forestomach lesions due to intensive feeding with easily-digested carbohydrates, particularly starch. During the examination of the liver at meat inspection, it is very important, and should be a requirement in all cases in cattle older than 6 weeks, to open the caudal vena cava which lies above the dorsal section of the liver. This is because hidden abscesses quite frequently rupture and spread to this vein.

Zonal necroses can histologically be divided into several types depending on their exact locations in the "acinus", the functional liver unit (periacinar, midzonal, centroacinar, paracentral and as massive necrosis). Macroscopically, it is often not possible to determine the exact location of the zonal necroses, but they present as increased lobulisation of the liver. Because zonal necroses reflect the functional liver unit, the aetiology is typically toxic in nature or, in cases of periacinar necroses, hypoxic. Massive liver necrosis is understood as necrosis of an entire liver lobule, often in contiguous areas with several necrotic lobules. Typical causes of massive liver necrosis are intoxication (e.g. massive iron intake in pigs), or deficiency reactions. The latter is for example the case in vitamin E and selenium deficiency (hepatosis diaetetica in pig and nutritional panniculitis ("yellow fat") in pig and horse). Zonal and massive necrosis (acute and subacute) necessitate total condemnation. The reason for the distinction between acute/subacute necrosis and chronic necrosis is the risk for a systemic effect such as fever and intoxication in acute cases.

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Chronic liver injury and pigmentation [9.40 – 9.58]

Chronic liver injury can result in conditions with atrophy, hypertrophy, pigmentation and/or fibrosis.

Diffuse atrophy of the liver is often due to general malnutrition. In cases of atrophy, the liver will often appear darker than normal due to accumulation of lipofuscin. Local atrophy of the liver is most frequently seen in horses, in which chronic overload of the stomach causes atrophy of the left liver lobe. In contrast, overload of the colon dextrum or caecum can cause atrophy of the right lobe. In cattle, chronic overload of the rumen for example as a result of Hoflund's syndrome may also be the cause of local liver atrophy. Cases of local atrophy of the liver caused by compression necessitates condemnation of the liver. Finally, the liver can atrophy in connection with other lesions such as chronic congestion, amyloidosis and "end-stage" conditions.

Hypertrophy of the hepatocytes will manifest macroscopically in hepatomegaly. The basis for the hypertrophy in chronic conditions is either an expression of proliferation of certain cellular organelles, accumulation in these, or formation of abnormally large hepatocytes (megalocytosis). Clarification of the cause of liver hypertrophy requires histological examination. Hypertrophy of liver lobes may also be seen as compensation for atrophy of other liver lobes.

A number of pigments can accumulate in the liver. This applies in particular to bile pigment, haemosiderin, lipofuscin, and melanin. Bile pigment can accumulate as a result of either intrahepatic or extrahepatic cholestasis. The condition often develops simultaneously with jaundice in which the liver assumes a yellow-green colour (see p. 263). Accumulation of haemosiderin which is an iron-containing pigment, may take place not only in hepatocytes but also in Kupffer cells. The condition occurs typically at systemic overload with iron, such as that seen in excessive degradation of erythrocytes. The liver appears darker in colour due to accumulation of haemosiderin. Hepatic melanosis presents as black discolouration of the tissue, and occurs most frequently in pigs and calves. The pigmented areas are irregular with patchy spread. The size of the spots varies from a few mm to several cm. This is a benign congenital condition which disappears with age.

Fibrosis in the liver is one of the most common chronic reactions to injury, as it is in many other organs. In the early stages of liver fibrosis, localisation is in many cases reflecting on the cause of the primary lesions. On the other hand, more extensive and long-term fibrosis may often give rise to a so-called "end-stage liver", and may result from several liver injuries (e.g. toxins, cholestasis, iron poisoning, inflammation or hypoxia). The exact site of the fibrosis, particularly in pig and cattle, can in some cases be determined macroscopically. At the lobular level, fibrosis can be divided into centrilobular (e.g. right-sided cardiac failure, and exposure to many different toxins), portal (centroacinar) (e.g. in chronic inflammations and exposure to toxins) or bridging fibrosis (particularly toxins). Repair of larger, confluent necroses may appear as large irregular connective tissue in the parenchyma. This type of fibrosis is called "postnecrotic scarring". In massive liver necrosis, the fibrosis can assume a lobular form. Other types of liver fibrosis include peribiliar fibrosis and interstitial fibrosis, in which there is formation of connec-

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tive tissue around the biliary tree in the interstitium between each liver lobule. In pigs with extensive chronic suppurative lesions and/or pyaemia, the liver may be the site of diffuse interstitial fibrosis. The condition is most probably due to excessive production of bacterial toxins, and is therefore also known as "abscess liver". A very common form of fibrosis is focal or multifocal/disseminating fibrosis. These forms reflect the reparatory phase in focal and multifocal or disseminating necroses/abcesses.

As previously noted, many chronic liver injuries which undergo repair through connective tissue formation, could also result in so-called "end-stage livers". One special type of this condition is called cirrhosis. This condition is characterised by loss of normal lobulisation, nodular regeneration, and fibrosis. As in "end-stage liver", the changes are diffusely spread. In the end-stage, the liver itself can be enlarged or smaller, regardless of whether or not cirrhosis is present. In most cases of "end-stage liver" there is abnormal vascularisation, causing the appearance of various types of vascular anastomoses, due to the increased pressure in the venous portal system. As mentioned, a large number of liver injuries can develop into an "end-stage" condition. This applies for example in cases of toxins, cholestasis, hepatitis, cholangitis, cholangiohepatitis and long-term massive hepatic congestion. Naturally, an "end-stage liver" will not function normally, and the condition often causes sequelae which necessitate total condemnation.

Parasite-related liver injury [9.59 – 9.84]

The life-cycle of many parasites involves migration, passage and/or developmental phases in the liver. Other parasites that do not normally pass through the liver or parasites of other animal species are occasionally transmitted to the animal, and may be carried to the liver by the portal vein. Here, these parasites are caught in the liver's capillary network where they die leaving small, chronic granulomatous and calcified, greenish lesions. Typical examples of parasites that can leave so-called "parasitic nodules" in the liver include strongylus and cross-infection with roundworm (e.g. infection of sheep with canine roundworm).

Echinococci and the large liver fluke (*Fasciola hepatica*) are examples of parasites whose normal development involves the liver. *Echinococcus granulosus* is divided into two subspecies: *E. granulosus granulosus* (definitive host: dog and fox; intermediate host: ruminants, pigs and humans) and *E. granulosus equinus* (definitive host: dog; intermediate host: horse and donkey). In the intermediate host, the echinococci larvae are primarily carried to the lungs and liver where the hydatid cysts develop (metacestode). The cysts which are usually located in the liver and lungs are generally 3-5 cm in diameter. However, they can be considerably larger. The cyst is firm, slightly fluctuant and encapsulated in a thick host capsule. It is usually located deep in the liver or lung tissue. A differential diagnosis to *E. granulosus* is the cystforming *Cysticercus tenuicollis*. *C. tenuicollis* is soft and never found in the deep tissue of the liver much less the lungs. Viable echinococcal cysts contain a jelly-like cyst wall which can be freed from the thick host capsule. This characteristic ability to free the capsule is an important tool differentiating between parasitic and nonparasitic cyst. In the latter, it is not possible to separate the host capsule and the cyst wall. Dead echinococcal

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cysts contain an inspissated (dry) mass with a concentric structure, which may be calcified. These structures can be confused with liver necroses or liver abscesses.

Infection with liver flukes which can infect the liver either via the abdominal cavity (*F. hepatica*) or ascend via the bile ducts (*Dicrocoelium dendriticum*), gives rise to uniform, but nevertheless differentiated, changes in the chronic stage. At acute infection with *F. hepatica*, the liver will be enlarged and criss-crossed by tracts containing necrotic tissue and blood. A fibrin layer may be seen where the larvae have penetrated the liver from the abdominal cavity (primarily the left liver lobe in cattle). In the chronic stage of liver fluke infection, the parasites can be found easily by cutting open the large intrahepatic bile ducts, preferably in the central section of the liver. The lumen of the bile ducts is dilatated, and the bile ducts are thickened due to fibrosis. Very often it will be the site of mineralisation (particularly in cattle) too. Varying degrees of fibrosis will be seen around the bile ducts and sporadically in the liver, with most present in the left lobe. Even though ruminants are most frequently infected with liver flukes, the infection can also occur in horses and pigs, for example. In spite of the localisation of the parasites in the bile ducts, jaundice is rarely seen as a complication of liver flukes. On the other hand, highly infected animals can develop clinical manifestations such as anaemia, failure to thrive, or emaciation. At infection with the small liver fluke (*D. dendriticum*) the bile ducts are also the site of fibrous thickening and, possibly, mineralisation.

Typical examples of parasites that normally just pass through the liver include cysticerci and roundworms. Both types of parasites reach the liver via spread through the hepatic portal vein. In the liver, both types of parasites migrate in the parenchyma where they leave behind tunnels which in the acute stage can be filled with necrotic cells and blood. Later, the tracts are filled with connective tissue. In cysticercal infections, the migratory stage ends when the parasite migrates to the surface of the liver where it can be located in cyst form (*C. tenuicollis*). Because the cysticerci might migrate further subperitoneally, they can be found at any location within the abdominal cavity of ruminants and pigs. If the cysts of the cysticerci are eaten by dogs, foxes or other similar carnivores, the tapeworm *Taenia hydatigena* will develop within the small intestine.

At repeated infection with *Ascaris suum* in pigs, immunological conditions will cause development of a multifocal/disseminated characteristic fibrosis of the interstitium – the so-called hepatitis interstitialis parasitaria chronica multiplex. The changes appear as white thickened areas of the interstitium that peripherally extends and blends with the normal interstitial tissue. The changes disappear with time, but during the healing phase so-called lymphadenopathies may also form. These lesions which can be found immediately below the liver capsule and in the deep liver tissue are grey, semi-transparent, and sharply demarcated from the surrounding parenchyma. The lesions, which contain large amounts of B lymphocytes, range in diameter from 2 to 5 mm. Lymphadenopathies can also occur in the lungs of pigs after migration of *A. suum*. As with the fibrous interstitial lesions caused by *A. suum*, lymphadenopathies also disappear with time, usually after a few weeks. It is important to differentiate lymphadenopathies from lesions caused by generalised infection with mycobacteria. As with lymphadenopathies, the granulomatous inflammation seen at infection with mycobacteria (pigs are susceptible to infection with *Mycobacterium tuberculosis, M. bovis* and *M. avium subsp. avium*)

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are macroscopically semitransparent greyish processes. The processes, which are also distinctly separated from the surrounding tissue, will when located intralobulary be circular. When localized interstitially, they will often be confluent due to merging of more processes due to lymphangitis. In contrast to lymphadenopathies the granulomatous processes sometimes contain necrotic areas (caseous necrosis) and/or mineralisation. Both lymphadenopathies and granulomatous processes are grey and semitransparent due to the high content of mononuclear cells and absence of fibrosis. By contrast to these, the interstitial scars developing following infection with *A. suum* are whiter due to substantial connective tissue formation.

In horses, various large strongylus (*Strongylus edentatus* and *S. equinus*) migrate through the liver via various routes. Some of the parasites die during passage through the liver, and just like the cross-infections will leave small (mm large) fibrous and possibly calcified lesions. These are often located just below the liver capsule, and therefore often project slightly above the surface. In the liver of the horse, migration of the large strongylus, and possibly also the cross-infection parasites, is probably the reason for the very high frequency of filamentous fibrous deposits on the surface. Similar formations are frequently seen in other cranially situated organs in the abdominal cavity of the horse. It is assumed that the fibrous formations appear after fibrosis of the fibrin exudate in connection with penetration/migration of the parasites in the liver.

At meat inspection, various infections of the liver due to parasites will almost always necessitate partial condemnation. The presence of complications at parasitic infections necessitates total condemnation of the animal. Nevertheless, in connection with *A. suum*-related changes in the liver in the pig, approval may be given for preprocessing for animal feed.

Toxic liver injury

The liver is the organ that is most susceptible to toxic injury. This is primarily due to two factors. Firstly, the liver receives 70-80% of its blood supply via the portal vein. This is the reason why intake of toxic substances in feed will be transported directly to the liver. Secondly, the liver contains enzyme systems that are able to metabolise innumerable endogenous and exogenous substances which should really be excreted, but which as a result of metabolism become toxic (bioactivation).

Toxic liver injury can result in a wide range of changes in the liver depending on the animal's constitution and other factors (including age and gender), the type and amount of toxin, the duration of the effect, etc. These changes can vary from mild, particularly centrilobular degeneration with subsequent accumulation of intracellular fluid and/or fat, so-called parenchymatous/hydropic degeneration and fat degeneration, to hypertrophy, or to zonal or massive liver necroses. The degenerative changes cannot generally be determined by macroscopic examination. In other cases, a toxin (e.g. aflatoxin, nitrosamines and pyrrolizidine alkaloids) could give rise to megalocytosis in which abnormally large hepatocytes are present. Again, this is a condition that can only be diagnosed by histological examination. Furthermore, a toxin (e.g. aflatoxin) may in case of prolonged exposure cause neoplasia. In general, toxic liver injury will always be

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apparent throughout the entire liver and cause an increased lobular pattern. In chronic cases of intoxication of the liver, the result will in most cases be one form or other of liver fibrosis. Other frequent manifestations in the chronic stage include proliferation of the bile ducts and, in some cases, nodular regeneration of the liver parenchyma. In many cases therefore, the final stage of toxic liver injury cannot be differentiated from "end-stage liver" or cirrhosis due to other causes.

At meat inspection, scoring complies with the general regulations in which acute to subacute necroses necessitate total condemnation. In the absence of complications, the chronic stages necessitate partial condemnation. It must be emphasised that intoxication, including toxaemia, always necessitates total condemnation. Specifically, changes caused by aflatoxin always necessitate total condemnation.

Amyloidosis [9.85]

Amyloidosis in livestock is nearly always due to deposits of amyloid-associated (AA) fibrils, so-called secondary amyloidosis. AA fibrils are formed from serum amyloid-associated (SAA) protein which is produced in the liver. Production of SAA and thereby potential deposition of AA fibrils is mostly seen in cattle with chronic infections and/or serious suppurative inflammations. In addition, the liver of horses used for serum production, which are subject to frequent immunisation and blood sampling, is a relatively frequent site of amyloidosis. In livestock, amyloid deposits are primarily seen in the kidneys, liver, spleen, intestinal mucous membranes, adrenals and thyroid glands. Hepatic amyloidosis is relatively rare compared to renal amyloidosis, for example. In hepatic amyloidosis, the liver becomes enlarged, pale and heavy, and acquires a friable consistency. Because of this brittleness, the liver can occasionally rupture in amyloidosis. This is most common in horses.

The amyloid is deposited in the liver in the space of Disse and causes atrophy of the hepatocytes. When the amyloid deposits in the space of Disse are substantial, the contact between the blood plasma and the hepatocytes is reduced. This means there can be a risk for hepatic failure. Meat inspection of hepatic amyloidosis necessitates as a minimum condemnation of the liver, but must take into account other underlying causes and the presence of any complications.

Circulatory disorders and vascular changes [9.86 – 9.100]

Hepatic congestion in cattle is most often due to right-sided cardiac failure or thrombosis in the caudal vena cava which causes increased pressure in the caudal vena cava and its supply vessels. Other causes include hepatic veno-occlusive disease in which toxic affection causes development of primary fibrosis around the central vein. This condition can be seen in connection with various types of intoxication. Depending on the duration of the hepatic congestion (acute – chronic) and severity, the appearance of the liver will vary. Mild hepatomegaly occurs in acute hepatic congestion, and blood will ooze from a cut section. The liver has an increased lobular pattern due to accumulation of blood around the central veins in the centre of the lobules.

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In persistent congestion, hypoxia and absent nutrition supply will cause atrophy of the centrilobularly located hepatocytes. As a result of atrophy of the hepatocytes, the sinusoids dilate and appear bright red. The concomitant presence of hypoxia in the perilobular areas means that the hepatocytes here will undergo steatotic changes (fat degeneration) and appear yellowish. In cattle in particular, this increased lobulisation has a characteristic appearance, the so-called "nutmeg liver". In addition to these lobular changes, chronic congestion is also associated with widespread fibrosis, particularly in the portal areas but also around the central veins with possibly involvement of the interstitium.

Infarctions are rarely seen in the liver due to the organ's double blood supply. Liver infarctions can appear pale or bright red and occur most frequently in the border of the liver. In the acute stage the cut section appears dry. The best known examples of infarction occur by torsion of a single liver lobe, or at compression in connection with eventration/herniation of the entire liver or sections of it through defects in the diaphragm.

Capillary ectasias (teleangiectasias) are a frequent finding in cattle, but can also occur sporadically in the liver of other species. The reason for the changes is a localised expansion of the hepatic sinusoids with concomitant loss of associated hepatocytes. The pathogenesis of capillary ectasias is unknown, but theories involving local hypoxic conditions have been proposed. It must also be noted that this condition does not occur in young animals. Capillary ectasias are most often multiple and can be detected both on the surface and in the deep tissue of the liver. The changes manifest as blue-black areas (few mm to several cm in size), which are slightly concave compared to the surface/cross-section.

Congenital portosystemic shunts which enable blood in the portal vein to pass through anastomoses to post-hepatic vessels, and thus avoid the liver, occur very rarely in slaughter animals. Acquired shunts may also be seen, however rarely.

At meat inspection, circulatory disorders and vascular changes necessitate partial condemnation as a minimum, but the underlying cause and the presence of any complications must be taken into account.

Proliferative lesions, neoplasms and cysts [9.101 – 9.126]

In principle, there are three types of parenchymal cell proliferation: hyperplasias, regenerative nodules and neoplasms. Hyperplasias occur rarely in livestock, and their cause is unknown. These are typically focal, well-demarcated proliferative lesions without fibrosis. Compared to the surrounding tissue, the hyperplastic areas may be pale due to the fat content of the newly-formed hepatocytes. This is characteristic for hyperplasias in pigs and calves. Regenerative nodules which are formed in response to injury will often contain large amounts of connective tissue (fibrosis), and can thus be differentiated from hyperplasia. Primary hepatic neoplasms are rarely seen in livestock. However, hepatic metastases due to certain neoplasms are a relatively frequent finding, particularly in older cows. Hepatic neoplasms can arise from the epithelial elements (hepatocytes and bile duct epithelium) or the mesenchymal elements (blood vessels and connective tissue). Hepatocellular adenomas (hepatomas/adenomas) are benign neoplasms that occur spo-

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radically in calves and pigs. These are mostly red-brown proliferative lesions which compress the adjacent parenchyma. They are typically spherical and may be pedunculated. Malignant hepatocellular neoplasms (carcinomas) will most often be solitary or involve an entire liver lobe. Metastases from neoplasms comprise important macroscopic evidence when assessing malignancy. Cholangiocellular hyperplasia is a nonspecific reaction which can be seen associated with almost all types of chronic liver injury. These must be distinguished from neoplastic proliferative lesions. Malignant cholangiocellular neoplasms can be comprised of either a single tissue mass or multiple tissue masses. Cystic cavities and necrosis are frequently seen in neoplasms, and may give rise to invagination of the surface (umbilicated). All types of malignant primary hepatic neoplasms generally metastasise to the regional lymph nodes, lungs and, in implantation metastasis, to the peritoneum. At meat inspection, all benign hepatic neoplasms without complications necessitate partial condemnation, whereas all malignant neoplasms necessitate total condemnation regardless of whether they are primary neoplasms or metastases.

Cysts in the liver can arise from the capsule (serous cysts), but almost always arise from the bile ducts. These can be congenital bile duct cysts, which are most often found in localised areas of the liver, or retention cysts. In the latter, the cause is nearly always the presence of intrahepatic calculi formation (gall stones), which are occasionally found in connection with infestation with liver flukes. It is important to distinguish between congenital bile duct cysts and parasitic cysts, in particular *C. tenuicollis*, which are relatively common in small ruminants and pigs. All types of hepatic cysts necessitate partial condemnation.

Gall bladder [9.127 – 9.132]

The horse is the only slaughter animal that does not have a gall bladder. Pathologic conditions occur rarely in the gall bladder. Nevertheless, calculi (gall stones) may occasionally be found in the larger bile ducts and gall bladder. The presence of calculi is only of significance if they disturb the flow of bile with subsequent development of jaundice or malabsorption, for example. Bile is hepatotoxic, and compromised bile flow, which can cause ectasis of the major intrahepatic bile ducts, can result in liver fibrosis. The gall bladder is seldom the site of inflammatory and proliferative lesions. Pathologic conditions in the gall bladder always necessitate partial condemnation, but as with liver disease, any associated condition must be taken into account.

Complications [9.133 – 9.135]

Due to its diverse functions, liver injury may lead to several changes in the body. These are briefly summarised below. At meat inspection, all the complications due to liver injury listed below necessitate total condemnation. Nevertheless, it must be noted that final scoring can be postponed for 24 hours if the carcase or parts thereof have an abnormal odour or colour (jaundice in new-born animals, or in connection with severe haemorrhage). If the discolouration has disappeared after 24 hours, the scoring is unconditional approval.

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Jaundice

Normally bilirubin, which is a degradation product from haemoproteins, is conjugated in the liver and excreted via the bile. In connection with liver injury (inadequate uptake, conjugation or excretion of bilirubin), and/or compromised bile outflow (intrahepatic and extrahepatic) the blood saturation point (albumin binding) for bilirubin can be exceeded. In this case, the substance is deposited, in particular in elastin-containing tissue. Other than liver injury and compromised bile outflow, increased production of bilirubin can also be a cause of jaundice; this is seen at increased degradation of erythrocytes.

Fluid retention and portal hypertension (ascites)

All forms of diffuse liver injury can be accompanied by general fluid retention including ascites. The mechanism of general fluid retention is not completely clear, but it is assumed that abnormal Na^+ retention via the kidneys plays a central role. Development of hypoalbuminaemia may also play a role. Portal hypertension can occur in prehepatic, hepatic and posthepatic lesions which compromise the venous flow via the portal vein from the gastro-intestinal tract. Prehepatic causes include neoplasms and abscesses which compress the veins. Hepatic causes of portal hypertension include diffuse fibrosis and portal fibrosis. Right-sided endocarditis and thrombus formation in the caudal vena cava are the most important posthepatic causes of hypertension in the portal vein of cattle.

Encephalopathy

The essential factor in the pathogenesis of central nervous system disorders associated with liver disorders ("liver staggers") is inadequate amine metabolism in the liver. Regardless of whether this lack of metabolism is due to injury to the hepatocytes or due to the blood being shunted past the liver (by portal hypertension and portosystemic shunts), the result is hyperammonaemia. Ammonia affects the function of the central nervous system and the neuromuscular system.

Photosensitisation

Degradation of chlorophyll in the gastro-intestinal tract results in the formation of the photoactive substance phylloerythrin. This substance is carried to the liver in the portal blood. In liver disorders in which liver activity is impaired, the substance can pass through the liver with subsequent accumulation in the lysozymes of skin macrophages. In the presence of sunlight, photooxidation of the lysosome membranes occurs resulting in release of the lysosomal enzymes and subsequent necrosis and inflammation of the skin.

Emaciation

Emaciation associated with liver disorders can be due to many factors. Hepatic malabsorption can in principle be caused by two conditions. It is seen in the absence of bile acid production/secretion and at portal hypertension. Bile acid is essential for micelle formation, and lack of bile acid will thus result in steatorrhoea. Because portal hy-

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pertension results in congestion in the gastro-intestinal region, this situation will also compromise the portal transport of substances taken up from the gastro-intestinal tract. General interruption of hepatic metabolism of fat, carbohydrates, proteins and, in ruminants, volatile fatty acids, will also result in failure to thrive and emaciation.

Coagulopathies

A large number of coagulation factors and fibrinogen are synthesised in the liver; and therefore extensive injury to the liver could cause abnormal coagulation.

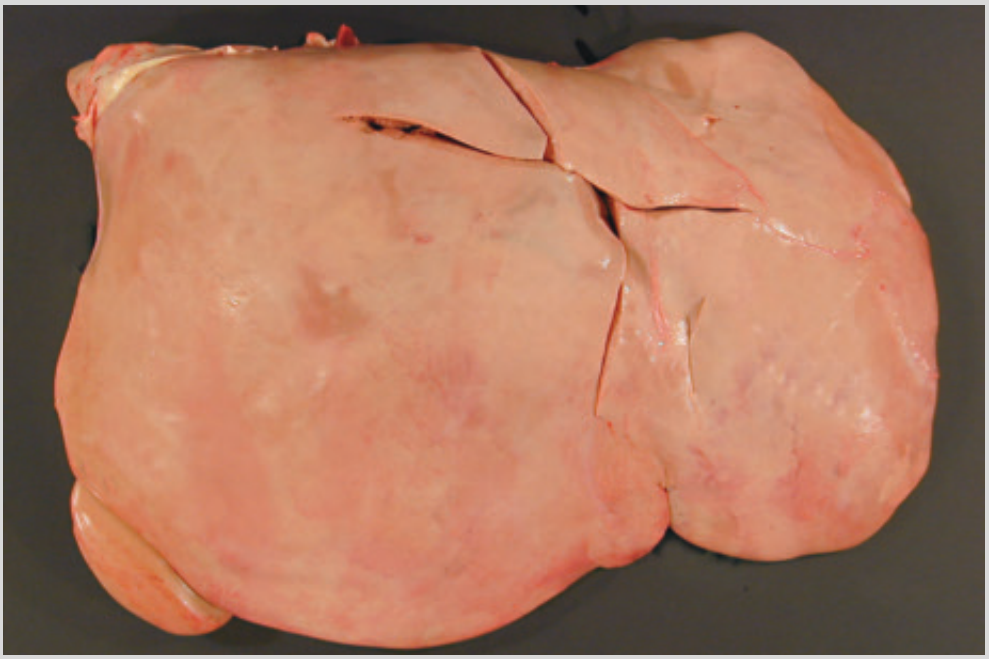
As previously noted, supply of bile acid to the intestinal tract is critical for uptake of lipids as well as the fat soluble vitamins (A, D, E and K). It is therefore understandable that at liver injury, a condition could arise with insufficient uptake of vitamin K, which would result in an increased bleeding tendency (haemophilia).

Abnormal odour

When liver function is compromised, the meat can emit an abnormal odour. It is assumed that the condition arises due to inadequate metabolism of substances taken up from the gastro-intestinal tract via the portal vein. These substances could also be shunted past the liver and thus accumulate unmetabolised in the muscles.

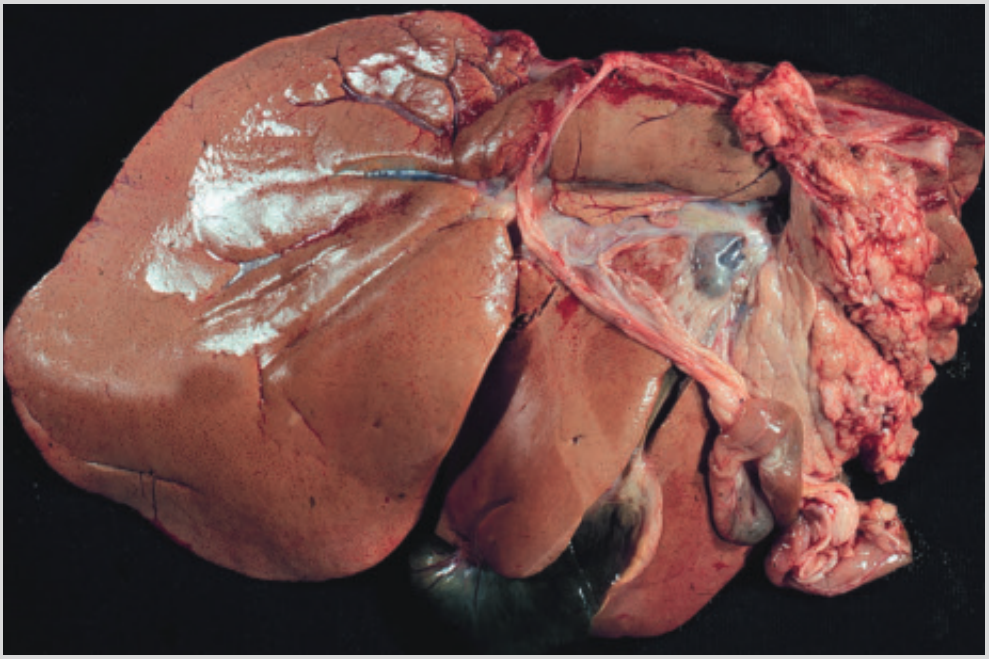
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9.01



Animal species/Organ	Cattle/Liver
Lesion	Diffuse steatosis
Scoring	Partial condemnation
Comments	If pathologic, this condition necessitates total condemnation

9.02



Animal species/Organ	Sheep/Liver
Lesion	Diffuse steatosis
Scoring	Partial condemnation
Comments	If pathologic, this condition necessitates total condemnation

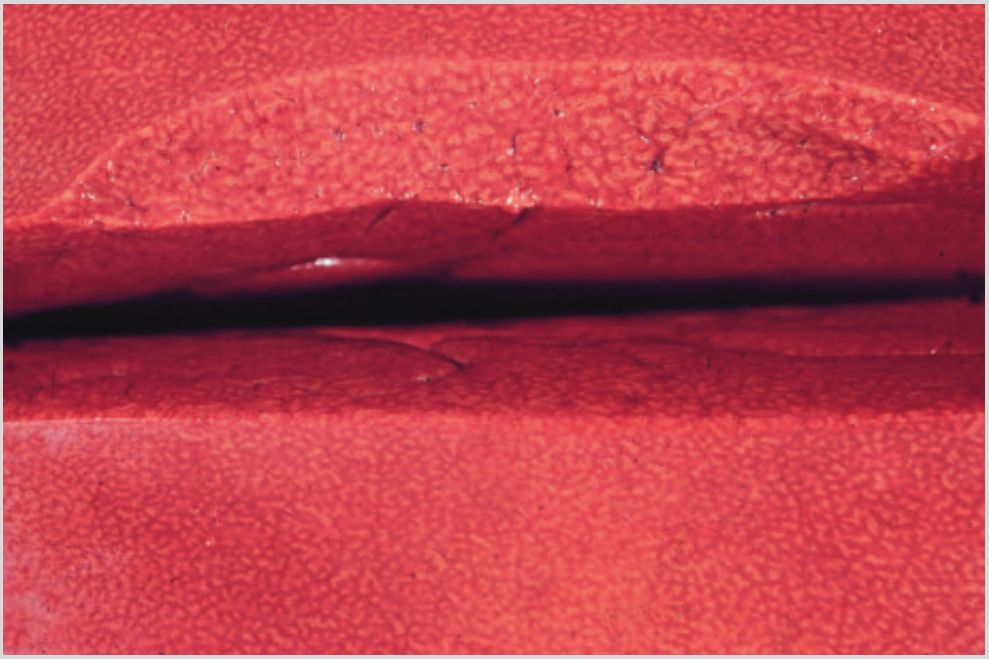
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9.03



Animal species/Organ	Cattle/Liver
Lesion	Diffuse steatosis
Scoring	Partial condemnation
Comments	If pathologic, this condition necessitates total condemnation

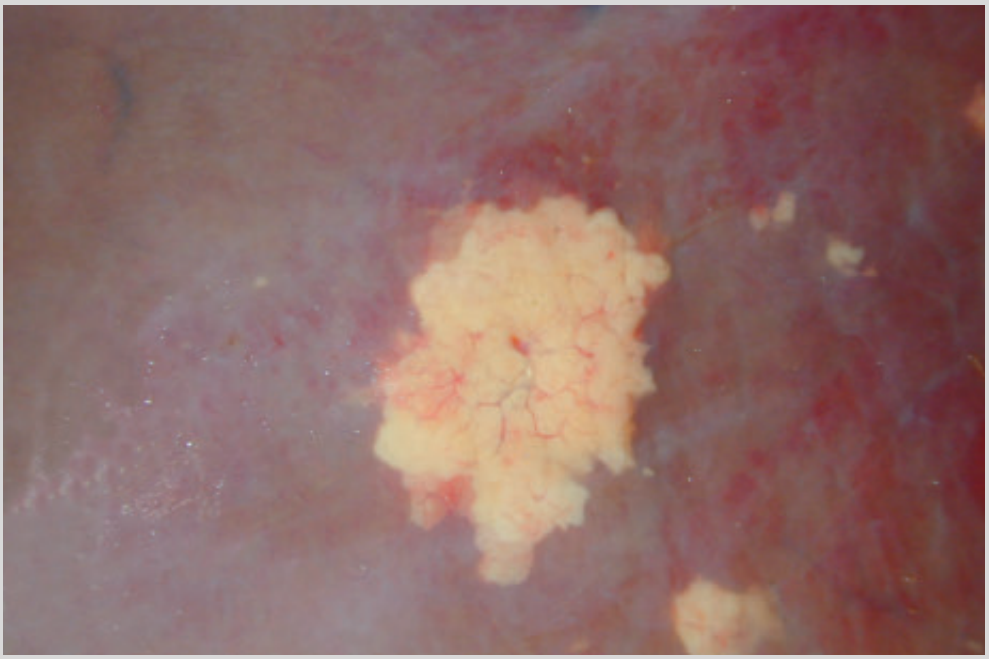
9.04



Animal species/Organ	Cattle/Liver
Lesion	Diffuse steatosis
Scoring	Partial condemnation
Comments	If pathologic, this condition necessitates total condemnation

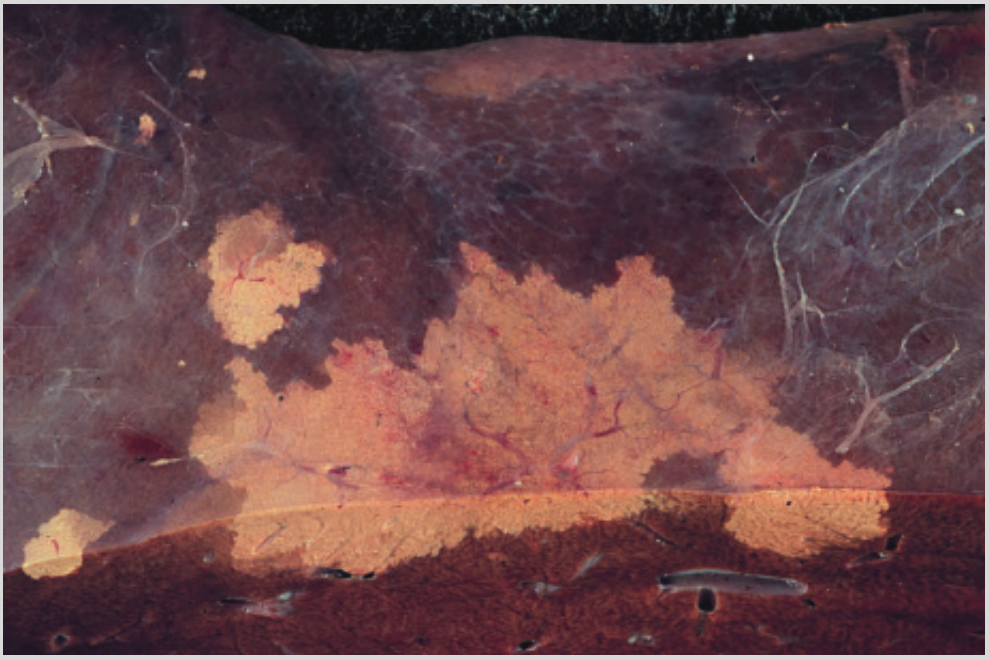
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9.05



Animal species/Organ	Cattle/Liver
Lesion	Localised tension steatosis
Scoring	Partial condemnation
Comments	If only present in a few areas local stripping can be performed

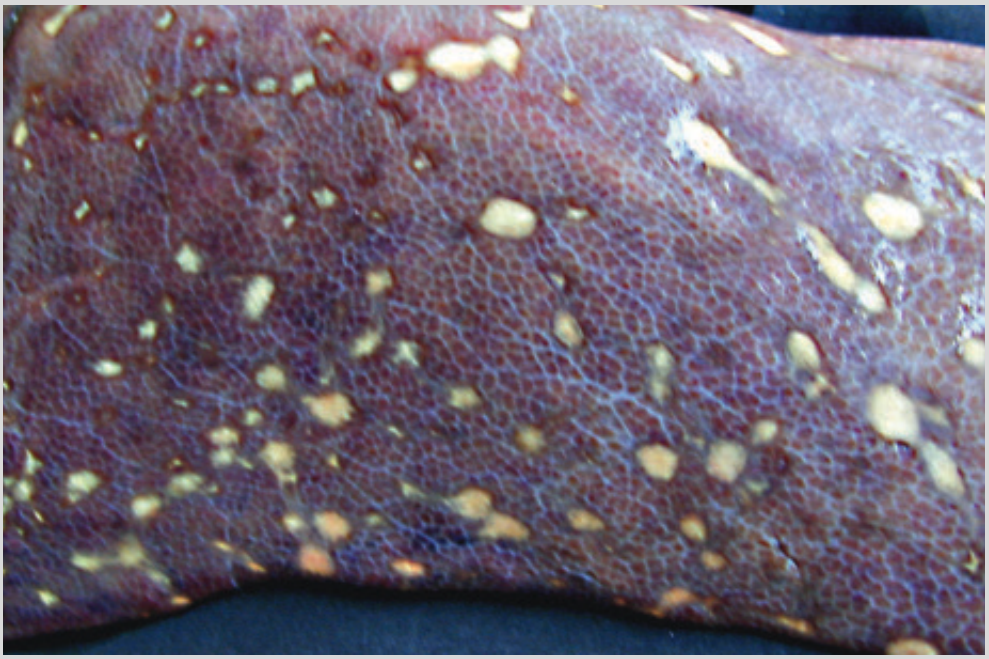
9.06



Animal species/Organ	Cattle/Liver
Lesion	Localised tension steatosis
Scoring	Partial condemnation
Comments	If present in only a few areas local stripping can be performed

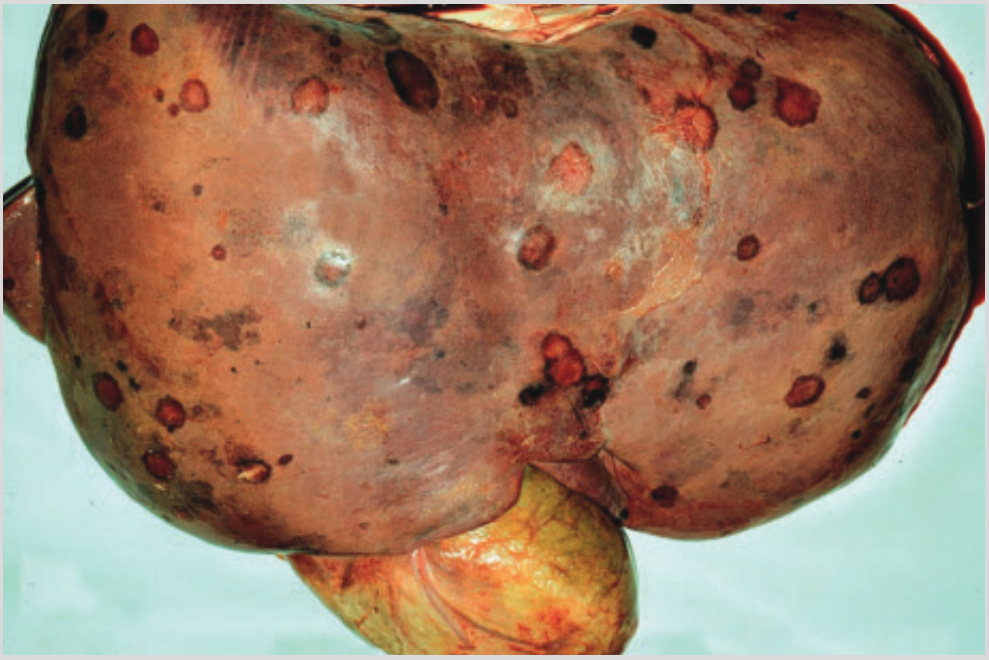
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9.07



Animal species/Organ	Pig/Liver
Lesion	Disseminated lipomatosis
Scoring	Partial condemnation
Comments	If present in only a few areas local stripping can be performed

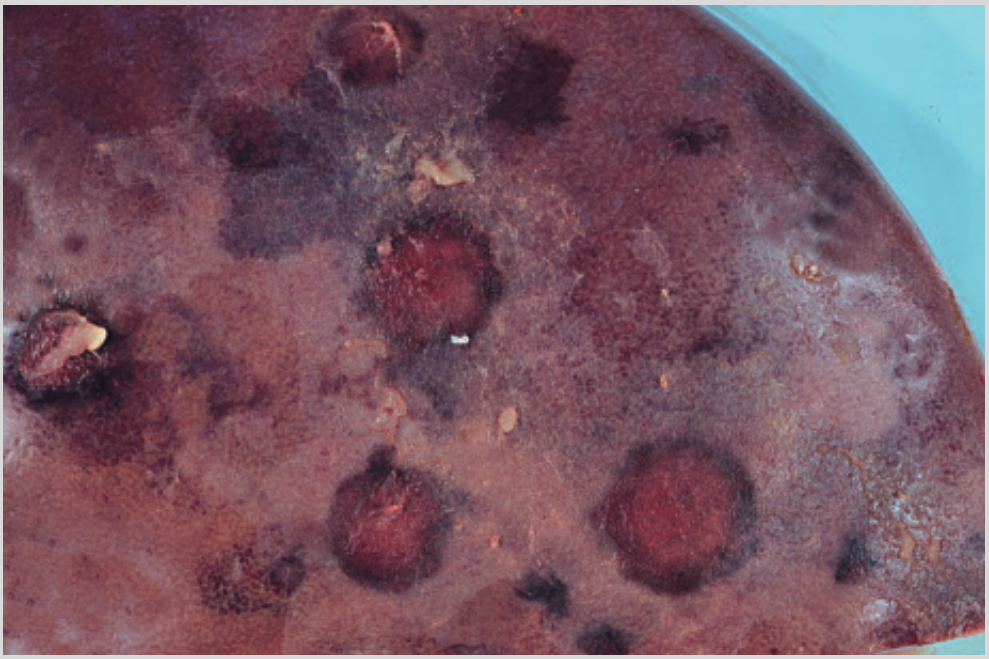
9.08



Animal species/Organ	Cattle/Liver
Lesion	Acute, disseminated necroses
Scoring	Total condemnation
Comments	There is concomitant diffuse steatosis

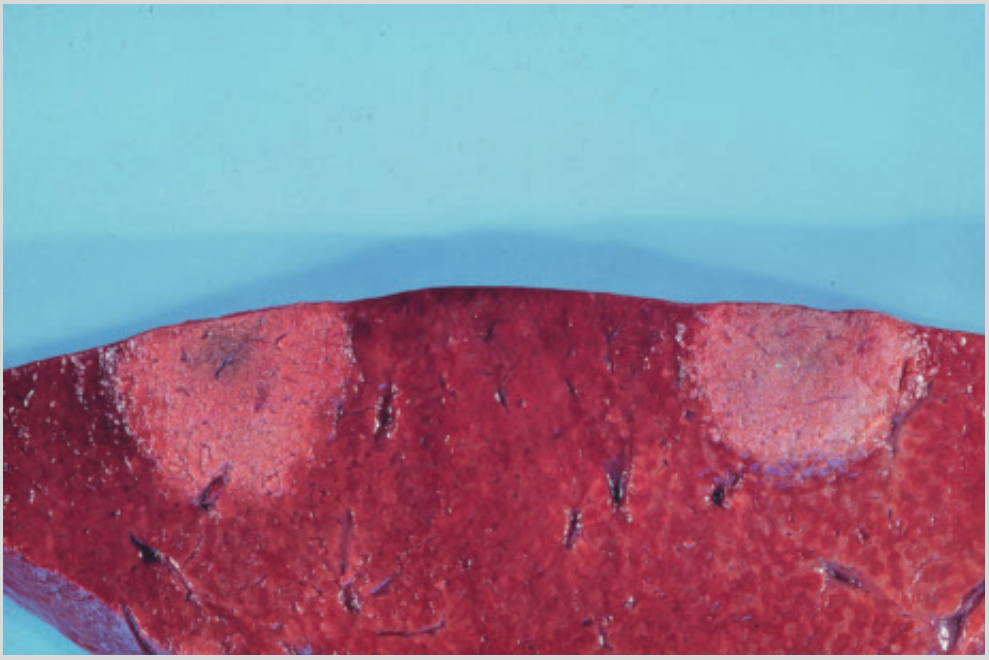
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9.09



Animal species/Organ	Cattle/Liver
Lesion	Acute, disseminated necroses with acute, fibrinous perihepatitis
Scoring	Total condemnation
Comments	In acute necroses, fibrin exudate is often seen on the surface of the liver

9.10



Animal species/Organ	Cattle/Liver
Lesion	Acute necroses
Scoring	Total condemnation
Comments	Acute necroses appear dry on the cut surface

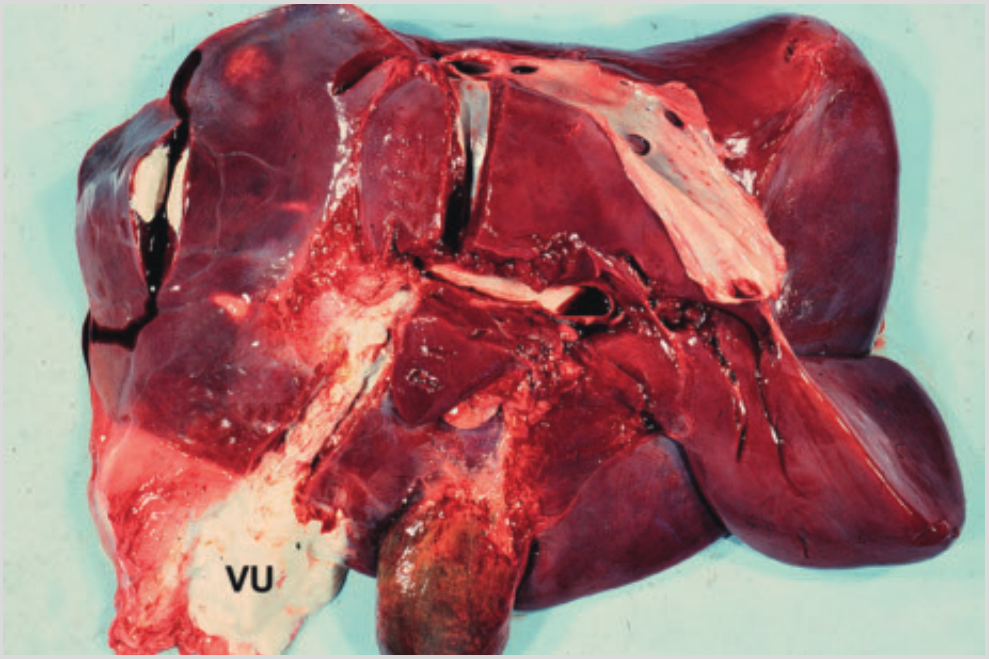
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9.11



Animal species/Organ	Cattle/Liver
Lesion	Chronic, multifocal abscesses
Scoring	Partial condemnation
Comments	The liver abscesses are localised on the left side of the liver

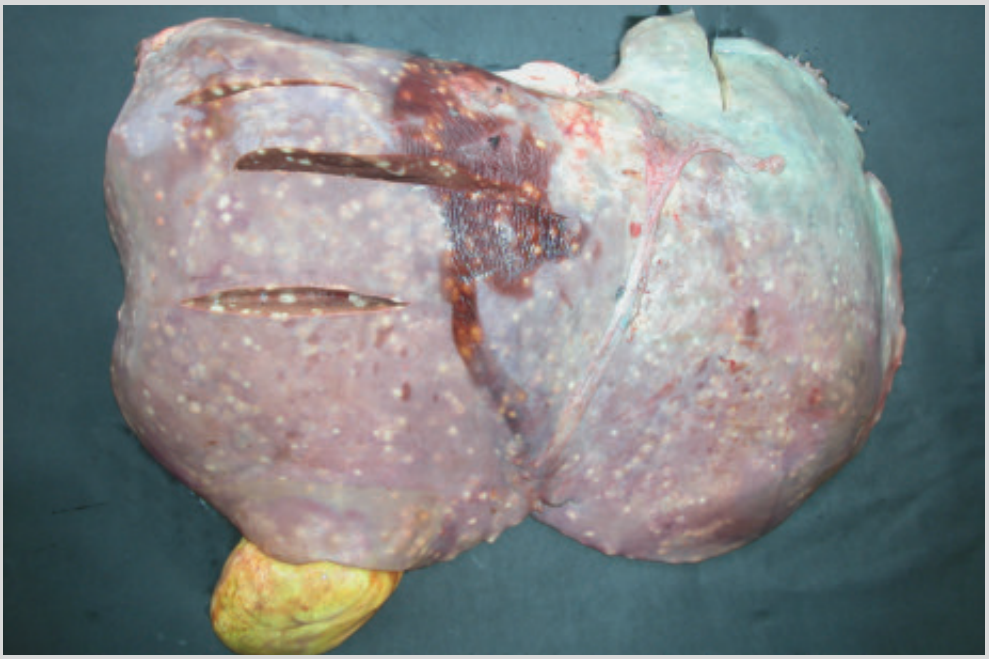
9.12



Animal species/Organ	Cattle/Liver
Lesion	Chronic, purulent phlebitis and multifocal abscesses
Scoring	Partial condemnation
Comments	The purulent phlebitis is localised to the umbilical vein (VU)

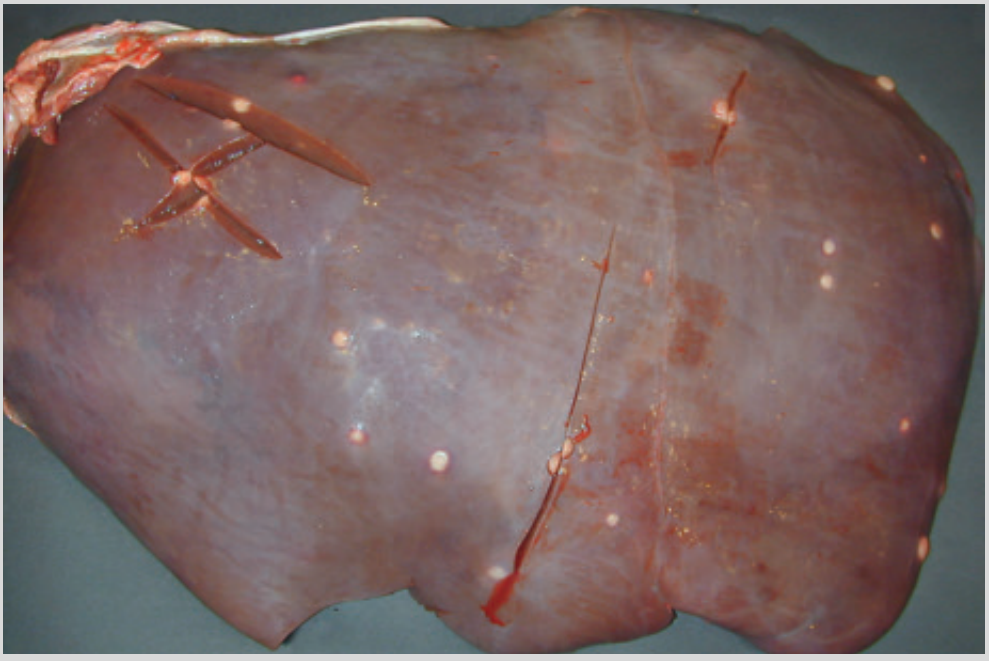
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9.13



Animal species/Organ	Cattle/Liver
Lesion	Chronic, disseminated abscesses and diffuse fibrous perihepatitis
Scoring	Partial condemnation
Comments	Spread to the liver has most probably occurred via the portal vein

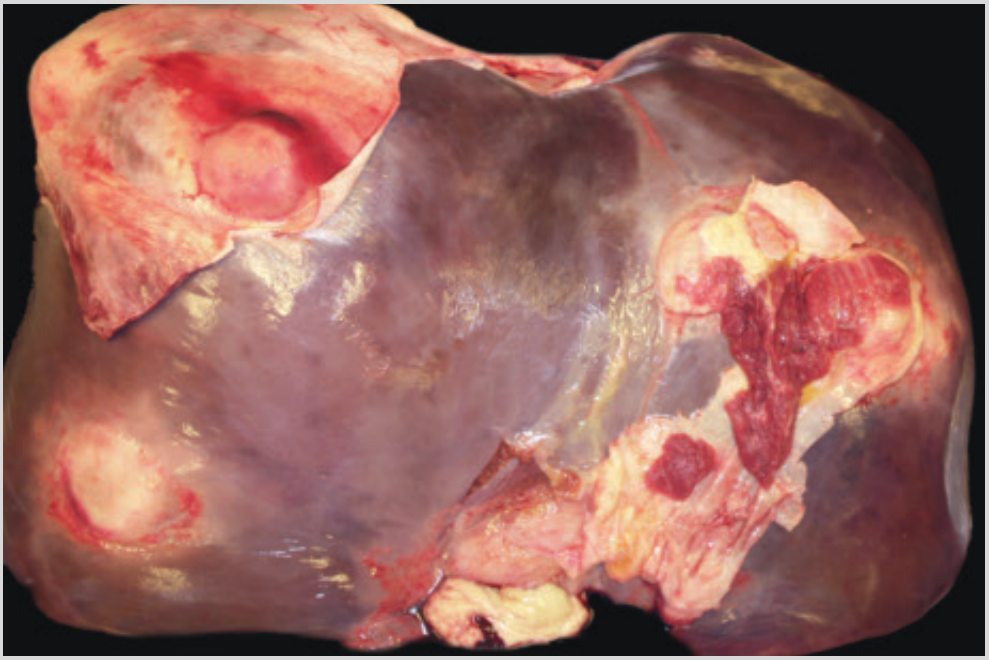
9.14



Animal species/Organ	Cattle/Liver
Lesion	Chronic, disseminated, hepatitis with abscess formation
Scoring	Partial condemnation
Comments	Spread to the liver has most probably occurred via the portal vein

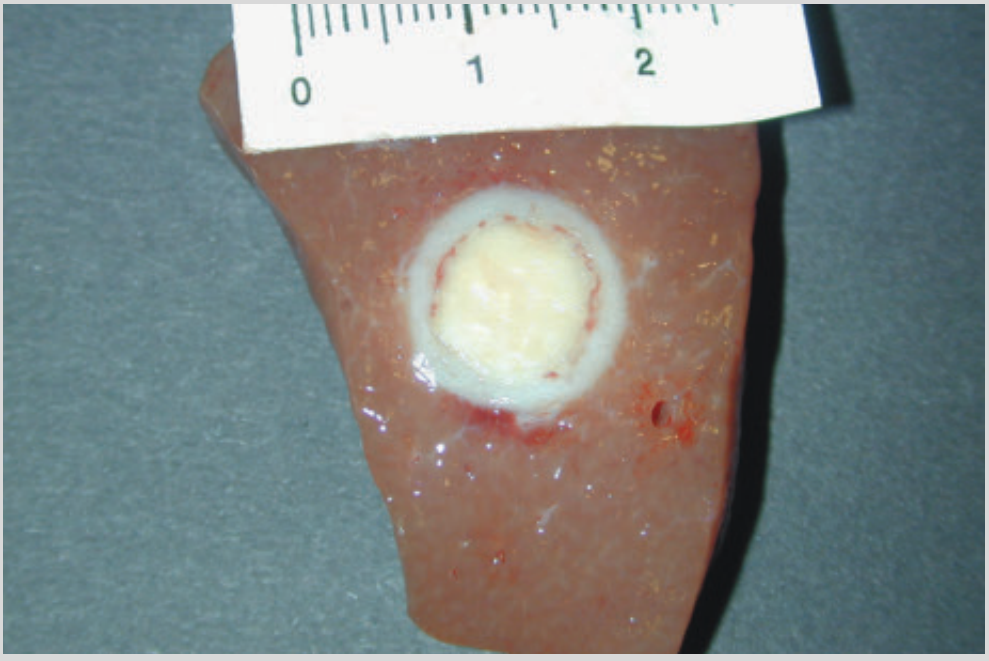
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9.15



Animal species/Organ	Cattle/Liver
Lesion	Chronic, disseminated, hepatitis with abscess formation, and overlying fibrous, adhesive perihepatitis
Scoring	Partial condemnation
Comments	The caudal vena cava must be examined for rupture

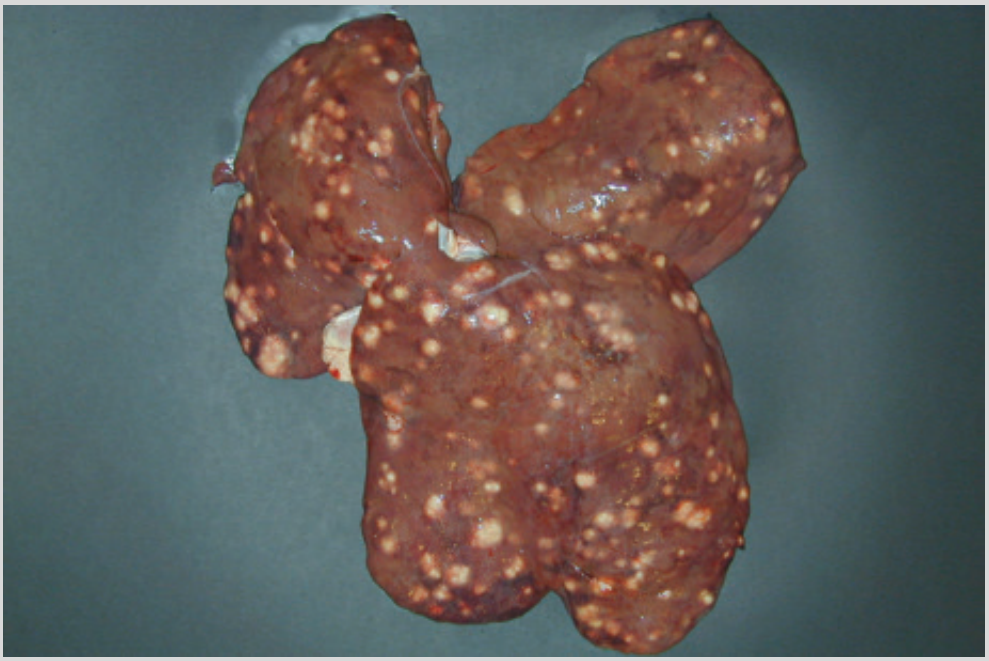
9.16



Animal species/Organ	Cattle/Liver
Lesion	Chronic hepatitis with abscess formation
Scoring	Partial condemnation
Comments	Note the thick connective tissue capsule

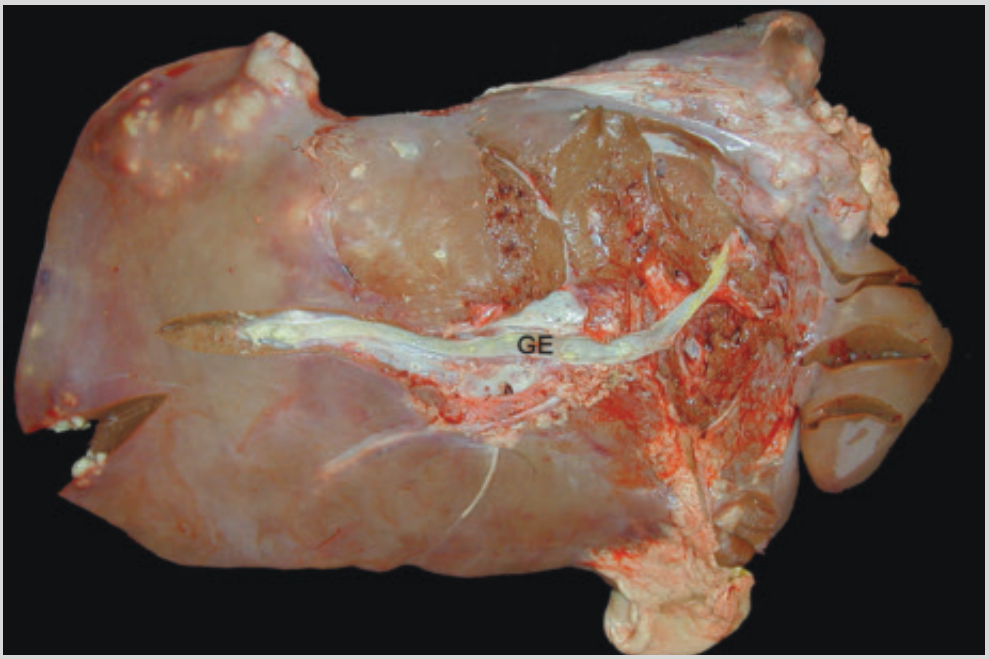
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9.17



Animal species/Organ	Pig/Liver
Lesion	Chronic, disseminated abscesses
Scoring	Partial condemnation
Comments	Spread to the liver has most probably occurred via the portal vein

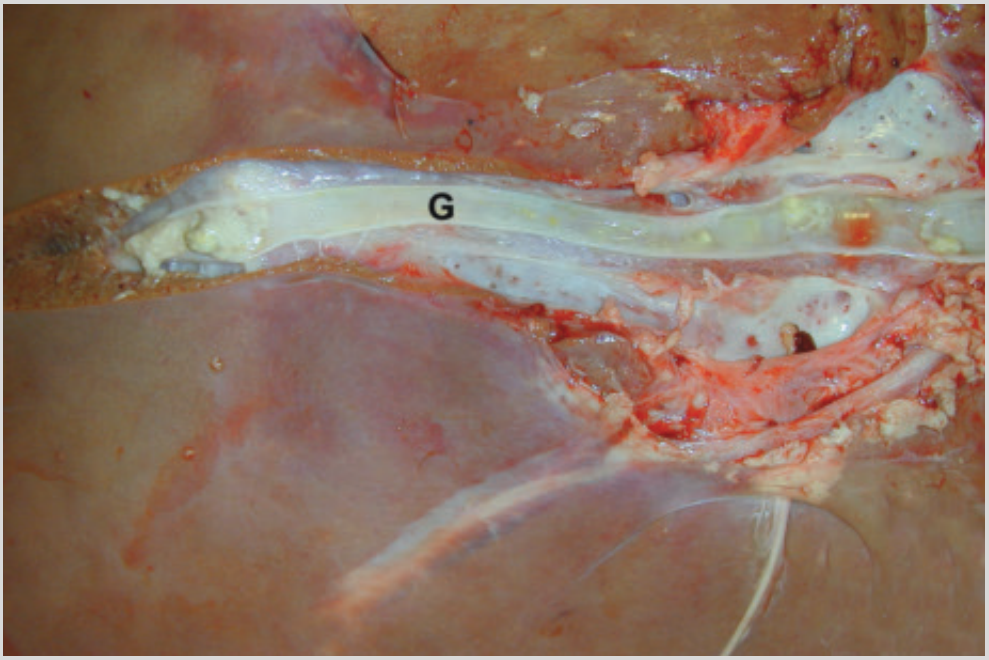
9.18



Animal species/Organ	Cattle/Liver
Lesion	Chronic, purulent cholangitis with multifocal cholangiectasias
Scoring	Partial condemnation
Comments	Ectasias of the bile ducts (GE) can easily be confused with abscesses

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9.19



Animal species/Organ	Cattle/Liver
Lesion	Chronic, purulent and fibrosing cholangitis
Scoring	Partial condemnation
Comments	Pus accumulation can be seen in the opened bile duct (G)

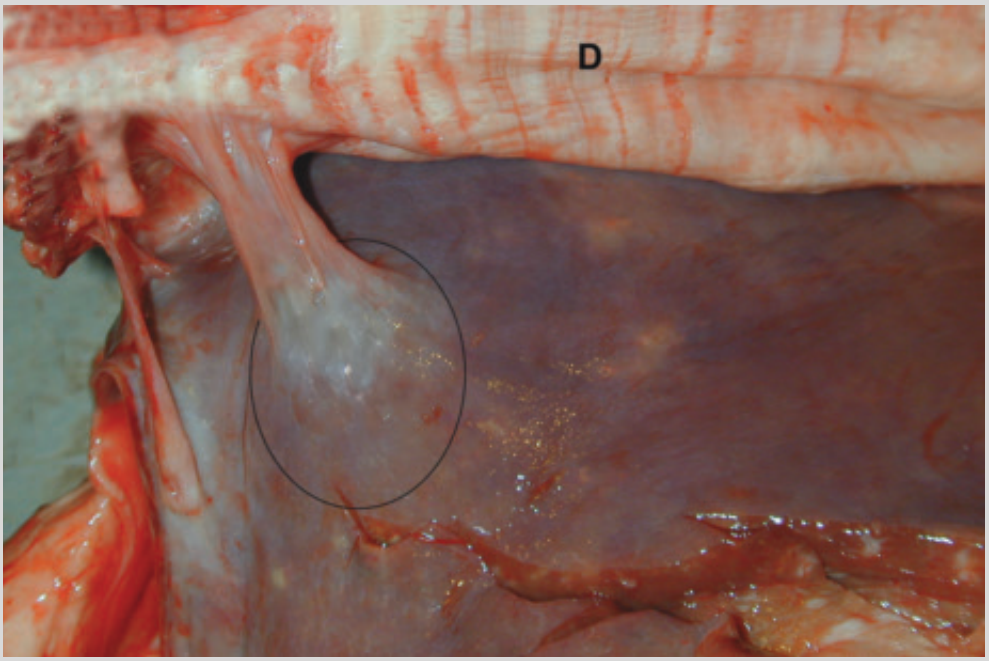
9.20



Animal species/Organ	Pig/Liver
Lesion	Chronic, focal abscess
Scoring	Partial condemnation
Comments	Spread to the liver has most probably occurred via the portal vein

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9.21



Animal species/Organ	Cattle/Liver and diaphragm (D)
Lesion	Chronic, focal, hepatitis with abscess formation (circle), and fibrous, adhesive perihepatitis
Scoring	Partial condemnation
Comments	The condition can be easily confused with subphrenic abscesses

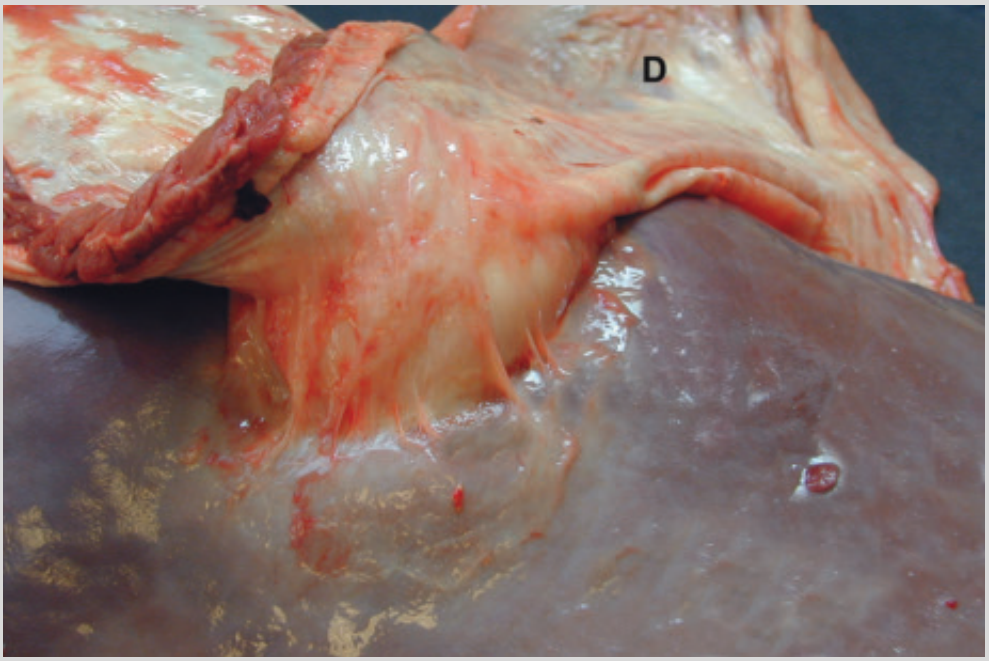
9.22



Animal species/Organ	Cattle/Liver and diaphragm (D)
Lesion	Chronic, local, subphrenic abscess with fibrous adhesion
Scoring	Condemnation of liver and diaphragm
Comments	At differential diagnosis, the lesion can be easily confused with hepatic abscesses

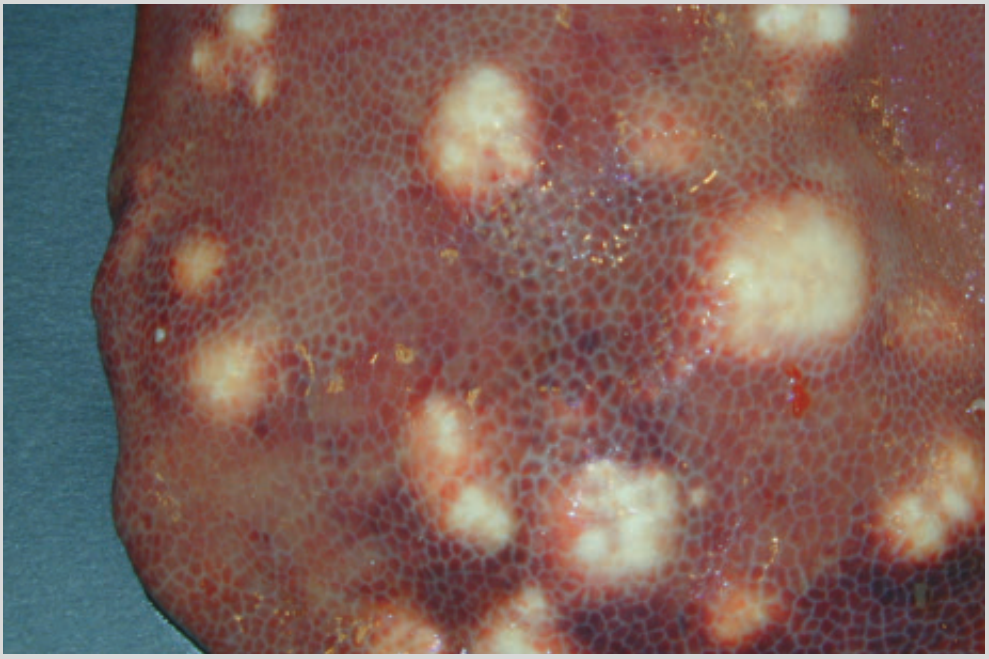
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9.23



Animal species/Organ	Cattle/Liver and diaphragm (D)
Lesion	Chronic, local, subphrenic abscess with fibrous adhesion
Scoring	Condemnation of liver and diaphragm
Comments	At differential diagnosis, the condition can be easily confused with hepatic abscesses

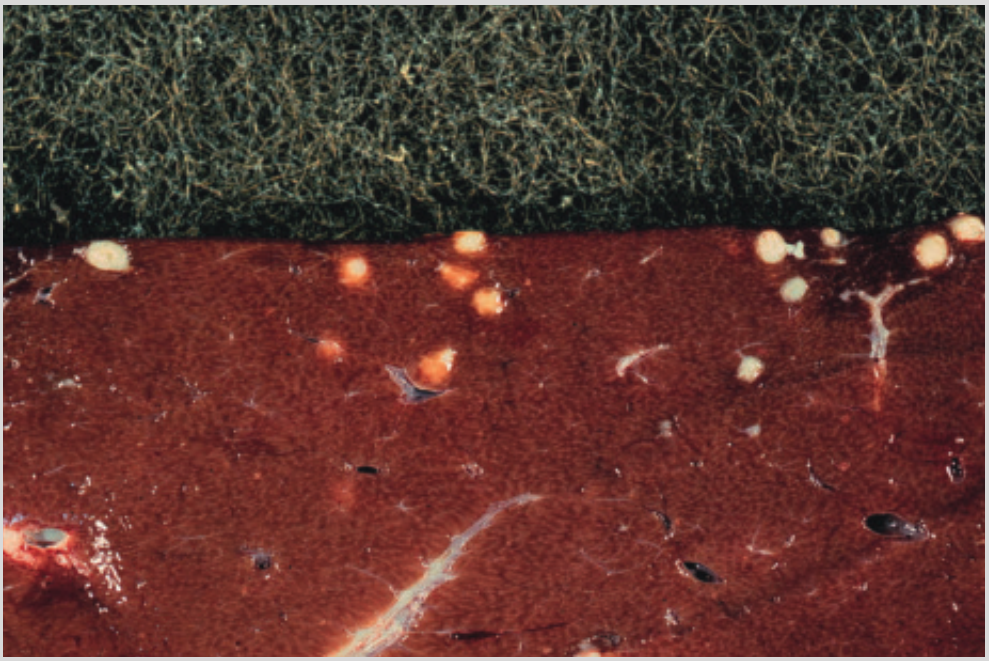
9.24



Animal species/Organ	Pig/Liver
Lesion	Chronic, multifocal, hepatitis with abscess formation
Scoring	Partial condemnation
Comments	Spread to the liver has most probably occurred via the portal vein

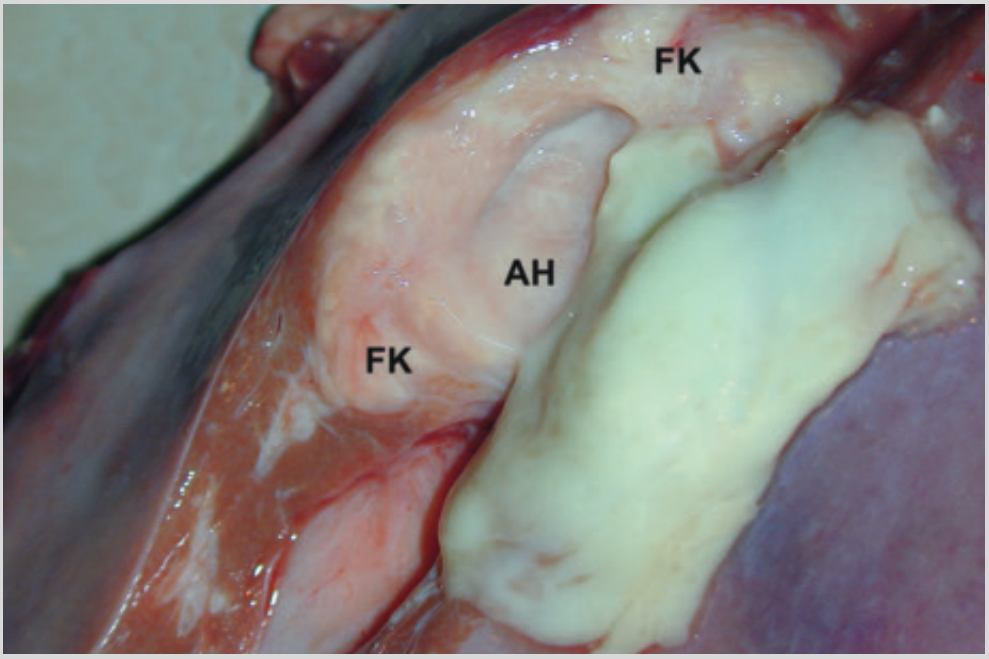
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9.25



Animal species/Organ	Cattle/Liver
Lesion	Chronic, multifocal abscesses
Scoring	Partial condemnation
Comments	Spread to the liver has most probably occurred via the portal vein

9.26



Animal species/Organ	Cattle/Liver
Lesion	Chronic, focal abscess
Scoring	Partial condemnation
Comments	The abscess cavity (AH) is surrounded by a thick fibrous capsule (FK)

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9.27



Animal species/Organ	Cattle/Liver
Lesion	Chronic, cystic conglomerate of abscesses
Scoring	Partial condemnation
Comments	Spread to the liver has most probably occurred via the portal vein

9.28



Animal species/Organ	Cattle/Liver
Lesion	Chronic, focal, fibrous (scar-forming) hepatitis and perihepatitis
Scoring	Partial condemnation
Comments	Fibrous healing of hepatic abscesses

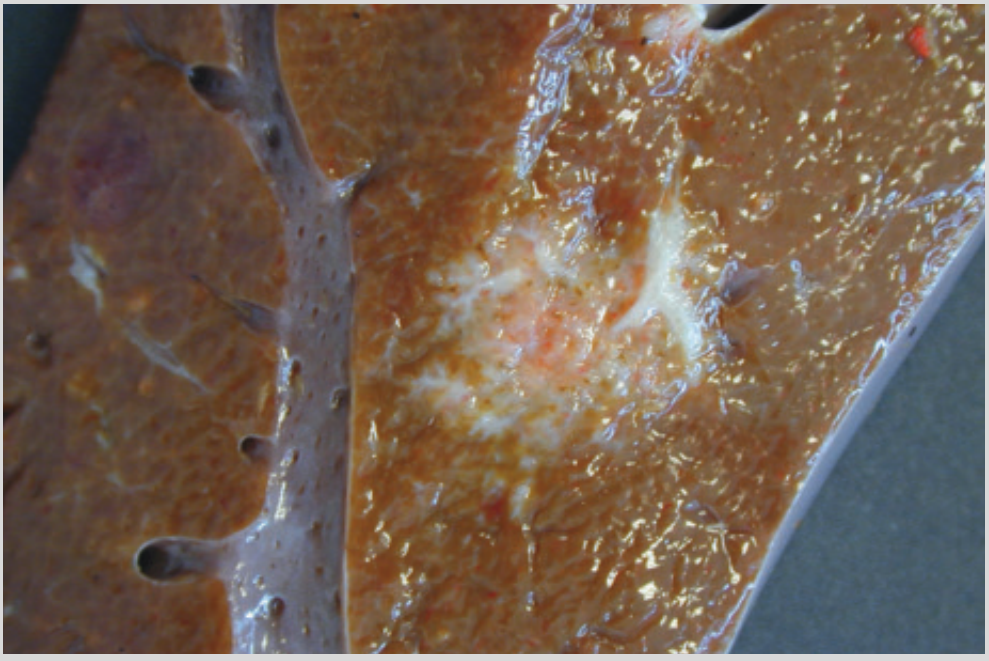
Vet-ebooks.com

9.29



Animal species/Organ	Cattle/Liver
Lesion	Chronic, focal, fibrous (scar-forming) hepatitis and perihepatitis
Scoring	Partial condemnation
Comments	Fibrous healing of hepatic abscess

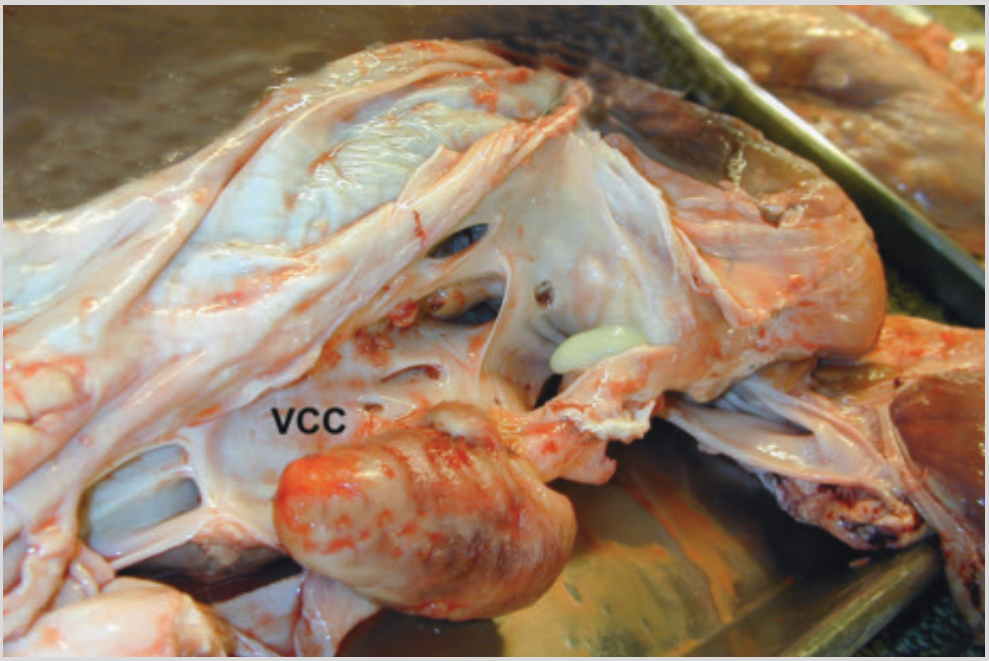
9.30



Animal species/Organ	Cattle/Liver
Lesion	Chronic, focal, fibrous (scar-forming) hepatitis
Scoring	Partial condemnation
Comments	Fibrous healing of hepatic abscess

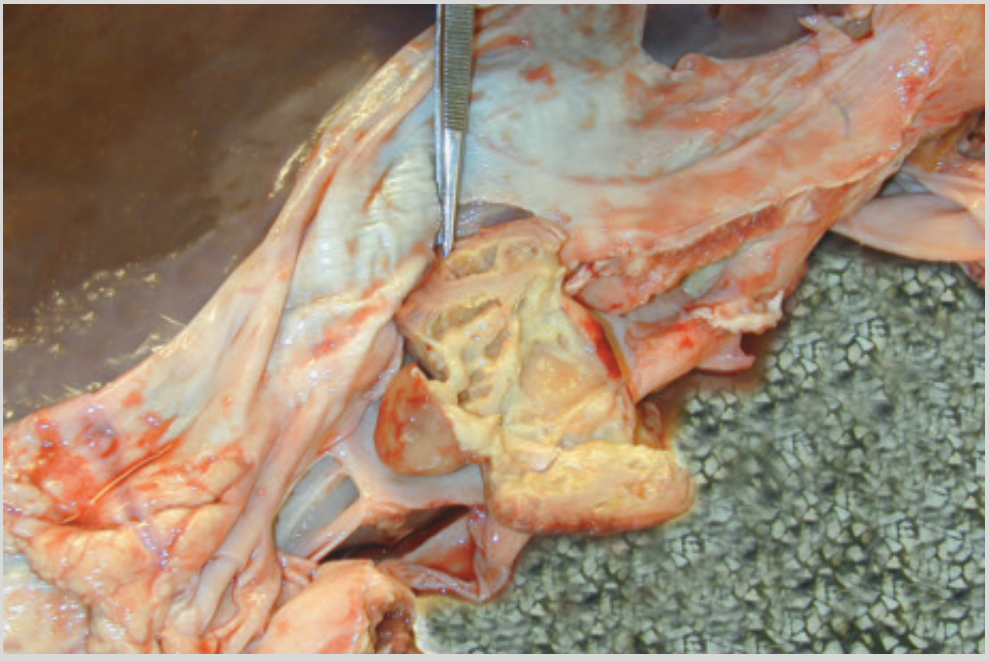
Vet-ebooks.com

9.31



Animal species/Organ	Cattle/Liver with opened caudal vena cava (VCC)
Lesion	Chronic, thrombotic endophlebitis
Scoring	Total condemnation
Comments	The thrombotic mass is dull on the surface

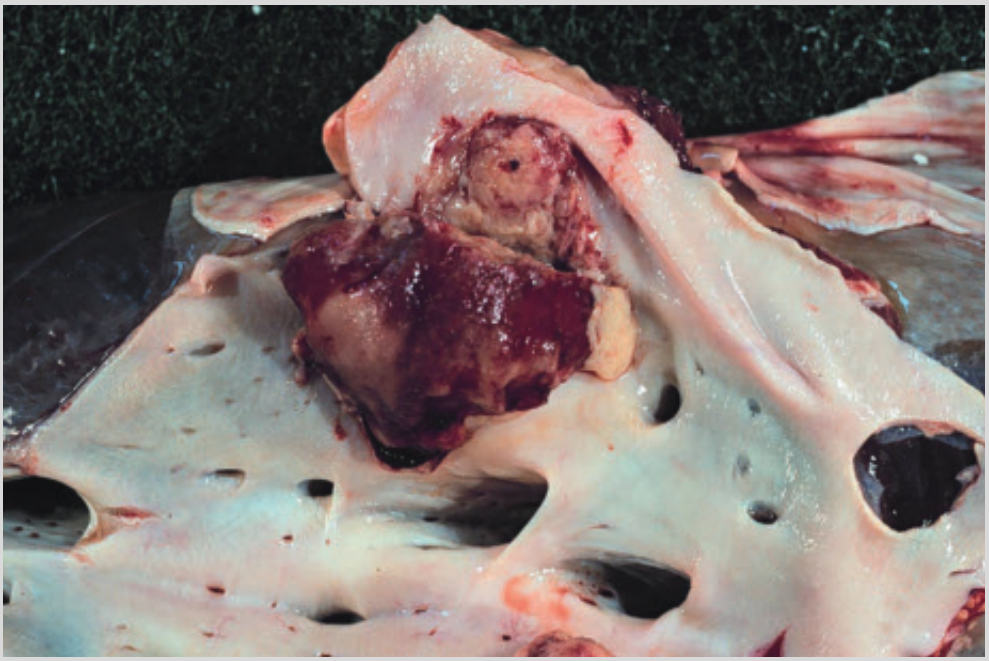
9.32



Animal species/Organ	Cattle/Liver with opened caudal vena cava
Lesion	Chronic, purulent and thrombotic endophlebitis
Scoring	Total condemnation
Comments	The thrombotic mass has been cut longitudinally

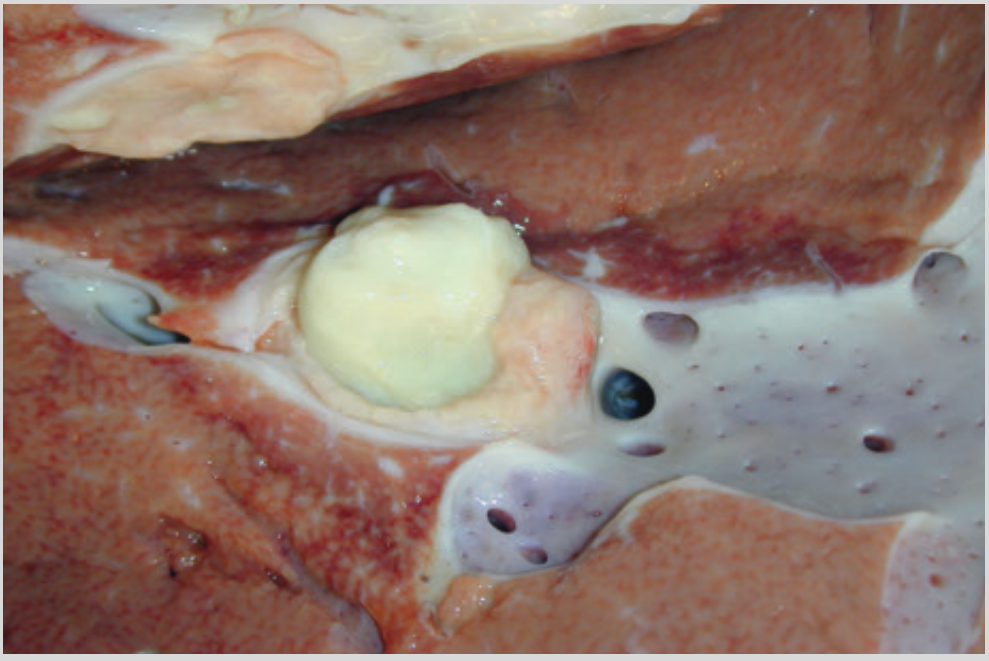
Vet-ebooks.com

9.33



Animal species/Organ	Cattle/Liver with opened caudal vena cava
Lesion	Chronic, thrombotic endophlebitis
Scoring	Total condemnation
Comments	Blood and lack of organisation can be seen on and in the thrombus

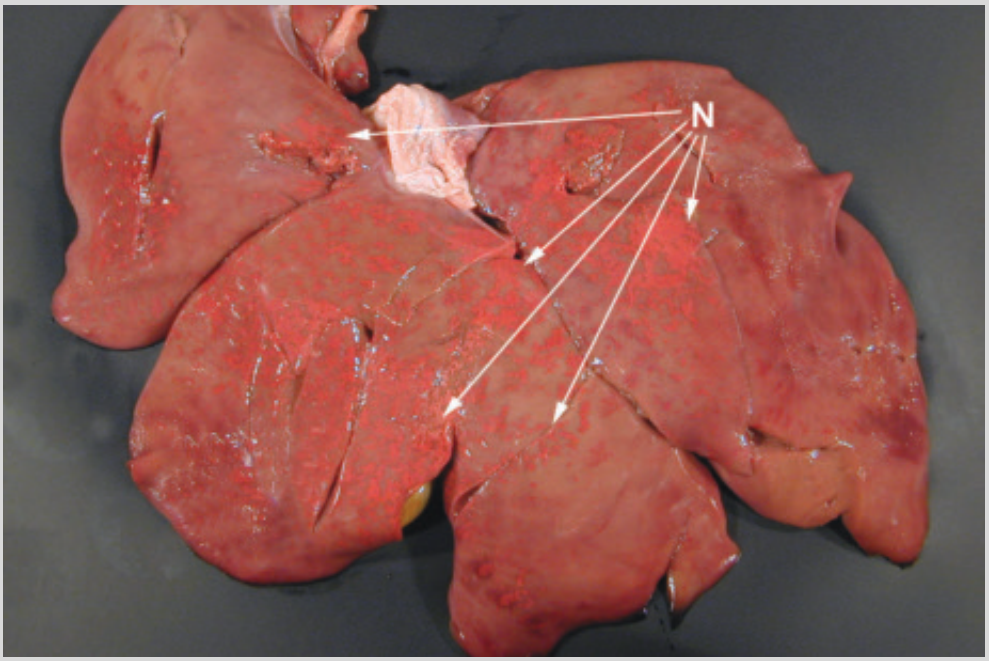
9.34



Animal species/Organ	Cattle/Liver with opened branch of the hepatic vein
Lesion	Chronic, thrombotic endophlebitis with abscess formation
Scoring	Total condemnation
Comments	If the lesion does not involve the blood vessel, only the liver must be condemned

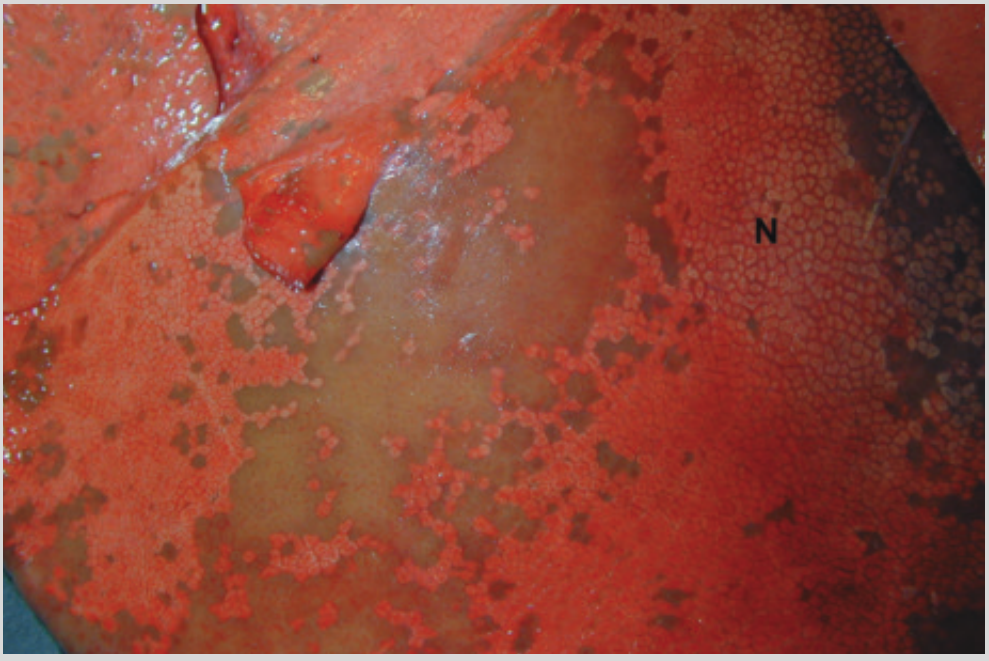
Vet-ebooks.com

9.35



Animal species/Organ	Pig/Liver
Lesion	Acute, multifocal massive liver necrosis (N)
Scoring	Total condemnation
Comments	There is a characteristic non-uniform distribution of the necrotic areas

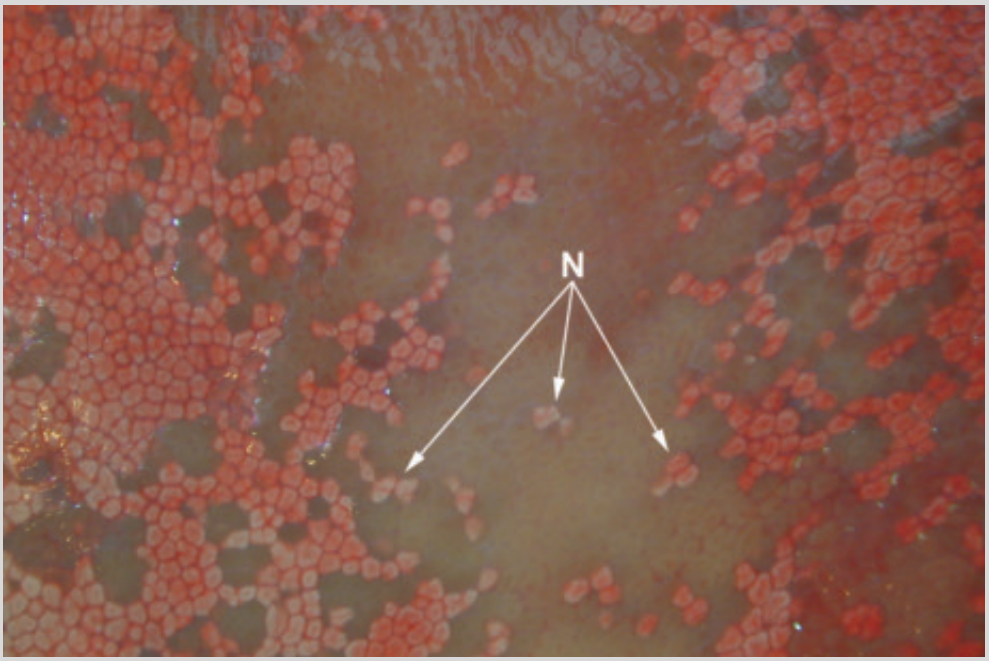
9.36



Animal species/Organ	Pig/Liver
Lesion	Acute, massive liver necrosis
Scoring	Total condemnation
Comments	Many of the necrotic lobules are contiguous (N)

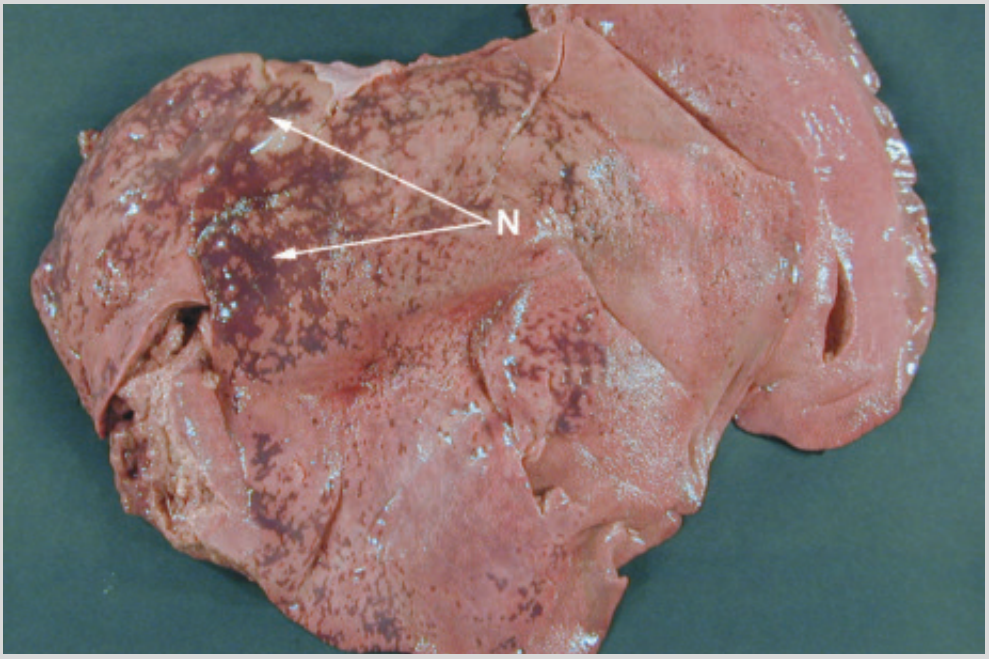
Vet-ebooks.com

9.37



Animal species/Organ	Pig/Liver
Lesion	Acute, massive liver necrosis
Scoring	Total condemnation
Comments	It can be clearly seen that the necroses cover entire lobules (N)

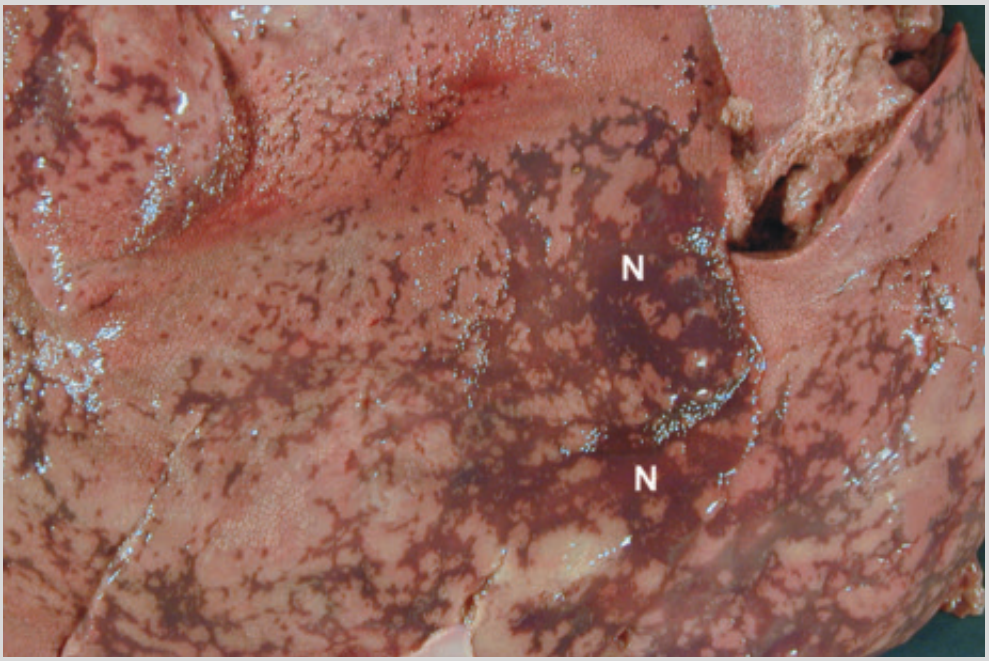
9.38



Animal species/Organ	Pig/Liver
Lesion	Acute, almost diffusely distributed, massive liver necrosis
Scoring	Total condemnation
Comments	Only a few areas are normal (N)

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9.39



Animal species/Organ	Pig/Liver
Lesion	Acute, massive liver necrosis
Scoring	Total condemnation
Comments	Only a few areas are normal (N)

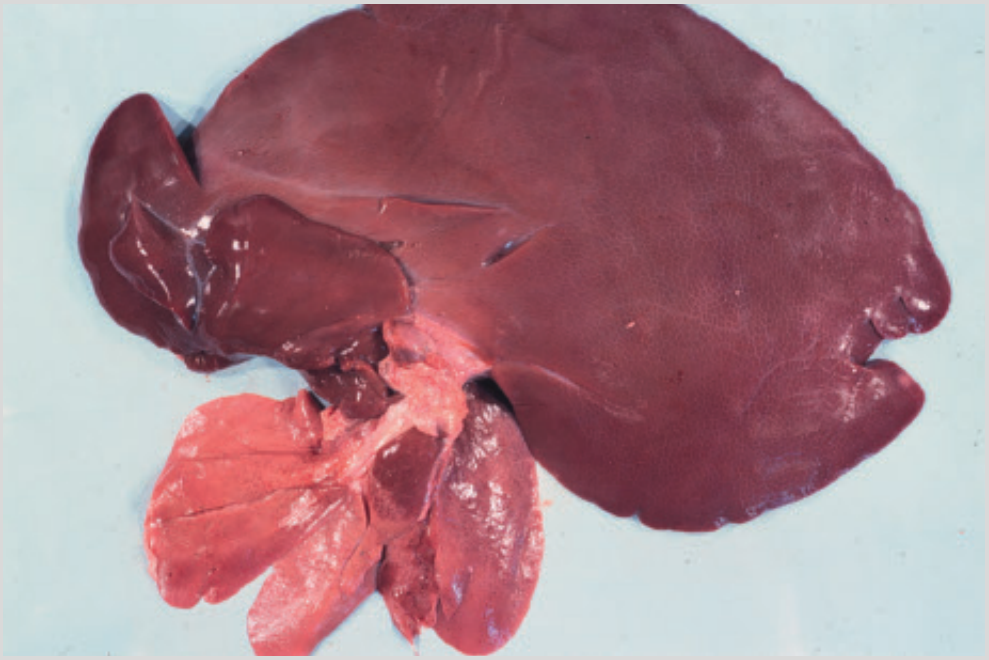
9.40



Animal species/Organ	Cattle/Liver
Lesion	Pressure atrophy of the left liver lobe
Scoring	Partial condemnation
Comments	The condition is generally due to ruminal atony

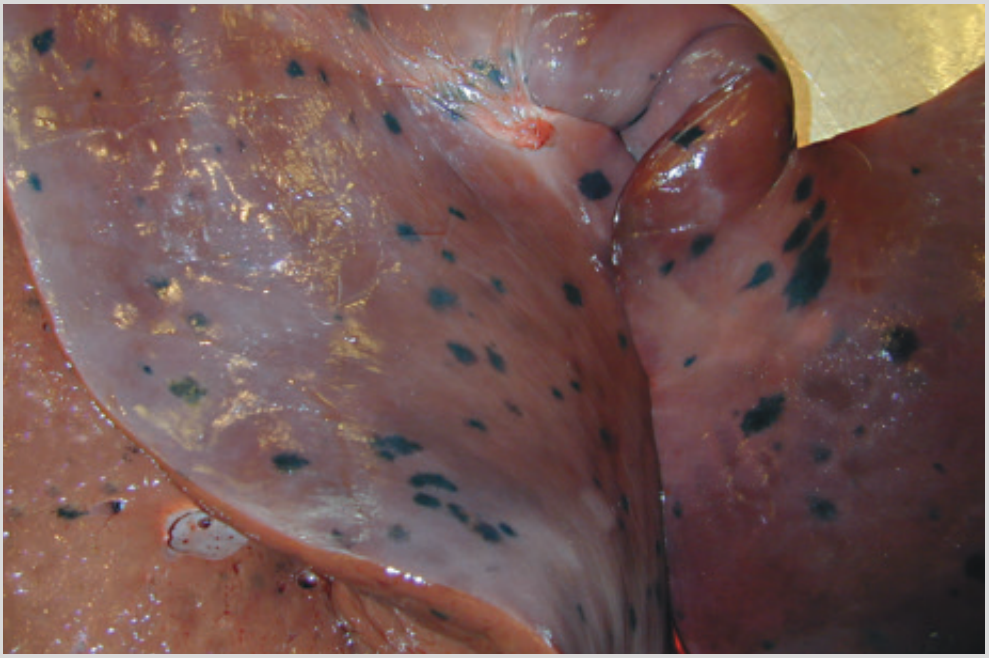
Vet-ebooks.com

9.41



Animal species/Organ	Pig/Liver
Lesion	Atrophy of the central liver lobe
Scoring	Partial condemnation
Comments	There is concomitant hypertrophy of the other liver lobes

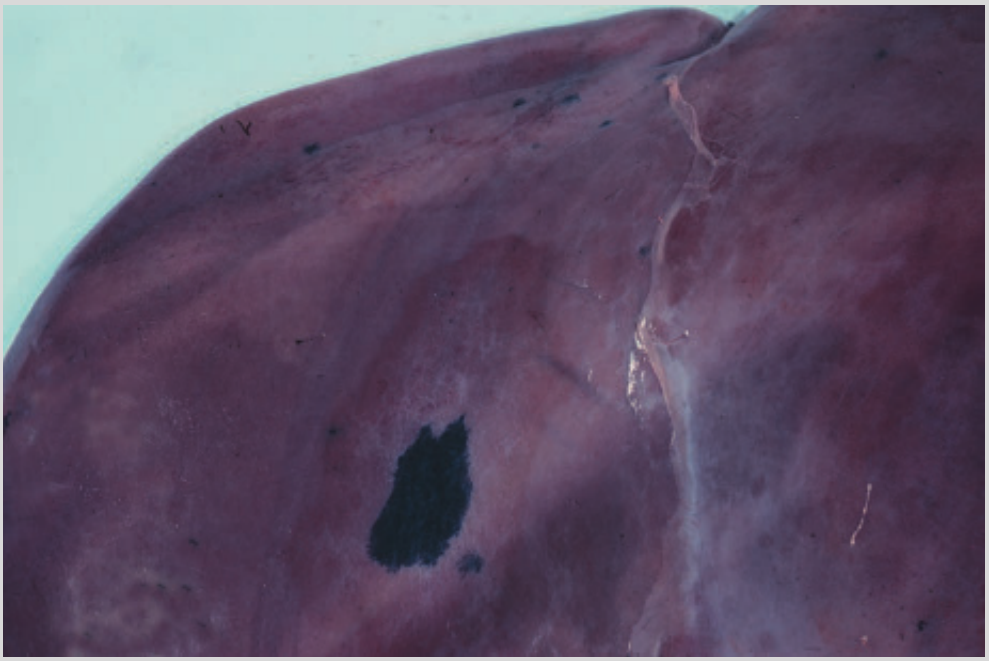
9.42



Animal species/Organ	Cattle/Liver
Lesion	Multifocal melanosis (melanosis maculosa)
Scoring	Partial condemnation
Comments	The changes disappear with age

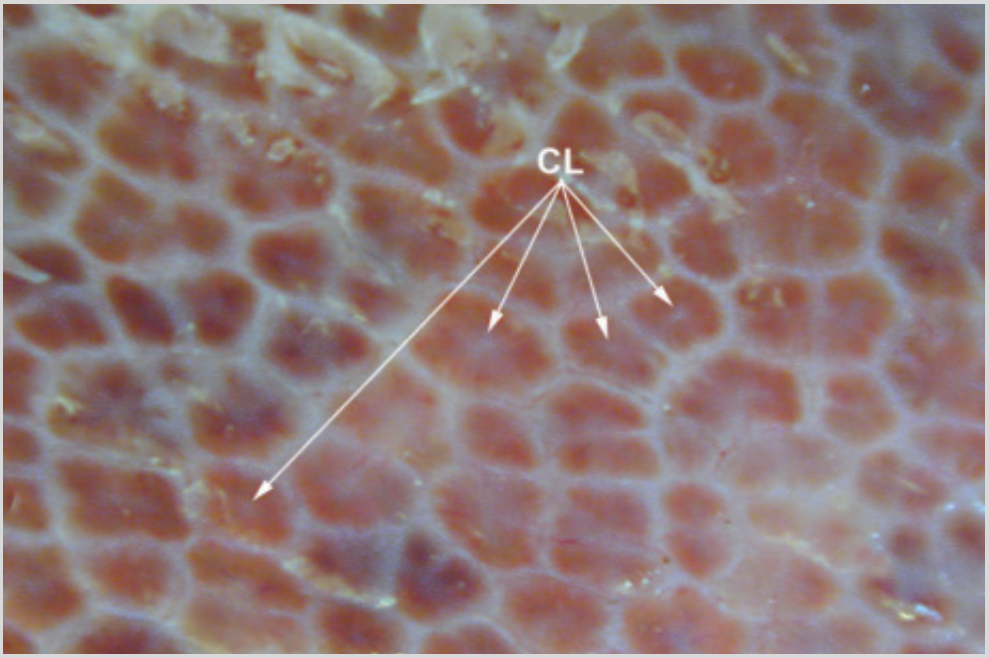
Vet-ebooks.com

9.43



Animal species/Organ	Cattle/Liver
Lesion	Focal melanosis (melanosis maculosa)
Scoring	Partial condemnation
Comments	The changes disappear with age

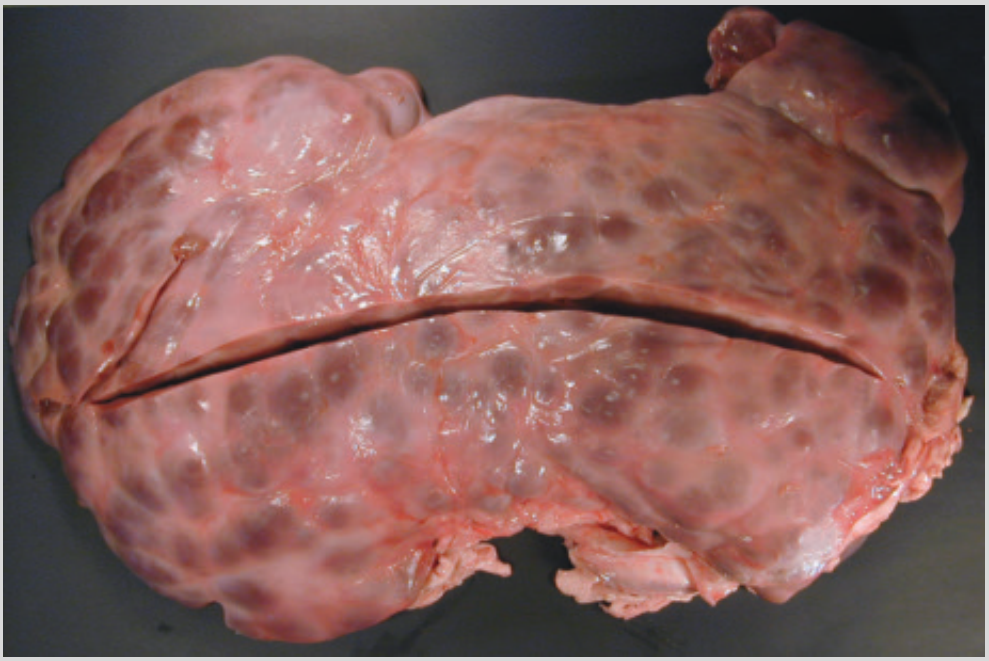
9.44



Animal species/Organ	Pig/Liver
Lesion	Chronic, interstitial and centrilobular (CL) fibrosis
Scoring	Partial condemnation
Comments	The changes are nonspecific with regard to the aetiology

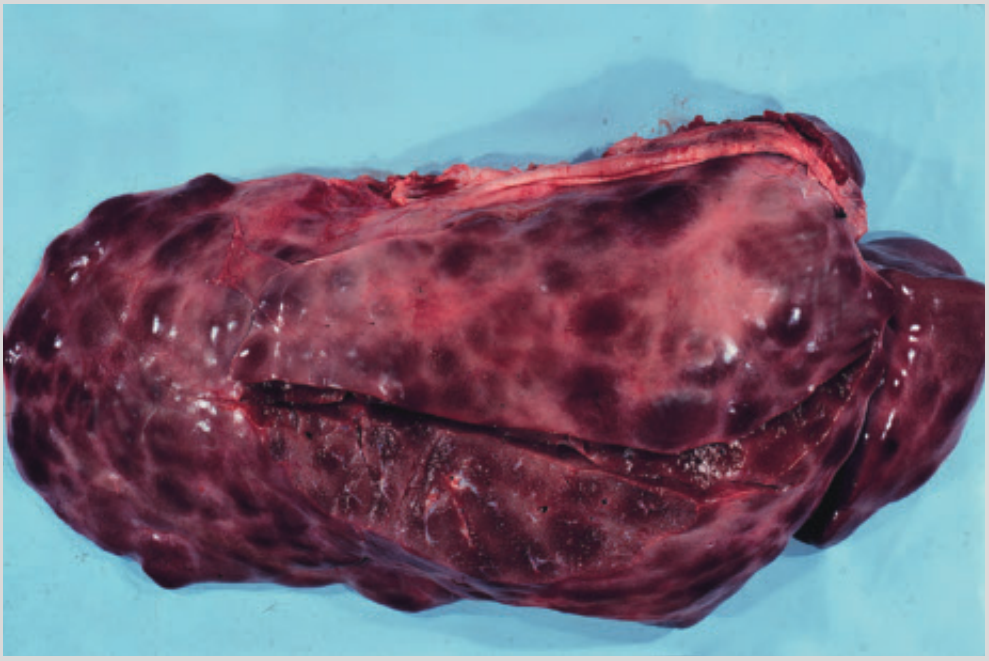
Vet-ebooks.com

9.45



Animal species/Organ	Cattle/Liver
Lesion	Widespread fibrosis (“postnecrotic scarring”) and nodular regeneration
Scoring	Partial condemnation
Comments	The presence of complications necessitates total condemnation

9.46



Animal species/Organ	Cattle/Liver
Lesion	Widespread fibrosis (“postnecrotic scarring”) and nodular regeneration
Scoring	Partial condemnation
Comments	The changes reflect repair of larger necroses

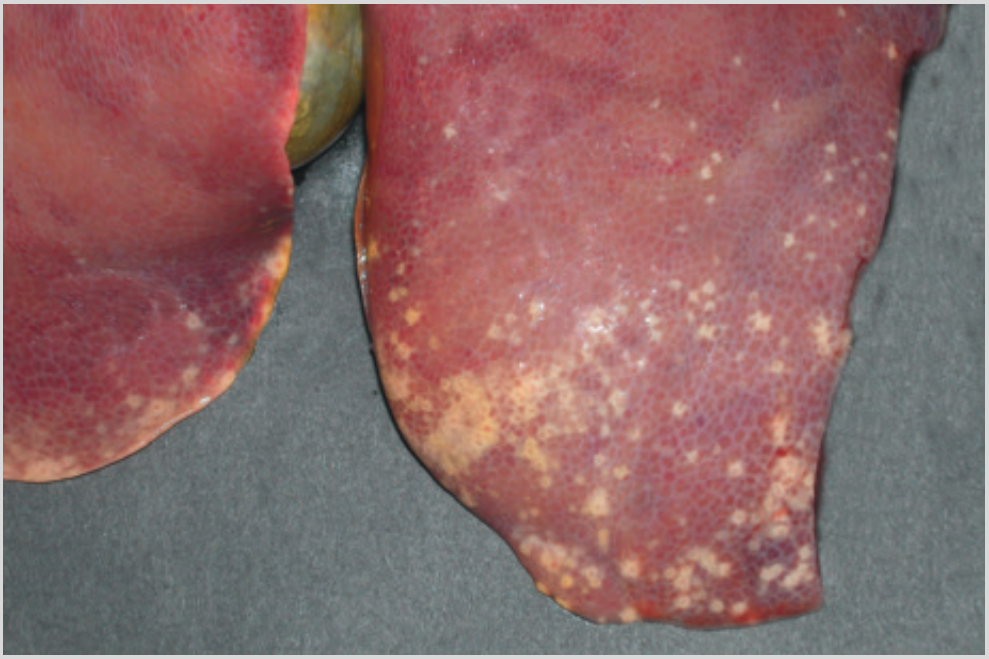
Vet-ebooks.com

9.47



Animal species/Organ	Cattle/Liver
Lesion	Widespread fibrosis (“postnecrotic scarring”)
Scoring	Partial condemnation
Comments	The changes reflect repair of larger necroses

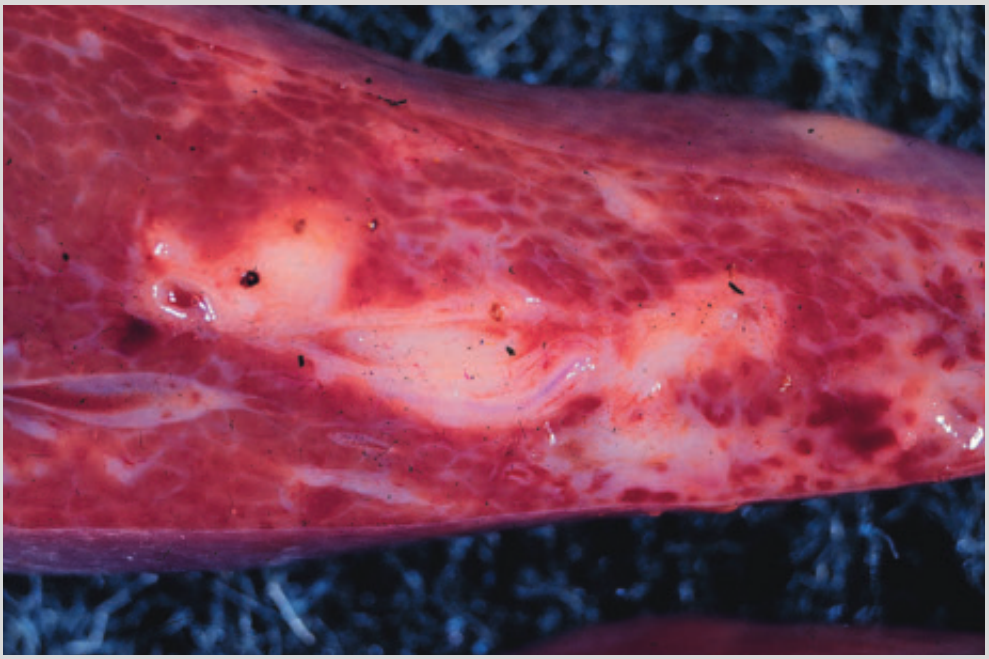
9.48



Animal species/Organ	Pig/Liver
Lesion	Localised lobular fibrosis
Scoring	Partial condemnation
Comments	Probably reflects repair of lobular necroses

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9.49



Animal species/Organ	Cattle/Liver
Lesion	Chronic, interstitial and peribiliar fibrosis
Scoring	Partial condemnation
Comments	Fibrosis associated with infection with *Fasciola hepatica*

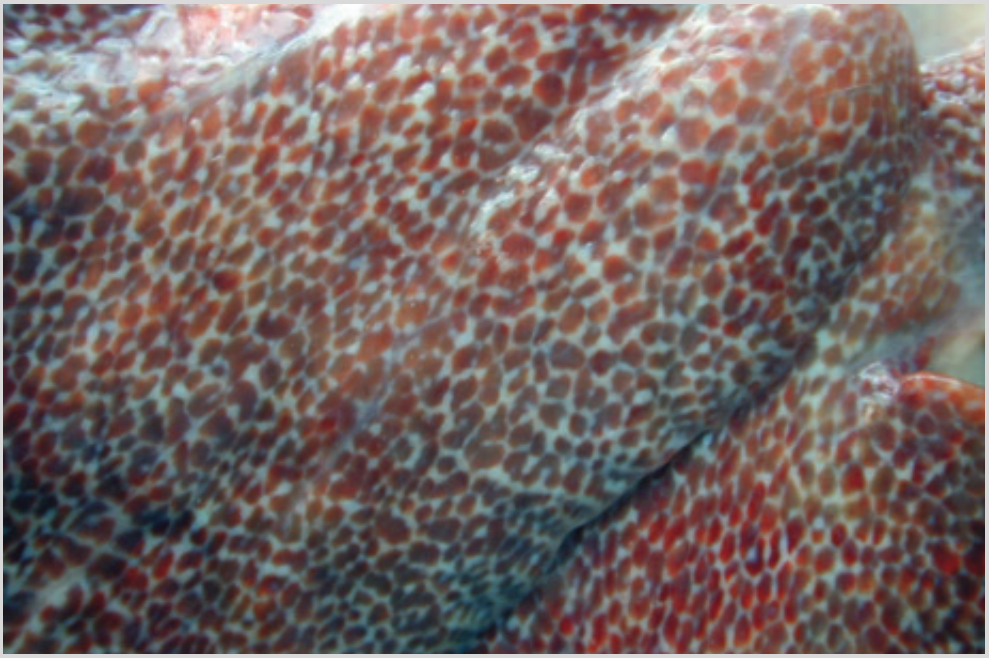
9.50



Animal species/Organ	Pig/Liver
Lesion	Chronic, diffuse, interstitial hepatitis
Scoring	Partial condemnation
Comments	The reaction is nonspecific with regard to the aetiology

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9.51



Animal species/Organ	Pig/Liver
Lesion	Chronic, diffuse, interstitial hepatitis
Scoring	Partial condemnation
Comments	The reaction is nonspecific with regard to the aetiology

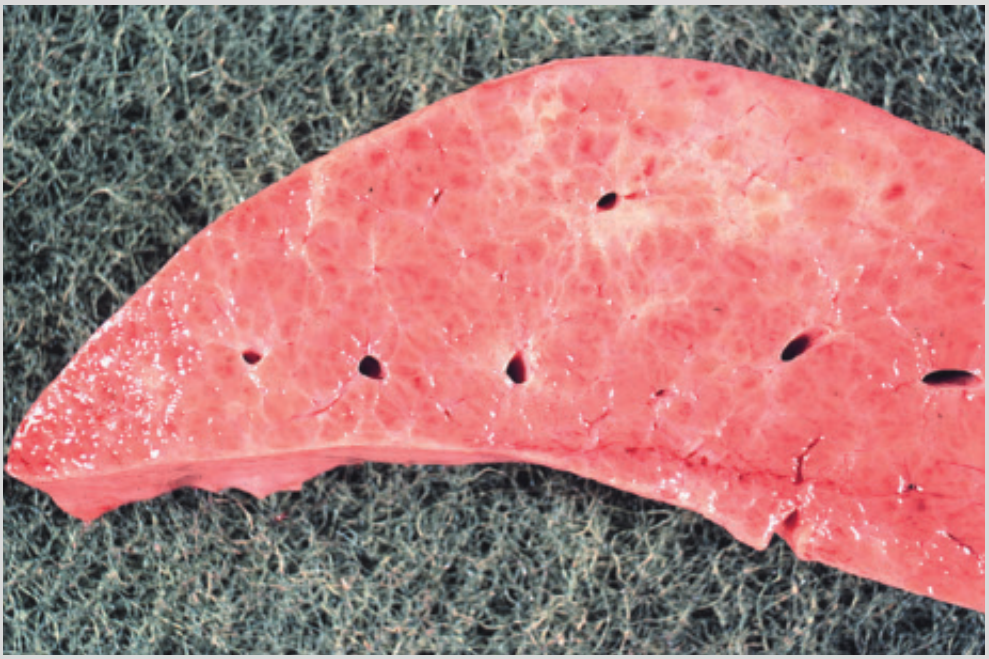
9.52



Animal species/Organ	Pig/Liver
Lesion	Cirrhosis
Scoring	Partial condemnation
Comments	Nonspecific “end-stage” condition with regard to the aetiology

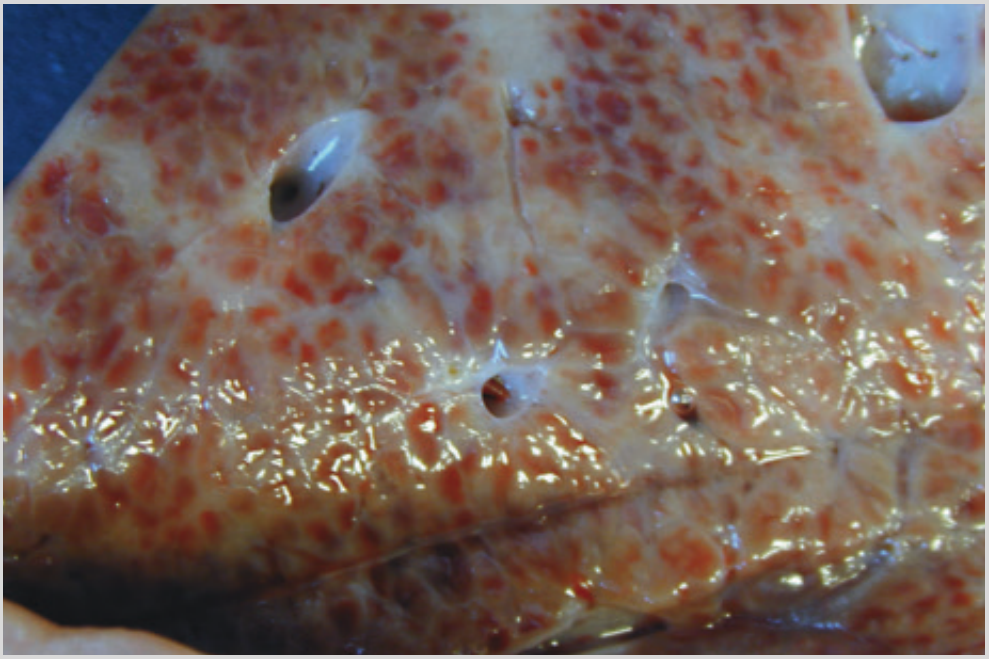
Vet-ebooks.com

9.53



Animal species/Organ	Pig/Liver
Lesion	Cirrhosis
Scoring	Partial condemnation
Comments	Nonspecific “end-stage” condition with regard to the aetiology

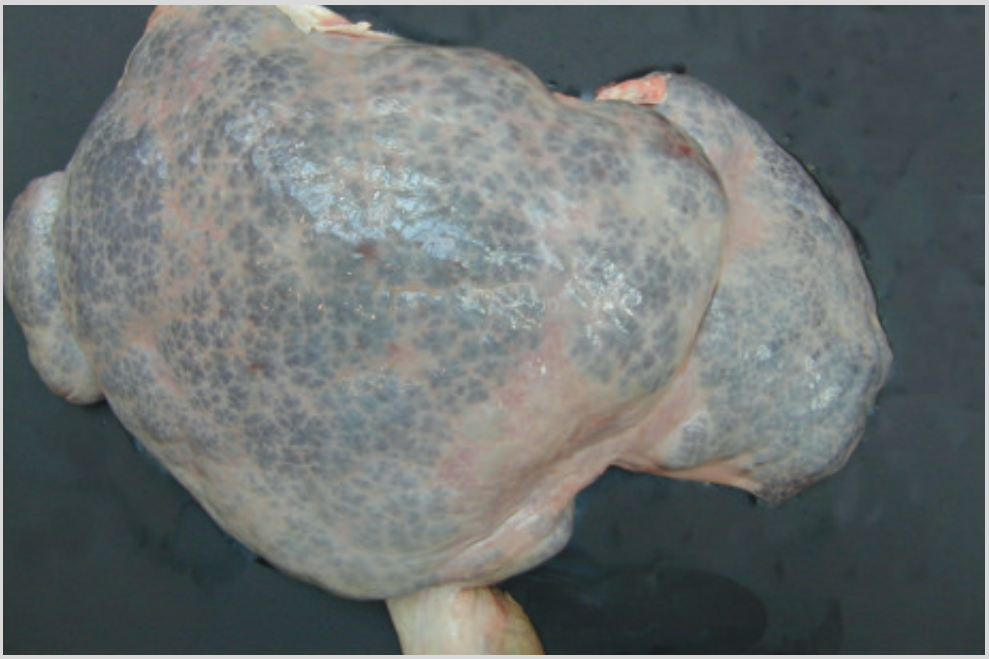
9.54



Animal species/Organ	Pig/Liver
Lesion	Cirrhosis
Scoring	Partial condemnation
Comments	Nonspecific “end-stage” condition with regard to the aetiology

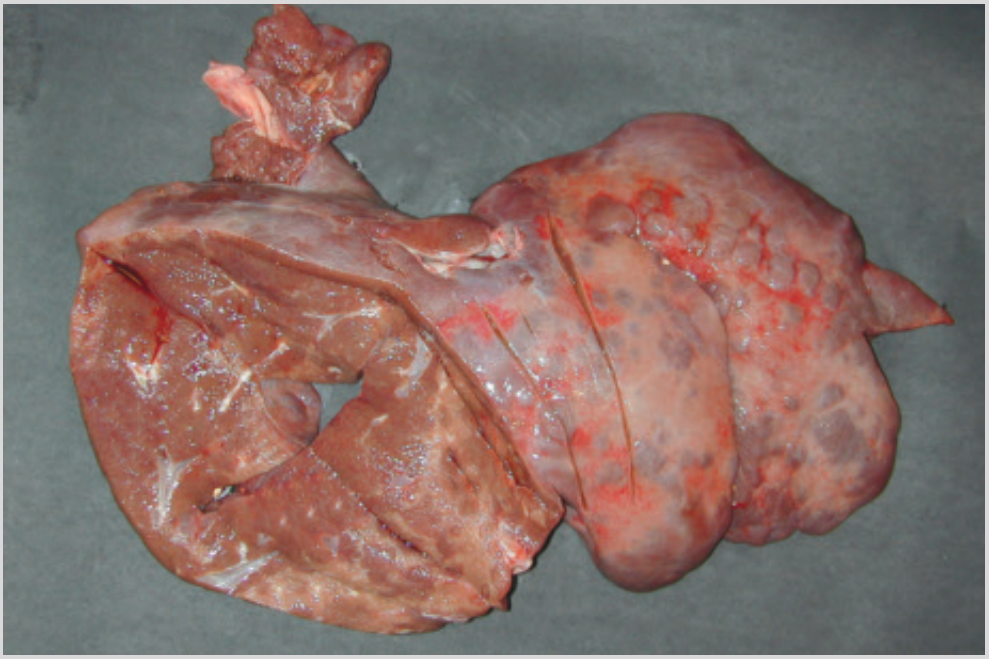
Vet-ebooks.com

9.55



Animal species/Organ	Cattle/Liver
Lesion	Cirrhosis
Scoring	Partial condemnation
Comments	Nonspecific “end-stage” condition with regard to the aetiology

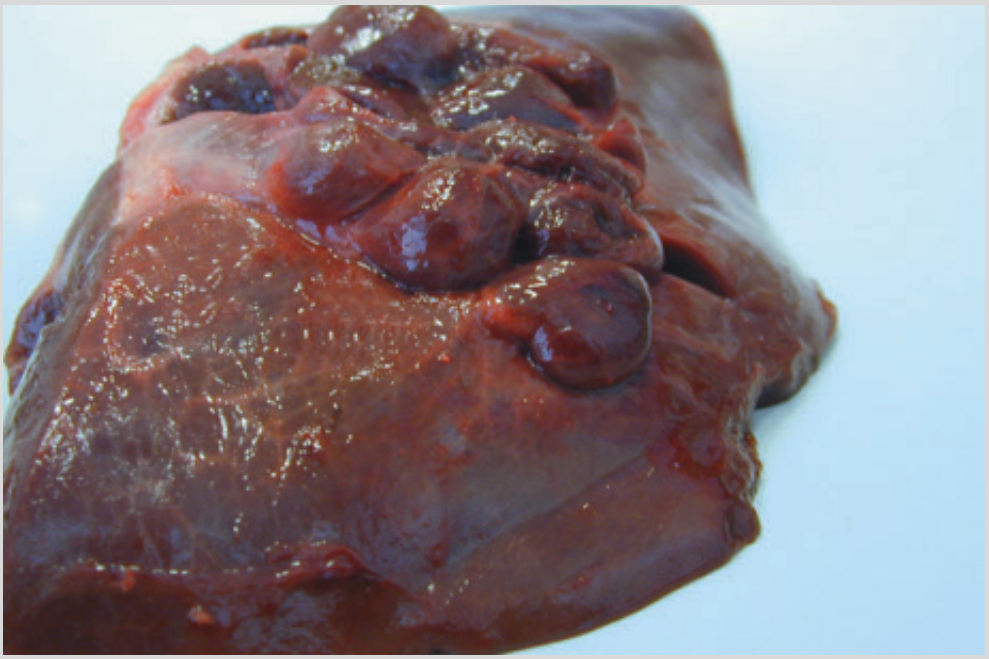
9.56



Animal species/Organ	Cattle/Liver
Lesion	Cirrhosis
Scoring	Partial condemnation
Comments	Nonspecific “end-stage” condition with regard to the aetiology

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9.57



Animal species/Organ	Cattle/Liver
Lesion	Cirrhosis
Scoring	Partial condemnation
Comments	Nonspecific “end-stage” condition with regard to the aetiology

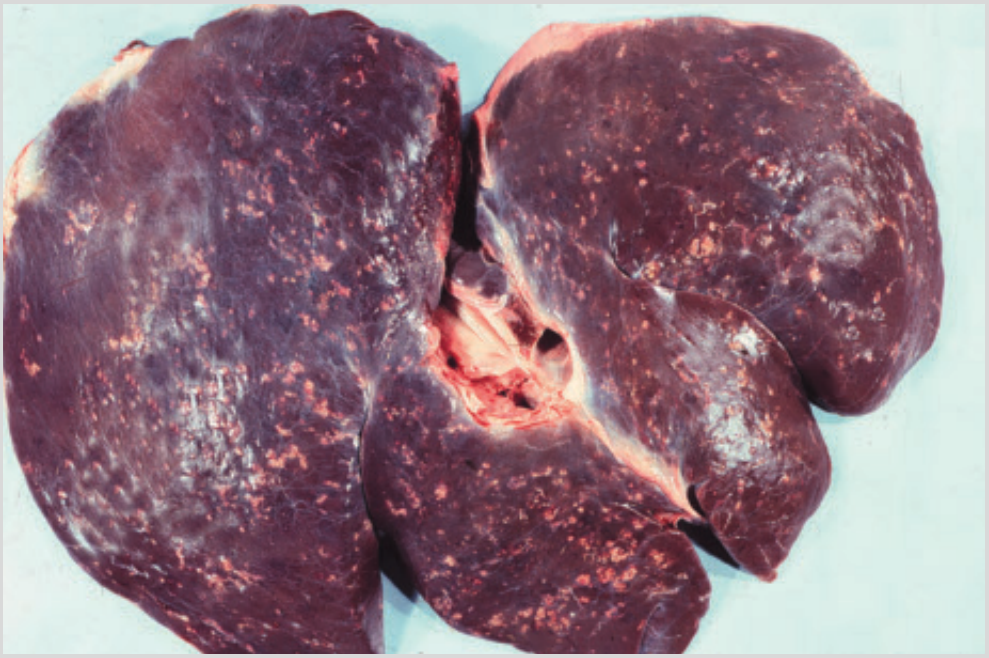
9.58



Animal species/Organ	Pig/Liver
Lesion	Chronic, diffuse, fibrous perihepatitis
Scoring	Partial condemnation
Comments	Due to fibrosis of the capsule, the liver has developed a “rounded shape”

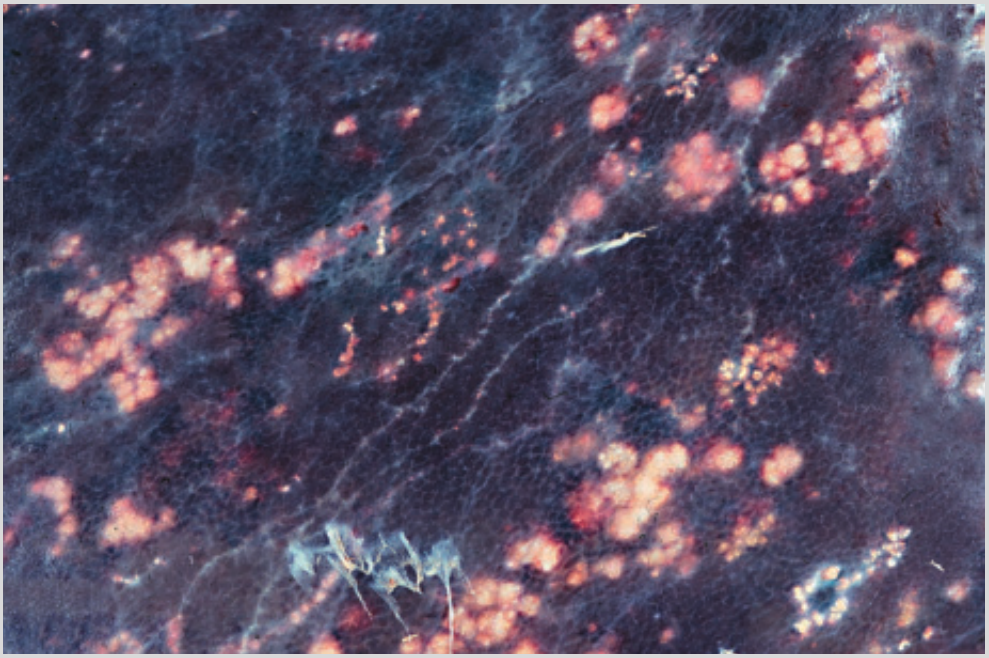
Vet-ebooks.com

9.59



Animal species/Organ	Horse/Lever
Lesion	Chronic, disseminated mineralised fibroses
Scoring	Partial condemnation
Comments	The lesions ("worm nodules") are typically located immediately below the liver capsule

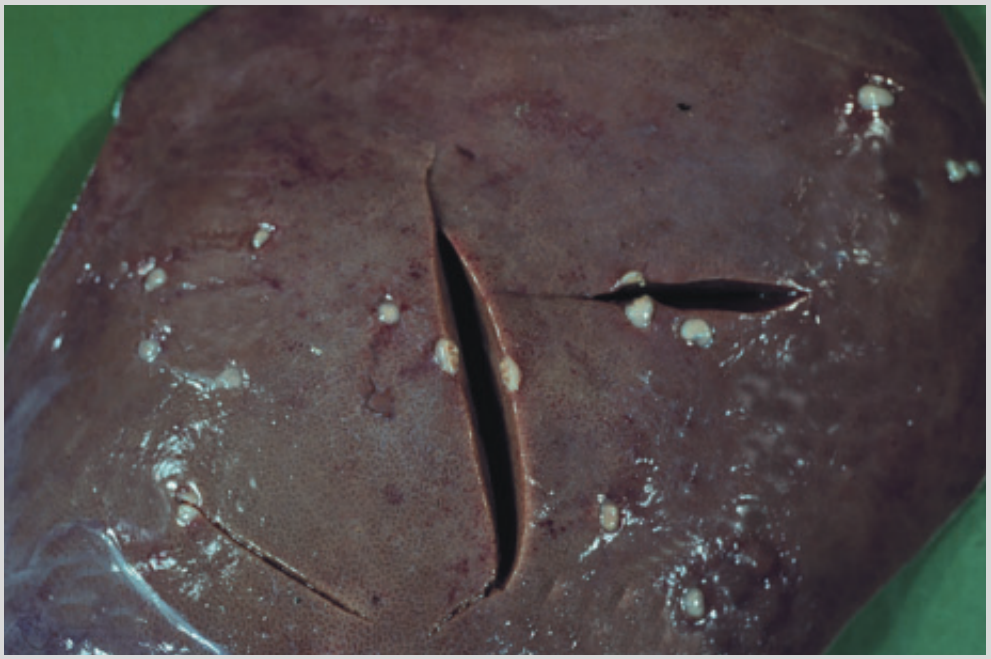
9.60



Animal species/Organ	Horse/Liver (close-up of 9.59)
Lesion	Chronic, disseminated mineralised fibroses
Scoring	Partial condemnation
Comments	The lesions ("worm nodules") are typically located immediately below the liver capsule

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9.61



Animal species/Organ	Sheep/Liver
Lesion	Chronic, multifocal mineralised fibroses
Scoring	Partial condemnation
Comments	The lesions ("worm nodules") are typically located immediately below the liver capsule

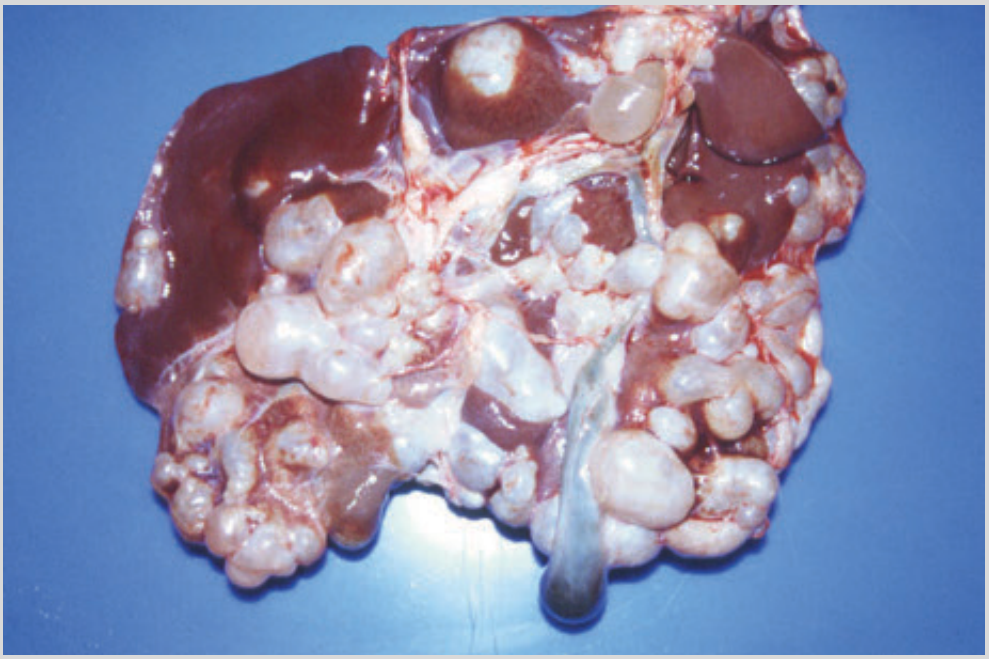
9.62



Animal species/Organ	Horse/Lever
Lesion	Chronic, focal, parasitic hepatitis (echinococcosis)
Scoring	Partial condemnation
Comments	Similar changes can be found in the lungs

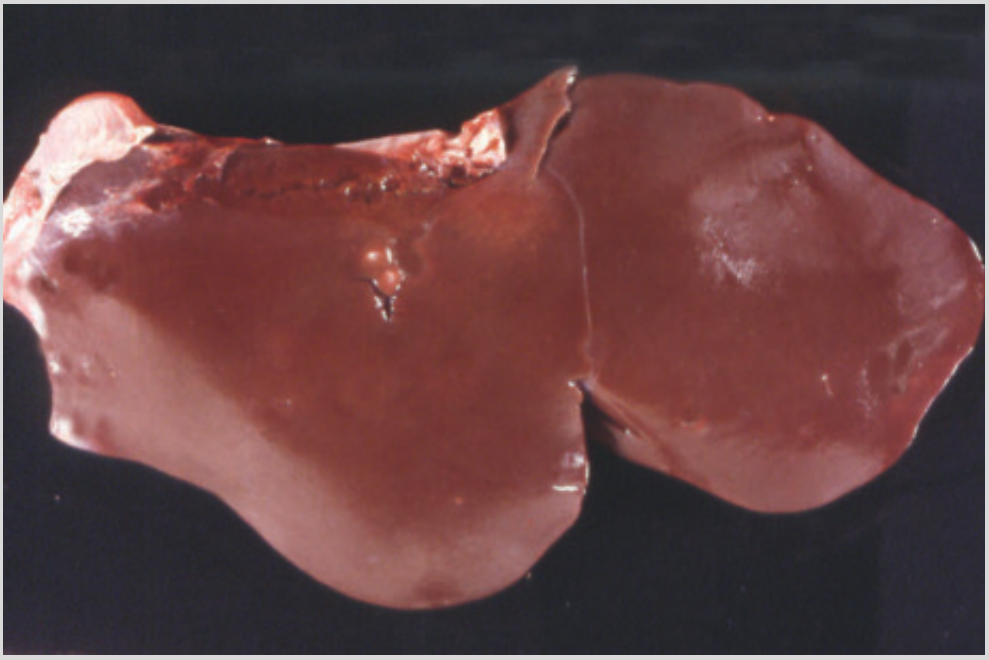
Vet-ebooks.com

9.63



Animal species/Organ	Sheep/Liver
Lesion	Chronic, multifocal, parasitic hepatitis and perihepatitis (echinococcosis)
Scoring	Partial condemnation
Comments	At differential diagnosis cysticercosis must be considered

9.64



Animal species/Organ	Sheep/Liver
Lesion	Chronic, multifocal, parasitic hepatitis and perihepatitis (echinococcosis)
Scoring	Partial condemnation
Comments	At differential diagnosis bile duct cysts must be considered

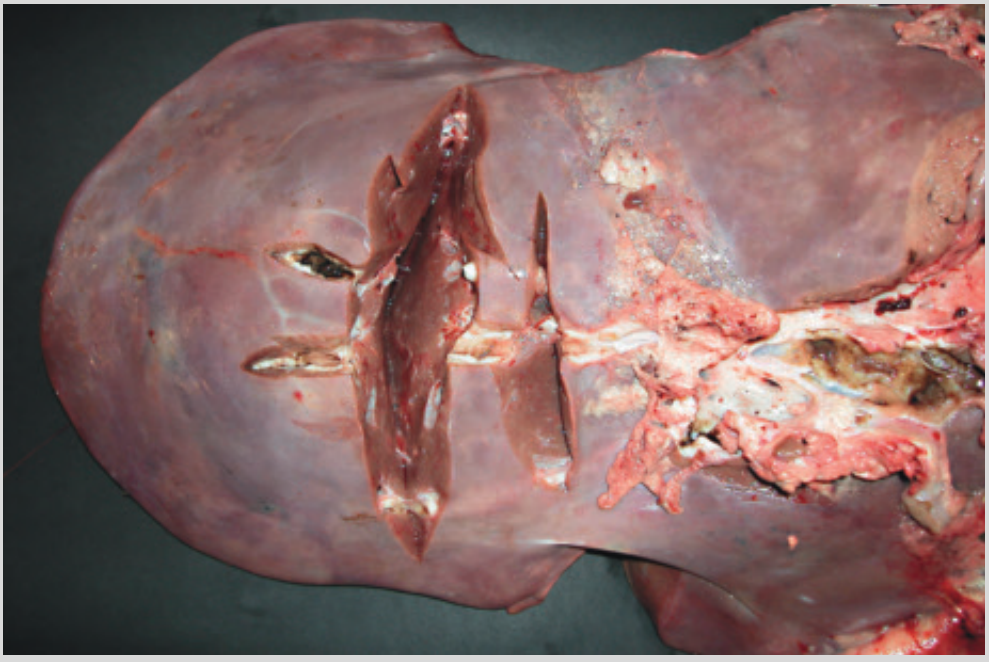
Vet-ebooks.com

9.65



Animal species/Organ	Sheep/Liver
Lesion	Acute, haemorrhagic and necrotising hepatitis
Scoring	Total condemnation
Comments	Status of acute infection with *Fasciola hepatica*

9.66



Animal species/Organ	Cattle/Liver
Lesion	Chronic, fibrotic cholangiohepatitis with ectasia of bile ducts
Scoring	Partial condemnation
Comments	Status of chronic infection with *Fasciola hepatica*

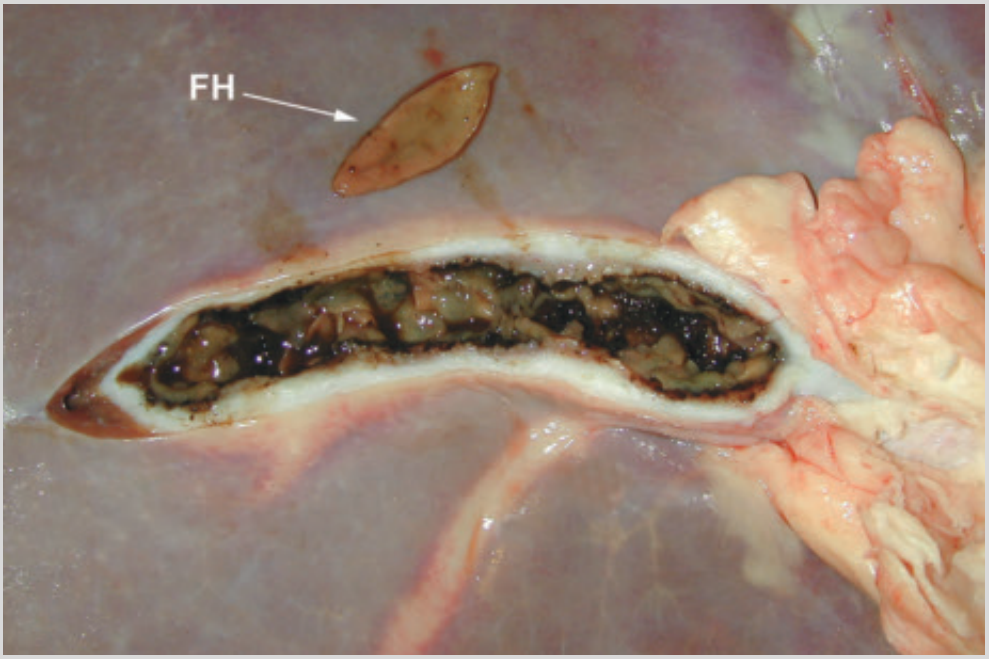
Vet-ebooks.com

9.67



Animal species/Organ	Cattle/Liver
Lesion	Chronic, fibrotic cholangiohepatitis with ectasia of bile ducts
Scoring	Partial condemnation
Comments	Status of chronic infection with *Fasciola hepatica*

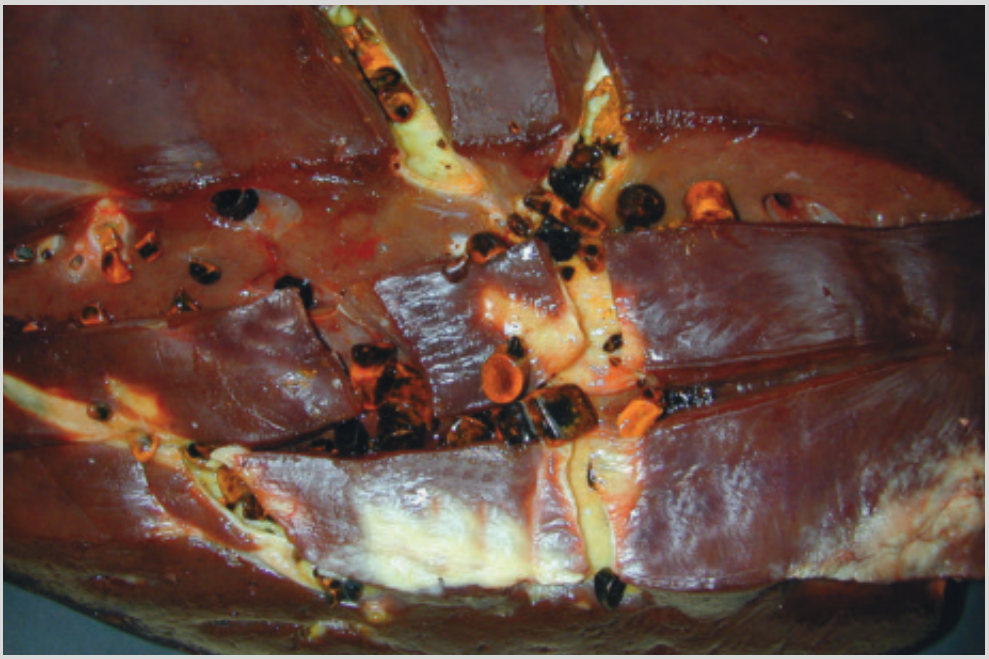
9.68



Animal species/Organ	Cattle/Liver
Lesion	Chronic, fibrotic cholangiohepatitis with ectasia of bile ducts
Scoring	Partial condemnation
Comments	Status of chronic infection with *Fasciola hepatica* (FH)

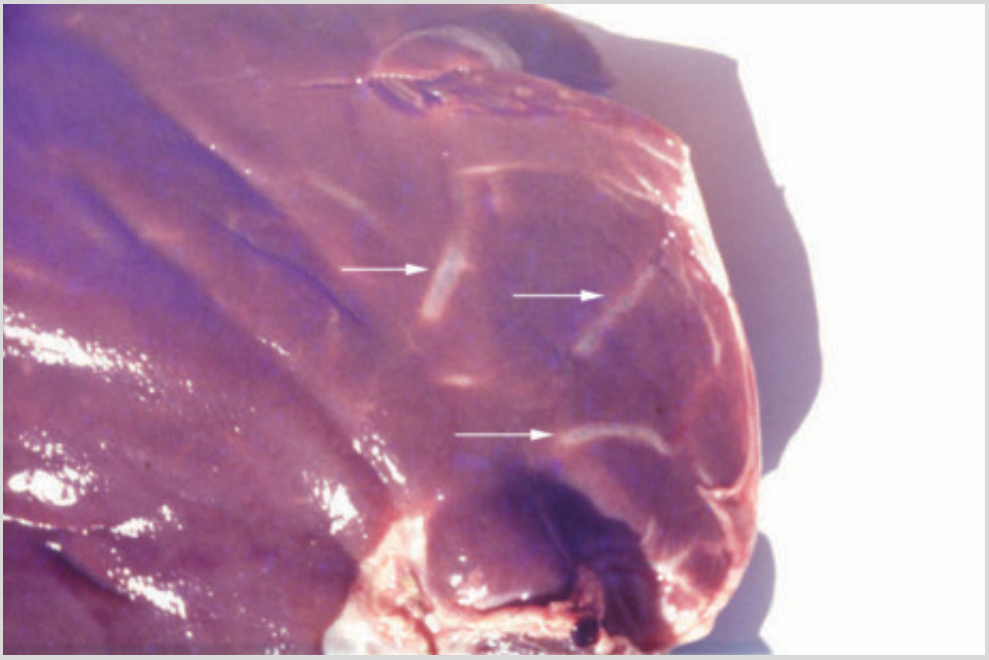
Vet-ebooks.com

9.69



Animal species/Organ	Cattle/Liver
Lesion	Chronic, fibrotic cholangiohepatitis with ectasia of bile ducts and jaundice
Scoring	Total condemnation
Comments	Status of chronic infection with *Fasciola hepatica*

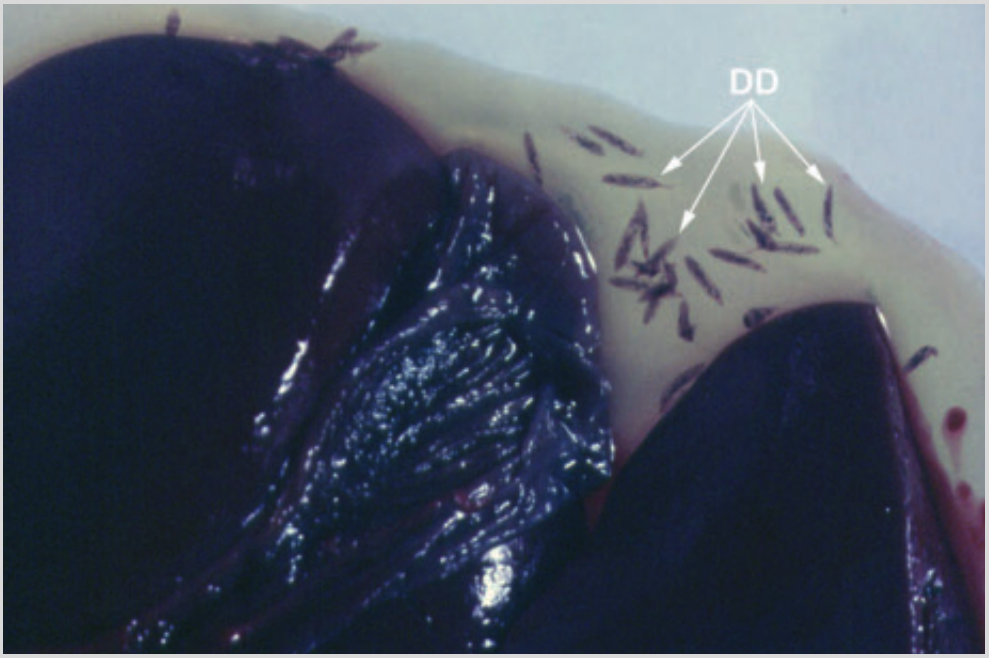
9.70



Animal species/Organ	Sheep/Liver
Lesion	Chronic, fibrotic cholangiohepatitis (→)
Scoring	Partial condemnation
Comments	Status of chronic infection with *Dicrocoelium dendriticum*

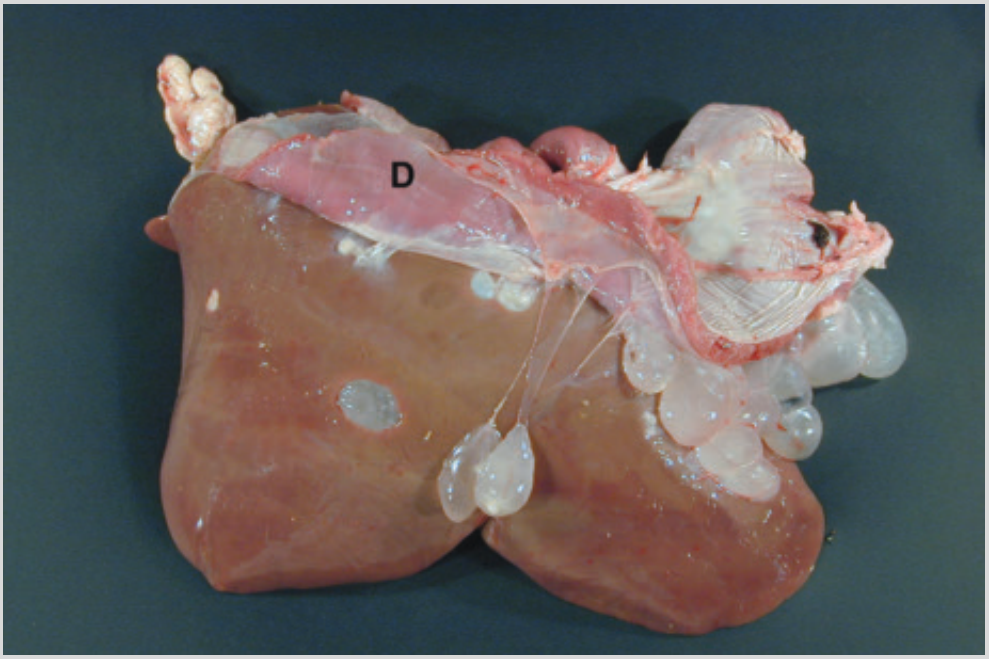
Vet-ebooks.com

9.71



Animal species/Organ	Sheep/Liver
Lesion	Chronic, fibrotic cholangiohepatitis (not in the picture)
Scoring	Partial condemnation
Comments	Infection with *Dicrocoelium dendriticum* (DD)

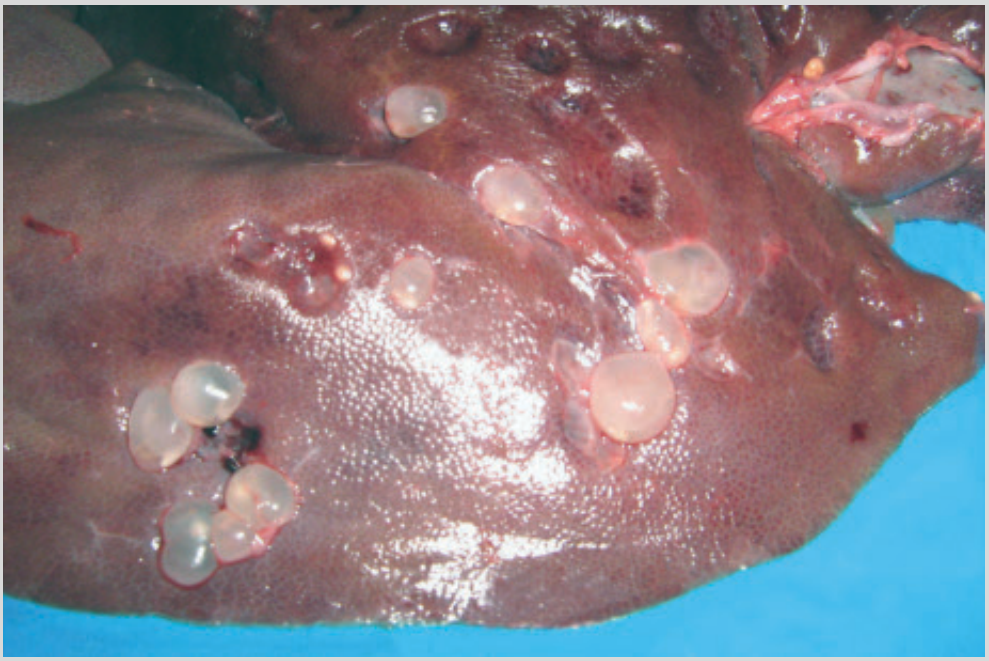
9.72



Animal species/Organ	Sheep/Liver and diaphragm (D)
Lesion	Chronic, peritoneal and perihepatic cysticercosis
Scoring	Partial condemnation
Comments	*Cysticercus tenuicollis* is never found intrahepatically

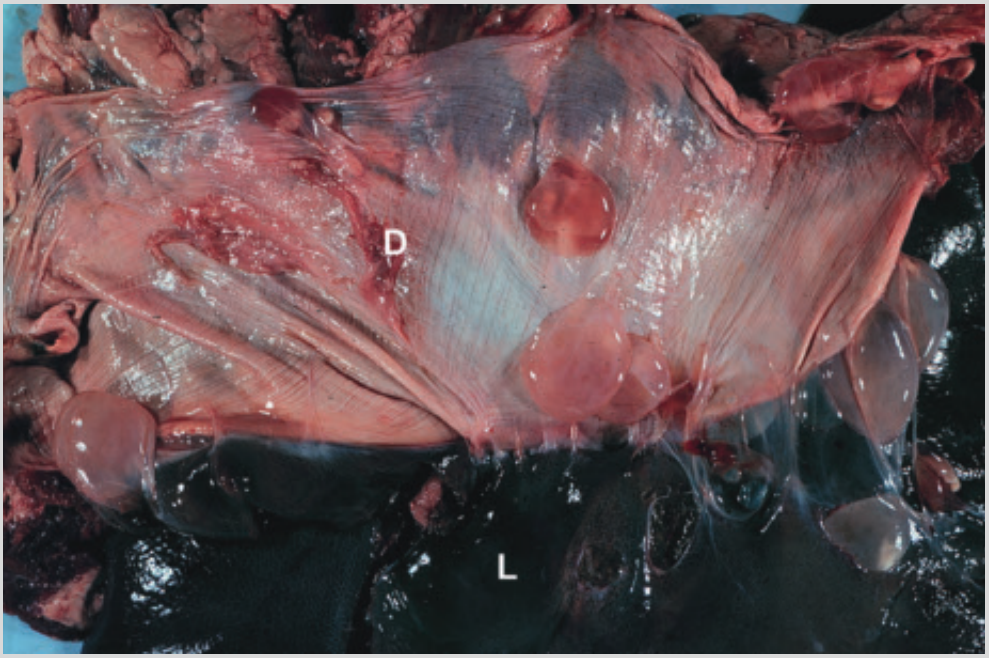
Vet-ebooks.com

9.73



Animal species/Organ	Pig/Liver
Lesion	Chronic, perihepatic cysticercosis
Scoring	Partial condemnation
Comments	*Cysticercus tenuicollis* is never found intrahepatically

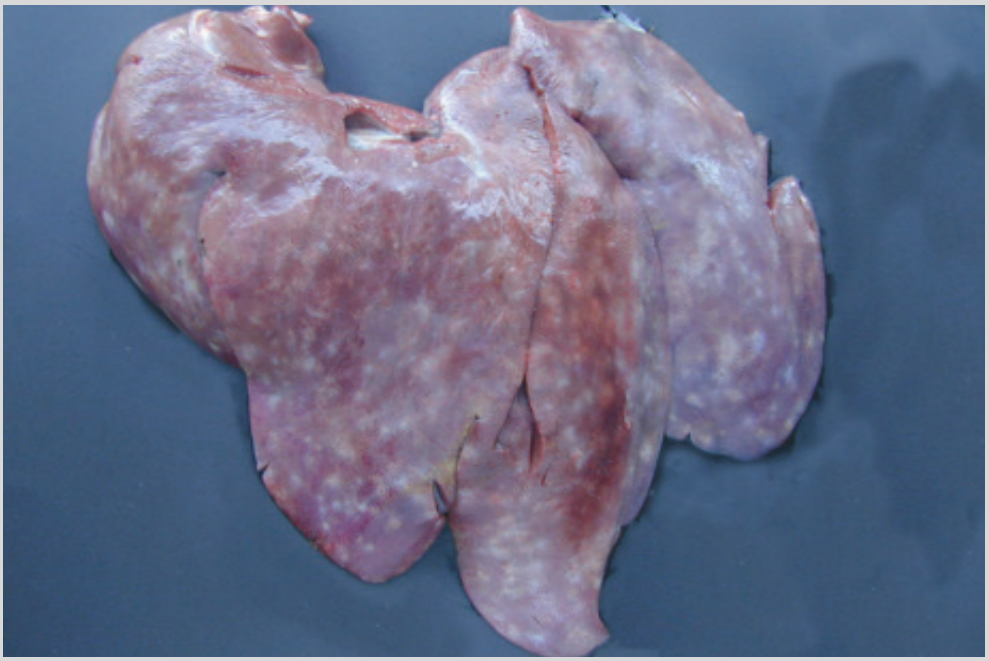
9.74



Animal species/Organ	Pig/Liver (L) and diaphragm (D)
Lesion	Chronic, peritoneal and perihepatic cysticercosis
Scoring	Partial condemnation
Comments	*Cysticercus tenuicollis* is never found intrahepatically

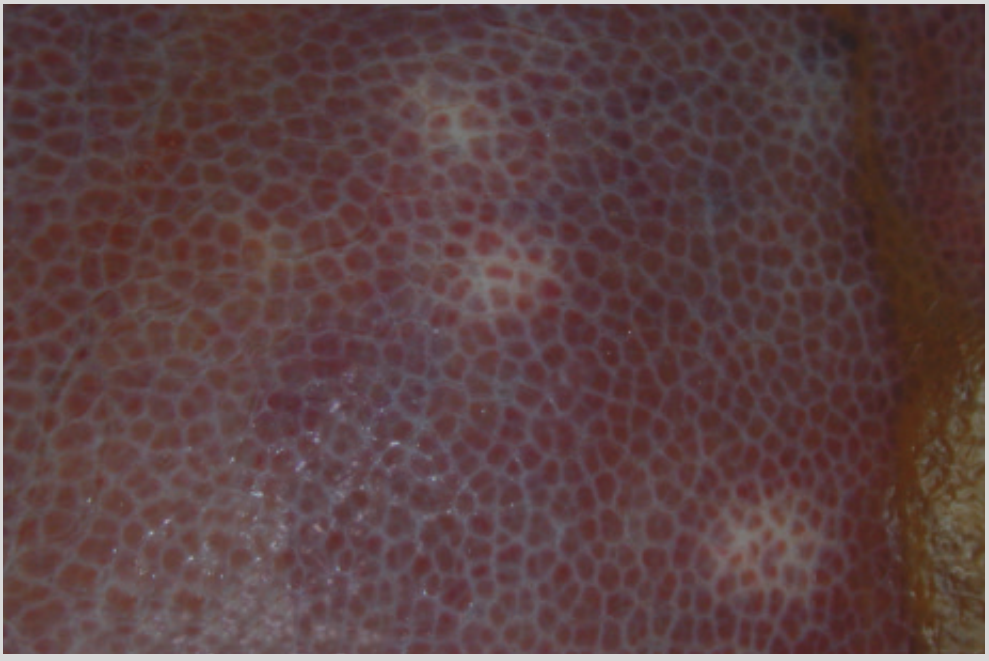
Vet-ebooks.com

9.75



Animal species/Organ	Pig/Liver
Lesion	Chronic, multifocal, fibrous, interstitial hepatitis
Scoring	Partial condemnation or approval for animal feed
Comments	The changes are a reaction to migration of *Ascaris suum* larvae

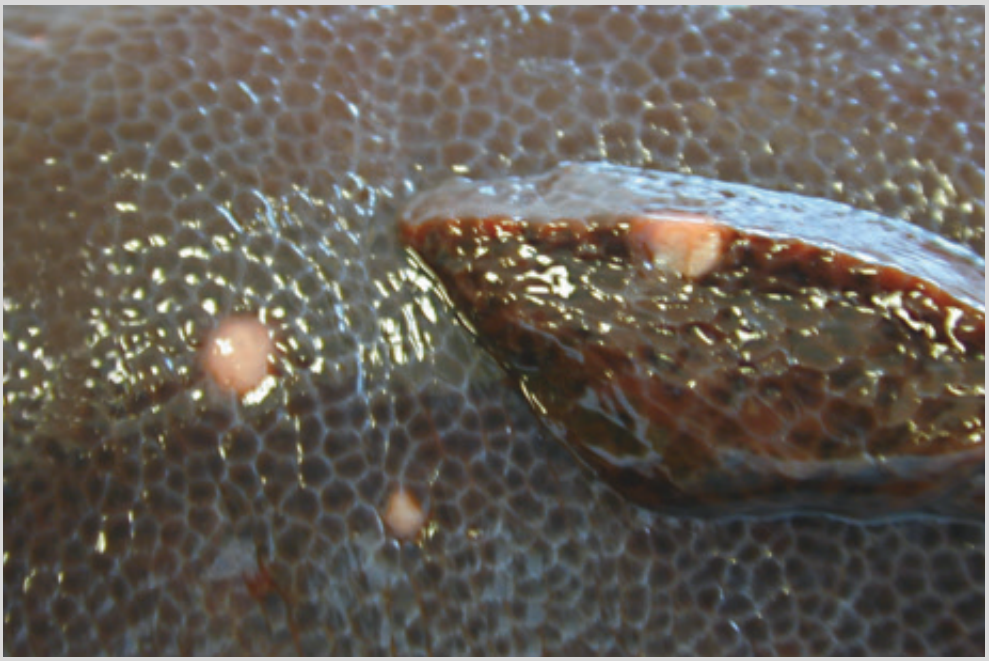
9.76



Animal species/Organ	Pig/Liver
Lesion	Chronic, multifocal, fibrous, interstitial hepatitis
Scoring	Partial condemnation or approval for animal feed
Comments	The changes are a reaction to migration of *Ascaris suum* larvae

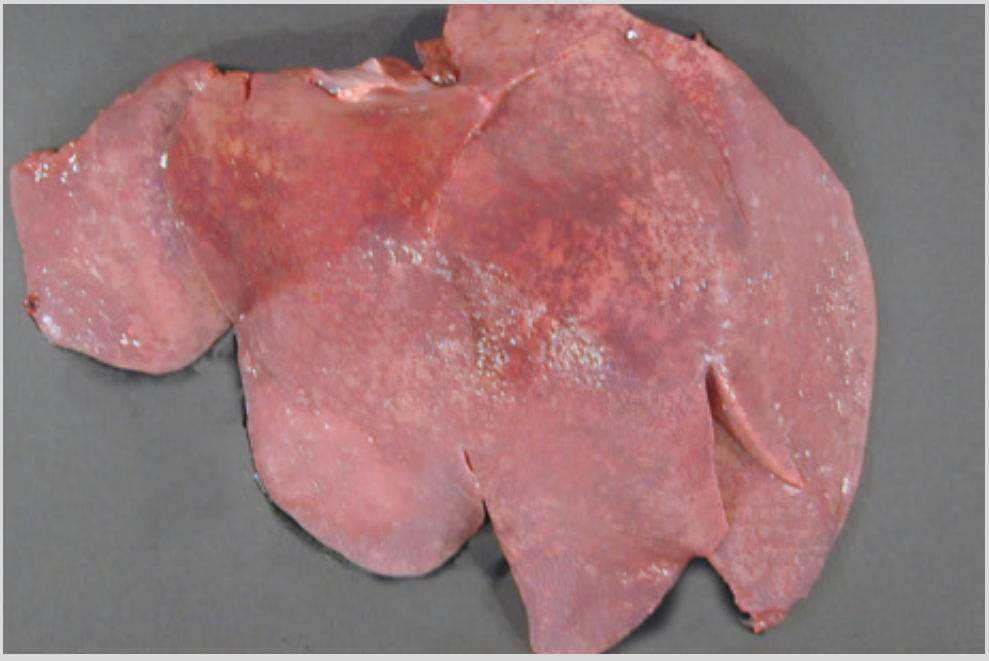
Vet-ebooks.com

9.77



Animal species/Organ	Pig/Liver
Lesion	Lymphadenopathies
Scoring	Partial condemnation or approval for animal feed
Comments	The changes are a reaction to migration of *Ascaris suum* larvae

9.78



Animal species/Organ	Pig/Liver
Lesion	Chronic, disseminated, granulomatous hepatitis
Scoring	Partial condemnation if exclusively hepatic localisation
Comments	The changes are typical for infection with *Mycobacterium avium* subsp. *avium*

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9.79



Animal species/Organ	Pig/Liver
Lesion	Chronic, disseminated, granulomatous hepatitis and lymphadenitis
Scoring	Partial condemnation if exclusively hepatic localisation
Comments	The changes are typical for infection with *Mycobacterium avium* subsp. *avium*

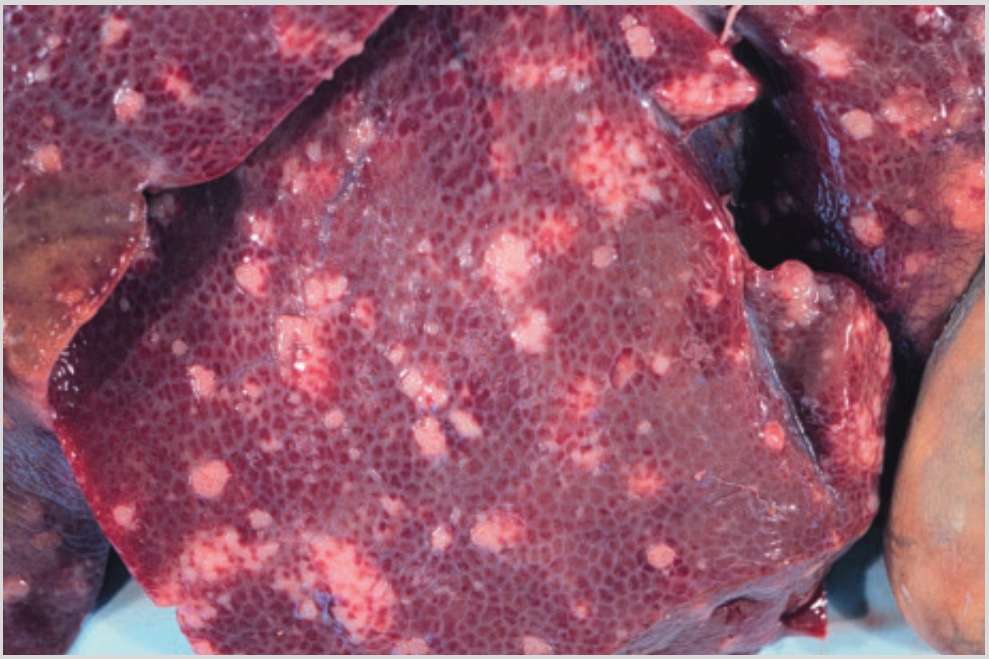
9.80



Animal species/Organ	Pig/Liver
Lesion	Chronic, disseminated, granulomatous hepatitis
Scoring	Partial condemnation if exclusively hepatic localisation
Comments	The changes are typical for infection with *Mycobacterium avium* subsp. *avium*

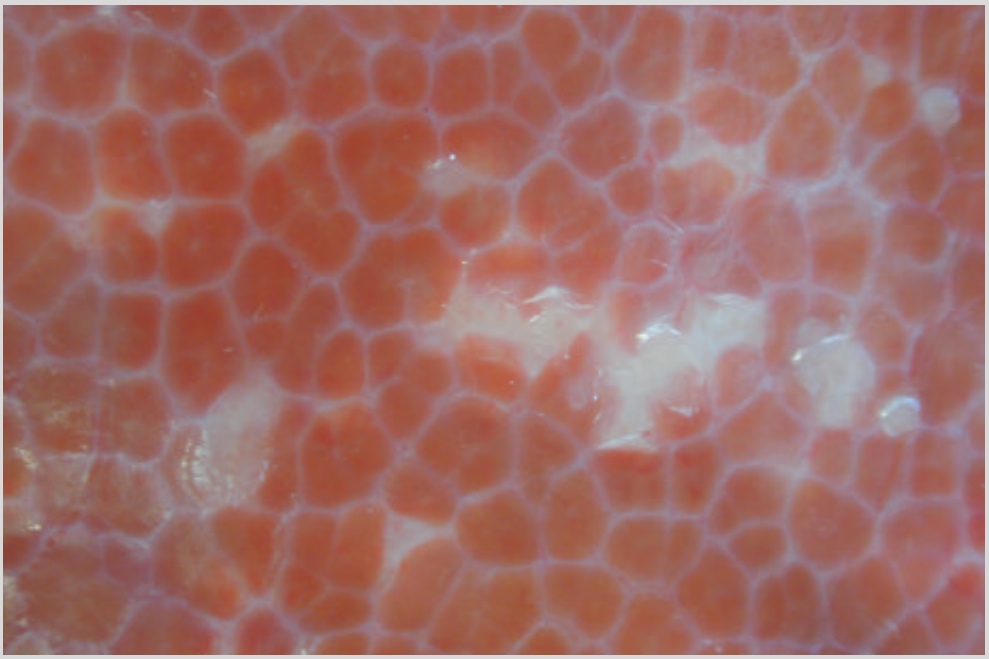
Vet-ebooks.com

9.81



Animal species/Organ	Pig/Liver
Lesion	Chronic, disseminated, granulomatous hepatitis
Scoring	Partial condemnation if exclusively hepatic localisation
Comments	The changes are typical for infection with *Mycobacterium avium* subsp. *avium*

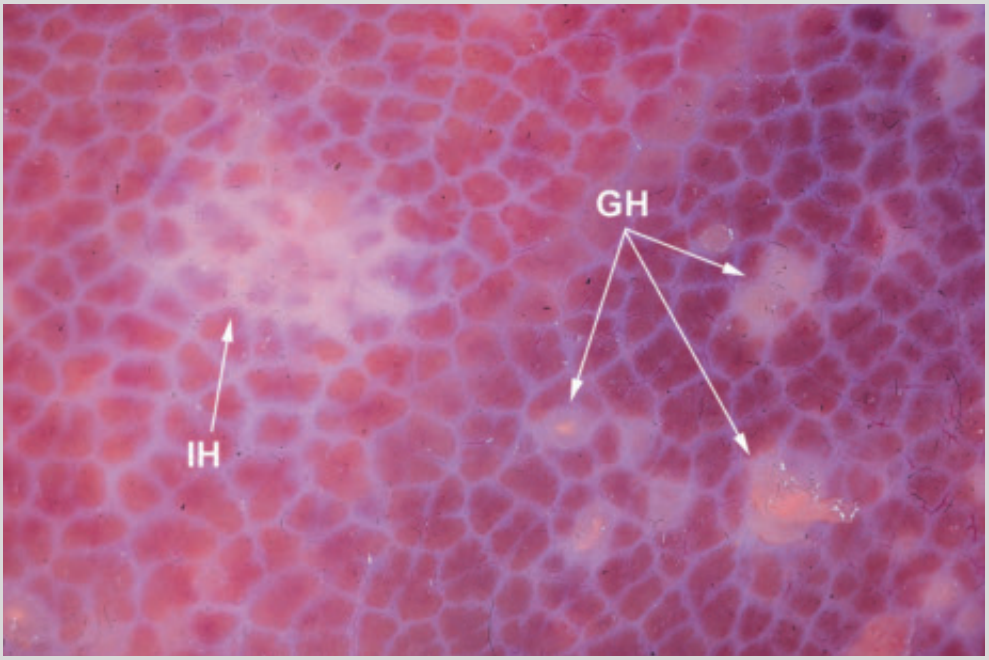
9.82



Animal species/Organ	Pig/Liver
Lesion	Chronic, disseminated, granulomatous hepatitis with convergence of the lesions
Scoring	Partial condemnation if exclusively hepatic localisation
Comments	The changes are typical for infection with *Mycobacterium avium* subsp. *avium*

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9.83



Animal species/Organ	Pig/Liver
Lesion	Chronic, focal, interstitial hepatitis (IH) and granulomatous hepatitis (GH)
Scoring	Partial condemnation if exclusively hepatic localisation
Comments	Chronic double infection with *Ascaris suum* (IH) and *Mycobacterium avium* subsp. *avium* (GH)

9.84



Animal species/Organ	Horse/Lever
Lesion	Chronic, focal, fibrous, filamentous perihepatitis
Scoring	Partial condemnation
Comments	Is probably caused by parasite migration in the liver

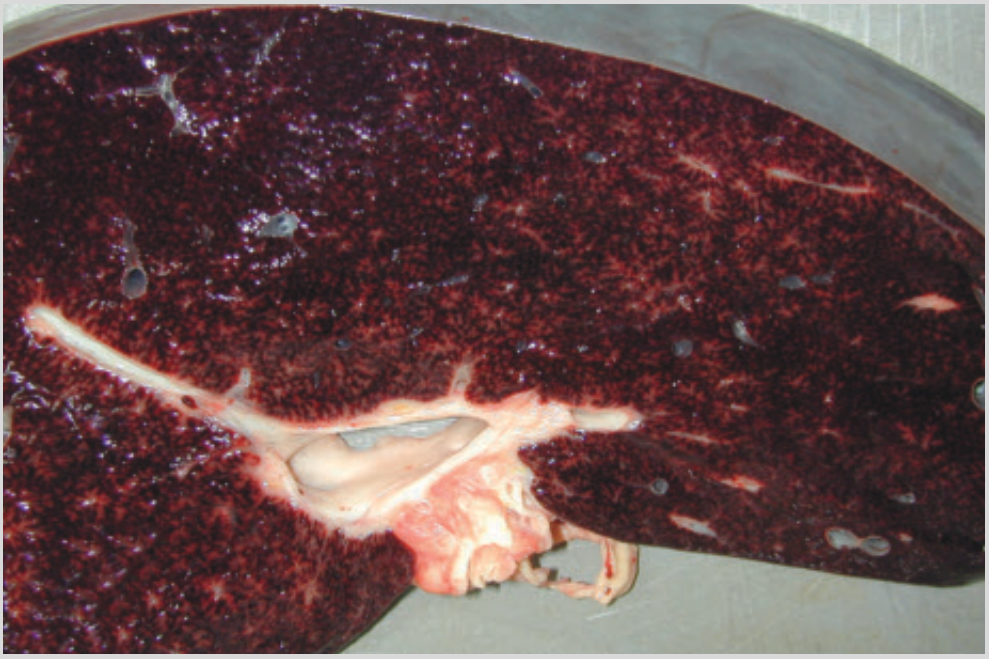
Vet-ebooks.com

9.85



Animal species/Organ	Cattle/Liver
Lesion	Amyloidosis
Scoring	Partial or total condemnation
Comments	Scoring is based on the underlying cause of the condition

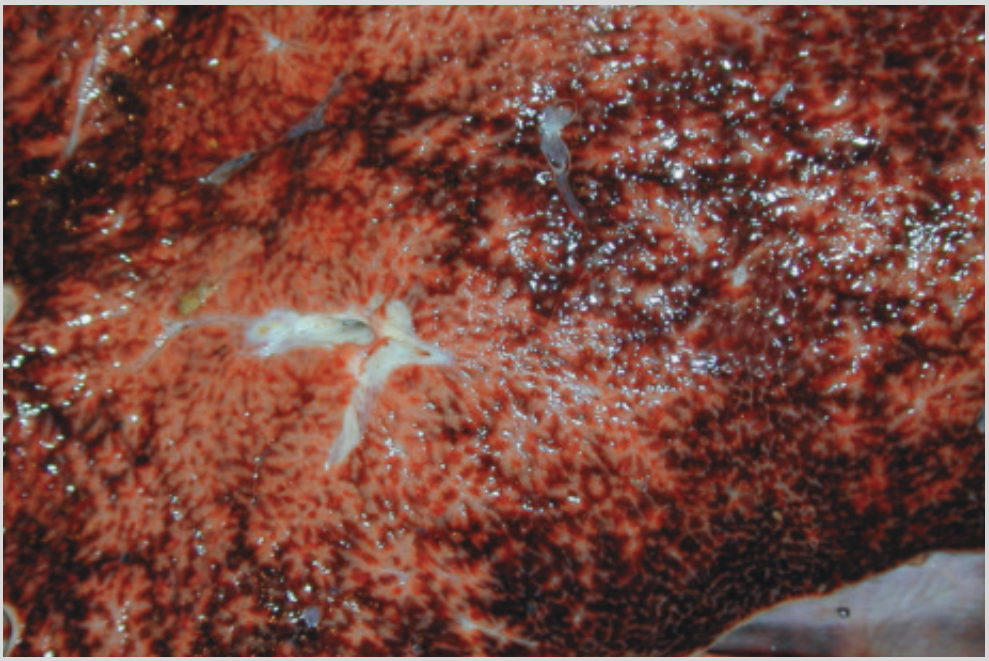
9.86



Animal species/Organ	Cattle/Liver
Lesion	Chronic congestion
Scoring	A secondary condition. Scoring is therefore always based on the primary cause; as a minimum partial condemnation
Comments	The mottled appearance is characteristic

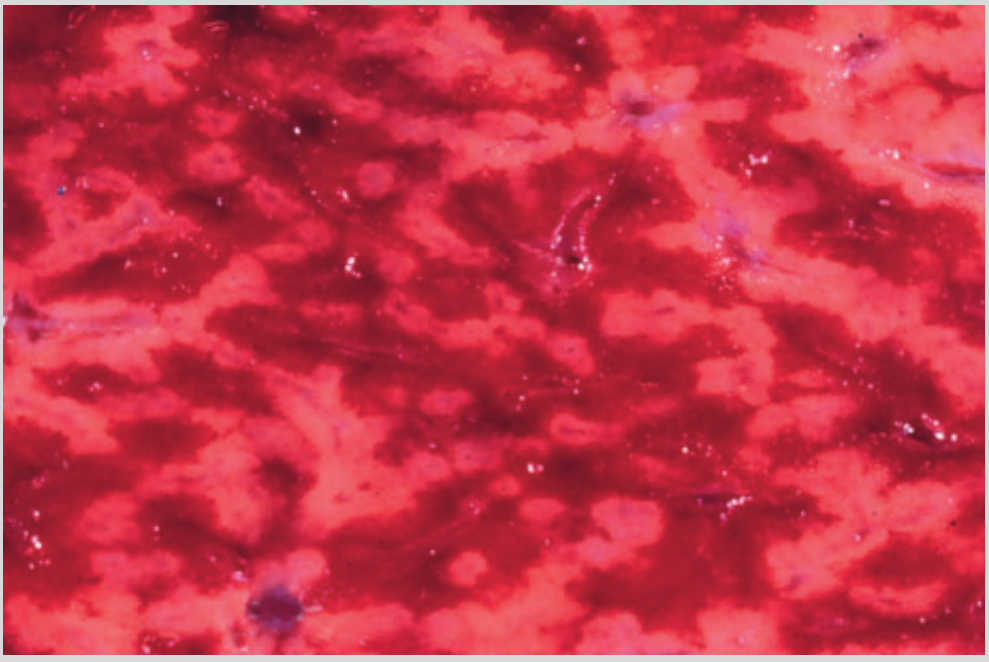
Vet-ebooks.com

9.87



Animal species/Organ	Cattle/Liver
Lesion	Chronic congestion
Scoring	A secondary condition. Scoring is therefore always based on the primary cause; as a minimum partial condemnation
Comments	The mottled appearance is characteristic

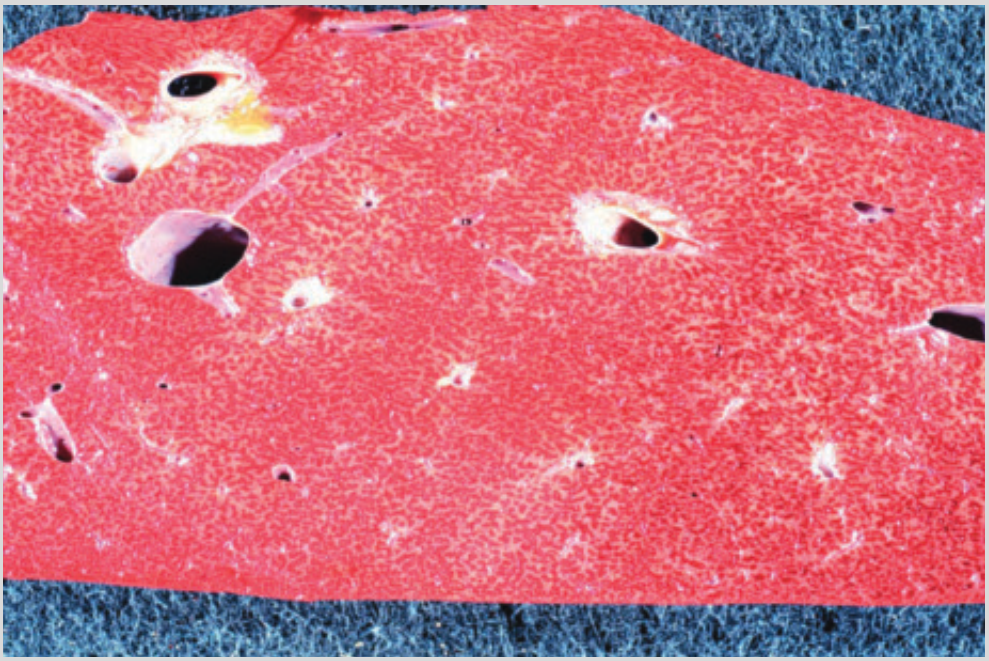
9.88



Animal species/Organ	Cattle/Liver
Lesion	Chronic congestion
Scoring	A secondary condition. Scoring is therefore always based on the primary cause; as a minimum partial condemnation
Comments	The mottled appearance is reminiscent of the cut surface of a nutmeg

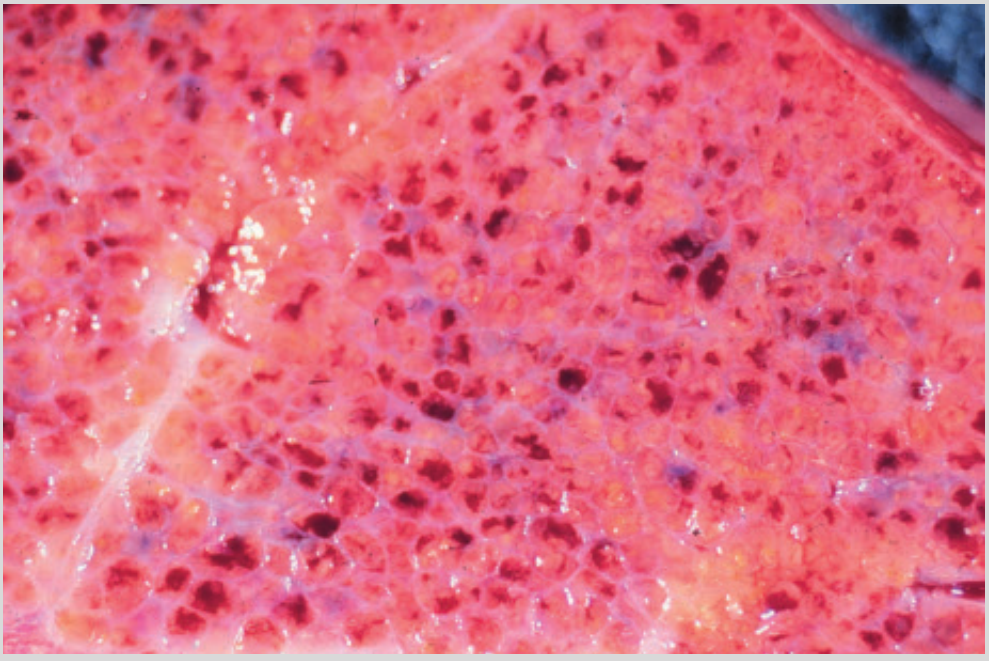
Vet-ebooks.com

9.89



Animal species/Organ	Pig/Liver
Lesion	Chronic congestion
Scoring	A secondary condition. Scoring is therefore always based on the primary cause; as a minimum partial condemnation
Comments	In severe fibrosis, both bright red and white areas are seen

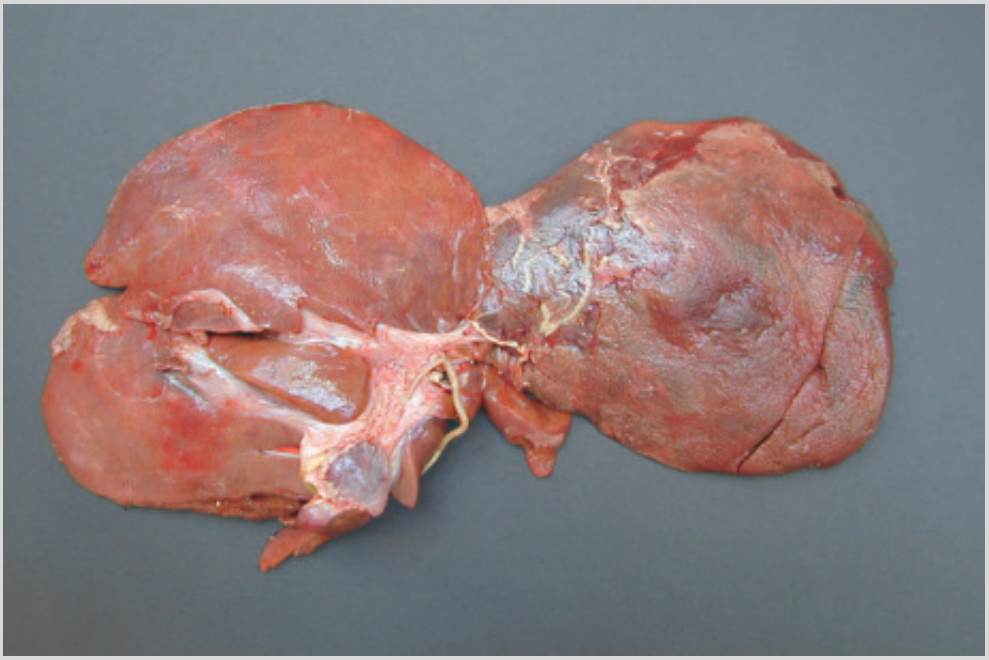
9.90



Animal species/Organ	Pig/Liver
Lesion	Chronic congestion
Scoring	A secondary condition. Scoring is therefore always based on the primary cause; as a minimum partial condemnation
Comments	In severe fibrosis, both bright red and white areas are seen

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9.91



Animal species/Organ	Pig/Liver
Lesion	Acute torsion of liver lobe
Scoring	Total condemnation
Comments	The twisted liver lobe is covered by fibrin

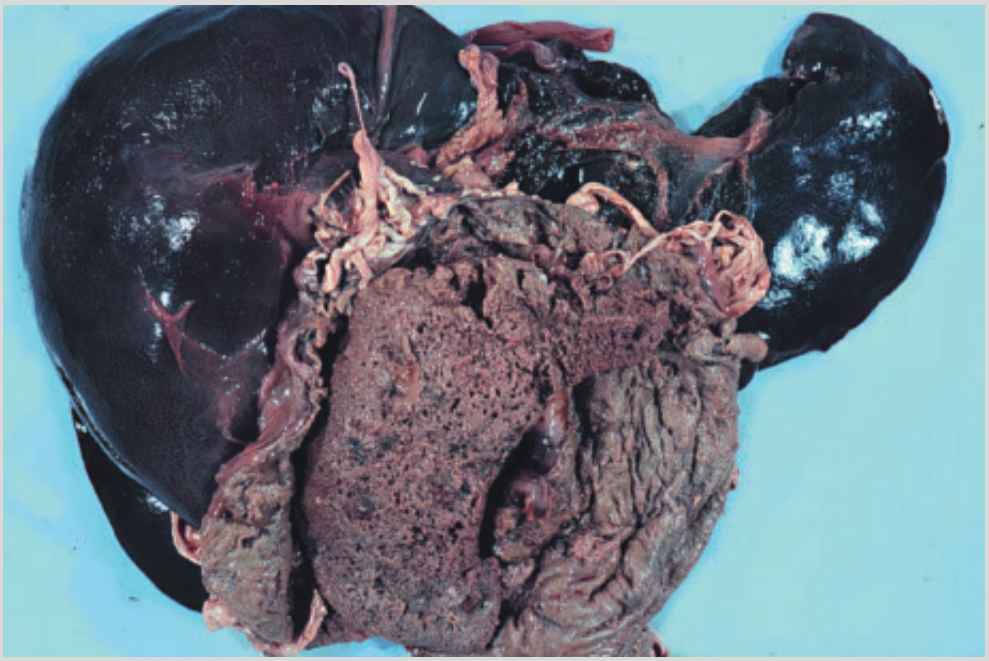
9.92



Animal species/Organ	Pig/Liver
Lesion	Acute torsion of liver lobe
Scoring	Total condemnation
Comments	The cut surface reveals the twisted liver lobe to be necrotic (dry)

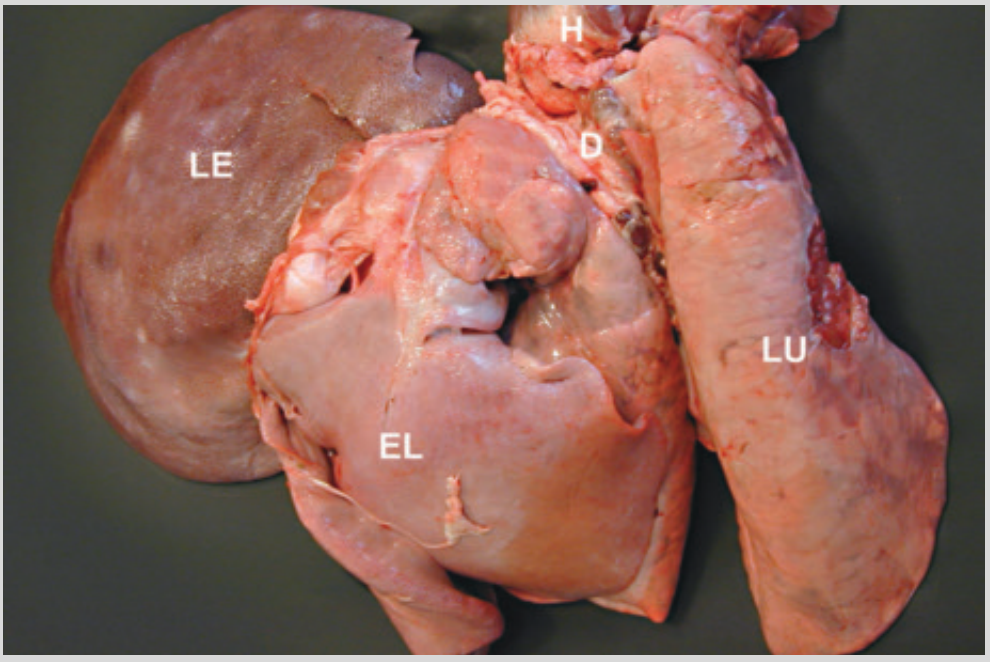
Vet-ebooks.com

9.93



Animal species/Organ	Pig/Liver
Lesion	Chronic torsion of liver lobe with sequestration
Scoring	Partial condemnation
Comments	The necrotic tissue has been released and separated from the surroundings

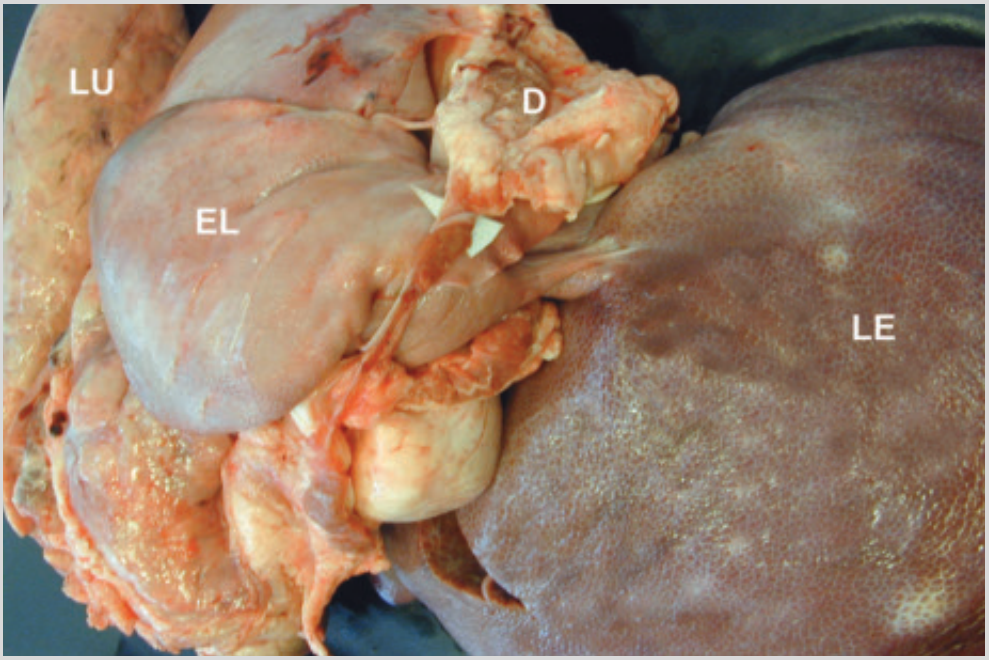
9.94



Animal species/Organ	Pig/Liver (LE), heart (H), diaphragm (D), lung (LU) and eventrated liver lobe (EL)
Lesion	Chronic eventration of liver lobe through diaphragm defect
Scoring	Partial condemnation
Comments	The eventrated liver lobe is diffusely fibrotic

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9.95



Animal species/Organ	Pig/Liver (LE), diaphragm (D), lung (LU), and eventrated liver lobe (EL)
Lesion	Chronic eventration of liver lobe through diaphragm defect ( )
Scoring	Partial condemnation
Comments	Chronic, multifocal, interstitial, parasitic hepatitis is also present

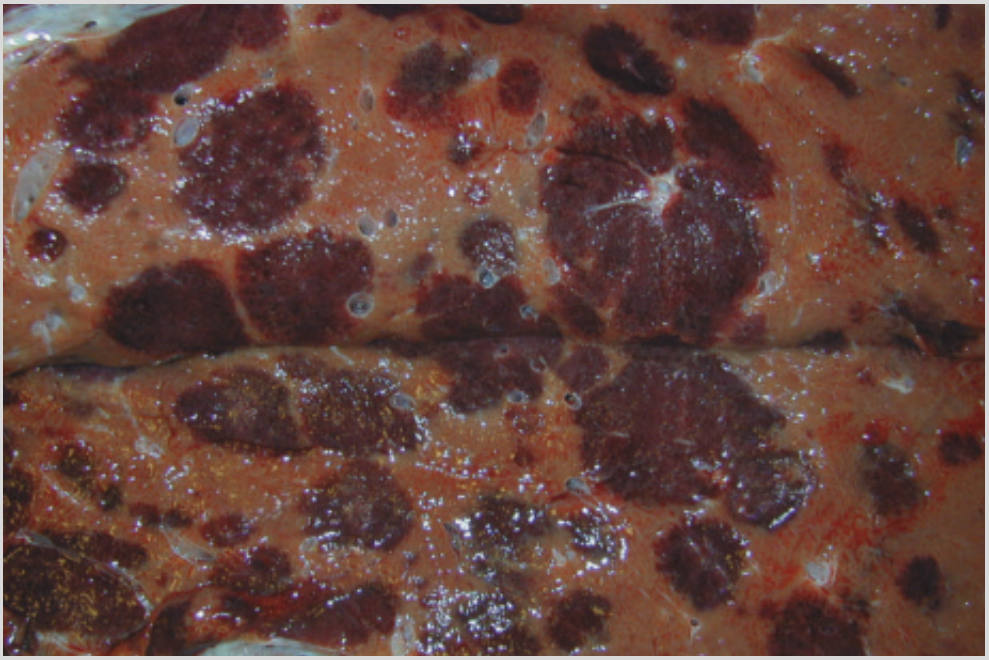
9.96



Animal species/Organ	Cattle/Liver
Lesion	Multiple teleangiectasias
Scoring	Partial condemnation
Comments	The lesions can be seen to be concave compared to the surface

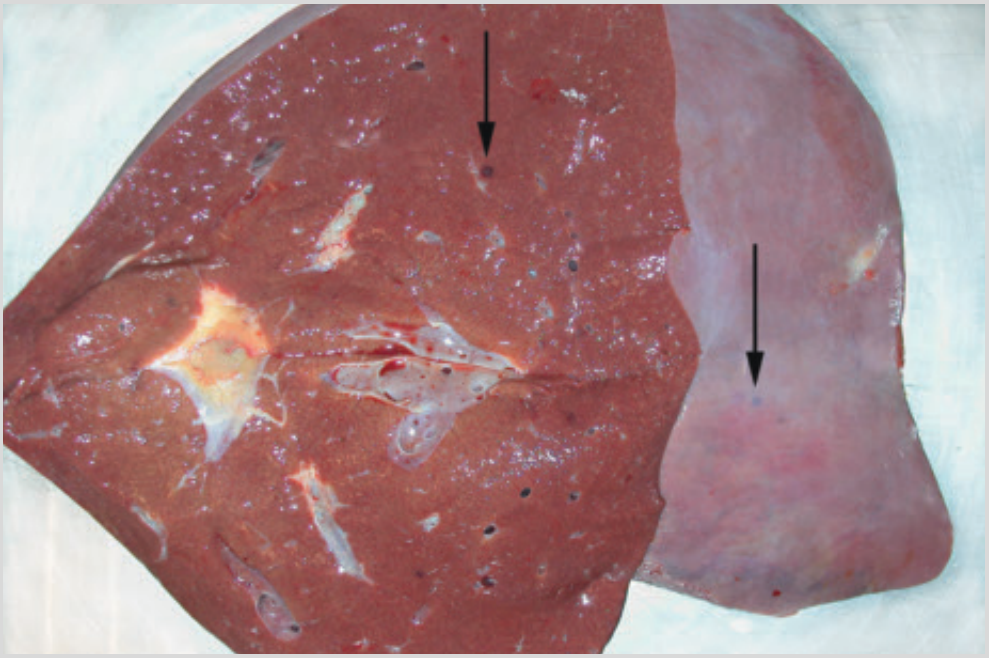
Vet-ebooks.com

9.97



Animal species/Organ	Cattle/Liver
Lesion	Multiple teleangiectasias
Scoring	Partial condemnation
Comments	The lesions can be seen to be concave compared to the surface

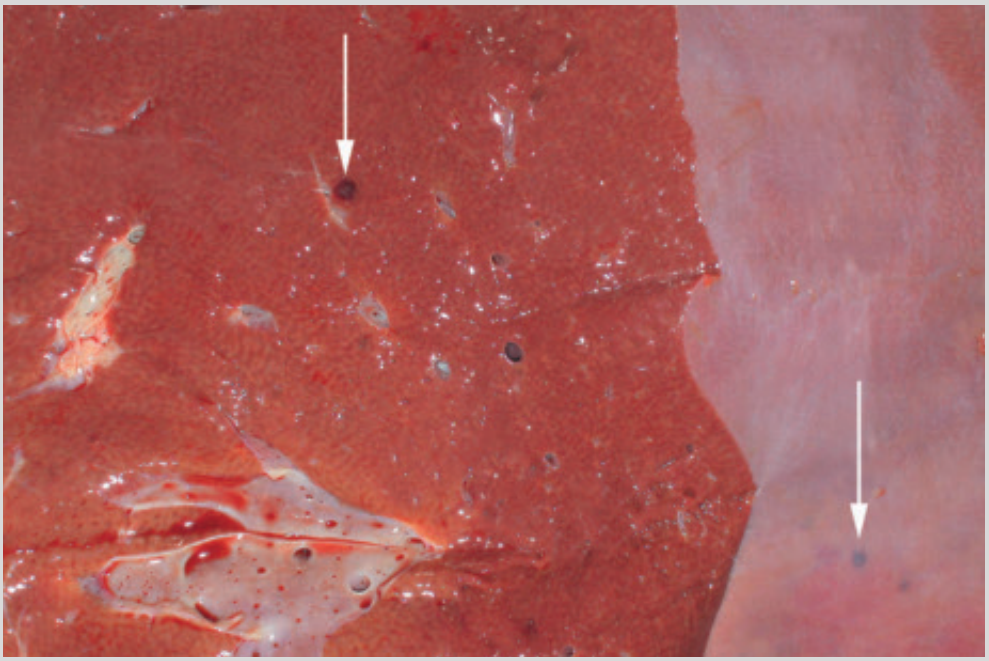
9.98



Animal species/Organ	Cattle/Liver
Lesion	Focal teleangiectasias (→)
Scoring	Partial condemnation
Comments	The lesions can vary greatly in size and distribution

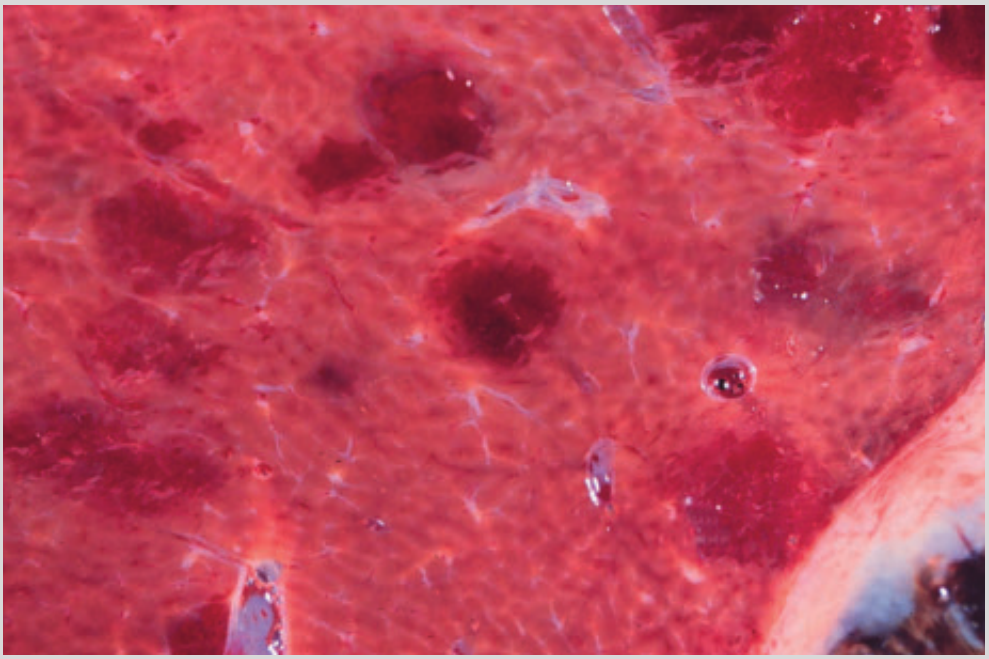
Vet-ebooks.com

9.99



Animal species/Organ	Cattle/Liver (close-up of 9.98)
Lesion	Focal teleangiectasias (→)
Scoring	Partial condemnation
Comments	The lesions can vary greatly in size and distribution

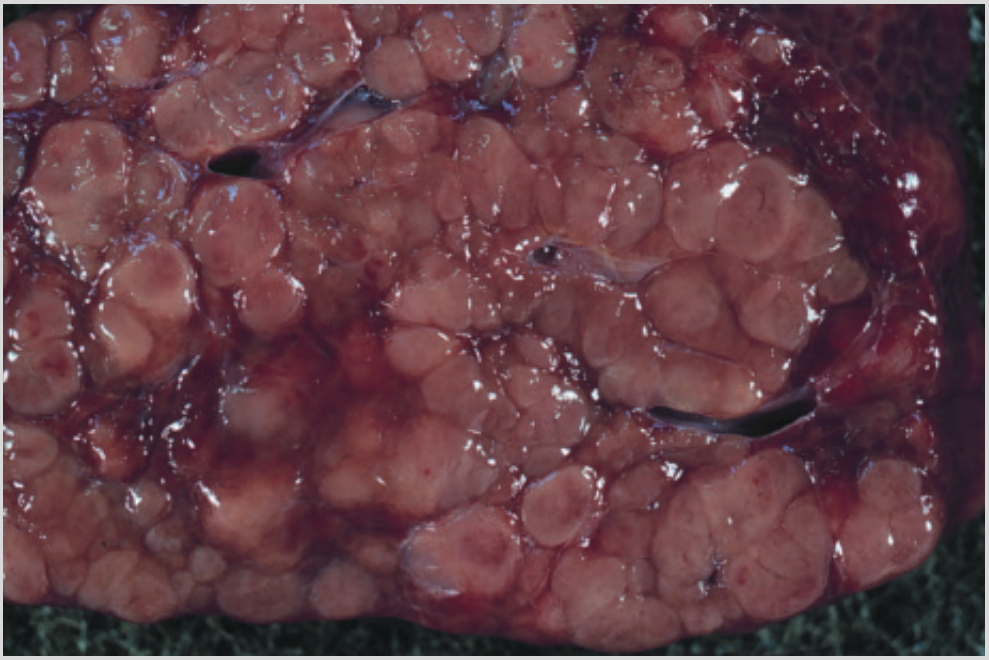
9.100



Animal species/Organ	Cattle/Liver
Lesion	Focal teleangiectasias
Scoring	Partial condemnation
Comments	The lesions can vary greatly in size and distribution

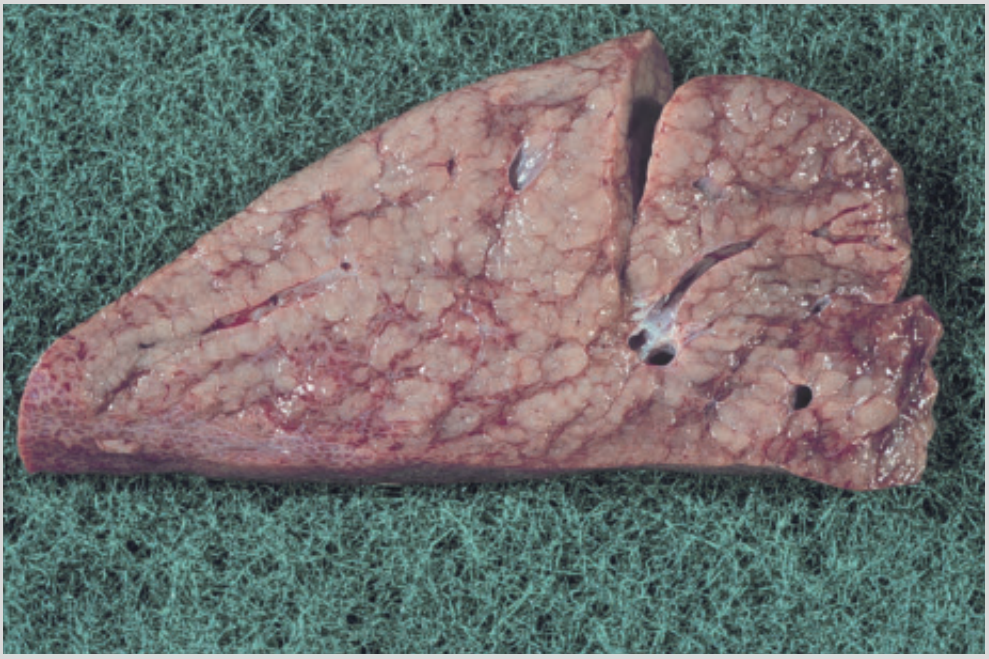
Vet-ebooks.com

9.101



Animal species/Organ	Pig/Liver
Lesion	Multiple hyperplasias
Scoring	Partial condemnation
Comments	The pale colour is due to the fat content

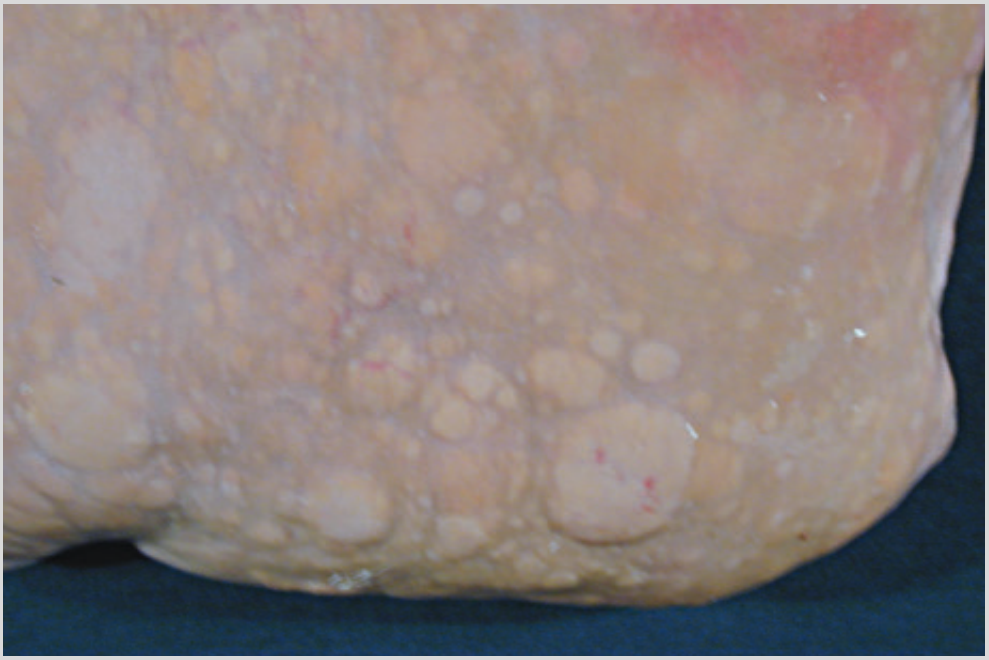
9.102



Animal species/Organ	Pig/Liver
Lesion	Multiple hyperplasias
Scoring	Partial condemnation
Comments	The pale colour is due to the fat content

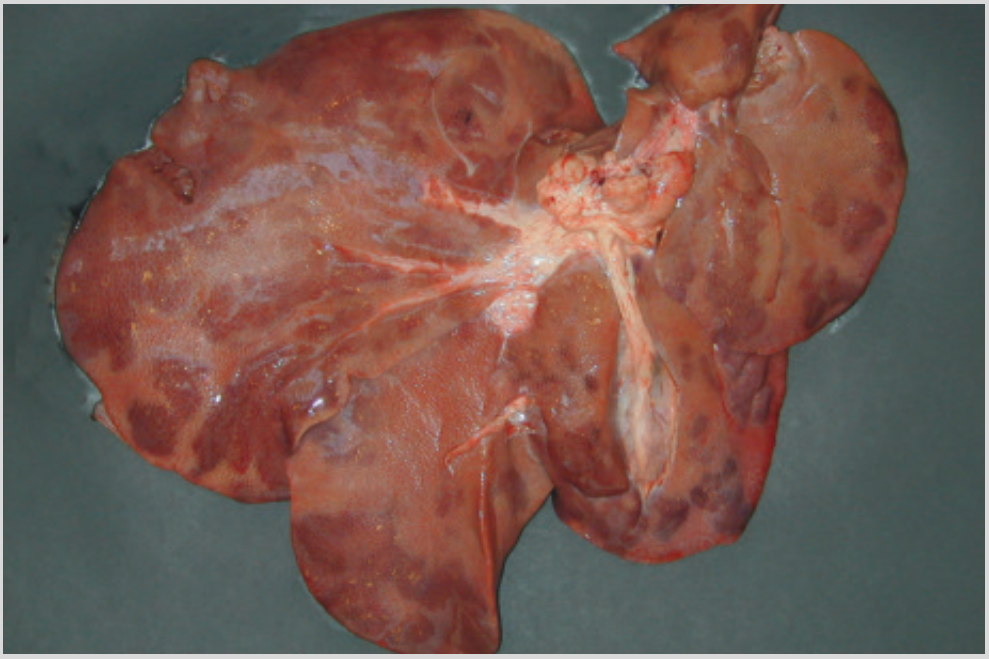
Vet-ebooks.com

9.103



Animal species/Organ	Cattle/Liver
Lesion	Multiple hyperplasias
Scoring	Partial condemnation
Comments	The pale colour is due to the fat content

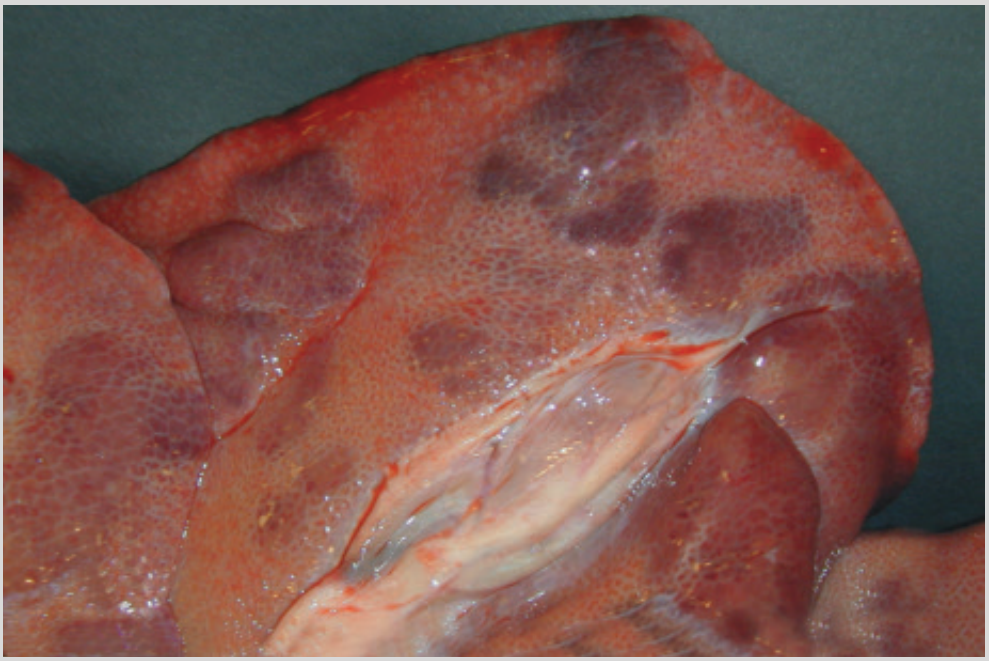
9.104



Animal species/Organ	Pig/Liver
Lesion	Multiple hyperplasias
Scoring	Partial condemnation
Comments	The hyperplasias are prominent on the surface

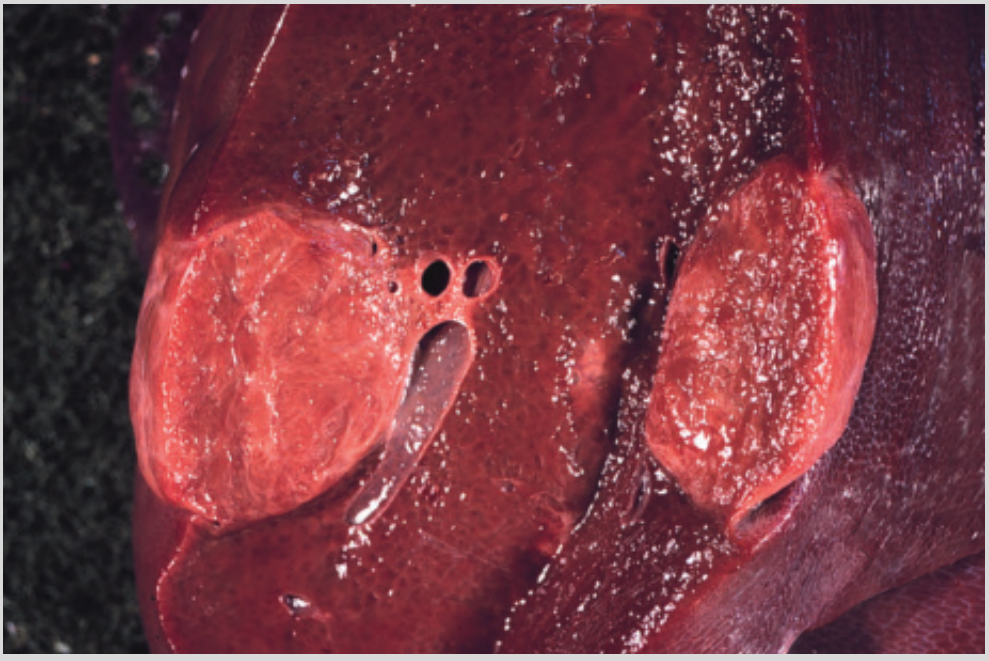
Vet-ebooks.com

9.105



Animal species/Organ	Pig/Liver (close-up of 9.104)
Lesion	Multiple hyperplasias
Scoring	Partial condemnation
Comments	The hyperplasias are prominent on the surface

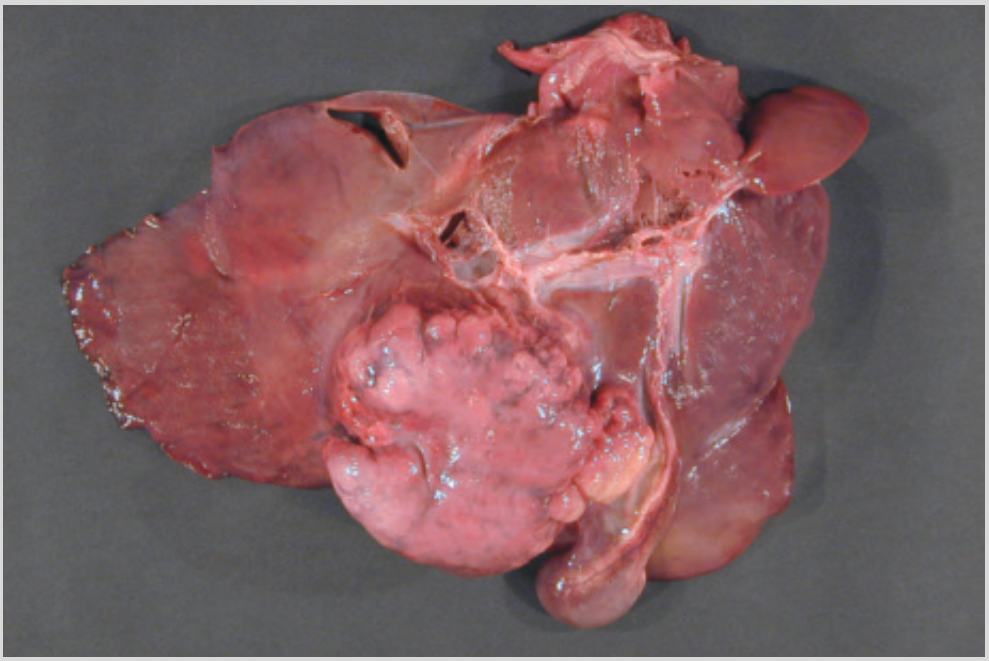
9.106



Animal species/Organ	Cattle/Liver
Lesion	Hepatoma
Scoring	Partial condemnation
Comments	Hepatomas are typically protuding and well-defined

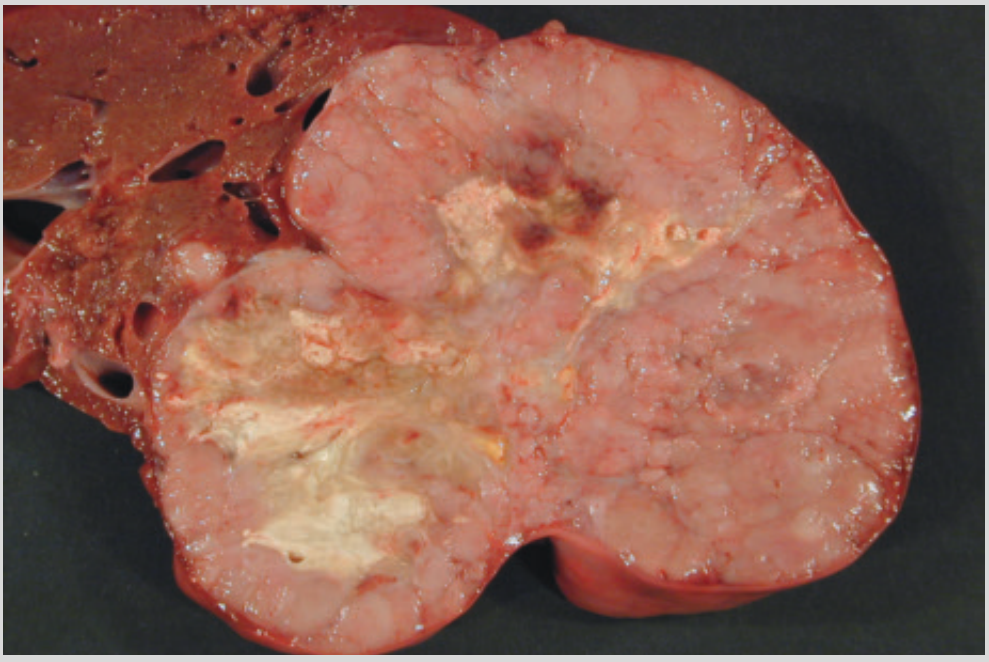
Vet-ebooks.com

9.107



Animal species/Organ	Sheep/Liver
Lesion	Solitary carcinoma (probably metastasis from a pancreatic carcinoma)
Scoring	Total condemnation
Comments	Hepatic carcinomas in livestock are most often metastases

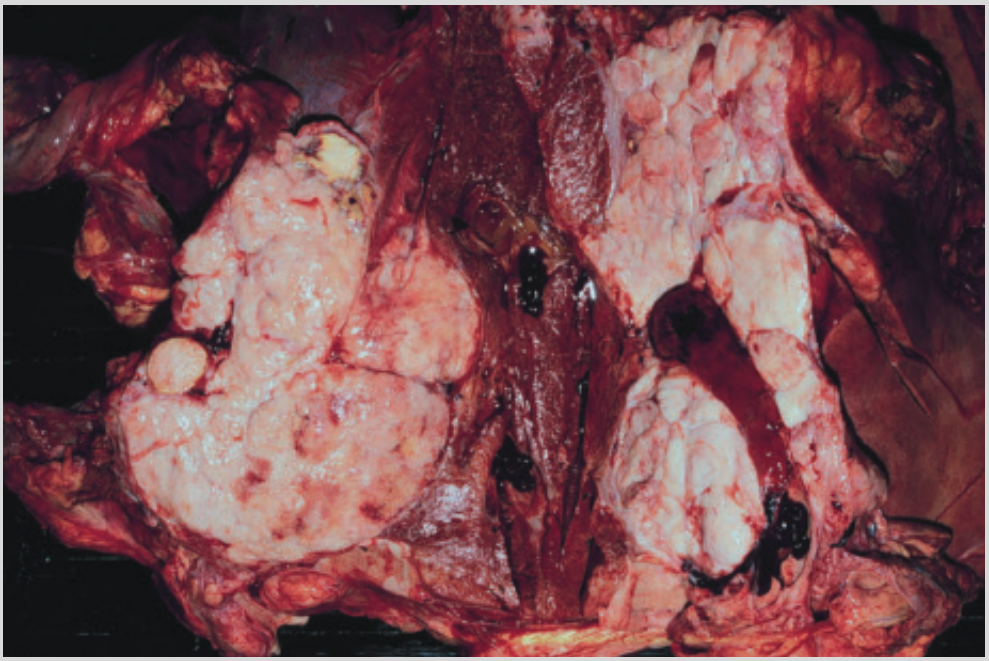
9.108



Animal species/Organ	Sheep/Liver
Lesion	Solitary carcinoma with central necrosis (probably metastasis from a pancreatic carcinoma)
Scoring	Total condemnation
Comments	Hepatic carcinomas in livestock are most often metastases

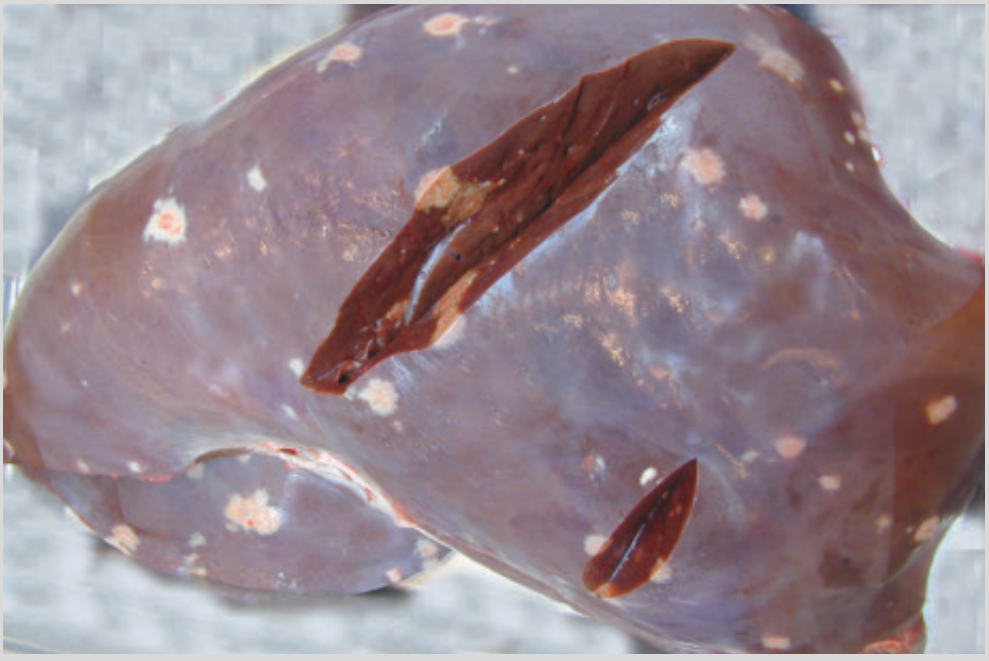
Vet-ebooks.com

9.109



Animal species/Organ	Cattle/Liver
Lesion	Localised carcinoma (probably metastasis from a pancreatic carcinoma)
Scoring	Total condemnation
Comments	Hepatic carcinomas in livestock are most often metastases

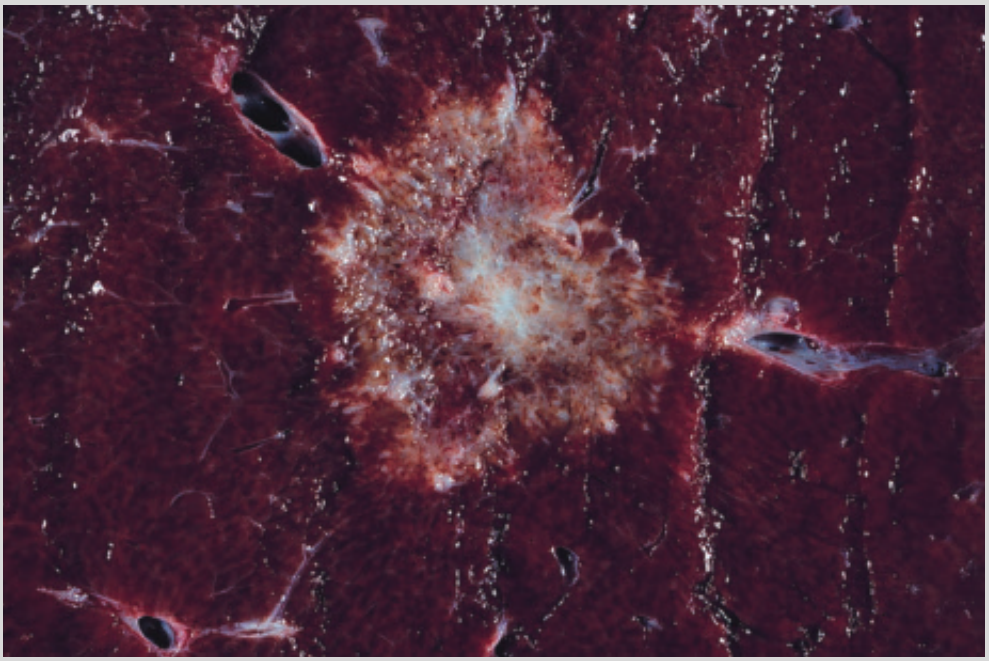
9.110



Animal species/Organ	Cattle/Liver
Lesion	Disseminated carcinomas (metastases from a uterine carcinoma)
Scoring	Total condemnation
Comments	Hepatic carcinomas in livestock are most often metastases

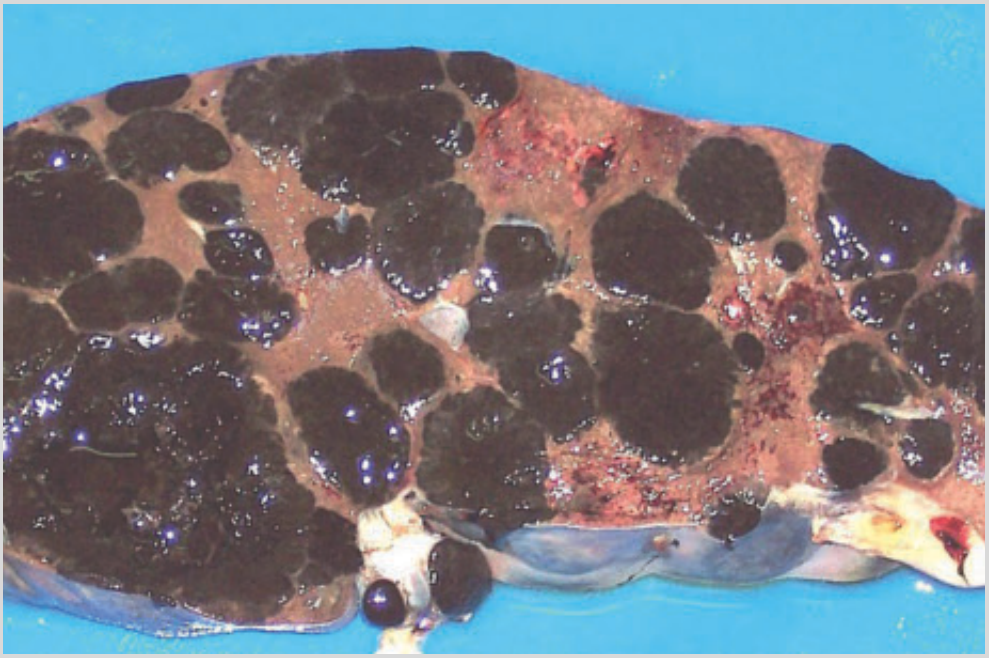
Vet-ebooks.com

9.111



Animal species/Organ	Cattle/Liver
Lesion	Localised, infiltrating carcinoma (metastasis from a uterine carcinoma)
Scoring	Total condemnation
Comments	Hepatic carcinomas in livestock are most often metastases

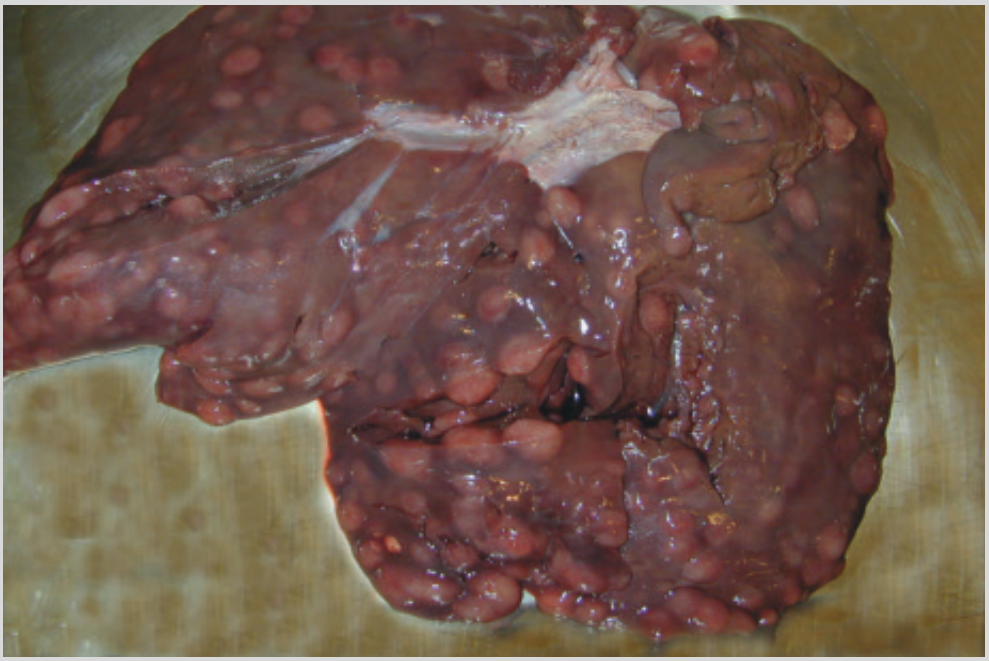
9.112



Animal species/Organ	Sheep/Liver
Lesion	Disseminated melanoma
Scoring	Total condemnation
Comments	Malignant neoplasms always necessitate total condemnation

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9.113



Animal species/Organ	Pig/Liver
Lesion	Disseminated, multicentric nodular lymphomasarcoma
Scoring	Total condemnation
Comments	Lymphosarcomas can be nodular or diffuse, infiltrative types

9.114



Animal species/Organ	Pig/Liver
Lesion	Disseminated, multicentric nodular lymphomasarcoma
Scoring	Total condemnation
Comments	Lymphosarcomas can be nodular or diffuse, infiltrative types

Vet-ebooks.com

9.115



Animal species/Organ	Pig/Liver
Lesion	Disseminated, multicentric nodular lymphomasarcoma
Scoring	Total condemnation
Comments	Lymphosarcomas can be nodular or diffuse, infiltrative types

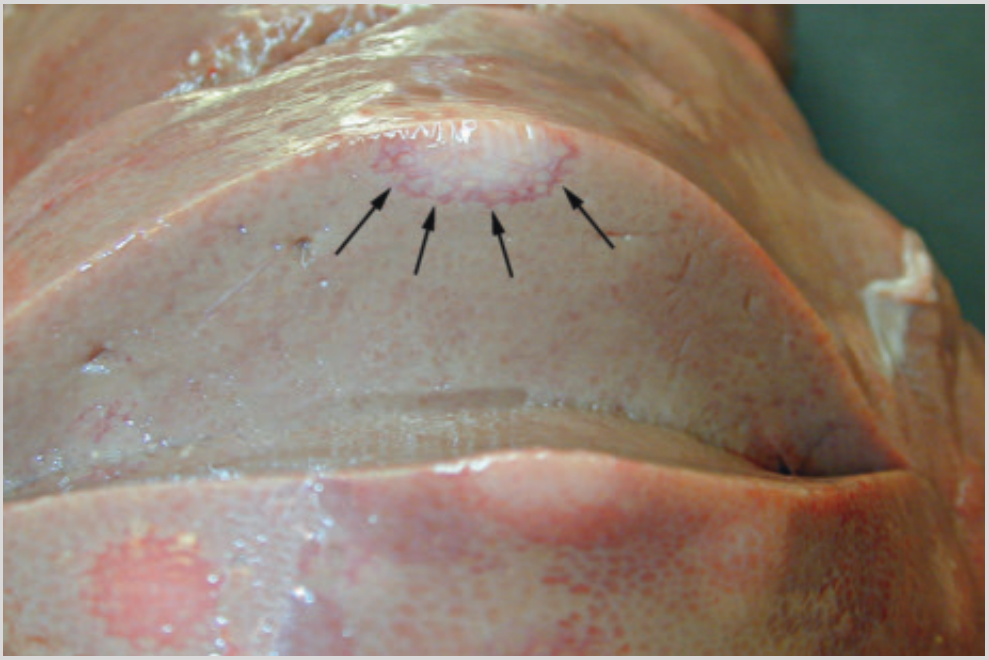
9.116



Animal species/Organ	Pig/Liver
Lesion	Disseminated, multicentric nodular lymphomasarcoma
Scoring	Total condemnation
Comments	In pigs, nodular infiltrations are often surrounded by haemorrhage

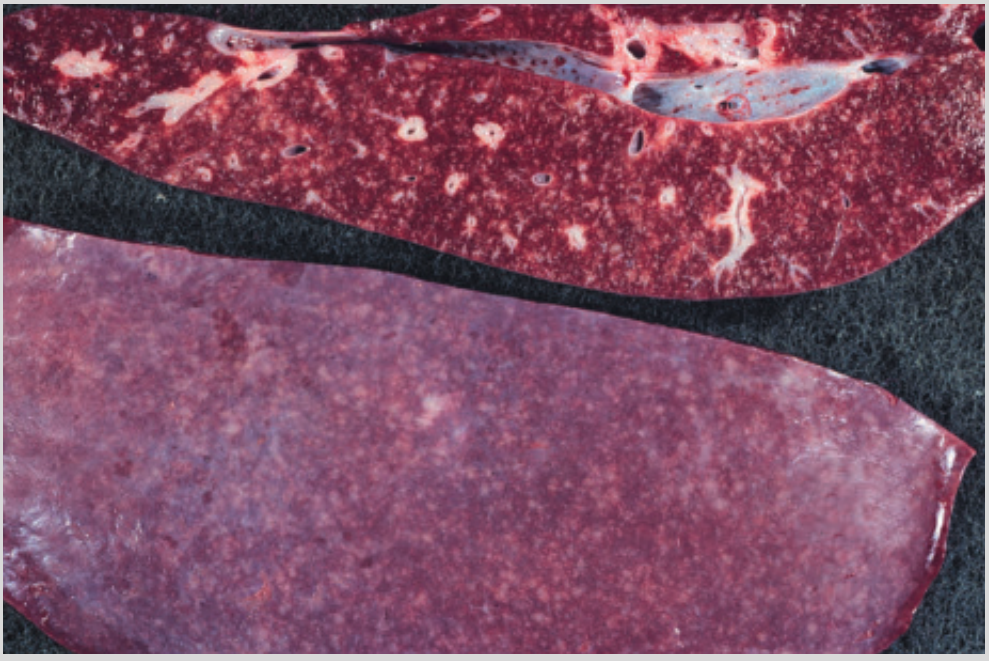
Vet-ebooks.com

9.117



Animal species/Organ	Pig/Liver
Lesion	Multicentric, nodular lymphomasarcoma
Scoring	Total condemnation
Comments	In pigs, nodular infiltrations are often surrounded by haemorrhage (→)

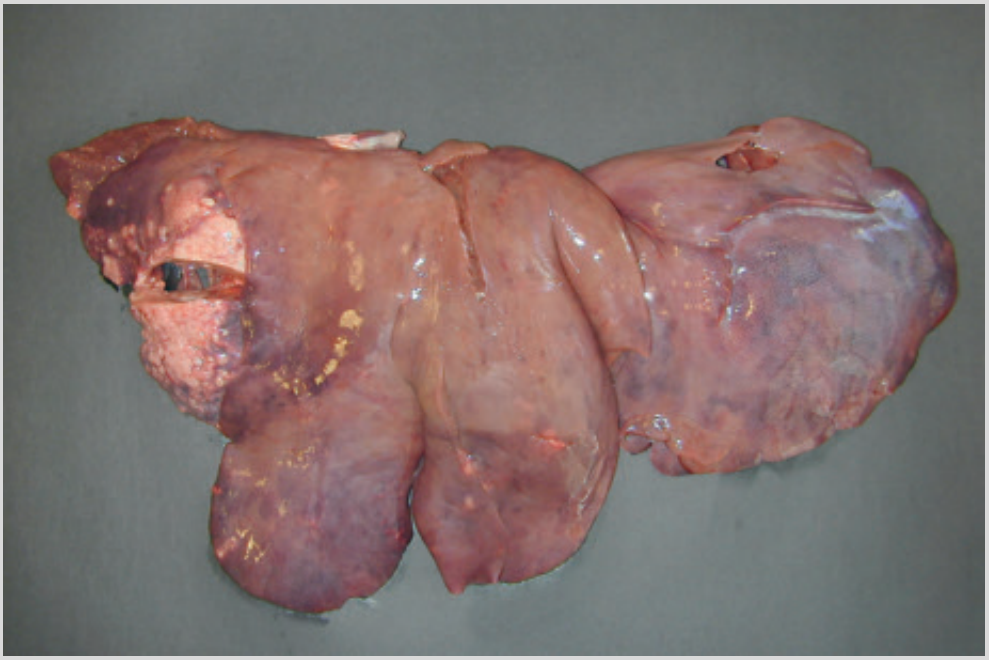
9.118



Animal species/Organ	Cattle/Liver
Lesion	Diffuse lymphomasarcoma
Scoring	Total condemnation
Comments	Lymphosarcomas can be nodular or diffuse, infiltrative types

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9.119



Animal species/Organ	Pig/Liver
Lesion	Bile duct carcinoma
Scoring	Total condemnation
Comments	Bile duct carcinomas occur rarely in livestock

9.120



Animal species/Organ	Pig/Liver
Lesion	Bile duct carcinoma (close-up of 9.119)
Scoring	Total condemnation
Comments	Bile duct carcinomas occur rarely in livestock

Vet-ebooks.com

9.121



Animal species/Organ	Pig/Liver
Lesion	Haemangiosarcomas
Scoring	Total condemnation
Comments	Haemangiosarcomas are very rare in livestock

9.122



Animal species/Organ	Sheep/Liver
Lesion	Widespread bile duct hyperplasia
Scoring	Partial condemnation
Comments	Hyperplasia of the bile ducts is a nonspecific reaction

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9.123



Animal species/Organ	Sheep/Liver (close-up of 9.122)
Lesion	Widespread bile duct hyperplasia
Scoring	Partial condemnation
Comments	Hyperplasia of the bile ducts is a nonspecific reaction

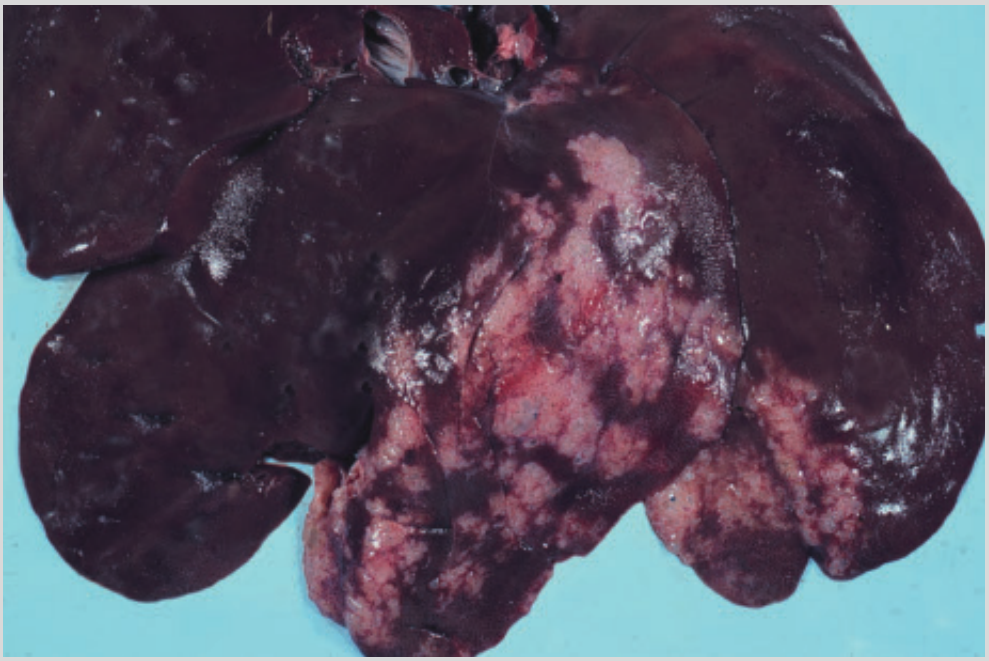
9.124



Animal species/Organ	Cattle/Liver
Lesion	Serous hepatic cyst originating from the capsule
Scoring	Partial condemnation
Comments	The cysts disappear with age

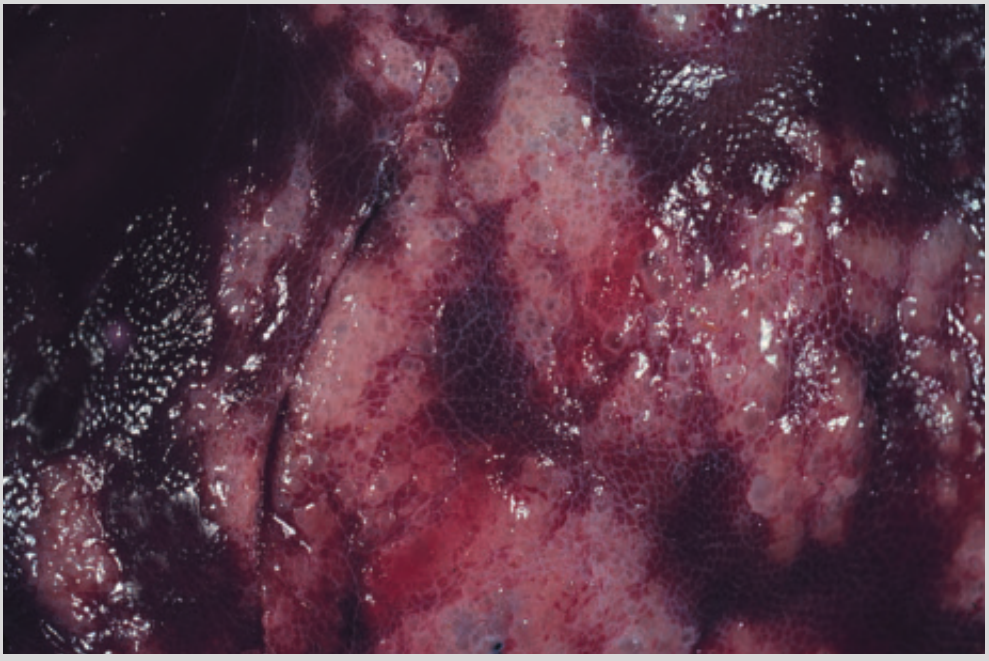
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9.125



Animal species/Organ	Pig/Liver
Lesion	Bile duct cysts
Scoring	Partial condemnation
Comments	The localised bile duct cysts are most often congenital

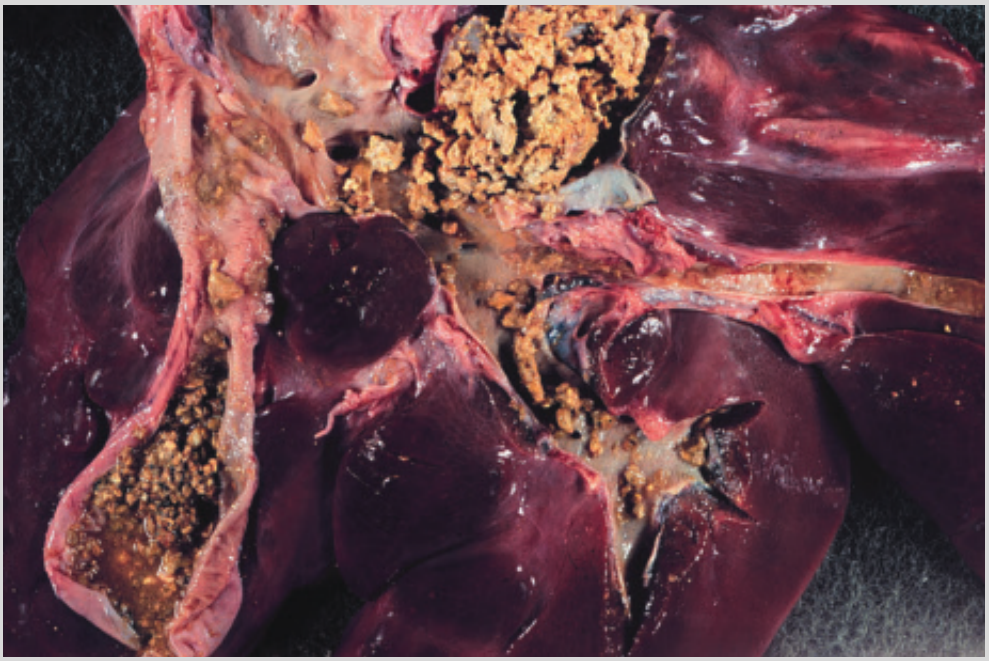
9.126



Animal species/Organ	Pig/Liver (close-up of 9.125)
Lesion	Bile duct cysts
Scoring	Partial condemnation
Comments	The localised bile duct cysts are most often congenital

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9.127



Animal species/Organ	Pig/Lever with opened bile ducts and gall bladder
Lesion	Cholelithiasis
Scoring	Partial condemnation
Comments	Concomitant presence of jaundice necessitates total condemnation

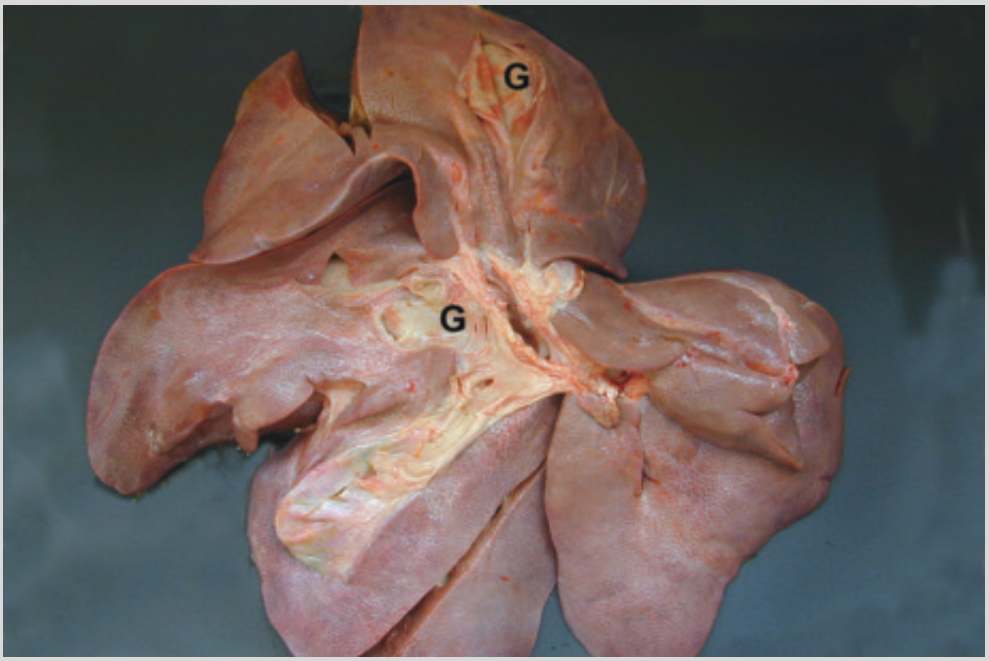
9.128



Animal species/Organ	Pig/Liver
Lesion	*Ascaris suum* in the common bile duct
Scoring	Partial condemnation
Comments	This is most probably post mortem condition

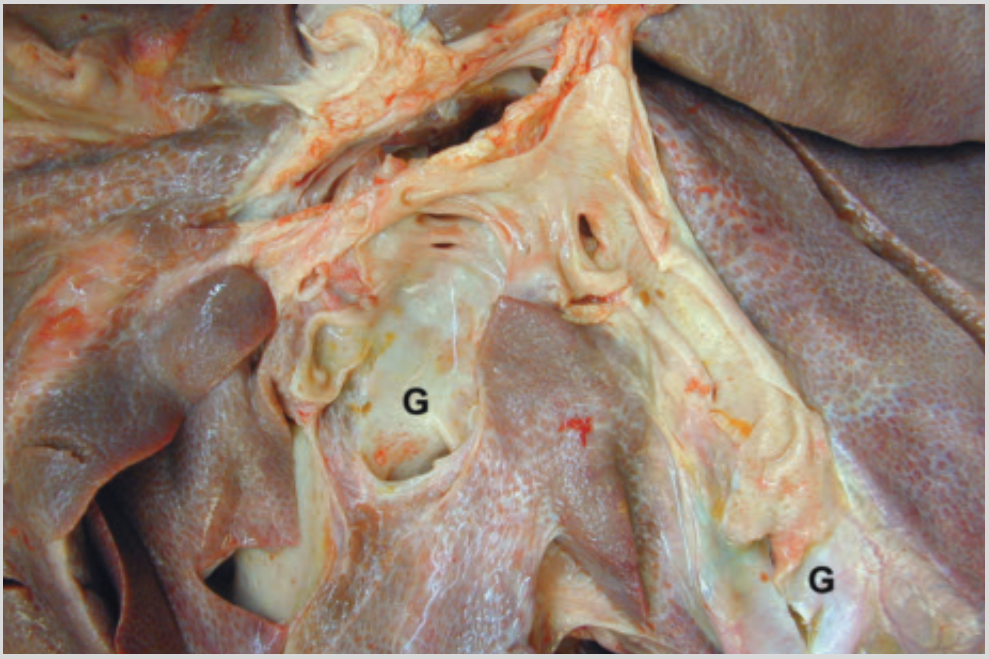
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9.129



Animal species/Organ	Pig/Liver
Lesion	Chronic, diffuse interstitial fibrosis and ectasia of bile ducts (cut open (G))
Scoring	Partial condemnation
Comments	The bile ducts (G) are distended due to extrahepatic biliary congestion

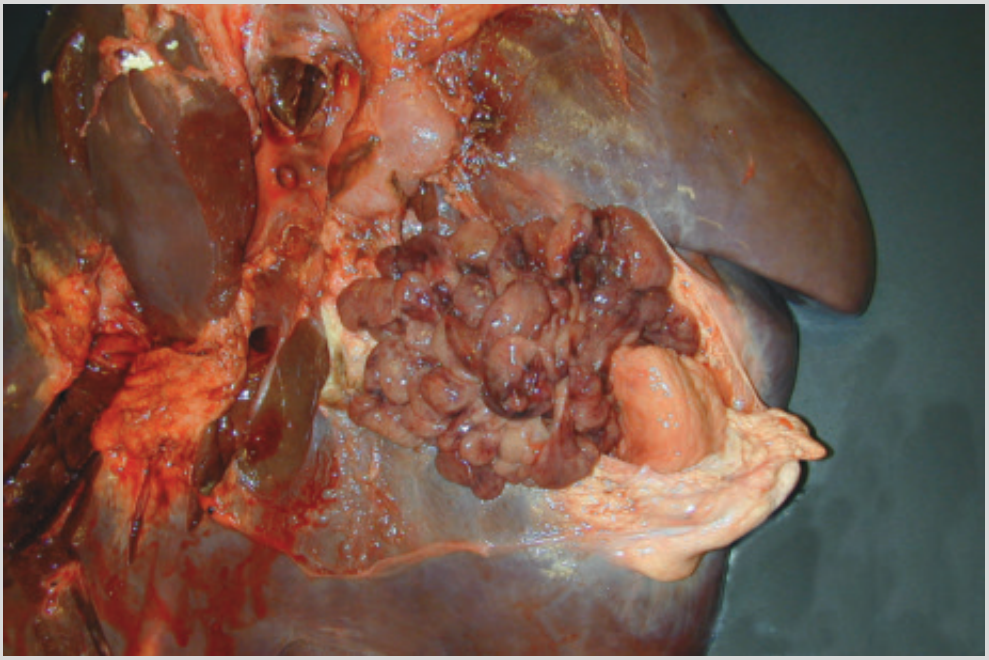
9.130



Animal species/Organ	Pig/Liver (close-up of 9.129)
Lesion	Chronic, diffuse interstitial fibrosis and ectasia of bile ducts (cut open (G))
Scoring	Partial condemnation
Comments	The bile ducts (G) are dilatated due to extrahepatic biliary congestion

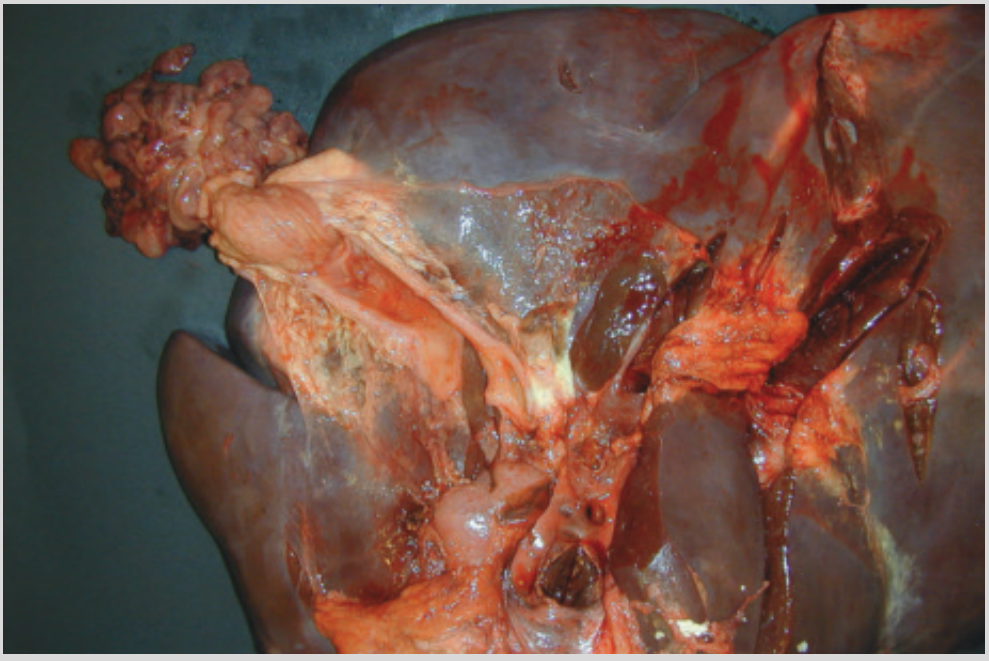
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9.131



Animal species/Organ	Cattle/Liver
Lesion	Chronic, proliferative cholecystitis (proliferative lesions almost fill the gall bladder)
Scoring	Partial condemnation
Comments	Proliferative lesions in the gall bladder do not generally give rise to complications

9.132



Animal species/Organ	Cattle/Liver
Lesion	Chronic, proliferative cholecystitis (the proliferative lesions have been excised from the opened gall bladder)
Scoring	Partial condemnation
Comments	Proliferative lesions in the gall bladder do not generally give rise to complications

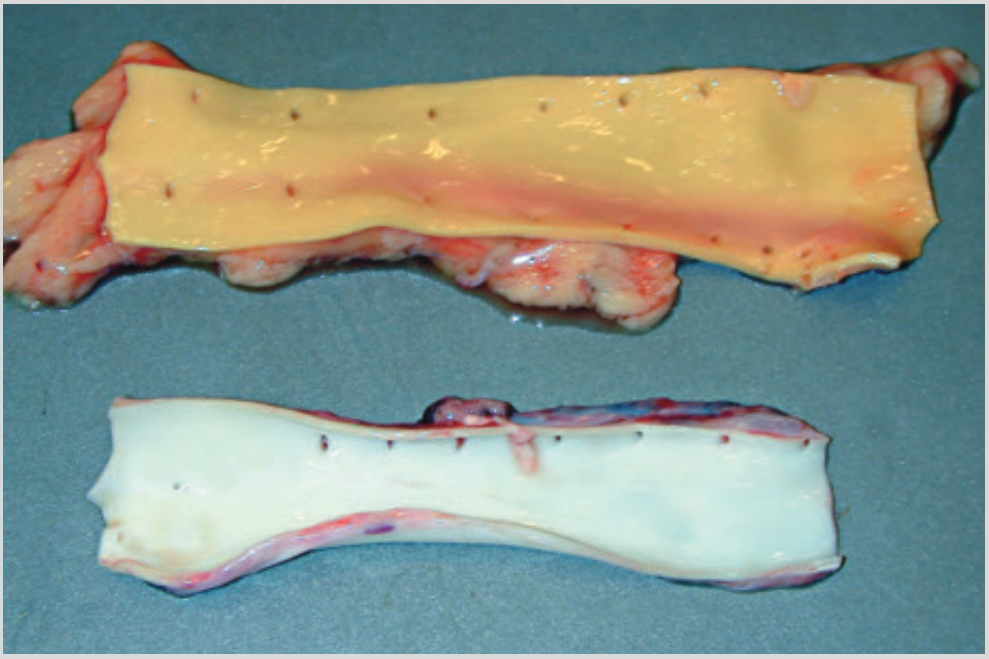
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9.133



Animal species/Organ	Horse/Intestinal tract
Lesion	Icteric discolouration
Scoring	Total condemnation
Comments	Scoring can be postponed for 24 hours if the yellow colour is due to haemorrhage, for example

9.134



Animal species/Organ	Pig/Aorta (for comparison, a normal-coloured aorta is presented at the bottom)
Lesion	Icteric discolouration
Scoring	Total condemnation
Comments	Scoring can be postponed for 24 hours if the yellow colour is due to haemorrhage, for example

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Animal species/Organ	Cattle/Entire carcase
Lesion	Icteric discolouration
Scoring	Total condemnation
Comments	Scoring can be postponed for 24 hours if the yellow colour is not due to a liver condition, which always necessitates total condemnation if jaundice is present

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10 Haematopoietic System

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Lymph nodes p. 335
Spleen p. 337
Lymphosarcoma (leukosis) p. 340

Introduction

The haematopoietic system is an ill-defined entity that includes the spleen, bone marrow, lymph nodes and thymus. The term "haematopoietic system" has gained favour in medical terminology, but it is is not particularly appropriate because the system serves far more purposes than just to make blood. The haematopoietic system plays a central role in the organism's immune defence, and many of the diseases which manifest in the haematopoietic system are due to its role in seeking out and neutralising invading microorganisms.

Blood [10.01 – 10.05]

Anaemia

Anaemia is caused either by an increased turnover of erythrocytes, for example due to blood loss, or by reduced production of erythrocytes. Increased turnover is also seen in haemolytic conditions and can then be combined with varying degrees of jaundice. Reduced production of erythrocytes is seen in iron deficiency, cobalt deficiency, and in a number of toxic and neoplastic diseases that involve suppression of bone marrow function.

Anaemia manifests macroscopically as pale mucous membranes and tissues. Muscles are far paler than normal, and this is utilised in production of "veal calves", which are anaemic as a result of deliberately being fed a low-iron feed.

At meat inspection, anaemia is always considered to be a pathologic condition and necessitates total condemnation. Cases of doubt are decided by the animal's nutritional status.

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Haemorrhage

Haemorrhage occurs relatively frequently in slaughter animals. In most cases, this is due to local traumatic lesions, which are not too difficult to interpret at meat inspection. Problems occur in cases of so-called haemorrhagic diatheses with widespread haemorrhage in skin, muscles, and internal organs. This is particularly relevant in pigs, where such haemorrhages can easily be confused with those seen in hog cholera or African swine fever.

Meat inspection follows the principal rule that haemorrhages are stripped out and, if complete stripping is not possible, the carcase is rejected. In generalised haemorrhage, total stripping is generally impossible. Moreover, the underlying cause of the changes will in itself necessitate total condemnation. This applies for example to sepsis, poisoning with anticoagulants (e.g. rat poison) and uraemia. In many cases, the cause of the haemorrhagic diathesis is not known. They are often sporadic cases that are due to a defect in the coagulation system. Such defects are well-known and can manifest as reduced platelet function or coagulation factor deficiency (haemophilia). Porcine circovirus 2 (PCV2) can cause extensive haemorrhage in the skin in pigs. The haemorrhages represent infarctions, and are apparent as large haemorrhagic patches on the skin particularly on the hind legs and in the perineum. Haemorrhage can also be present in other organs and muscles as a result of systemic necrotising vasculitis. Often, the animal will also have glomerulonephritis with swollen kidneys, and petecchial haemorrhages in the cortex. This condition, which is called PDNS (porcine dermatitis and nephropathy syndrome), is believed to be due to a type 3 reaction against PCV2. At meat inspection, acute PDNS necessitates total condemnation. Uncomplicated chronic cases, that are particularly characterised by chronic changes in kidneys and skin necessitate partial condemnation.

Haemolysis

Haemolysis can be due to a number of infectious, immunologic, toxic, or metabolic conditions. In Denmark there are only one or two infectious haemolytic diseases. *Babesia divergens* causes babesiosis in cattle. The condition occurs in certain geographical areas where it is called Texas fever, tick fever, or redwater fever. *Mycoplasma* (previously *Eperythrozoon*) *ovis*, *M. wenyoni* and *M. suis* cause the sporadic disease mycoplasmosis (eperythrozoonosis) in sheep, cattle, and pigs, respectively. The most important toxic cause of haemolysis is copper poisoning in sheep. Puerperal haemoglobinuria is seen particularly in cows in the first months after calving, and is due to hypophosphataemia. Haemoglobinuria in calves is seen particularly after transportation of the animals. Haemoglobinuria can be observed at ante-mortem inspection, and icteric discolouration can be seen in the slaughtered animal. Postponing slaughter after transport reduces the risk for jaundice.

Haemolysis is apparent post-mortem as discolouration of the kidneys and urine due to renal excretion of haemoglobin. The extent of the jaundice depends on the animal's ability to conjugate and excrete the released pigments. The spleen can also be enlarged with a firm, meaty consistency due to increased phagocytic activity.

At meat inspection, scoring depends on the cause and presence of jaundice, which

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can necessitate total condemnation. Babesiosis and mycoplasmosis with no complications other than haemoglobinuria and splenomegaly necessitate partial condemnation with rejection of the affected organs. Poisonings, puerperal haemoglobinuria, and haemoglobinuria in calves necessitate total condemnation. However, calves with haemoglobinuria which have no visible discolouration, and in which haemoglobinuria only is observed, can be approved.

Porphyria

Porphyria occurs sporadically in cattle and pigs. The condition can be genetic in cattle, with the Holstein breed in particular being affected. Whether there is a genetic predisposition to porphyria in pigs is uncertain. Lesions with porphyria are characterised by brownish discolouration of bones and teeth. There may also be concomitant haemolytic anaemia and photosensitisation. Animals with porphyria are approved for deboning unless secondary changes such as skin lesions or jaundice are so pronounced that they necessitate total condemnation.

Lymph nodes [10.06 – 10.15]

The lymph nodes have a central position at meat inspection. Many diseases manifest first and foremost as changes in the lymph nodes. Therefore guidelines have been drawn up for examination of a number of lymph nodes, including necessary incisions, at routine meat inspection. Lesions in lymph nodes should always necessitate inspection of the draining area for lesions. Conversely, lesions in organs and tissues whether haemorrhages, inflammations, or tumours, should always result in inspection of the regional lymph nodes for lesions, and stripping.

Pigmentation

Pigment can accumulate in the lymph nodes for many reasons. Intestinal lymph nodes are often dark due to plant pigments which are present in the feed. Chronic haemorrhages can cause accumulation of haemoglobin degradation products in the regional lymph nodes. These could be haemosiderin or haematoidin, and the colour can vary from brown to yellow. The pulmonary lymph nodes are often dark as a result of accumulation of carbon particles present in the atmosphere (anthracosis). Finally, tattoos often result in accumulation of ink in the regional lymph nodes. Pigment-containing lymph nodes must be stripped out at meat inspection.

Cysts and emphysema

Lymph-containing cysts are seen particularly in pigs and may occur in combination with reactive hyperplasia. The reason for the formation of these cysts is not known. It is possibly due to an obstruction in the efferent lymphatics. Emphysematous lymph nodes occur in connection with mesenteric emphysema in pigs (see Chapter 8). Cystic and emphysematous lymph nodes must be stripped out.

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Atrophy

Atrophy of lymph nodes and other lymphoid tissue is seen particularly in older animals and cachectic animals. Certain viral infections (e.g. bovine viral diarrhoea virus) and toxins can similarly cause atrophy of the lymph nodes. The condition is not normally detected at meat inspection, and scoring depends on the primary condition. Thus the lymph nodes are either rejected or approved with the rest of the carcase.

Hyperplasia

Enlarged lymph nodes (lymphadenomegaly) can be due to immunologic stimulation (reactive hyperplasia), inflammation (lymphadenitis), or tumours. Reactive hyperplasia of the lymph nodes is due to inflammation in their draining area and subsequent stimulation of lymphocytes in particular in the lymph nodes' cortex and paracortex. Increased lymph flow from the draining area also contributes to hyperplasia. Reactive hyperplasia is most often local and affects only a few lymph nodes, for example those that drain a limb or organ. Certain diseases can be accompanied by generalised lymph node hyperplasia. This is seen for example in malignant catarrhal fever in cattle and in a number of sepsis conditions. Reactive hyperplasia is often accompanied by spread of the infectious agents to the lymph node with consequent concomitant lymphadenitis.

Lymph nodes, which are the site of reactive hyperplasia, are always stripped out together with the primary inflammatory lesion. Generalised hyperplasia resulting from malignant catarrhal fever or sepsis necessitates total condemnation.

Lymphadenitis

Lymphadenitis is characterised by the presence of the infectious agent in the lymph node with consequent inflammatory reaction. The condition is always accompanied by some reactive hyperplasia, and the two conditions are often impossible to distinguish macroscopically. A definite indication of lymphadenitis is the presence of pus in a lymph node. Lymphadenitis can be due to viruses, bacteria, fungi, or parasites. One important viral cause in Denmark is PCV2, which causes granulomatous lymphadenitis in pigs. Many different bacteria can cause lymphadenitis, which is generally purulent (most frequently *Trueperella (Arcanobacterium) pyogenes*, streptococci or staphylococci) or granulomatous (most frequently mycobacteria, *Staphylococcus aureus* or *Actinobacillus lignieresii*). Purulent lymphadenitis presents as pus, possibly as an abscess, in the lymph node. Granulomatous lymphadenitis can be difficult to diagnose macroscopically, but the lesions are apparent as an enlarged lymph node with varying degrees of fibrosis and yellowish or brownish areas from which, in cases of pyogranulomatous inflammation, small amounts of pus can be squeezed (see Chapter 20). Caseous lymphadenitis in sheep is due to the bacterium *Corynebacterium pseudotuberculosis*. The lesions can be seen in many lymph nodes and manifest as abscesses with relatively firm content which forms concentric lamellae. The infection originates generally in a lesion in the skin, with subsequent lymphangitic spread to the lymph node. The infection has a tendency to persist in the lymph node, and is occasionally seen as a fistular eruption to the skin. Caseous lymphadenitis in pigs is seen particularly in the neck and intestinal lymph nodes. The condition is in all probability most frequently due to the bacterium *Rhodococcus equi*.

Mycotic lymphadenitis is generally due to an infection with filamentous fungi and is most frequently seen in the intestinal lymph nodes in cattle. The acute changes are characterised by necrosis and haemorrhage; in the chronic stage there is necrosis and granulomatous reaction. Parasitic lymphadenitis is seen particularly in the large intestinal lymph nodes in horses, where it is due to aberrant migration of *Strongylus vulgaris* larvae. Often the larvae can be demonstrated directly in the lesions.

At meat inspection, lymphadenitis necessitates stripping of the affected lymph node. The lymph node draining areas are also examined for lesions. It is important to be aware that these could be tubercular lesions, which would be an aggravated finding necessitating submission of material for type determination (see Chapter 20). In most cases, it is not possible to decide macroscopically whether a granulomatous, caseous lymphadenitis is due to infection with parasites, fungi or mycobacteria.

Neoplasms

Tumours in the lymph nodes are generally a sign of lymphosarcoma or a metastatic tumour from the lymph node's draining area. In both cases the lesions necessitate total condemnation. In lymphosarcoma, several lymph nodes and perhaps other organs will be affected (see p. 340). Metastases in the lymph nodes are a definite sign of malignancy. Occasionally tumours are present in lymph nodes when no primary tumour is present in the lymph nodes' draining area. This is seen for example in horses with malignant melanomas, where the axillary lymph nodes are often the site of metastases.

Spleen [10.16 – 10.27]

The spleen's main immunologic function is to monitor the blood so that an effective immune response can be initiated when infectious materials are present. In addition, the spleen has a central role in removal of defective erythrocytes from the circulation. Lesions in the spleen are therefore frequently a sign of systemic disease and, apart from directly introduced bacteria from forestomach lesions, the presence of microorganisms is always an indicator of a generalised infection. Hyperplasia of splenic white pulp is seen in chronic generalised infections and manifests as accentuation of the white lymphoid tissue.

Developmental anomalies

Minor developmental anomalies in the form of notches and folds occur relatively frequently in the spleen, particularly in horses, but are of no significance. Accessory spleens (supernumerary spleens) are occasionally found, particularly cranially in the abdominal cavity. Multiple small accumulations of splenic tissue on serosal surfaces in the abdominal cavity can represent malformations, but are probably more likely to be due to splenic rupture, at which released splenic tissue implants on the serosal surface. The condition is called splenosis and can be seen in all animal species. Splenosis must not be confused with hemal nodes, which are normal anatomic structures, the structure and function of which are similar to that of the spleen. They are to be found retroperitoneally, particularly dorsally, and are often quite conspicuous in cattle.

Amyloidosis

Amyloid deposits in the splenic white pulp occurs occasionally as part of generalised amyloidosis. Amyloidosis is seen primarily in ruminants with chronic pyogenic infections (pyaemia, mastitis, etc.), but frequently the actual cause cannot be identified. The condition is nearly always due to deposits of AA amyloid, which originate from the acute phase protein serum amyloid A (SAA), which is produced in the liver in connection with infections. A spleen with amyloidosis has a very conspicuous greyish, transparent white pulp that resembles cooked sago (hence the term "sago spleen"). Amyloidosis without complications necessitates partial condemnation.

Infarctions

Anaemic splenic infarcts can be the result of aseptic thrombi in the splenic artery or its branches. More frequently, however, these are complications associated with generalised viral or bacterial infections. Venous splenic infarcts are primarily due to dislocation of the spleen and are discussed later.

Splenic infarcts are seen particularly in cattle. The infarctions can be sterile or infected. Infected infarcts are seen particularly in cattle with pyaemia. Generally they develop into abscesses and are then called embolic splenitis. In most cases, the cause of sterile infarcts is unknown, but as with renal infarcts they occur particularly in newly-calved animals, and in animals with serious infections or circulatory disorders. There are some indications that activation of the animal's acute phase response predisposes to development of thrombi and thus infarcts in these animals.

Splenic infarcts are an important finding in hog cholera. The infarcts are dark red, 5 to 20 mm in diameter, and project above the surrounding splenic tissue. The infarcts are not always present in hog cholera, but if they are present, they can be considered as pathognomonic for the disease. Splenic infarcts also occur in African swine fever, but it is often difficult to see them because the spleen is generally enlarged due to congestion.

In pigs, incomplete contraction of splenic tissue is occasionally seen which then becomes blood-filled and projects above the surface of the spleen. It can be very difficult to distinguish between these lesions and acute infarcts. The changes are unremarkable at palpation, and necrosis of the splenic tissue is absent.

Aseptic splenic infarcts without complications necessitate rejection of the spleen. Septic splenic infarcts are scored as splenitis (see p. 339) or in accordance with the rules on sepsis, pyaemia and viraemia.

Dislocation and rupture

Due to anatomical reasons, dislocation of the spleen occurs primarily in pigs. This could be torsion of the entire spleen around the hilus or torsion of part of the spleen around its longitudinal axis. The acute lesions at splenic torsion are characterised by pronounced congestion due to terminated or reduced venous outflow. The torsioned spleen is swollen and dark, with fibrin exudation on the surface. There may be concomitant jaundice. The tissue undergoes necrosis, and in the chronic stage fibrin is replaced by collagen. The spleen will often be entangled in and adhere to the omentum. Sufficient oxygen diffuses into the splenic capsule from the surroundings that it does not

become necrotic. Later, lysis of the necrotic splenic tissue occurs due to invasion of inflammatory cells. Necrotic splenic tissue is highly susceptible to secondary infection, and haematogenously spread bacteria therefore have a strong tendency to colonise the tissue with subsequent secondary development of a splenic abscess. Splenic torsions appear to be particularly common among sows, in which the entire spleen or a large part of it is often absent and replaced by connective tissue.

Rupture of the spleen occurs occasionally as sequelae to trauma, for example in connection with transportation to the slaughterhouse, or secondary to splenic torsion in which the highly congested spleen can be very friable. The condition can result in development of haemoperitoneum and possibly splenosis.

Rupture or torsion of the spleen with no complications other than venous infarction of the splenic tissue necessitates partial condemnation.

Splenomegaly

Splenomegaly can be caused by many factors. There are two types of splenomegaly: The first is due to accumulation of blood (congestion) in the spleen, and the second is due to proliferation of splenic cells. The first type is typically due to torsion of the spleen, but anthrax, sepsis, viraemias, and intoxications can be associated with a highly congested spleen. In the second type of splenomegaly, the spleen has a firm, meaty consistency. This is seen in haemolytic anaemias, for example, in which macrophages accumulate in the splenic red pulp. Infections can also cause this type of splenomegaly. This applies for example to salmonellosis, erysipelas and African swine fever.

Lymphosarcoma in the spleen can cause extreme splenomegaly. This is most common in pigs and horses. The tumour tissue will normally be recognisable as grey areas on the cut surface. The white pulp is generally highly accentuated.

Scoring of splenomegaly depends on the cause. Thus, torsion of the spleen without complications necessitates partial condemnation, whereas infectious conditions and lymphosarcomas necessitate total condemnation.

Splenitis

Bacterial splenitis is due either to haematogenous spread of bacteria to the spleen in connection with generalised infections or direct introduction of bacteria to the spleen via a foreign body in the forestomachs. The latter is seen only in cattle. Abscesses in the spleen must always be considered to be part of pyaemia, unless a traumatic cause can be demonstrated. Abscesses on and around the spleen are seen occasionally as part of traumatic reticuloperitonitis. Embolic splenitis, which involves acute lesions, necessitates total condemnation. If only limited, chronic lesions without complications are present the carcase is approved for deboning. Traumatic splenitis necessitates total condemnation except in cases of chronic, defined lesions without complications, which necessitates rejection of the affected parts.

Highly enlarged and indurated spleens are occasionally seen in pigs, and are generally associated with similar changes in the liver. These splenic changes are discussed in older literature as fibroplastic splenitis. This is diffuse inflammation with pronounced fibrosis and varying degrees of eosinophilic infiltration. The cause of these changes is

not known. The condition is frequently associated with complications in the form of anaemia, emaciation, and ascites, which necessitates total condemnation. Uncomplicated cases necessitate partial condemnation.

Neoplasms

Neoplasms in the spleen are most often lymphosarcomas (see below). Primary splenic tumours such as haemangiomas, haemangiosarcomas and fibrosarcomas occur only very rarely. Metastases to the spleen are far more frequent and are seen particularly in the horse. At meat inspection, the presence of malignant neoplasms always necessitates total condemnation.

Lymphosarcoma (leukosis) [10.28 – 10.38]

Leukosis is one of the most commonly occurring neoplastic diseases in slaughter animals. The term "leukosis" is often used for the disease itself, whereas the tumours are called lymphosarcomas (malignant lymphomas). Leukosis is distinct from other neoplastic diseases by occurring relatively frequently in young animals, including finisher pigs and calves. The disease always necessitates total condemnation.

Lymphosarcomas originate from lymphocyte populations in the lymphoid organs, which they also have a strong tendency to infiltrate. Thus they are often seen to be primarily localised to the lymph nodes, spleen, or thymus. Lymphosarcomas otherwise behave quite differently. They can occur only in one organ (e.g. kidney, intestine, or heart) and its associated lymph nodes, but more frequently several organs are affected. Most cases of leukosis are sporadic and have an unknown aetiology. In cattle, however, enzootic cases also occur that are due to a retrovirus (bovine leukaemia virus, BLV). Enzootic leukosis was last seen in Denmark around 1989.

Regardless of the cause and species, lymphosarcomas have a relatively stereotypic macroscopic appearance. They behave partly as definite lesion processes that project above their surroundings, partly as diffuse infiltrations in which the organ retains its form but is highly enlarged, is paler in colour, and has reduced tissue texture. Often lesion processes and infiltrations occur together in the same organ.

Lymphosarcomas are usually greyish, soft and friable. They are a frequent site for extensive haemorrhage and possibly necrosis. An incision in a lymphosarcoma results in doming of the cut surface, and scraping with a knife demonstrates that fluid is oozing from the tumour tissue.

Leukosis in cattle

There are four types of leukosis in cattle: Enzootic leukosis and three sporadic types.

As stated previously, enzootic leukosis is due to a retrovirus. The disease is notifiable, and is monitored continuously in Denmark through blood and milk sampling.

Enzootic leukosis is particularly common in 4-8 year old animals. The tumours' predilection sites are the lymph nodes, heart (particularly the right atrium and auricle), uterus, and abomasum. Less frequently, the tumour tissue can be localised to the liver, spleen, or kidneys. Animals with enzootic leukosis often have protruding eyes, due to

retrobulbar tumours. Congestive changes resulting from growth of tumour tissue into the right atrium can also be observed.

The three types of sporadic leukosis in cattle are calf leukosis, juvenile leukosis, and skin leukosis. Calf leukosis is seen in animals younger than 6 months, including the foetus. The lymph nodes, liver, and spleen are often severely enlarged. Tumour infiltration into the skeleton is often seen and can be the site of extensive necrosis. The thymus is generally not involved and can even be atrophic.

Juvenile leukosis or the thymic form is seen in animals less than 2 years old. The thymus is always involved and can be extremely enlarged (over 20 kg). There is compression and, to a lesser extent, invasion of surrounding structures including the oesophagus, jugular veins, and lungs, which can result in ruminal tympany, congestive lesions, and compression atelectasis. Other than local invasion and implantation metastases in the thoracic cavity, metastases to other organs are rarely seen.

Skin leukosis affects in particular animals less than 3 years old. Widespread, prominent lesions can be seen on the skin, particularly on the head, flanks, and perineum. The lesions are often hairless, and can be ulcerated. An incision through a lesion reveals the typical meaty tumour tissue in the corium. Skin leukosis can have a very long progression in which only the skin is affected. In the late phase, there is a tendency to generalisation with spread to the internal organs. The organ lesions can be difficult to differentiate from enzootic leukosis.

Leukosis in sheep and goats

Leukosis in sheep and goats resembles calf leukosis. However, the skeleton is rarely affected.

Leukosis in pigs

Lymphosarcomas in pigs can vary greatly with regard to distribution. All lymph nodes and the majority of internal organs, particularly the kidneys, spleen, and liver can be infiltrated. Cases may involve only one organ, but most frequently several organs with their associated lymph nodes are affected. Occasionally, extensive infiltrations are seen in the ovaries, skeleton (often the ribs), skeletal muscles, heart, or stomach. Lymphosarcomas in pigs are often accompanied by extensive haemorrhage.

Leukosis in horses

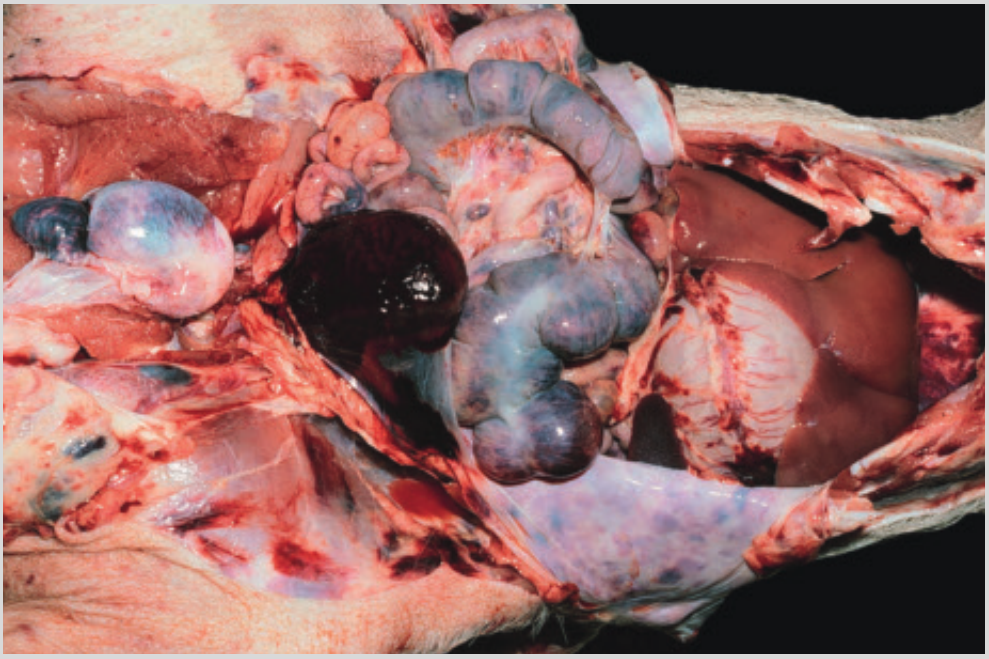
Leukosis in horses can be divided into 4 anatomical forms: multicentric, cutaneous, alimentary, and splenic. Multicentric lymphosarcomas are found particularly in the lymph nodes, mediastinum, and abdominal cavity, and many organs can be involved. Cutaneous lymphosarcomas manifest as multiple, prominent, well-defined lesions in the skin which when cut through have a white to yellowish surface. With alimentary lymphosarcomas, massive infiltrations are seen in the intestinal wall and the intestinal lymph nodes. Horses with alimentary lymphosarcoma have often suffered from malabsorption and diarrhoea for a long time, and can therefore be highly debilitated. The splenic form is characterised by a grotesquely enlarged spleen which can be prone to secondary ruptures.

10.01



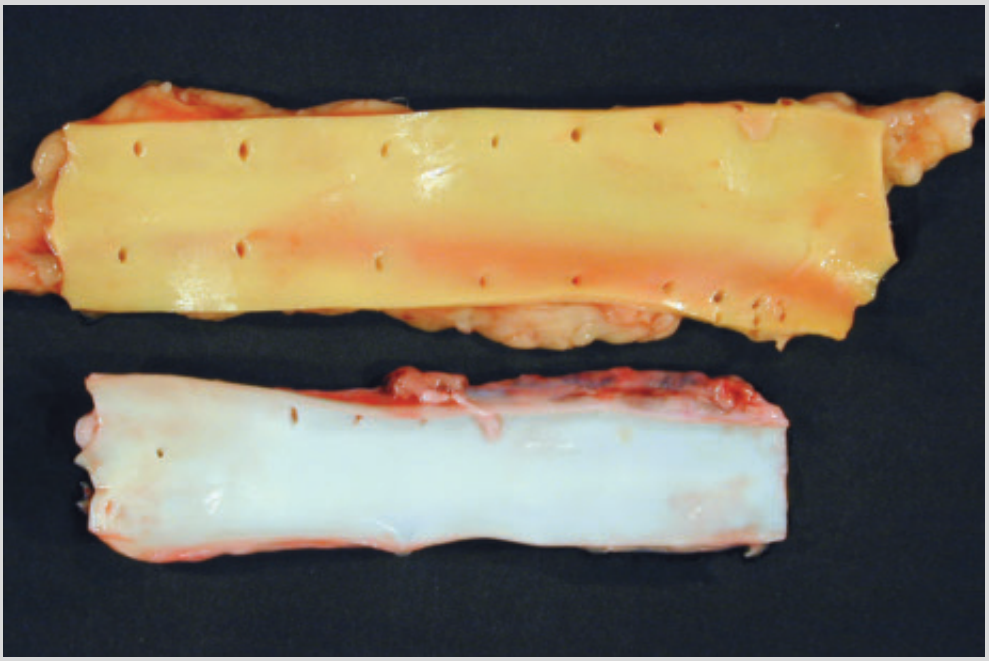
Animal species/Organ	Pig/Skin
Lesion	Haemorrhagic diathesis
Scoring	Total condemnation
Comments	Probably due to thrombocytopenia

10.02



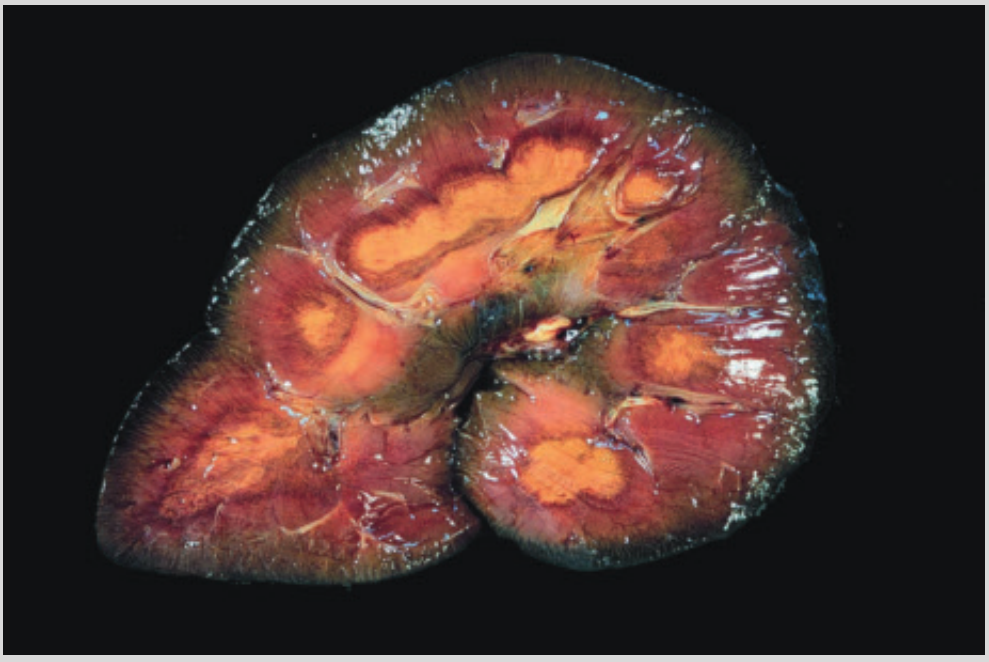
Animal species/Organ	Pig/Abdominal organs
Lesion	Haemorrhagic diathesis
Scoring	Total condemnation
Comments	Limited haemorrhage necessitates partial condemnation

10.03



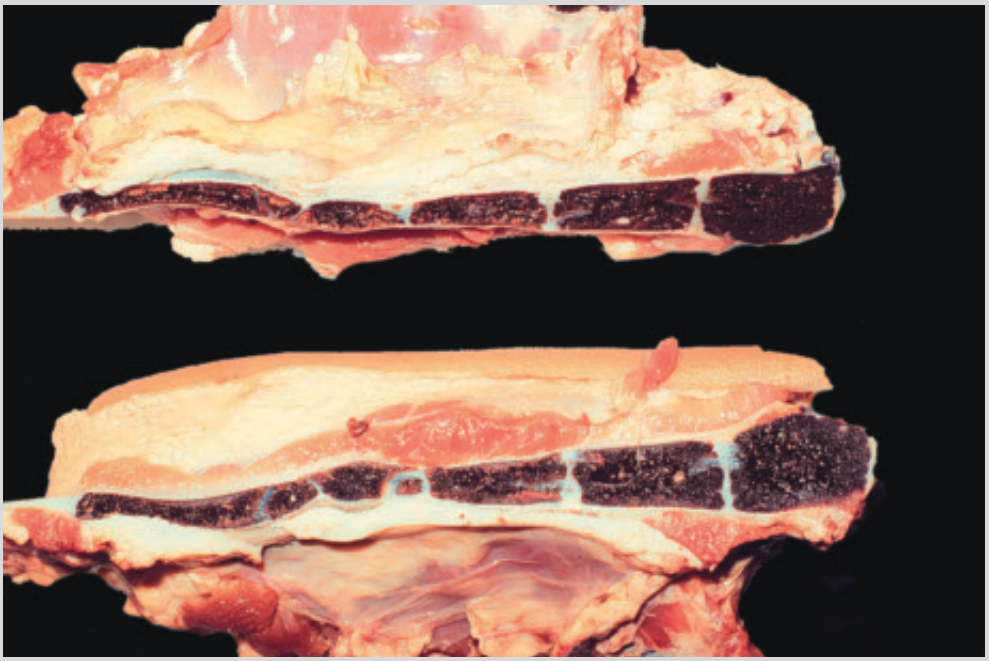
Animal species/Organ	Pig/Aorta
Lesion	Haemolytic jaundice
Scoring	Total condemnation if discolouration is visible 24 hours after slaughter
Comments	Normal aorta for comparison

10.04



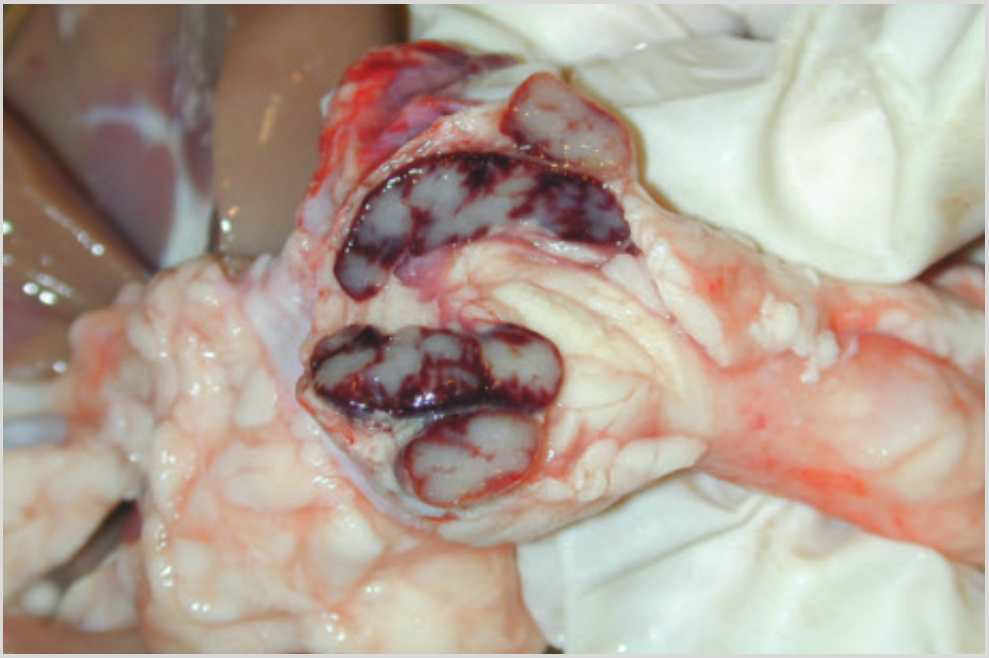
Animal species/Organ	Horse/Kidney
Lesion	Haemoglobinuria
Scoring	Total condemnation
Comments	There is dark discolouration of the cortex and icteric discolouration of the medulla

10.05



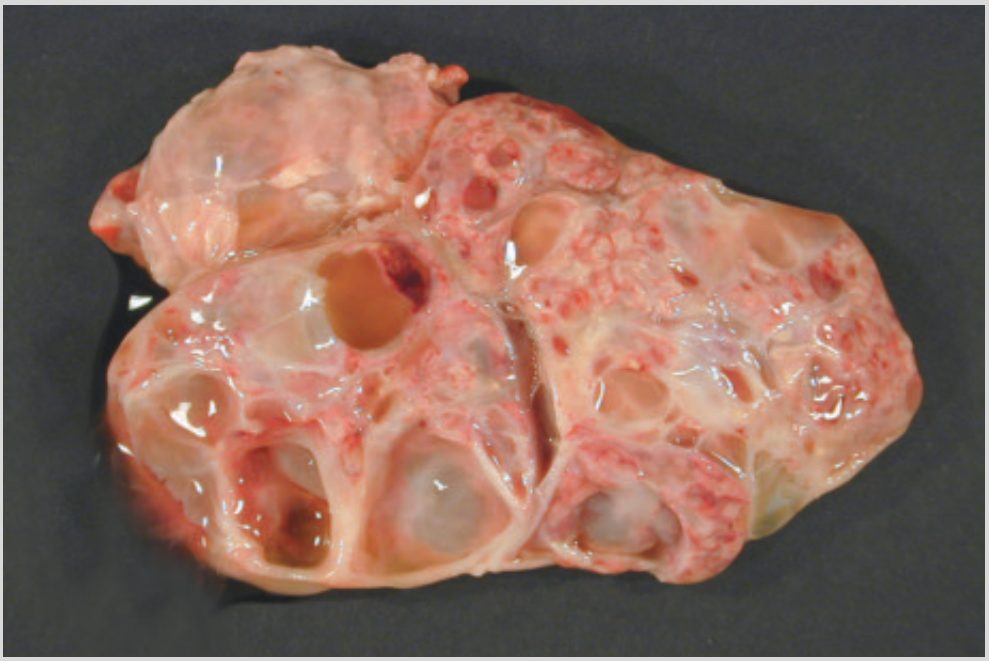
Animal species/Organ	Pig/Sternum
Lesion	Porphyria
Scoring	Approved for deboning
Comments	The entire skeleton and teeth are generally affected

10.06



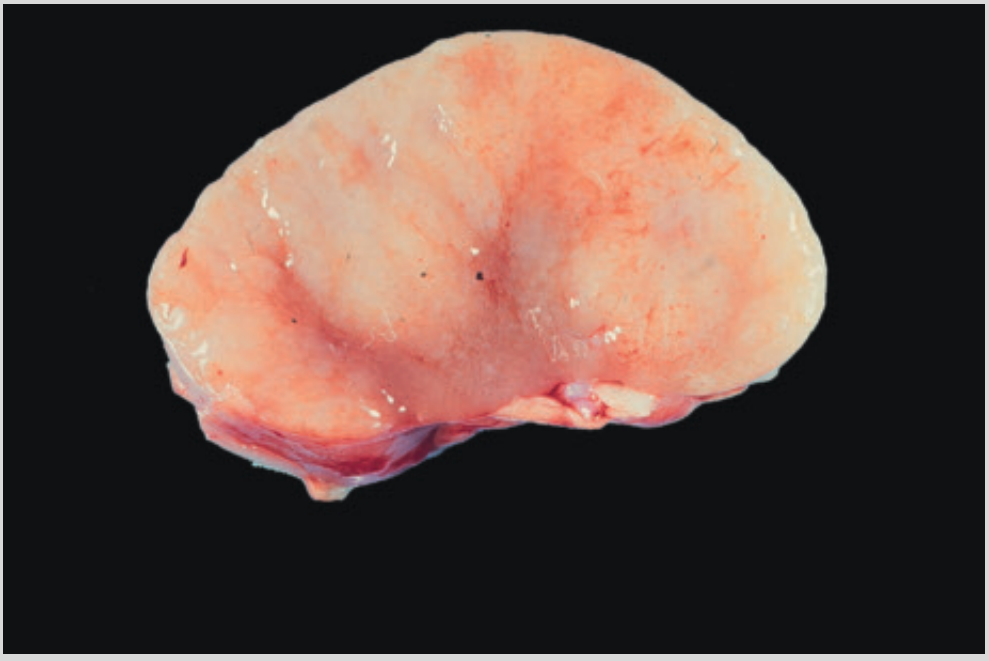
Animal species/Organ	Pig/Lymph node
Lesion	Blood resorption
Scoring	Partial condemnation
Comments	Due to trauma to the lymph node's draining area

10.07



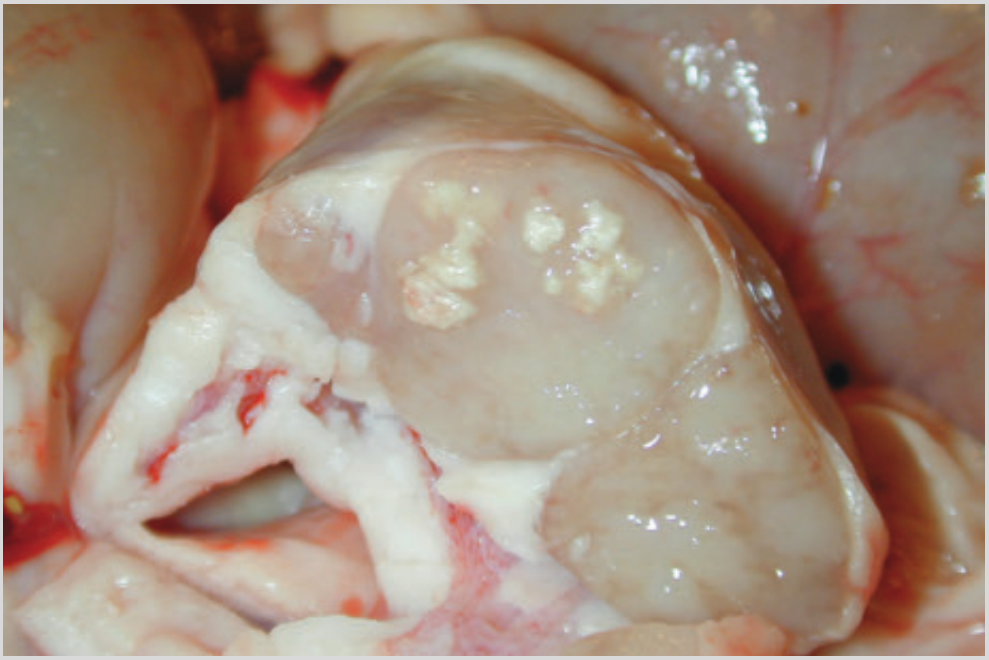
Animal species/Organ	Pig/Lymph node
Lesion	Cysts
Scoring	Partial condemnation
Comments	The cause of these changes is not known

10.08



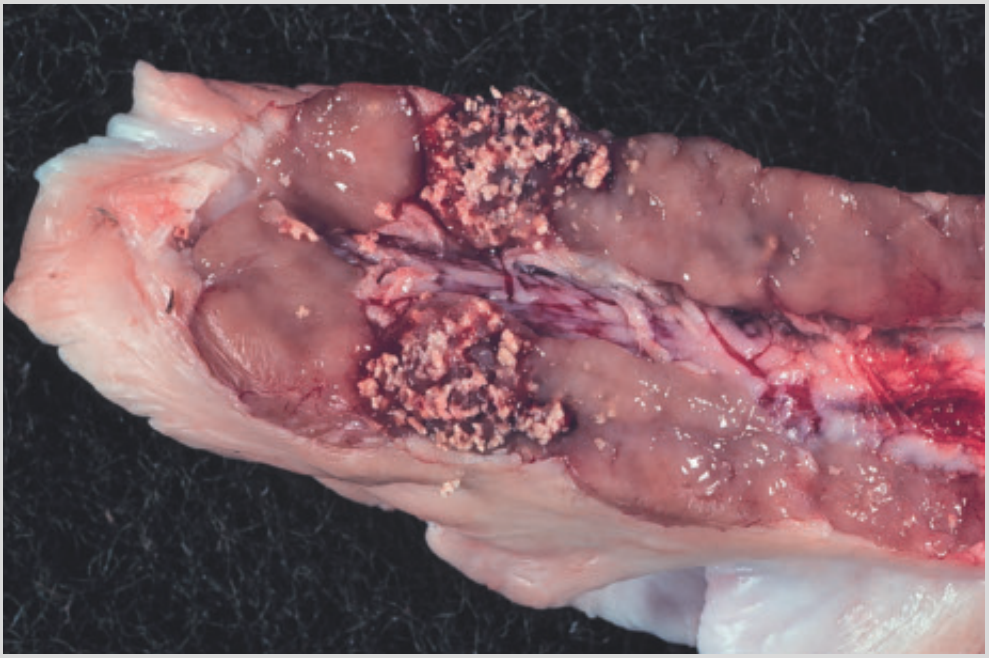
Animal species/Organ	Cattle/Lymph node
Lesion	Reactive hyperplasia
Scoring	Partial condemnation
Comments	Due to inflammation in the draining area

10.09



Animal species/Organ	Pig/Lymph node
Lesion	Chronic, purulent lymphadenitis
Scoring	Partial condemnation
Comments	Due to spread of bacteria from an infection in the draining area

10.10



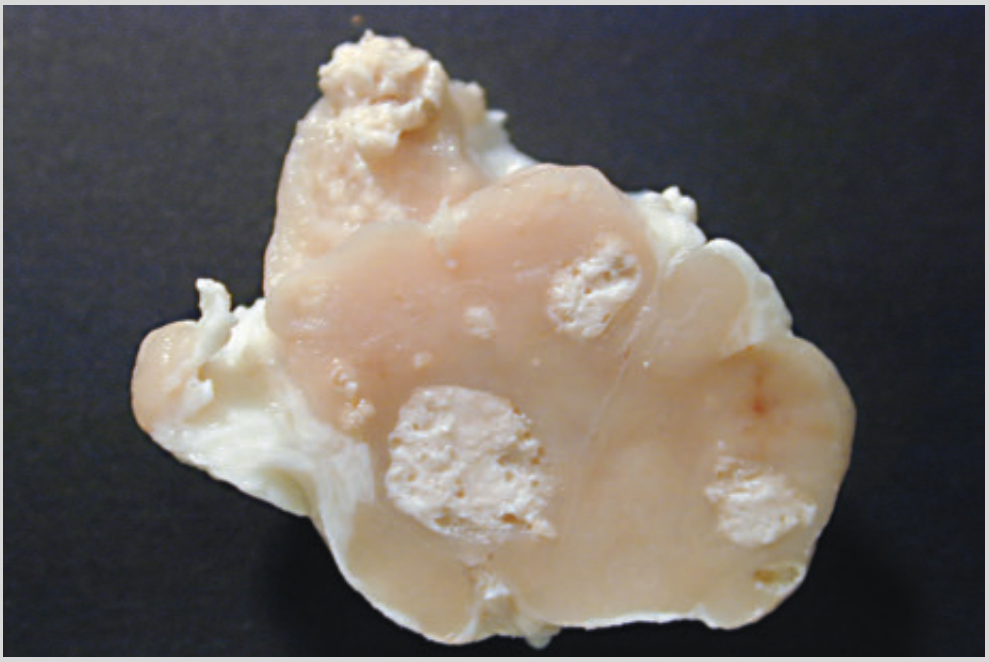
Animal species/Organ	Pig/Lymph node
Lesion:	Chronic, caseous lymphadenitis
Scoring	Partial condemnation
Comments	Avian tuberculosis in a mesenteric lymph node

10.11



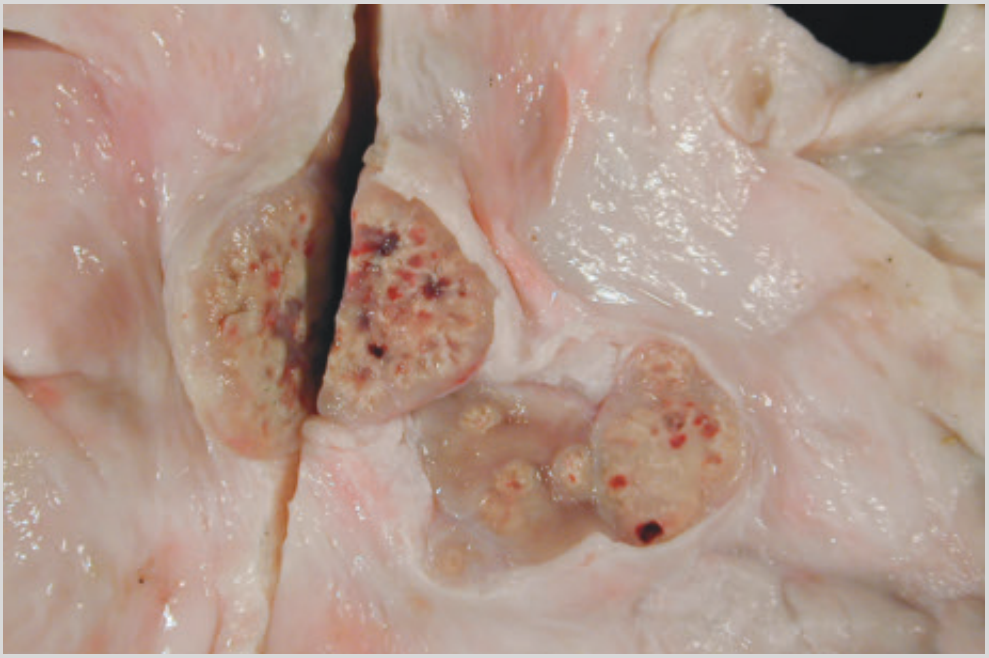
Animal species/Organ	Pig/Lymph node
Lesion	Chronic, pyogranulomatous lymphadenitis (botryomycosis)
Scoring	Partial condemnation
Comments	Due to *Staphylococcus aureus*

10.12



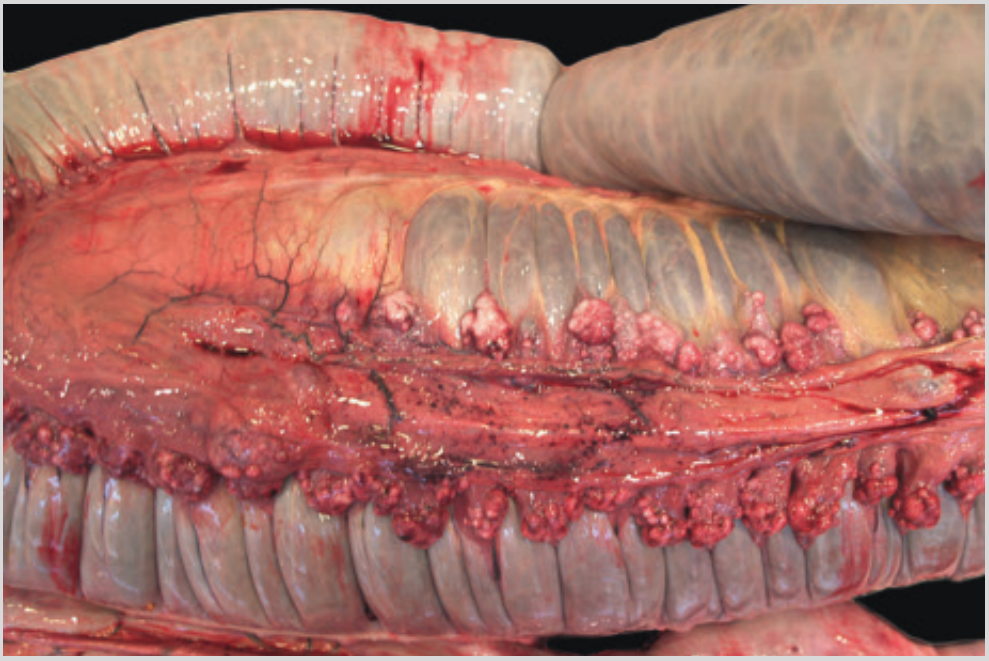
Animal species/Organ	Pig/Mandibular lymph node
Lesion	Chronic, caseous lymphadenitis
Scoring	Partial condemnation
Comments	Due to *Rhodococcus equi*

10.13



Animal species/Organ	Cattle/Lymph nodes
Lesion	Chronic, necrotising, mycotic lymphadenitis
Scoring	Partial condemnation
Comments	Due to fungal infection

10.14



Animal species/Organ	Horse/Large intestine with lymph nodes
Lesion	Chronic, granulomatous lymphadenitis
Scoring	Partial condemnation
Comments	Idiopathic condition that can be confused with neoplasms

10.15



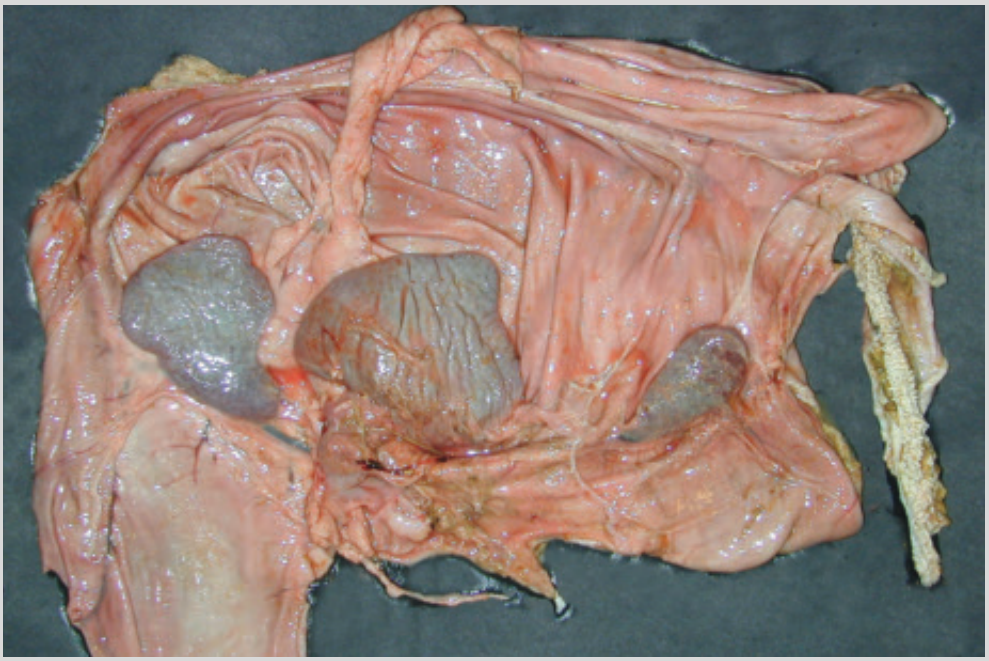
Animal species/Organ	Cattle/Lymph node
Lesion	Metastases from uterine carcinoma
Scoring	Total condemnation
Comments	Primary tumour is often difficult to detect

10.16



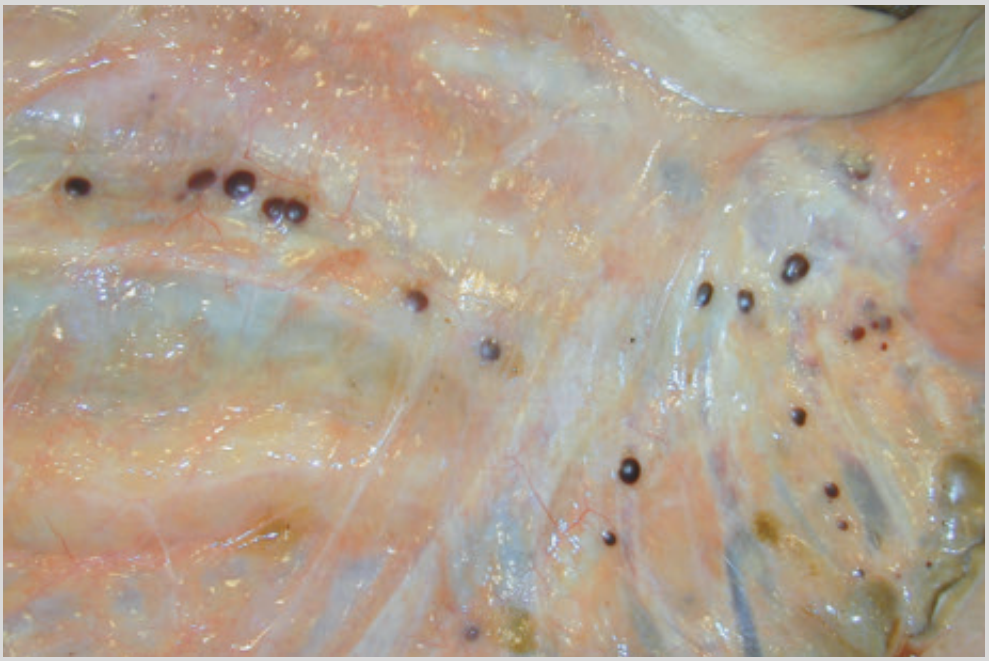
Animal species/Organ	Cattle/Spleen
Lesion	Hyperplasia of the white pulp
Scoring	Partial condemnation
Comments	Normal spleen on the right

10.17



Animal species/Organ	Sheep/Forestomachs and spleen
Lesion	Two accessory spleens (supernumerary spleens)
Scoring	Partial condemnation
Comments	Supernumerary spleens can occur in all species

10.18



Animal species/Organ	Cattle/Peritoneum
Lesion	Haemal nodes
Scoring	Normal anatomic structures
Comments	Occur only in ruminants

10.19



Animal species/Organ	Cattle/Spleen
Lesion	Chronic infarction
Scoring	Partial condemnation
Comments	Sharp transition between necrotic tissue (left) and vital tissue (right)

10.20



Animal species/Organ	Pig/Spleen
Lesion	Multiple acute infarcts (hog cholera)
Scoring	Total condemnation
Comments	The spleen is not enlarged

10.21



Animal species/Organ	Pig/Spleen
Lesion	Incompletely contracted areas
Scoring	Partial condemnation
Comments	Can be confused with acute infarcts

10.22



Animal species/Organ	Pig/Spleen
Lesion	Acute venous infarction
Scoring	Partial condemnation
Comments	Due to splenic torsion. Complications such as jaundice can necessitate total condemnation

10.23



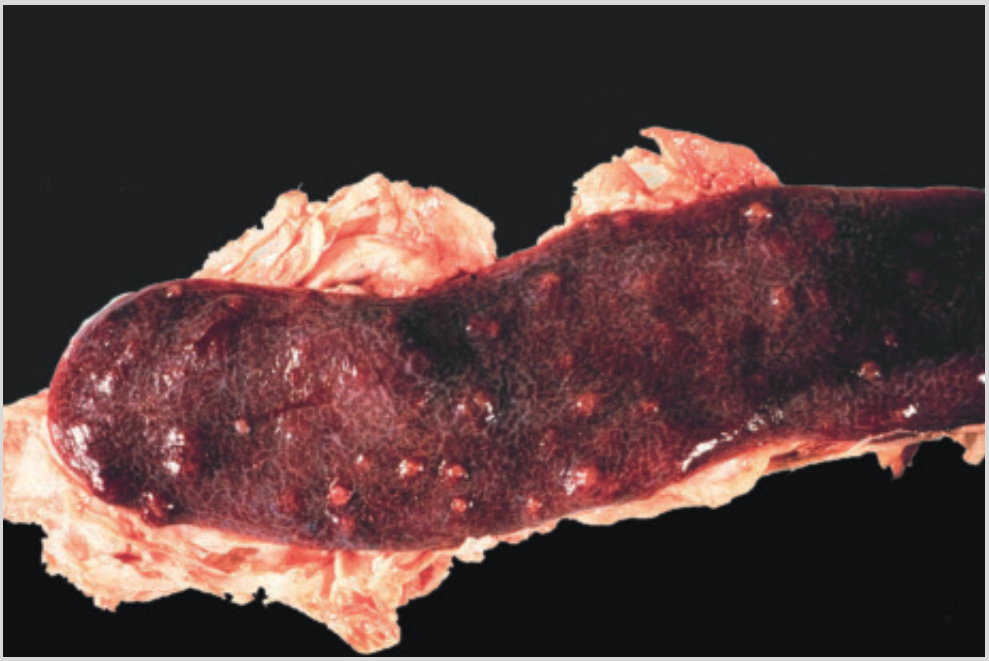
Animal species/Organ	Pig/Spleen
Lesion	Chronic infarction with adhesion to omentum majus
Scoring	Partial condemnation
Comments	Frequent finding at slaughter particularly in sows

10.24



Animal species/Organ	Cattle/Spleen
Lesion	Chronic, purulent traumatic splenitis and perisplenitis
Scoring	Partial condemnation
Comments	Total condemnation unless chronic, limited lesions without complications

10.25



Animal species/Organ	Pig/Spleen
Lesion	Chronic, embolic, splenitis with abscess formation
Scoring	Approved for deboning
Comments	Scoring based on the rules for pyaemia

10.26



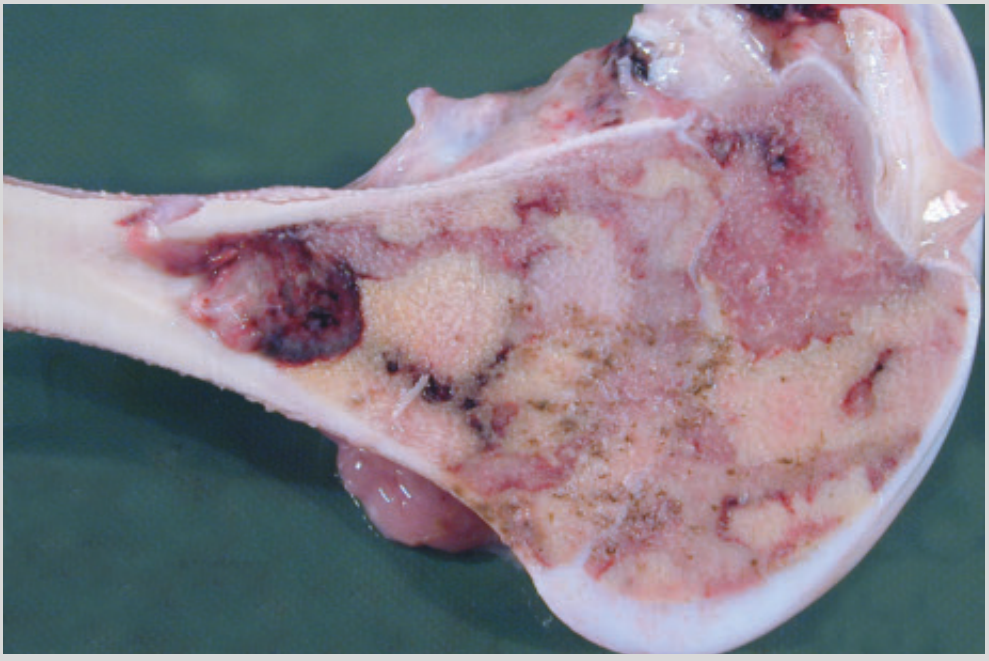
Animal species/Organ	Pig/Spleen
Lesion	Chronic, diffuse, fibroplastic splenitis
Scoring	Partial condemnation
Comments	Normal spleen for comparison. Presence of complications necessitates total condemnation

10.27



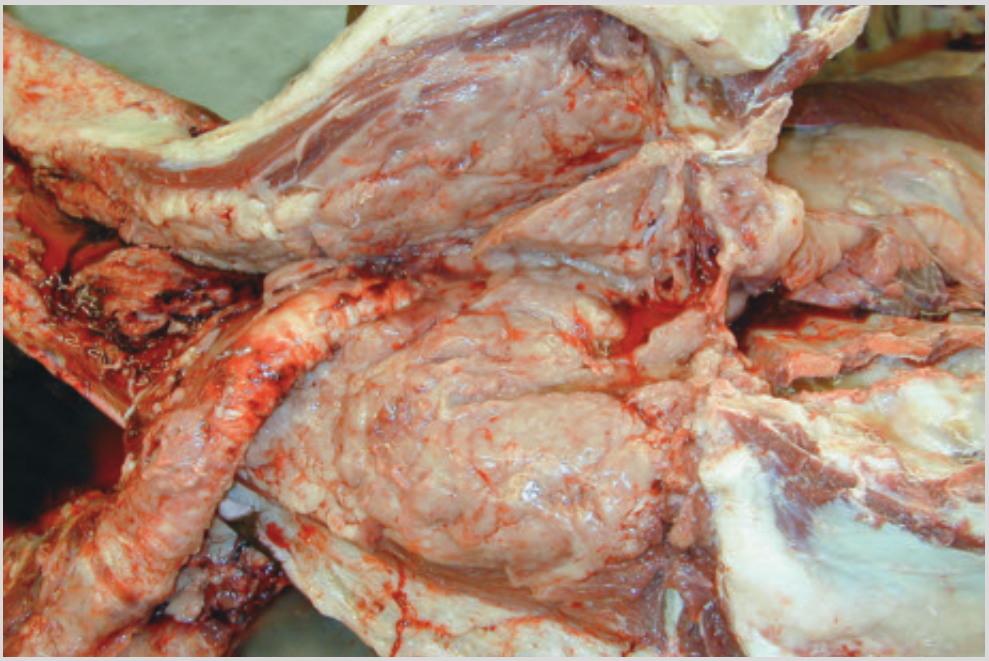
Animal species/Organ	Horse/Spleen
Lesion	Metastatic carcinoma of unknown origin
Scoring	Total condemnation
Comments	Note central umbilication of the processes due to necrosis

10.28



Animal species/Organ	Cattle/Femur
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	There is extensive necrosis in the bone tissue

10.29



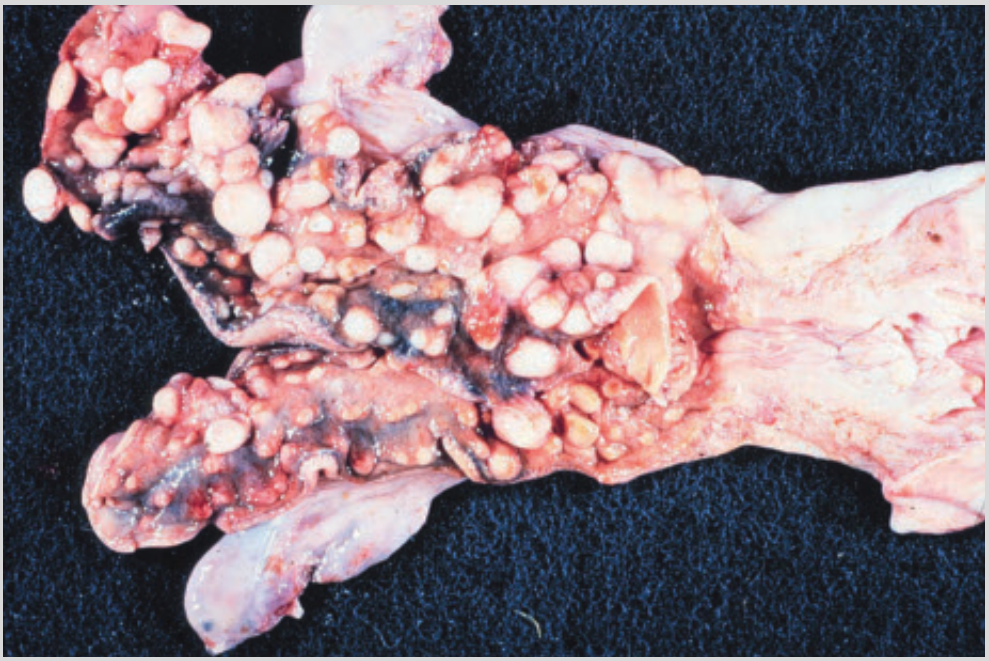
Animal species/Organ	Cattle/Thymus
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Predilection site in juvenile leukosis

10.30



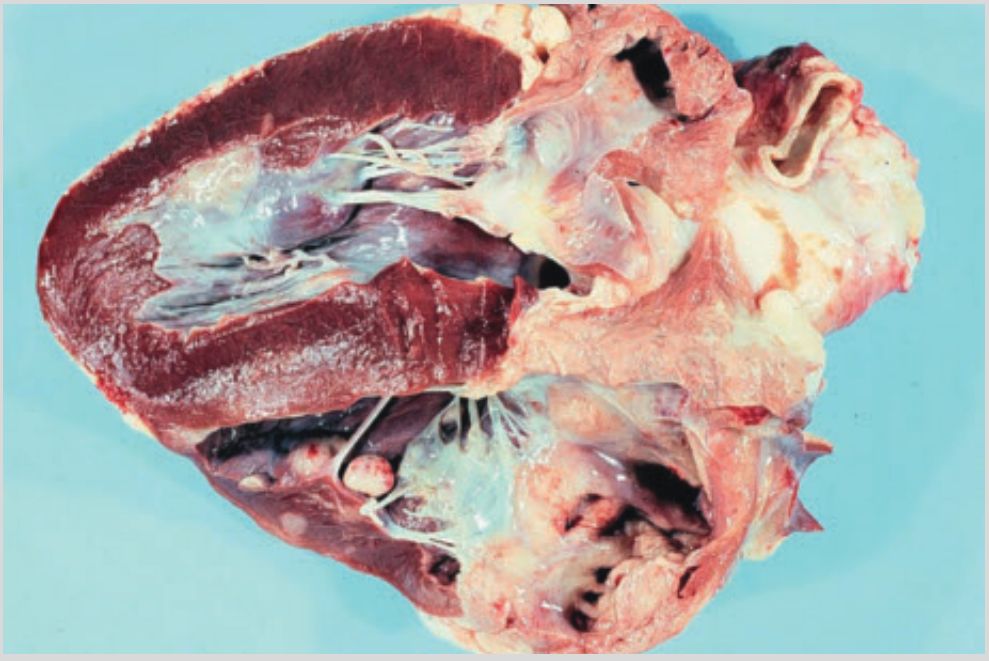
Animal species/Organ	Cattle/Udder skin
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Skin leukosis with multiple infiltrations in udder skin

10.31



Animal species/Organ	Cattle/Uterus
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	One of the predilection sites for enzootic leukosis

10.32



Animal species/Organ	Cattle/Heart
Lesion	Lymphosarcoma in the right side of the heart
Scoring	Total condemnation
Comments	One of the predilection sites for enzootic leukosis

10.33



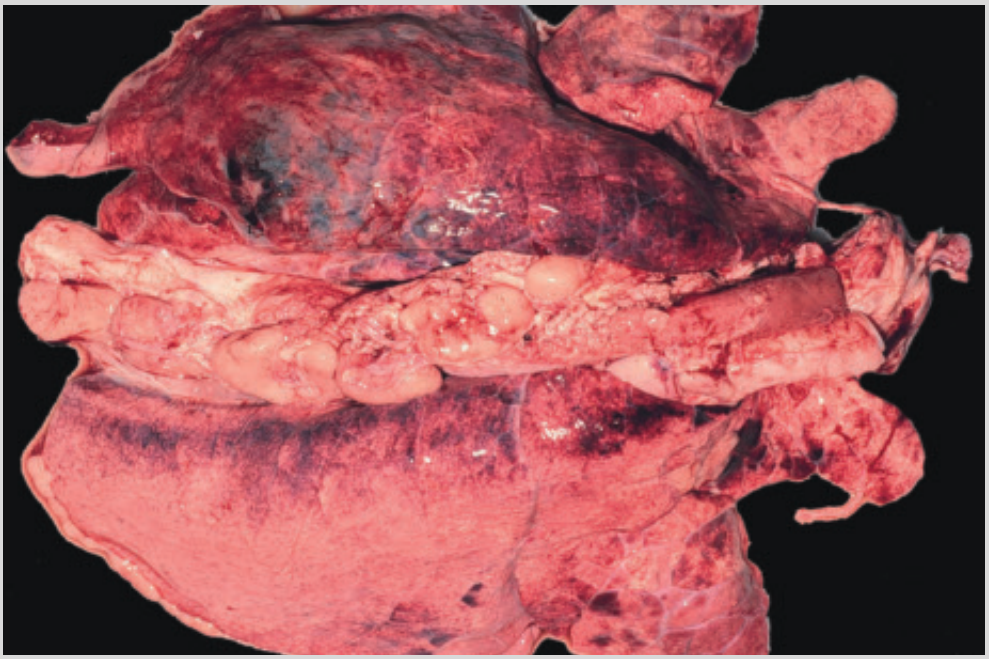
Animal species/Organ	Cattle/Spleen
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Note the irregular whitish infiltrations. Normal spleen on the left

10.34



Animal species/Organ	Goat/Spleen
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	The spleen is pale and uniformly enlarged

10.35



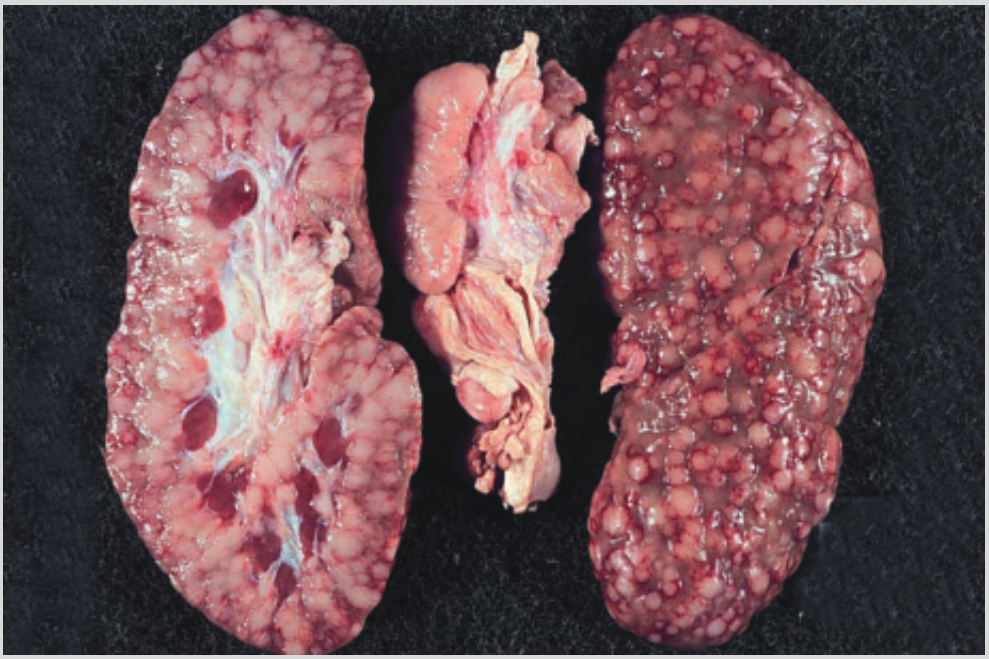
Animal species/Organ	Pig/Lungs
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Extensive tumour infiltration can be seen in the dorsal thoracic lymphocentrum

10.36



Animal species/Organ	Pig/Thoracic wall
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Tumour infiltration can be seen in all ribs

10.37



Animal species/Organ	Pig/Kidney
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Tumour tissue can also be seen in the renal lymph nodes

10.38



Animal species/Organ	Horse/Descending colon
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Tumour tissue is localised to the mesenteric lymph nodes

11 Urinary System

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Introduction

The urinary system includes the kidneys, ureters, urinary bladder, and urethra. Diseases in the urinary system are often localised and uncomplicated, necessitating partial condemnation at meat inspection. Notwithstanding, they can also be an indication of generalised conditions, or they can be accompanied by physiologic dysfunction and intoxications. Renal lesions that necessitate total condemnation of the animal can be divided into three categories:

1) Renal lesions resulting in impaired renal function with subsequent secondary lesions in other parts of the animal.
2) Acute renal lesions, resulting from haematogenous spread of microorganisms, and chronic non-defined pyaemic renal lesions (including infarcts).
3) Malignant tumours.

The kidneys are responsible for excreting nitrogenous waste products from the blood; for regulation of fluids, pH, and electrolyte balance; and for production of the hormones erythropoietin and dihydroxylcholecalciferol (vitamin D_3). Impairment of renal function can therefore manifest as renal failure, resulting in accumulation of waste products in the blood; impairment of fluid balance (dehydration or hydrops); impairment of acid-base balance (acidosis or alkalosis); impairment of ion balance (particularly potassium, sodium, phosphate and calcium), and anaemia.

Accumulation of nitrogenous waste products in the blood is called azotaemia and can lead to a toxic condition known as uraemia. Long-term uraemia can be accompanied by a number of extra-renal lesions, but these are seen rarely in livestock. The carcase can emit a urine odour, and uraemic colitis, in particular, may be present in cattle.

Developmental anomalies [11.01 – 11.08]

Minor developmental anomalies occur relatively frequently in the kidneys of finisher pigs. The most prevalent is focal dysplasia, which is apparent as indentations in the surface of the kidney. These indentations represent persistent foetal lobe division, and incisions will often reveal a deep cyst. Renal cysts may be congenital or acquired and they can be solitary, multifocal or disseminated. The presence of multifocal or disseminated renal cysts which dominate either one or both kidneys is known as polycystic kidneys. These are generally due to genetics or toxic agents, and in severe cases can result in renal failure. Cysts in the kidneys generally contain pre-urine, i.e. non-concentrated urine, and may have a secondary infection.

Inadequate separation of renal lobes occurs occasionally in cattle, but is not significant. This also applies to "horseshoe kidneys", in which the two kidneys have fused via the cranial or caudal ends.

A very small kidney on one side is generally accompanied by an enlarged kidney on the opposite side as a result of compensatory hypertrophy. Compensatory hypertrophy represents in the strictest sense a hyperplasia (i.e. an increased number of cells) but, because the number of nephrons has not increased, this is traditionally called hypertrophy. The small kidney may be small for many reasons such as hypoplasia, i.e. the kidney is small, but otherwise normal, or widespread dysplasia, i.e. abnormal development of the kidney. The two conditions often cannot be differentiated macroscopically; however, generalised dysplasia of the kidney occurs extremely rarely in livestock, and may be accompanied by fibrosis or cysts. Finally, there is renal atrophy which can have many causes; unilateral pyelonephritis and impaired blood supply to one kidney are probably the most common. Atrophic kidneys are often deformed and indurated.

Complete absence of one kidney (agenesis) occurs rarely; occasionally the kidney can be comprised of a primitive anlage only (aplasia). The latter condition presumably represents a transition form between agenesis and dysplasia. Abnormal localisation of the kidney is called ectopia or heterotopia and is generally unilateral. The ectopic kidney is often found in the pelvic region and the condition is frequently complicated by hydronephrosis due to kinking of the ureter in its abnormal course.

Uncomplicated renal malformations necessitate rejection of the affected kidney. Complications due to renal failure are seen particularly secondary to bilateral polycystic kidneys and necessitate total condemnation.

Hydronephrosis [11.09 – 11.11]

Hydronephrosis can be congenital or acquired, and unilateral or bilateral. The condition is always due to impaired outflow of urine due to an obstruction in the pelvis or urinary tract. Hydronephrosis manifests as cystic dilatation of the renal pelvis or (in cattle) calyces. The content consists of urine, but secondary infection is often present, possibly with accumulation of pus (pyonephrosis). In cattle the condition can, due to absence of the renal pelvis, resemble polycystic kidneys, but careful examination will reveal communication between the dilated calyces and the efferent branches of the ureter. Congenital

hydronephrosis occurs generally due to a malformation in the urinary tract. In finisher pigs, this is typically strictures and folds in one or both ureters. Acquired hydronephrosis can be due to inflammation, renal uroliths, or neoplasms in the pelvis or urinary tract. Very rarely, the condition is due to dislocation of the bladder and subsequent kinking resulting from prolapse, hernia or similar. Unilateral hydronephrosis can be highly developed without any resultant signs of renal failure. In contrast, bilateral hydronephrosis will often result in renal failure and uraemia. The course of hydronephrosis also depends on the degree of obstruction. Thus, partial obstruction will result in gradual development of the condition, whereas total cessation of urine outflow will result in an acute disease that is not necessarily associated with dilatation of the kidney. However, it can be dominated by circulatory disorders with haemorrhage and necrosis of the renal papillae or perhaps renal infarctions. The latter is seen particularly in bulls, rams, and male goats at acute onset of obstructive urolithiasis in the urethra.

Uncomplicated hydronephrosis necessitates rejection of the affected kidney. Complications necessitate total condemnation.

Circulatory disorders [11.12 – 11.26]

Hyperaemia in the kidneys is seen in acute nephritis as one of the cardinal symptoms of this acute inflammation, and is often accompanied by haemorrhage. Renal congestion is seen in impaired venous outflow from the kidneys and manifests as dark, blood-filled kidneys. Hyperaemia and congestion in the kidneys necessitate only partial condemnation, unless the underlying condition necessitates otherwise.

Haemorrhage

Haemorrhage in the kidneys often manifests as petechiae or ecchymosis, but more extensive haemorrhage with perhaps haematoma formation also occurs. Petechial haemorrhage often occurs in connection with the slaughter procedure and is then called non-specific blood splash. These occur particularly in the cortex and are not accompanied by other lesions such as oedema or enlarged lymph nodes. Petechial haemorrhage can also be a sign of generalised infections. Examples of diseases often accompanied by petechial renal haemorrhage include salmonellosis, acute erysipelas and hog cholera. Finally, petechial renal haemorrhage is an important macroscopic lesion in glomerulonephritis. In order to assess whether this is non-specific blood splash or indication of generalised disease, it is important to correlate the lesions with findings in the rest of the carcase. Furthermore, it is important to carefully examine the kidneys in order to detect oedema or embolic lesions. It is also highly important to examine the regional lymph nodes. Ecchymosis and other more extensive haemorrhage often occur due to coagulation dysfunction, which can be genetic or due to intake of anti-coagulants (e.g. rat poison). Trauma to the kidneys occurs occasionally in connection with transport to slaughter, and can manifest as ecchymosis or perirenal haematomas.

At meat inspection, scoring of renal haemorrhage depends on the cause, but as a minimum necessitates rejection of the affected kidneys. Scoring complies with the primary cause if known and, in cases of acute infectious conditions, will necessitate

total condemnation. Non-infectious glomerulonephritis without complications necessitates partial condemnation.

Infarction

Renal infarcts occur relatively frequently in livestock, particularly in cows. The infarcts can be sterile or infected. Infarcts with pyogenic infections generally develop into nephritis with abscess formation. In most cases, the cause of sterile infarctions is unknown, but they occur particularly in newly-calved animals, and in animals with serious infections or circulatory disorders. There are some indications that activation of the animal's acute phase response predisposes to development of thrombi and thus infarctions in these animals. In horses renal infarctions can be due to aberrant migration of *Strongylus vulgaris* larvae. Renal infarcts can be solitary or multiple, and often involve the outer part of the cortex or the entire cortex. However, they can also extend down into the medulla or even involve a major part of the kidney. The latter is seen particularly frequently in cattle; cutting open the renal artery and the interlobar arteries will often reveal thrombi. On a cut surface, a typical renal infarct presents as a triangular necrotic area in the cortex, with one side lying along the surface of the kidney while the opposite corner points to the medulla. Several infarcts can converge thereby acquiring a more rectangular appearance. Acute renal infarcts are haemorrhagic and initially bulge up from the surface of the kidney. The volume of blood in the infarct drops rapidly, and about 2 days after onset clearing of the centre can be detected. This clearing is due to enzymatic degradation of the erythrocytes in the infarct, and will initially be surrounded by a haemorrhagic margin caused by blood oozing from the surrounding viable renal tissue. The haemorrhagic margin is gradually replaced by a paler zone, which is comprised of infiltrating inflammatory cells. A chronic infarct is characterised by fibrous demarcation and will often fill less than the surrounding tissue due to phagocytosis of the necrotic tissue. The infarct eventually manifests as a cicatrix, i.e. a fibrous indentation on the surface of the kidney.

At meat inspection, renal infarcts are scored in the same way as embolic nephritis. The presence of acute and subacute lesions necessitates total condemnation. Chronic infarcts without purulent content and without complications are considered to be aseptic and necessitate rejection of the kidneys. Cases with only encapsulated pus-containing chronic lesions without complications are scored in accordance with the regulations on pyaemia which necessitate partial condemnation and approval for deboning.

Cortical and medullary necrosis

Extensive necrosis of the renal cortex can be an indication of so-called renal cortical necrosis. This condition is seen particularly in animals with septicaemia caused by gram-negative bacteria, or endotoxemia, and occurs due to microthrombi in the cortical blood vessels (disseminated intravascular coagulation). Because the lesions are due to a serious underlying condition, and moreover require a certain length of time to manifest macroscopically, it is highly unlikely that they will be seen in slaughter animals.

Necrosis of the renal papillae or medulla can, as previously mentioned, be seen in acute urolithiasis, but the condition can also be due to renal amyloidosis, particularly

in cattle. Primary papillary necrosis, i.e. necrosis of the renal papillae without any other predisposing renal condition, is seen particularly in animals that have been treated with non-steroidal anti-inflammatory drugs.

Cortical necrosis and medullary necrosis, or papillary necrosis without complications, necessitates rejection of the kidneys.

Tubular lesions [11.27 – 11.36]

Tubular diseases are characterised primarily by involvement of the tubular epithelial cells. In renal lipofuscinosis in cattle, accumulation of the pigment lipofuscin is observed in the proximal and distal tubules, resulting in a dark-coloured kidney. The condition is particularly prevalent in the Red Danish Dairy breed, but also occurs in Danish Holstein. Renal lipofuscinosis can be demonstrated particularly in animals older than 3 years. Kidneys with lipofuscinosis are rejected at meat inspection.

Steatosis

In renal steatosis ("fatty kidneys") fat accumulates as triglycerides in the renal tubular cells. The kidneys, particularly the cortex, become very pale, swollen and friable. The condition is most prevalent in fat cows with or without ketosis. Ponies with hyperlipaemia and small ruminants with pregnancy toxaemia can similarly have renal steatosis, as can finisher pigs and sows with infectious conditions and intoxications, and obese individuals. In the absence of complications, kidneys with steatosis are rejected.

Tubular necrosis

The tubular epithelial cells exhibit high metabolism and thus use a lot of oxygen. Furthermore, due to their function, they are exposed to much higher concentrations of waste products and toxic agents, which are excreted by the kidneys, than other cells. These two factors mean that the tubular cells are particularly susceptible to ischaemic and toxic injury.

Ischaemic renal injury resulting from thrombi has been mentioned in connection with renal infarctions and renal cortical necrosis, but ischaemic injury to the tubular epithelium can also occur in the absence of thrombi in the renal blood vessels. This is seen at reduced blood supply to the kidneys as a result of hypotension in, for example, dehydration, blood loss, or shock due to other cause. The reduced blood supply affects the tubular cells in particular which, because they have the greatest oxygen requirement, therefore undergo necrosis. This selective necrosis of the tubular epithelium is called tubular necrosis (nephrosis) and manifests macroscopically as pale, swollen, and oedematous kidneys with varying amounts of petechial haemorrhage on the surface of the kidney. At incision through the kidney, radial haemorrhage is seen, which is often concentrated around the corticomedullary transition. The renal lymph nodes can be oedematous and the site of blood resorption, but they are not as enlarged as in glomerulonephritis, for example.

Acute toxic tubular necrosis cannot be differentiated macroscopically from acute ischaemic tubular necrosis, but the toxic cases have a tendency to progress to a chronic

stage. This is because the toxic substances are often taken up in small concentrations over a longer period of time. The appearance of the chronic lesions can vary somewhat depending on the cause. Toxic tubular necrosis can have many causes, but under Danish conditions, only a few of the substances are relevant in slaughter animals. The most important cause of nephrotoxic tubular necrosis in pigs is ochratoxin, produced by fungi in mouldy feed. Ochratoxicosis appears macroscopically as fibrosis of the renal parenchyma. The lesions are often particularly pronounced in the ventral half of the kidneys, which can be severely atrophic as a result of loss of nephrons. Inspection of the surface of the kidneys reveals small pores which represent cystic dilated tubules. Other causes of nephrotoxic tubular necrosis in slaughter animals in Denmark can be acorns (containing tannin), oxalate-containing plants (incl. rhubarb), lead (in paints or accumulators) and vitamin D or its analogues (in cod liver oil or certain plants). Only the latter gives macroscopic lesions that could trigger suspicion of the cause. These are the extensive calcifications present in the renal tubuli in intoxications caused by vitamin D or its analogues. Otherwise the macroscopic lesions in chronic nephrotoxic tubular necrosis are characterised by diffuse fibrosis. The kidneys can be atrophic, normal in size or enlarged, all depending on the extent of nephron loss, and the tubular cells' ability to regenerate. The renal lymph nodes are normal or only slightly enlarged.

The so-called endogenous nephrotoxic tubular necrosis is due to excretion of nephrotoxic substances produced by the animal itself. These could be haemoglobin in haemoglobinuria as a result of haemolysis; myoglobin in rhabdomyolysis or other extreme muscle injury; and bile pigments in jaundice (cholaemic nephrosis). The pathogenesis of these conditions is not fully clarified. It is most likely not the bile pigment, haemoglobin or myoglobin, that is toxic, but presumably other substances that are also excreted. Moreover, the conditions are often accompanied by a weakened circulatory system with reduced renal blood supply which also contributes to development of the lesions. Animals that have survived an episode of haemoglobinuria or myoglobinuria, frequently have dark kidneys as a result of tubular accumulation of haemosiderin, which comes from degraded haemoglobin or myoglobin.

Acute and chronic tubular necrosis without complications necessitates rejection of the kidneys. However, puerperal haemoglobinuria in cattle, and haemoglobinuria in horses and calves with demonstrated discolouration necessitate total condemnation. In cases of tubular necrosis it is important to remember that this condition can be due to uptake of toxic substances (e.g. lead), for which the general rules on intoxication diseases apply.

Amyloidosis [11.37 – 11.39]

Amyloidosis is seen primarily in ruminants with chronic pyogenic infections (pyaemia, mastitis, etc.), but frequently the actual cause cannot be identified. The condition is nearly always due to deposits of AA amyloid, which originates from the acute phase protein serum amyloid A (SAA), which is produced in the liver in connection with infections. Amyloid is deposited particularly in the kidneys, where it is located partly in the glomerular mesangium, and partly along the tubular basal membranes. It can also be deposited in other organs particularly the liver, adrenals, and spleen. The deposits in the

glomeruli result in increased excretion of plasma proteins within the urine. This can result in hypoproteinaemia with consequent widespread oedema, ascites, and hydrothorax.

Kidneys with amyloidosis are enlarged, often extremely. The colour is paler than normal, frequently with a yellow to golden-brown hue. The texture varies somewhat and depends, as in toxic injury, on the degree of fibrosis secondary to the loss of nephrons. Very large kidneys with intra-renal oedema can have a softer texture, but more frequently they are firmer. The lesions are diffuse and the surface of the kidneys is smooth to vaguely granular. Yellow radial strips can be seen on the cut surface, particularly in the medulla. The lymph nodes are only slightly enlarged.

Renal amyloidosis without complications necessitates rejection of the kidneys.

Glomerulonephritis [11.40 – 11.49]

The glomeruli play a central role in the function of the kidneys. Large volumes of blood plasma are filtered through the glomerular filtration barrier, enabling excretion of pre-urine to the Bowman's capsule. This central role means that any pathogens in the blood can easily find their way into the glomerular capillaries. Glomerulonephritis thus always occurs via haematogenous spread, and can be caused by microorganisms and immune complexes. Several virus species, including bovine viral diarrhoea virus and hog cholera virus, infect the glomeruli during a viraemic phase. Septicaemias and pyaemias are often accompanied by bacterial spread to the glomeruli with subsequent embolic nephritis, which is discussed later. Most cases of glomerulonephritis in Danish slaughter animals are non-infectious and are caused by immune complexes that are deposited in the glomeruli. Immune complexes are comprised of antibodies and the antigens they react against. Normally, immune complexes are taken up by phagocytosing cells, but in certain circumstances they can be formed in excessive concentrations and deposited in the kidneys and other organs. Immune complexes can trigger an inflammation cascade, which attracts neutrophils that release numerous enzymes and substances toxic to tissues. These enzymes break down the glomerular filtration barrier such that those components of blood normally retained by the barrier (albumin, fibrinogen, erythrocytes, platelets, etc.), are excreted in large concentrations with the pre-urine. Immune complexes are formed in response to a primary condition that can be inflammatory, autoimmune, or neoplastic in nature. Chronic infections are probably the most common cause of glomerulonephritis in slaughter animals. In pigs these are particularly chronic erysipelas and infections with porcine circovirus type 2 (PCV2), whereas in cattle chronic mastitis and other pyogenic infections are most common. In individual cases, it is generally difficult or impossible to determine the cause of glomerulonephritis. The primary infection can have passed, and other factors can be involved in triggering the disease.

Because glomerulonephritis is a haematogenous disease, the lesions will always be disseminated and bilateral. The high density of glomeruli in the renal parenchyma means that the lesions in glomerulonephritis manifest macroscopically as diffuse. However, the associated haemorrhages are disseminated due to localisation of the blood in the glomeruli and tubules. Glomerular haemorrhage is apparent as spots on the cut

surface, whereas tubular blood accumulation appears macroscopically as spots on the surface of the kidney, and as stripes on the cut surface. The haemorrhage is particularly extensive in the acute stage, subsequently becoming less, but can persist into the chronic stage. The acute stage is otherwise particularly characterised by severe oedema. Disregarding the haemorrhage, the kidneys appear pale and swollen. When incising, the cut surface bulges out and, after removal of the capsule, the renal tissue is highly friable. The lymph nodes are grossly enlarged and blood-engorged. The haemorrhage and oedema subsequently abate, and the pale renal tissue becomes more obvious.

The chronic stage is characterised by diffuse fibrosis, and the surface of the kidneys can become uneven. On the cut surface, the fibrosis is seen in the cortex, which can have a granular appearance resulting from glomerular fibrosis. Even though the medulla is not directly involved, it will often be atrophic due to loss of nephrons. As in nephrotoxic tubular necrosis, the kidneys can be atrophic, and normal in size or enlarged, depending on the extent of nephron loss. It can be difficult to differentiate between chronic glomerulonephritis and chronic nephrotoxic tubular necrosis. Enlargement of the renal lymph nodes is generally more pronounced in glomerulonephritis, as is the petechial haemorrhage in the cortex, but there is no conclusive macroscopic criterion.

Acute infectious glomerulonephritis necessitates total condemnation of the animal. Other forms of glomerulonephritis without complications, i.e. non-infectious glomerulonephritis and chronic glomerulonephritis, necessitate rejection of the kidneys.

Embolic nephritis [11.50 – 11.55]

Embolic nephritis is due primarily to haematogenous spread of bacteria or parasites to the kidneys. These are incidental spread (emboli) to the kidneys, not selective colonisation of the renal tissue. Bacterial embolic nephritis is seen in pyaemia or septicaemia. The bacteria will typically be enclosed in fibrin threads thus constituting infected thromboemboli. These thromboemboli can in principle localise anywhere in the renal blood vessels, but the glomerular capillaries and the interlobular arteries are predilection sites. Arterial localisation will often be accompanied by infarction of the renal tissue. These renal infarct may be the only visible lesions in embolic nephritis. This is particularly the case if non-pyogenic bacteria are involved such as *Erysipelothrix rhusiopathiae*. In contrast, if pyogenic bacteria are involved, the infarctions will typically develop into abscesses which can be very extensive possibly with subcapsular rupture. The latter is particularly prevalent in pyaemia in cattle, in which *Trueperella (Arcanobacterium) pyogenes* is by far the most common causative agent. Other than the renal infarctions, the lesions in embolic nephritis typically comprise disseminated or multifocal lesions, predominantly localised to the cortex in both kidneys. The acute stage is accompanied by circulatory disorders in the form of oedema, hyperaemia, and haemorrhage. The lesions are initially small, but can grow, and generally develop into abscesses. Non-pyogenic bacteria will cause whitish infiltrations. In cattle the distribution of the lesions can sometimes be very irregular. This is a result of the relatively common occurrence of thrombi in the major renal arteries in pyaemia in this species. An infected thrombus in an interlobar artery can

release large quantities of infected material and thus cause multiple lesions in that part of the kidney to which it supplies blood.

Parasitic embolic nephritis is seen occasionally in slaughter animals and is due in particular to aberrant migration of nematode larvae. The most common cause in slaughter animals is *Ascaris suum*, but *Toxocara* spp. may also be involved. In horses the cause is particularly the larvae of *Strongylus vulgaris*. The lesions in parasitic embolic nephritis are often granulomatous and manifest as multifocal whitish or greenish lesions.

Embolic nephritis involving acute or subacute lesions necessitates total condemnation. If only limited, chronic purulent lesions without complications are present, the rules for pyaemia apply, and the animal is approved for deboning.

Interstitial nephritis [11.56 – 11.69]

Interstitial nephritis is due to haematogenous spread of infective agents (virus, bacteria, parasites) or immune complexes to the peritubular capillaries and tubules as part of a generalised disease. It is important to be aware that this is not embolic spread (i.e. random spread) as in embolic nephritis, but a more selective involvement of certain renal structures. This differentiation between interstitial nephritis and embolic nephritis can appear somewhat academic, but it nevertheless has practical significance because the infection in interstitial nephritis must be presumed to be limited to the kidneys, whereas in embolic nephritis embolic lesions can occur in other sites in the animal. It can be difficult in the individual cases to determine whether this is incidental spread or selective colonisation, but this is immaterial at meat inspection because chronic non-purulent embolic nephritis and chronic interstitial nephritis both necessitate rejection of the affected parts. Chronic purulent lesions in the kidneys that are not due to pyelonephritis, must always be considered to be embolic nephritis and scored in accordance with rules for pyaemia.

Acute interstitial nephritis, which is dominated by oedema and hyperaemia, is rarely seen. Generally in slaughter animals, chronic lesions are present, which manifest as disseminated non-purulent lesions comprised of pale stripes which run parallel with the nephrons in the cortex. This form of interstitial nephritis is an incidental finding in cattle in particular. In the mildest form it is not accompanied by change in shape of the kidney, and there is only a modest reaction in the renal lymph nodes. More extensive lesions with diffuse or disseminated infiltrations also occur, but are relatively rare. They are often accompanied by enlarged lymph nodes and atrophy of the renal papillae due to loss of nephrons. Heavy infiltrations can be confused with neoplasms (see below). In certain virus and bacterial infections (including malignant catarrhal fever and leptospirosis), pronounced changes with destruction of tubules can be seen, but most of these diseases occur rarely. The most important known viral cause of interstitial nephritis in Danish slaughter animals is PCV2, which causes interstitial nephritis in pigs. The disease (postweaning multisystemic wasting syndrome (PMWS)) affects smaller pigs in particular, but renal lesions which manifest as disseminated whitish infiltrations in the cortex, are detected occasionally in finisher pigs.

A special form of interstitial nephritis in calves is "white spotted kidney", which is presumed to be due to *Escherichia coli*. The lesions are characterised by whitish corti-

cal lesions, which can achieve almost tumour-like dimensions. Similar lesions are seen occasionally in adult cattle and pigs and can be confused with neoplasms, in particular lymphosarcomas. Infiltrations in interstitial nephritis have a great tendency to spread along the nephrons, and therefore generally have parallel edges; in contrast, lymphosarcomas are generally spherical. In contrast to the lymphosarcomas, haemorrhage is never seen in connection with interstitial nephritis, and the reaction in the lymph nodes is generally less pronounced.

Acute interstitial nephritis necessitates total condemnation of the animal. In chronic cases without complications the kidneys are rejected.

Pyelonephritis [11.70 – 11.88]

The term pyelonephritis incudes infection in the renal pelvis (pyelitis) and the kidneys (nephritis). In principle, pyelonephritis can occur due to infection via the urinary tract (ascending) or the blood (descending, haematogenous). Pyelonephritis that is due to haematogenous spread of the infective agent to the kidney occurs rarely as a complication of embolic nephritis. The term pyelonephritis should (unless otherwise indicated) always be understood to mean an ascending infection of the kidneys.

In its classical form, pyelonephritis manifests as accumulation of more or less purulent exudate in the renal pelvis with concomitant inflammation of the renal parenchyma. The lesions in the pelvis include varying degrees of ulceration and necrosis of the renal papillae. Inflammation of the renal parenchyma manifests as whitish to yellow stripes which extend into the capsule, sometimes giving rise to subcapsular rupture possibly with perirenal abscess formation. Characteristic for pyelonephritis is the irregular distribution of the lesions. This is particularly obvious in cattle, in which macroscopically normal renal lobes surrounded by lobes with more or less diffuse lesions can be present. Another characteristic is that the lesions in pyelonephritis are seen particularly at the renal poles. This predilection for the two poles is seen particularly in pigs, and is ascribed to the compound structure of the polar papillae in contrast to the primarily simple papillae in the rest of the kidney. It is believed that the compound papillae are more susceptible to ascending infections in the tubules and thus the rest of the renal parenchyma. Pyelonephritis can be unilateral or bilateral, and the disease is more prevalent in female animals than male. The condition can cause complications such as calculi formation, or even secondary hydronephrosis. It can also occur secondary to an obstruction in the urinary tract by which the urine is pressed back from the renal pelvis to the renal parenchyma (intrarenal reflux). A similar condition occurs particularly in animals with a defect in the vesico-ureteral junction with subsequent reflux of infected urine from the bladder to the ureters (vesicoureteral reflux).

In sows, purulent pyelonephritis is most frequently due to *Actinobaculum suis*, whereas in cattle *Corynebacterium renale, C. pilosum, C. cystitidis,* and *E. coli* are the main causative agents. Furthermore, in most species there are sporadic cases of purulent pyelonephritis that are primarily due to streptococci.

A special form of pyelonephritis in the pig is so-called leukolymphocytic pyelonephritis. Leukolymphocytic pyelonephritis is due to *E. coli*, but the bacteria can be extremely

difficult to demonstrate by cultivation. In the acute stage, leukolymphocytic pyelonephritis is characterised by multiple, particularly polar lesions, which manifest as a few-mm wide whitish stripes surrounded by a hyperaemic or haemorrhagic margin which extends into the cortex and medulla. The lesions in the pelvis are not particularly obvious, but as a rule varying degrees of hyperaemia or haemorrhage will be detectable. Atrophy of the renal papillae is however only seen late in the disease. After removal of the renal capsule, it will be possible to observe that the surface comprises these whitish lesions surrounded by a reddish zone. The whitish lesions comprise inflammatory exudate, but frank pus is rarely demonstrated. In the subacute stage, the hyperaemic/haemorrhagic margin is less obvious, and eventually disappears completely in the chronic stage where the lesions are dominated by fibrosis and papillae atrophy. Depending on the stage of the disease, varying degrees of tissue destruction can be seen in the affected areas with thinning of the renal parenchyma. The renal lymph nodes are always enlarged in leukolymphocytic pyelonephritis. Acute and chronic lesions are often found together in affected kidneys. This is a chronic-active leukolymphocytic pyelonephritis, and is most probably a recurring pyelonephritis due to obstruction or anomaly in the vesicoureteral junction. At differential diagnosis, acute leukolymphocytic pyelonephritis can be confused with multicentric lymphosarcomas. In both conditions, there is a tendency to polar localisation and, as with leukolymphocytic pyelonephritis, lymphosarcomas generally comprise pale lesions that are surrounded by a haemorrhagic zone and are always associated with enlarged lymph nodes. However, they do not have the regular dimensions seen in leukolymphocytic pyelonephritis, and on the cut surface appear as circular lesions not stripes.

In cattle, *E. coli* can cause quite severe cases of pyelonephritis, which in some aspects resembles porcine leukolymphocytic pyelonephritis. As in the pig, there is only minimal involvement of the pelvis, and the lesions are characterised by the presence of multiple purulent lesions surrounded by haemorrhage and hyperaemia. The purulent character is more obvious in cattle than pigs and overall there are more suppurative lesions in which infarctions can occasionally be seen (as a result of vessel damage secondary to bacterial (endo)toxin production) and subcapsular rupture. Chronic pyelonephritis in cattle can occasionally assume a tumour-like character similar to that seen in interstitial nephritis, and it can be difficult to differentiate from that condition. The distribution of the lesions in the kidneys provides the strongest criterion.

Acute and chronic pyelonephritis without complications necessitates rejection of the kidneys.

Polyarteritis nodosa [11.89 – 11.90]

Polyarteritis (panarteritis, periarteritis) nodosa occurs sporadically in pigs. This is a necrotising inflammation in the small and intermediate arteries. The chronic stage is characterised by severe periarterial fibrosis, which means that even small arteries become highly prominent. The cause of the disease in pigs is not known, but it is presumed to be an immunological reaction (type 3) with deposition of immune complexes in the arterial wall. The changes are seen most frequently in the kidneys, but are also found in other organs in particular the liver, spleen, and heart.

Renal polyarteritis nodosa without complications necessitates rejection of the kidneys.

Renal fibrosis [11.91 – 11.92]

The kidneys in animals with chronic renal failure are often very changed, and generally the changes are dominated by diffuse fibrosis. In these cases it will nearly always be impossible, at least macroscopically, to determine the actual cause of the lesions, and they are therefore called renal fibrosis, "end-stage kidneys" or nephrosclerosis. These are collective terms for a number of kidney conditions that have progressed to such an extent that the secondary lesions (fibrosis, calcifications, atrophy) overshadow the primary lesions.

Renal fibrosis is often accompanied by complications such as uraemia and fibrous osteodystrophy, which necessitate total condemnation. Uncomplicated cases necessitate rejection of the kidneys.

Neoplasms [11.93 – 11.108]

Primary renal tumours are seen mainly in finisher pigs and older cattle. In finisher pigs these are mainly nephroblastomas and lymphosarcomas (leukosis, malignant lymphomas), and in cattle carcinomas and lymphosarcomas. Benign renal tumours (adenomas) are occasionally found in horses; however, renal tumours other than these in this animal species are generally secondary (metastases).

Nephroblastomas occur relatively frequently in Danish finisher pigs. The cause is not known, but presumably genetic factors play a role. Nephroblastomas originate in embryonal stem cells in the renal tissue, and are therefore a type of tumour that is found exclusively in young animals. In humans there are known chromosomal defects which predispose for the disease, and presumably the same applies in pigs. Nephroblastomas can be solitary or multicentric. Solitary nephroblastomas are often localised to one renal pole, and they can attain a considerable size. The multicentric nephroblastomas generally occur in both kidneys. Even though the tumours can be numerous, they are not metastases but multiple primary tumours.

Nephroblastomas are whitish and firm to moderately fleshy. They are divided into lobes that are separated by fine connective tissue septa. Occasionally they contain cartilage, bone tissue, or striated muscle. The largest tumours can be the site of central haemorrhage and necrosis. They can cause compression of renal tissue and obstruct urine outflow particularly if they grow into the pelvis. Nephroblastomas metastasise only extremely rarely, and they must therefore be considered in principle to be benign.

Lymphosarcomas occur in the kidneys of finisher pigs with about the same incidence as nephroblastomas. Occasionally the kidneys are the only organ affected; in other cases lymphosarcomas occur in several organs. Lymphosarcomas also have a certain predilection for the renal poles; however, they can also be multifocal or diffuse where they infiltrate the renal tissue. Lymphosarcomas are greyish and fleshy which means that, when cut, the surface bulges. There is no lobe division, and they are often the site

of pronounced haemorrhage. Usually lymphosarcomas metastasise, as a minimum to the renal lymph nodes.

Lymphosarcomas in other species resemble those in pigs, but they occur far more rarely and are seldom accompanied by haemorrhage.

Renal carcinomas are only seen in older animals. Danish livestock rarely reach old age; therefore renal carcinomas are not particularly frequent, but do occur occasionally in older cows. Renal carcinomas can be very large (above 50 kg), and in extreme cases they may invade nearly all adjacent structures including the liver, diaphragm, and lungs. Their appearance can vary somewhat, but are generally characterised by extensive necroses and haemorrhage. The tumour tissue itself can be grey, yellow, or brown.

Tumour metastases occur in the kidneys of all species but, because tumours are generally more common in older animals, they are not particularly frequent. In older cows, uterine carcinomas in particular have a tendency to metastasise to the kidneys.

Adenomas and other benign tumours without complications, including nephroblastomas, necessitate rejection of the kidneys.

Renal carcinomas, lymphosarcomas, tumour metastases, and other malignant tumours necessitate total condemnation.

Urinary tract [11.109 – 11.120]

The majority of malformations in the urinary tract are relatively rare or at least they go unnoticed at slaughter. Folding and constriction of the ureters in slaughter animals are nevertheless relatively frequent, and have been mentioned as a cause of hydronephrosis. The ureters can also be the site of segmental aplasia, in which a segment is absent, or segmental atresia, in which the lumen is absent in a smaller or larger segment. These defects are often associated with defects in the ipsilateral kidney. Ureteral duplicity in which two ureters originate in the same kidney occurs in pigs. One of the ureters is generally also ectopic. Ectopic ureters do not end in the normal place in the trigone of the bladder, but have an abnormal outlet in the neck of the bladder, urethra, ductus deferens, vagina, or vesicular gland. Persistent urachus with urine flow from the bladder to the umbilicus is seen particularly in foals and calves. Diverticula originating in the urachus also occur. Malformations of the urethra are discussed in the chapter on reproductive organs.

Urolithiasis

Urolithiasis is due to the formation of calculi (uroliths, kidney stones) in the renal pelvis or urinary tract. The cause of urolithiasis is complicated. Urinary pH, the mineral content of the feed and thus the urine, dehydration with subsequent concentration of the urine, and urinary tract infections play a role. Urolithiasis is particularly a problem in male ruminants. This is because the male urethra is narrow and often has flexures. Urolithiasis with deposits of kidney stones in the urethra often progresses rapidly with development of uraemia. Severe cases can lead to rupture of the bladder with subsequent uroperitoneum. Rupture of the urethra with development of urinary phlegmon is seen particularly in bulls and bullocks, when the kidney stones localise at the ischial arch or in the sigmoid flexure, where they can cause necrosis of the urethra. In rams

and male goats, the kidney stones deposit typically in the urethral process. Urolithiasis in the bladder generally has a chronic course with secondary urocystitis and bilateral hydronephrosis. Urinary stones in the urinary tract in female animals are often washed out with the urine without causing any clinical symptoms. Urolithiasis in female animals therefore primarily manifests as nephrolithiasis (kidney stones).

Dislocation and trauma

Dislocation and traumatic injury of the bladder occur particularly in female animals as a complication at birthing. Prolapse of the vagina or uterus can be accompanied by caudal flexion of the bladder which can result in kinking of the urethra and decreased urine outflow. Rupture of the birthing canal as a result of a traumatic birth or birthing assistance can give rise to prolapse of the bladder and perhaps other organs. Partial necrosis of the bladder occurs particularly in cows after a difficult birth and is due to compression of the bladder between the pubic crest and the trapped calf. Prolapse of the bladder with eversion through the urethra is seen particularly in mares, which have a very wide urethra.

Urocystitis

Urocystitis is seen particularly in female animals. This is most probably due to the relatively short urethra in females and consequent higher risk for ascending infections. The causative bacteria are the same as those for pyelonephritis. In sows, urocystitis is most frequently due to *A. suis*, whereas in cattle it is mostly caused by *C. renale, C. pilosum, C. cystitidis* and *E. coli. Klebsiella* spp. is found in mares. Urocystitis is often necrotic, fibrinous and/or purulent, but the amount of exudate in the bladder is often modest due to the diluting effect of the urine. The condition can be accompanied by urethritis, ureteritis, and perhaps pyelonephritis. Secondary urolithiasis can result in hydronephrosis. In male animals, urolithiasis is often the primary condition with secondary urocystitis and chronic obstruction. The obstruction can result in extreme work hypertrophy of the smooth muscle of the urinary bladder. Polypoid urocystitis is seen exclusively in cattle. The lesions manifest as polyps originating in the trigone of the bladder. The condition is often an incidental finding, but can result in dysfunction of the vesicoureteral transition with subsequent hydronephrosis and hydroureter, often bilateral. The cause of polypoid cystitis is not known, however it may be linked to the intake of bracken fern.

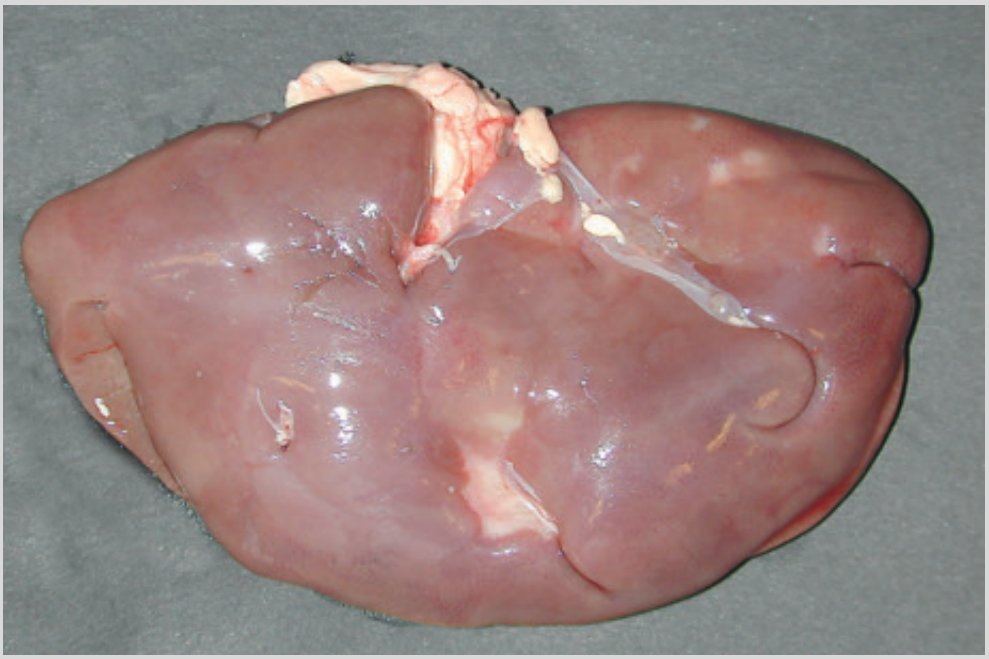
Neoplasms

Multicentric lymphosarcomas can originate in the bladder particularly in finisher pigs, other than this tumours occur only very rarely in the urinary tract of slaughter animals.

Scoring

Malignant tumours in the urinary tract necessitate total condemnation. All other lesions, i.e. malformations, urolithiasis, traumatic injuries, inflammation and benign tumours necessitate partial condemnation unless accompanied by complications.

11.01



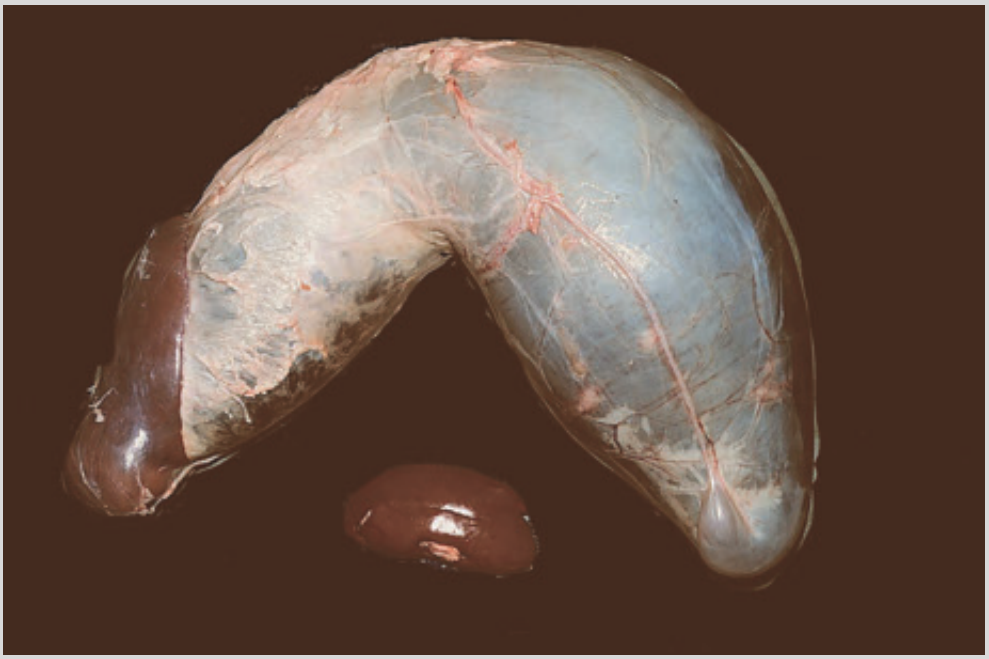
Animal species/Organ	Pig/Kidney
Lesion	Focal dysplasia
Scoring	Partial condemnation
Comments	Note the numerous indentations

11.02



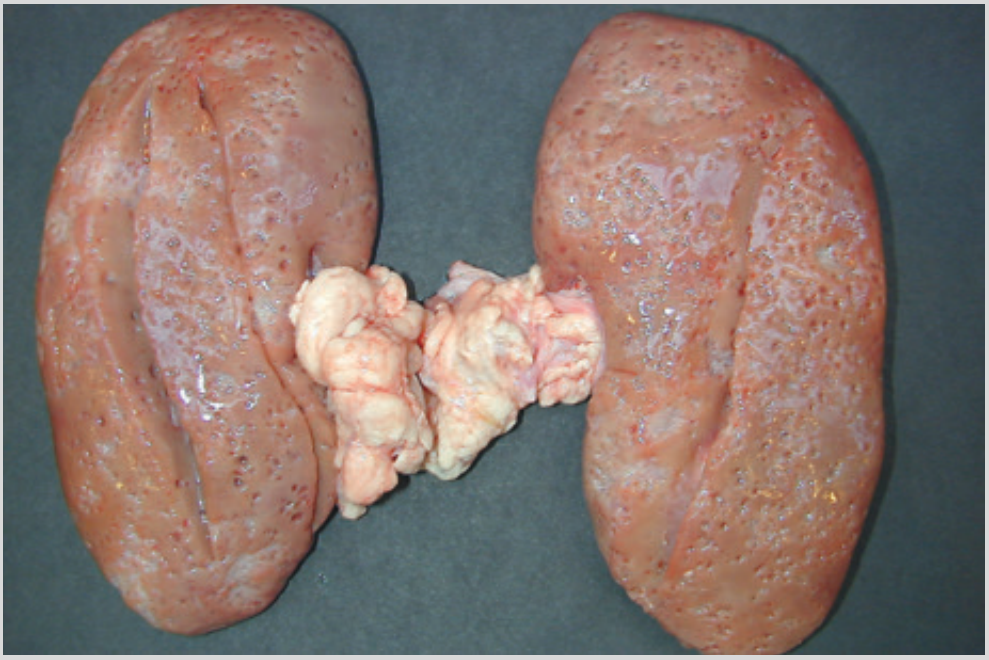
Animal species/Organ	Pig/Kidney
Lesion	Focal dysplasia and renal cyst
Scoring	Partial condemnation
Comments	Note the indentations around the cyst

11.03



Animal species/Organ	Pig/Kidney
Lesion	Renal cyst
Scoring	Partial condemnation
Comments	Normal kidney for comparison

11.04



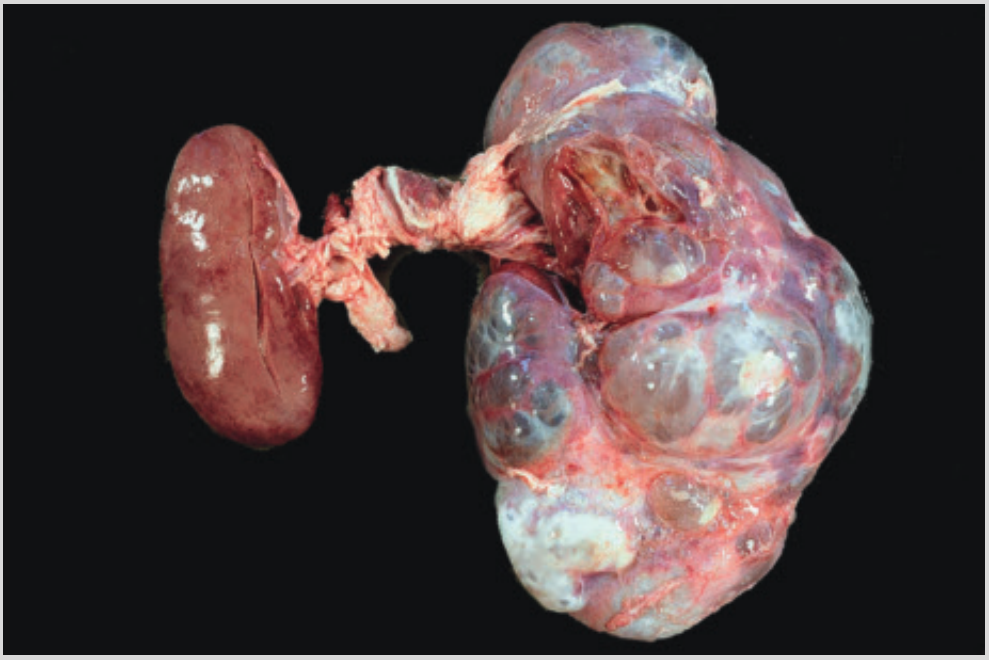
Animal species/Organ	Pig/Kidney
Lesion	Polycystic kidneys
Scoring	Partial condemnation
Comments	Disseminated, small cysts in both kidneys

11.05



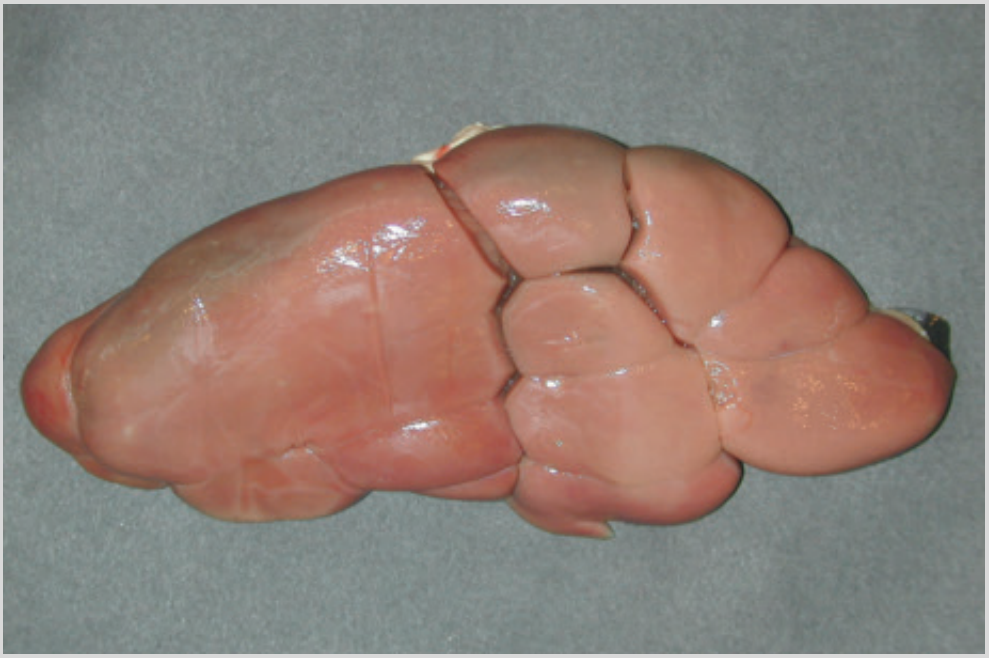
Animal species/Organ	Cattle/Kidney
Lesion	Polycystic kidney
Scoring	Partial condemnation
Comments	Note the irregular distribution of the lesions

11.06



Animal species/Organ	Pig/Kidney
Lesion	Unilateral polycystic kidney
Scoring	Partial condemnation
Comments	Unilateral lesions are rare

11.07



Animal species/Organ	Cattle/Kidney
Lesion	Incomplete separation of renculi
Scoring	Partial condemnation
Comments	The lesions can be unilateral or bilateral

11.08



Animal species/Organ	Pig/Kidney
Lesion	Unilateral hypoplasia with compensatory hypertrophy of the other kidney
Scoring	Partial condemnation
Comments	Both kidneys are rejected

11.09



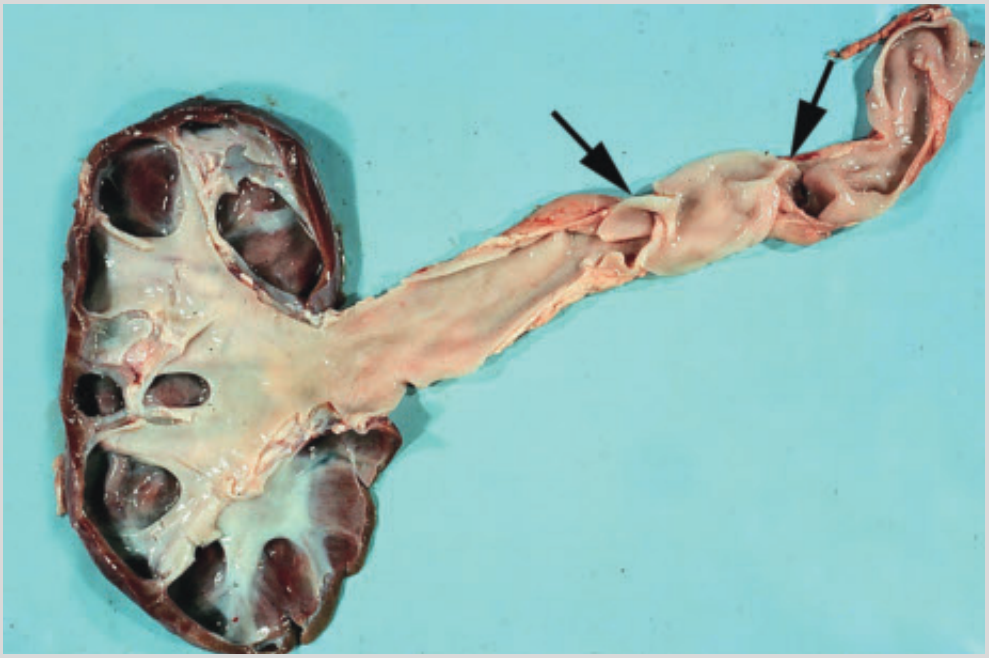
Animal species/Organ	Cattle/Kidney
Lesion	Hydronephrosis
Scoring	Partial condemnation
Comments	Several lobes have collapsed

11.10



Animal species/Organ	Cattle/Kidney
Lesion	Hydronephrosis
Scoring	Partial condemnation
Comments	Longitudinal section of the kidney in 11.09

11.11



Animal species/Organ	Pig/Kidney and ureter
Lesion	Hydronephrosis and hydroureter
Scoring	Partial condemnation
Comments	Due to congenital folding of the ureter (→)

11.12



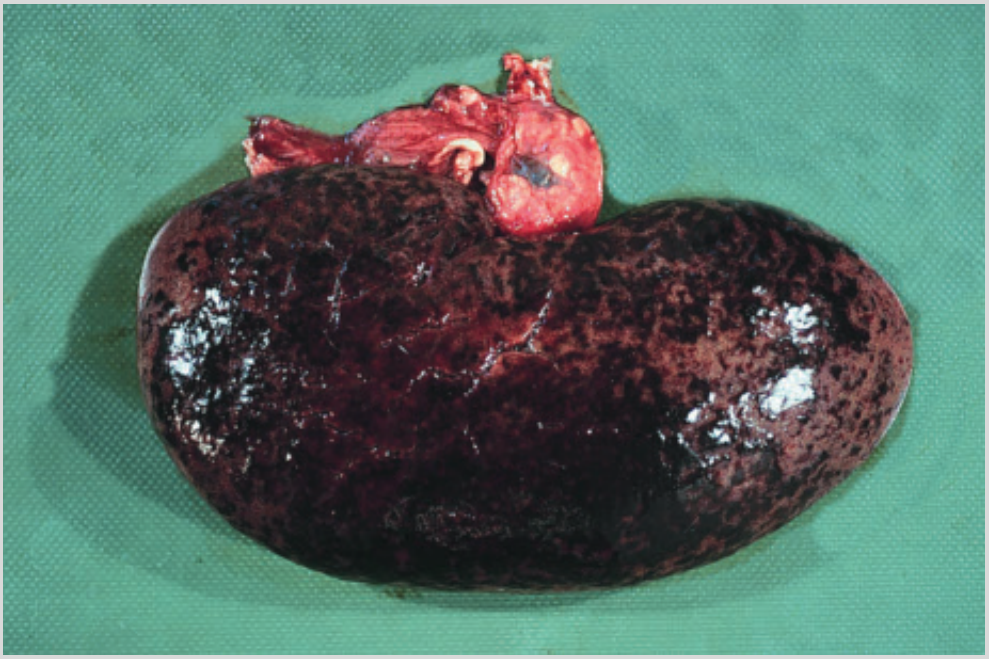
Animal species/Organ	Pig/Kidney
Lesion	Hyperaemia in acute immune-mediated glomerulonephritis
Scoring	Partial condemnation
Comments	Hyperaemia is generally due to acute inflammation. Infectious glomerulonephritis necessitates total condemnation

11.13



Animal species/Organ	Cattle/Kidney
Lesion	Petechial haemorrhage
Scoring	Partial condemnation
Comments	Subacute immune-mediated glomerulonephritis

11.14



Animal species/Organ	Pig/Kidney
Lesion	Ecchymosis and petechial haemorrhage
Scoring	Partial condemnation
Comments	Immune-mediated vasculitis

11.15



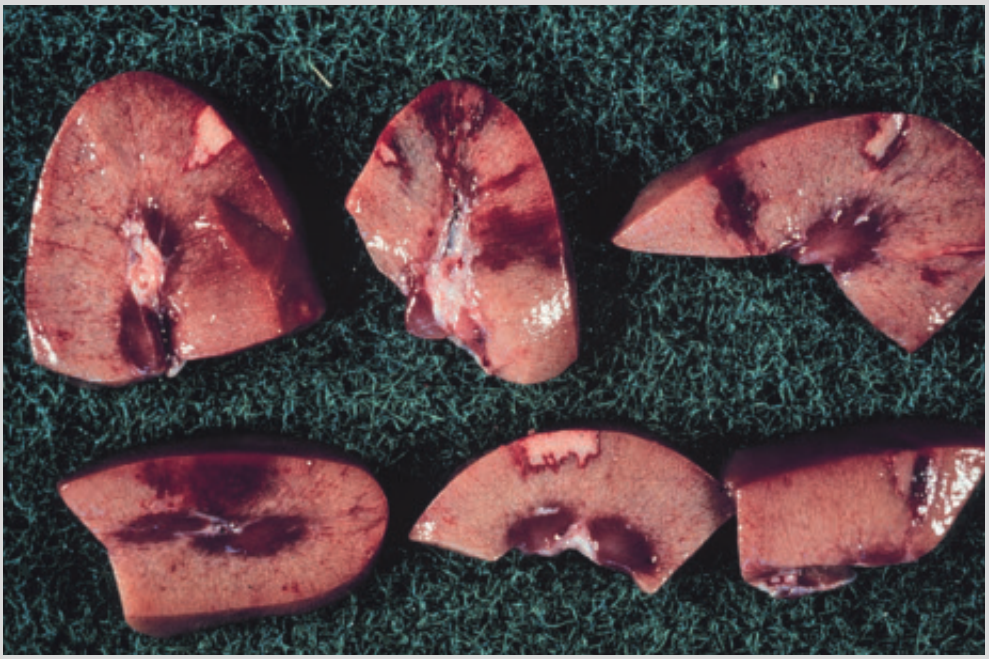
Animal species/Organ	Pig/Kidney
Lesion	Subepithelial haemorrhage in the pelvis resulting from thrombocytopenia
Scoring	Partial condemnation
Comments	Extensive haemorrhage in the muscles necessitates total condemnation

11.16



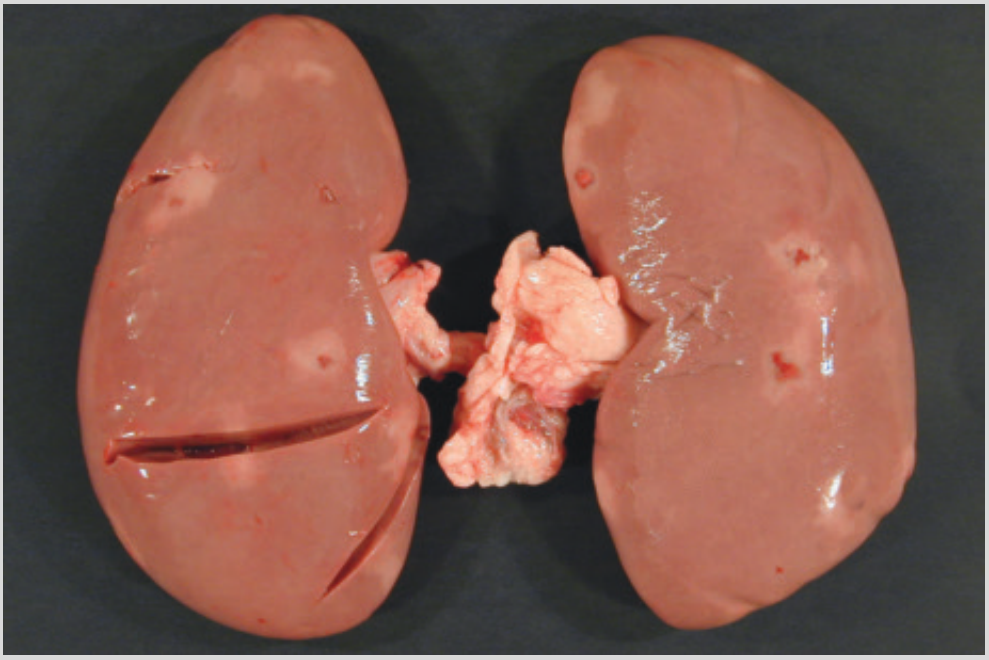
Animal species/Organ	Pig/Kidney
Lesion	Trauma-related haemorrhage
Scoring	Partial condemnation
Comments	Note the limited distribution

11.17



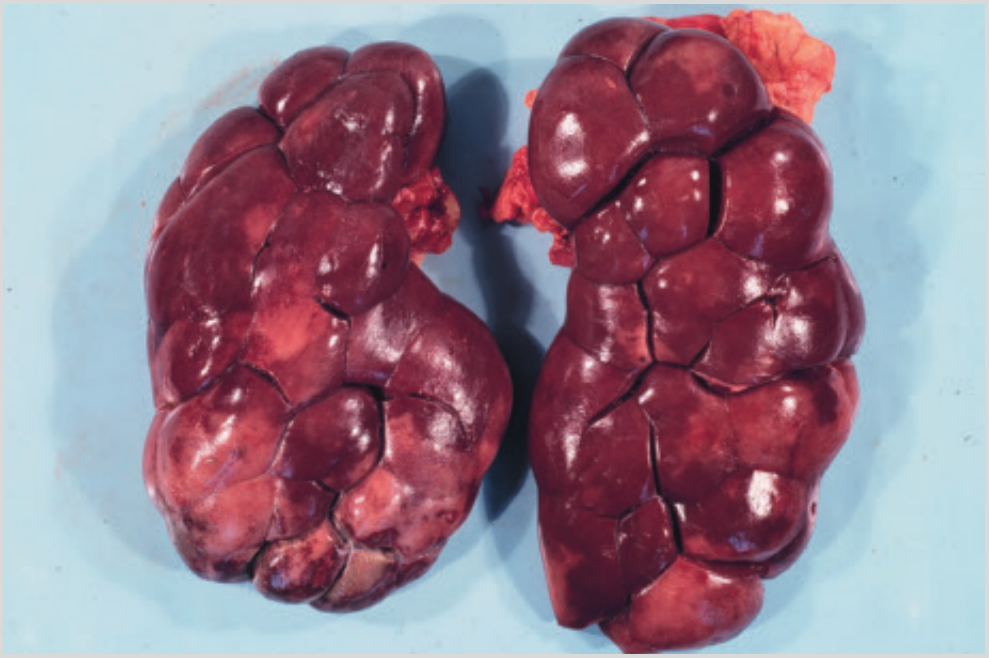
Animal species/Organ	Pig/Kidney
Lesion	Multiple acute and subacute infarcts
Scoring	Total condemnation
Comments	Acute, haemorrhagic infarcts necessitate total condemnation

11.18



Animal species/Organ	Pig/Kidney
Lesion	Multiple subacute infarcts
Scoring	Total condemnation
Comments	The haemorrhagic necroses are surrounded by a pale zone with cell reaction

11.19



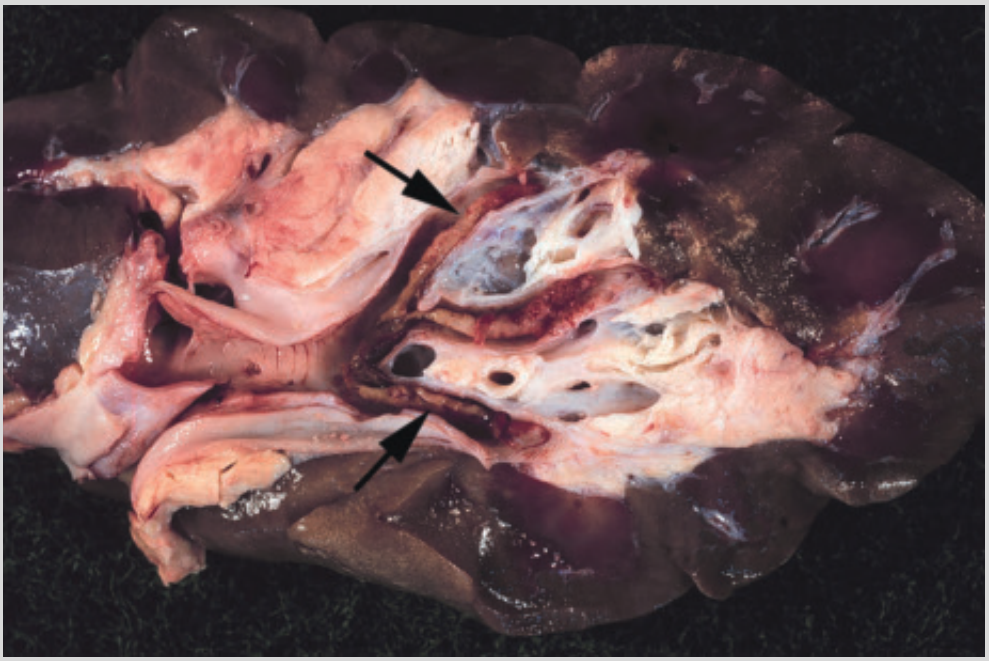
Animal species/Organ	Cattle/Kidney
Lesion	Multiple chronic infarcts
Scoring	Partial condemnation
Comments	Note the irregular distribution due to thrombi in the renal arteries

11.20



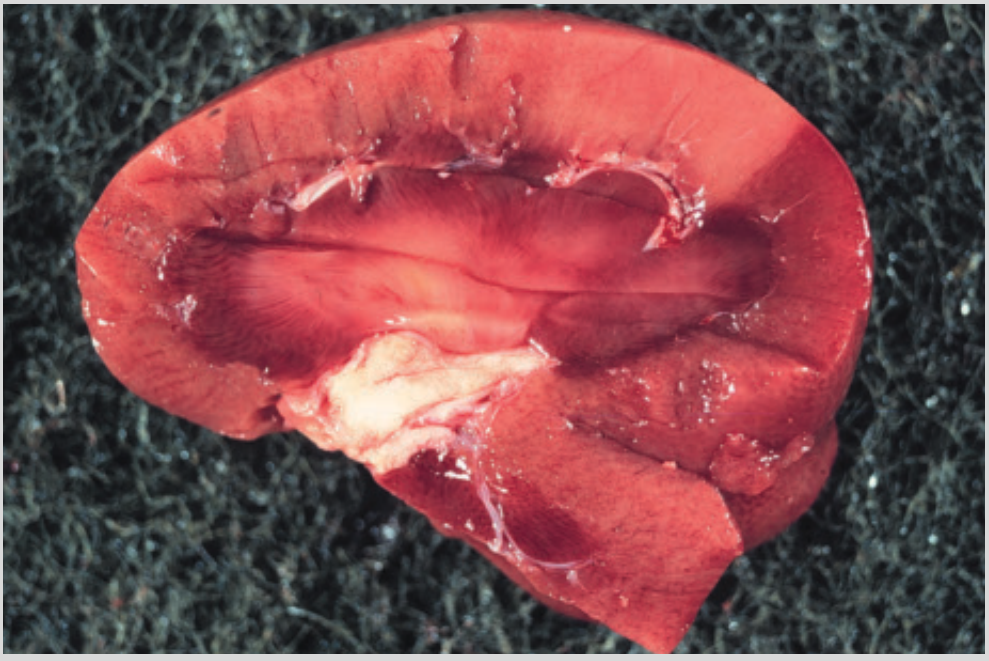
Animal species/Organ	Cattle/Kidney
Lesion	Chronic infarcts and thrombus in the renal artery
Scoring	Partial condemnation
Comments	Infected thrombi and acute infarcts necessitate total condemnation

11.21



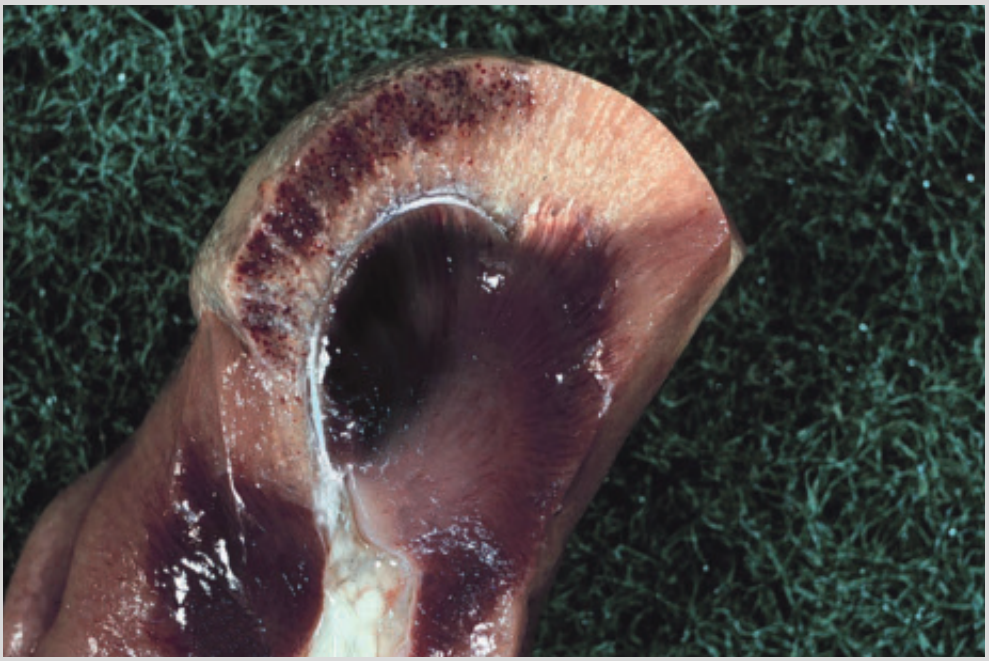
Animal species/Organ	Cattle/Kidney
Lesion	Thrombus (→) in the renal artery and the interlobar arteries
Scoring	Partial condemnation
Comments	Infected thrombi necessitate total condemnation

11.22



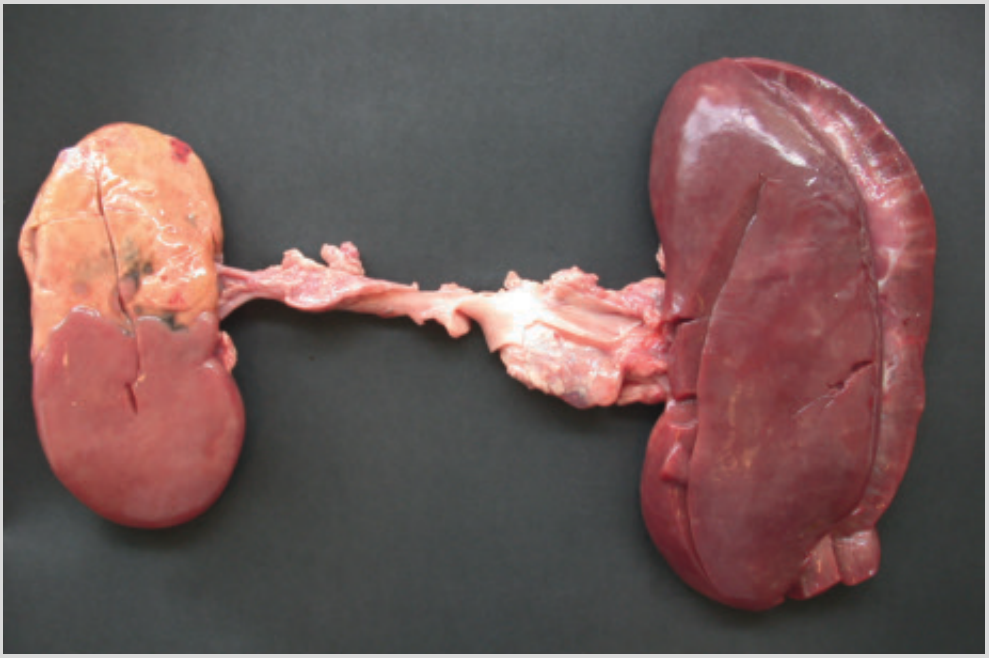
Animal species/Organ	Cattle/Kidney
Lesion	Chronic infarct
Scoring	Partial condemnation
Comments	The infarct is not complete

11.23



Animal species/Organ	Cattle/Kidney
Lesion	Chronic infarct
Scoring	Partial condemnation
Comments	The infarct is the site of mineralisation

11.24



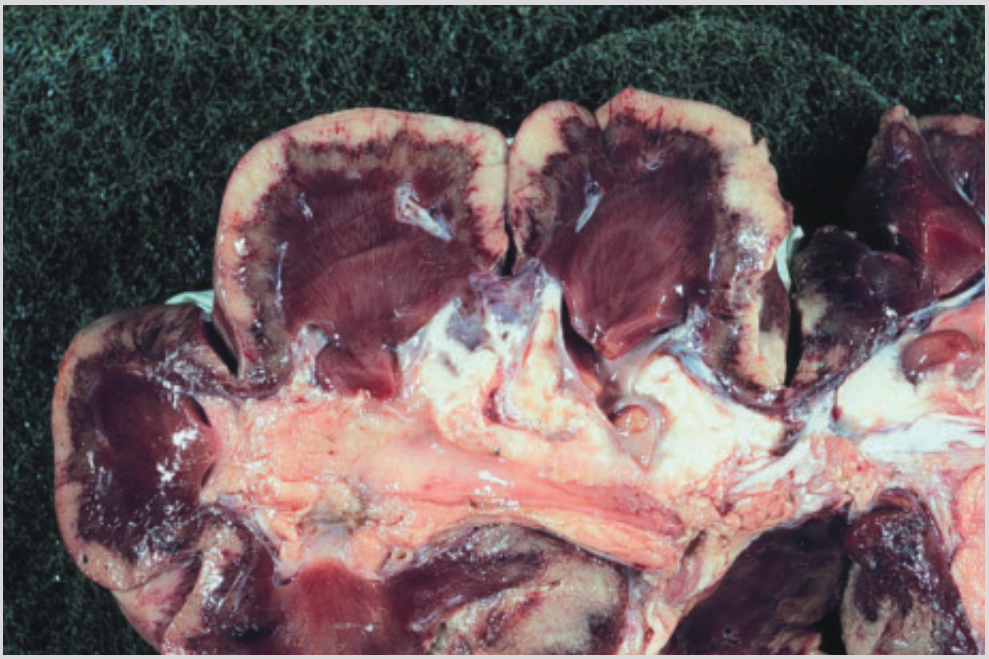
Animal species/Organ	Pig/Kidney
Lesion	Status after massive infarction in one kidney. The healthy kidney is hypertrophic
Scoring	Partial condemnation
Comments	All of the pale area is necrotic

11.25



Animal species/Organ	Pig/Kidney
Lesion	Status after massive infarction
Scoring	Partial condemnation
Comments	Residual islands of hypertrophic renal tissue can be seen

11.26



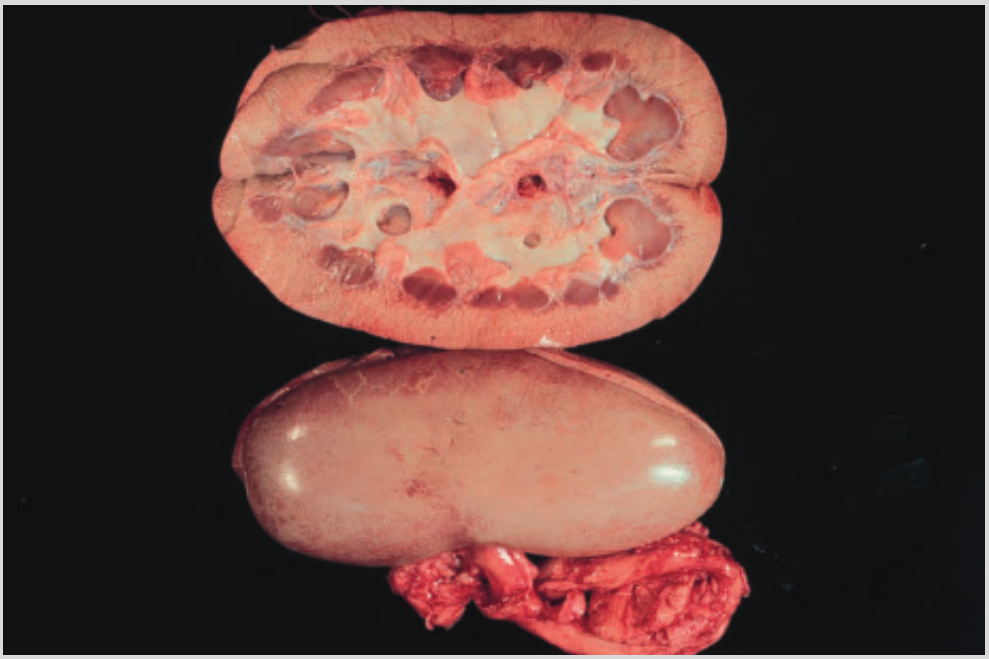
Animal species/Organ	Cattle/Kidney
Lesion	Cortical necrosis
Scoring	Partial condemnation
Comments	If the lesions are due to septicaemia, the scoring is total condemnation

11.27



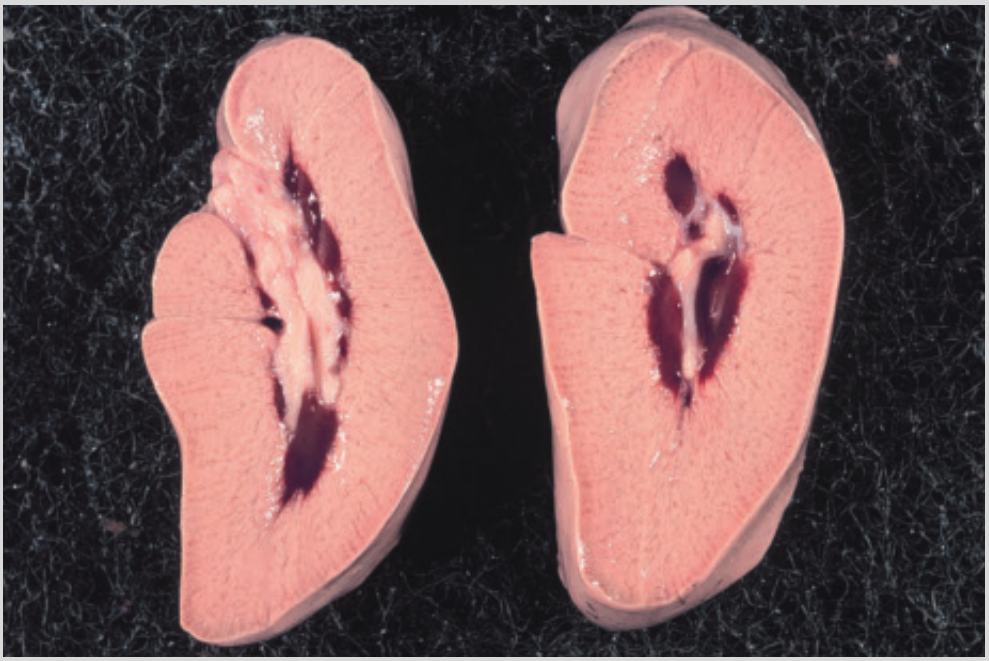
Animal species/Organ	Cattle/Kidney
Lesion	Lipofuscinosis
Scoring	Partial condemnation
Comments	The degree of pigmentation can vary greatly

11.28



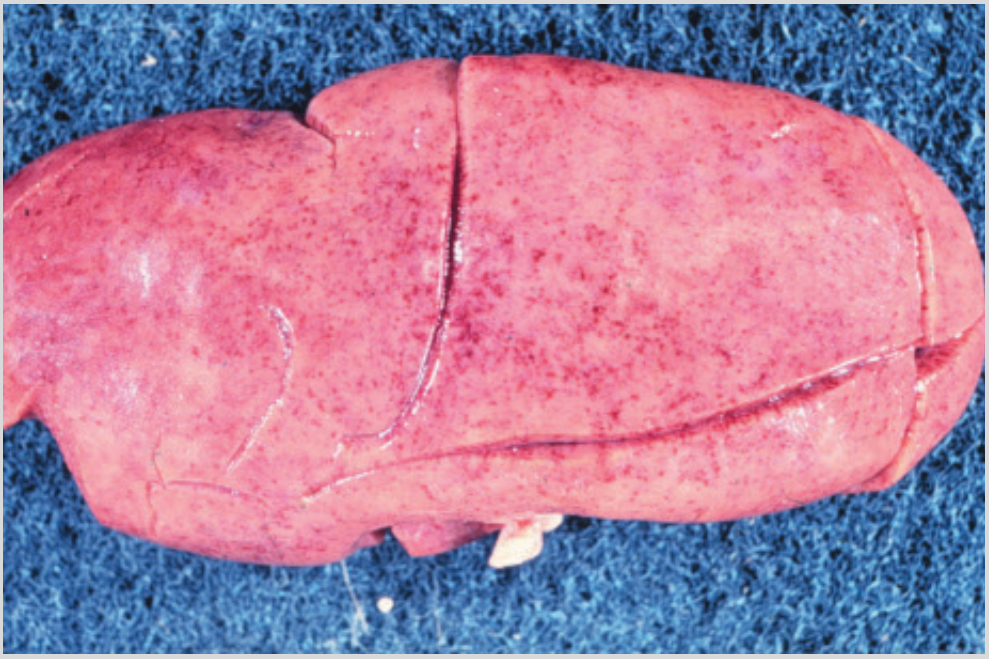
Animal species/Organ	Pig/Kidney
Lesion	Steatosis
Scoring	Partial condemnation
Comments	Intoxications necessitate total condemnation

11.29



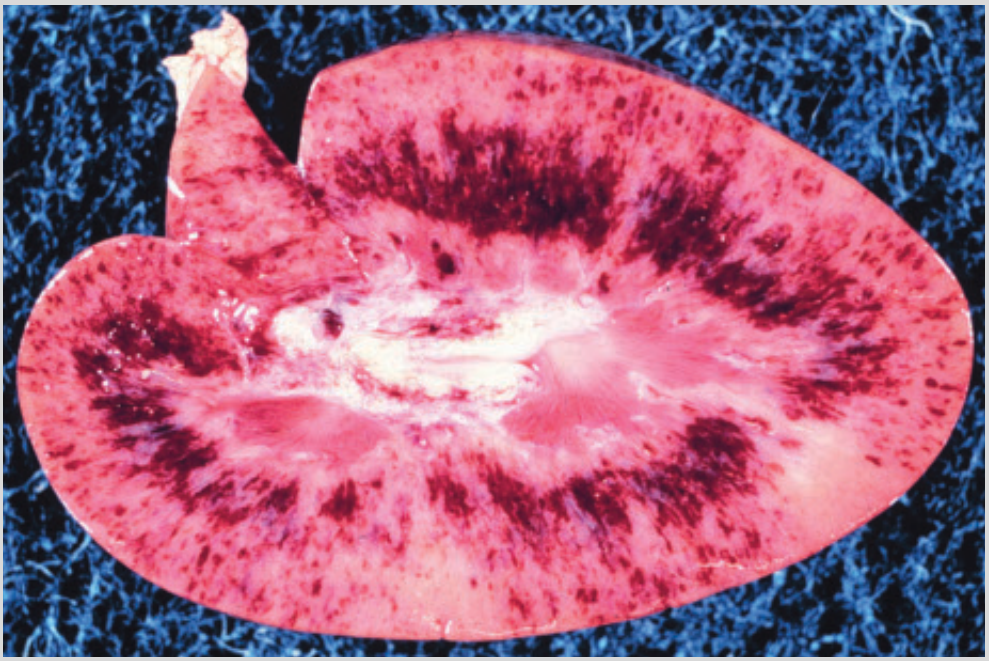
Animal species/Organ	Pig/Kidney
Lesion	Steatosis
Scoring	Partial condemnation
Comments	The medulla is unaffected

11.30



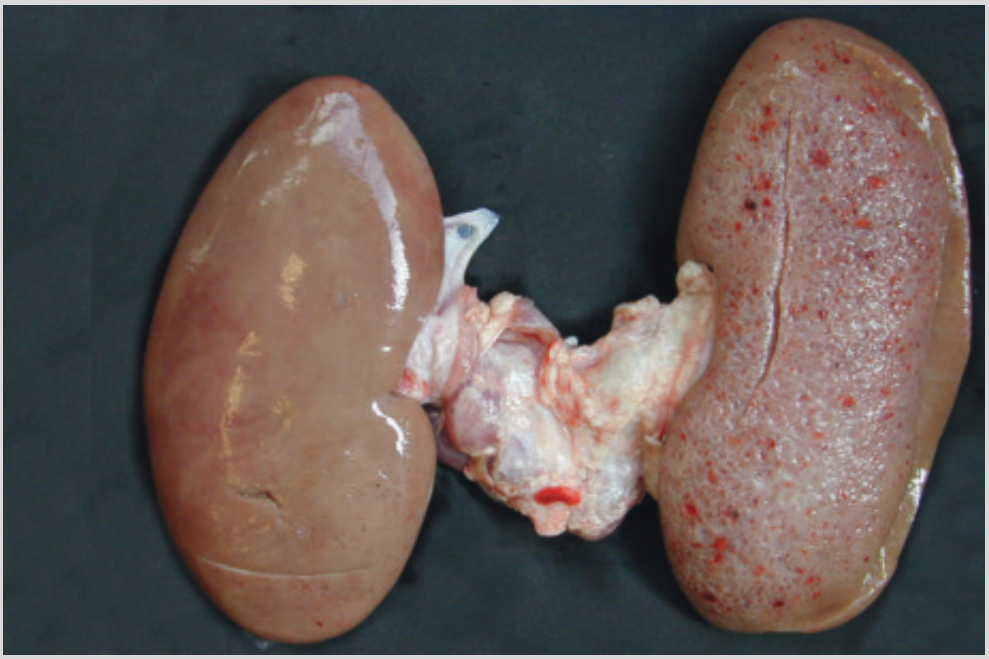
Animal species/Organ	Pig/Kidney
Lesion	Acute, tubular necrosis
Scoring	Partial condemnation
Comments	Pale kidney with extensive haemorrhage. Intoxications necessitate total condemnation

11.31



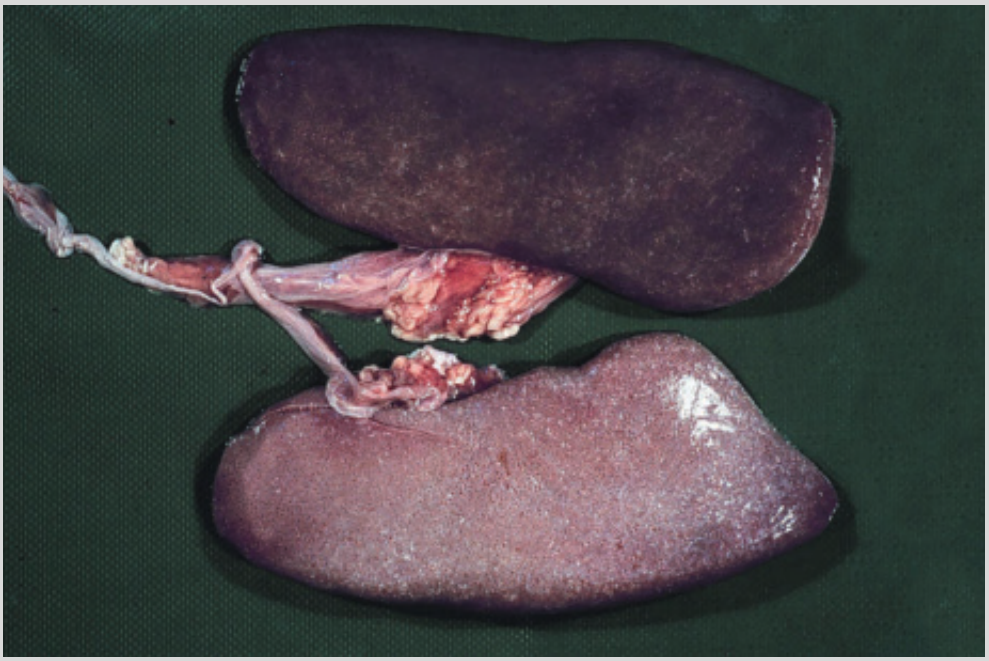
Animal species/Organ	Pig/Kidney
Lesion	Acute, tubular necrosis
Scoring	Partial condemnation
Comments	Cross-section of the kidney in 11.30 Intoxications necessitate total condemnation

11.32



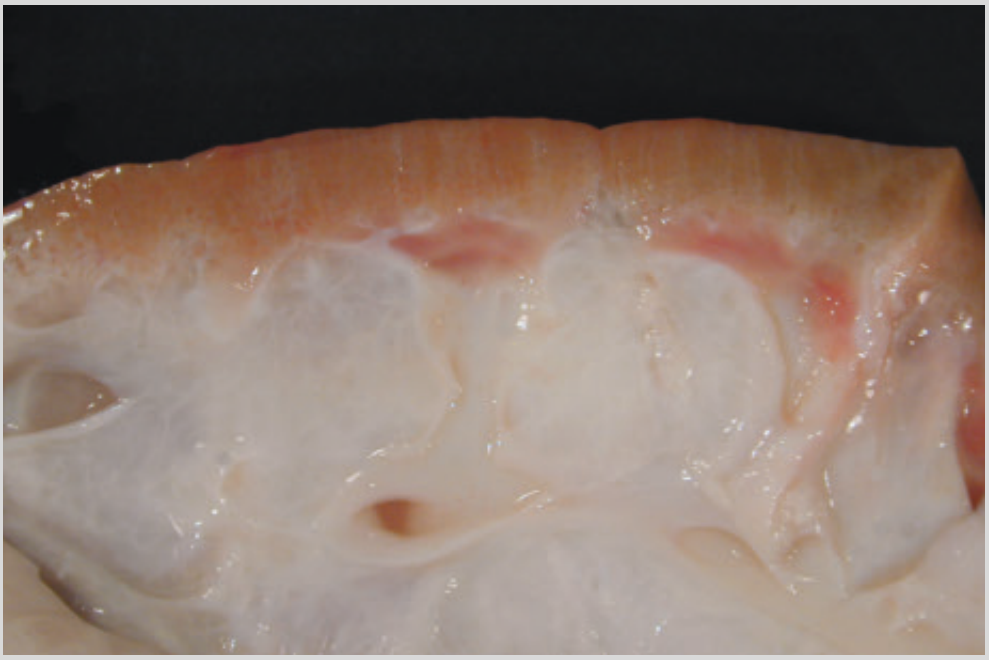
Animal species/Organ	Pig/Kidney
Lesion	Chronic, mycotoxic nephropathy (ochratoxicosis)
Scoring	Partial condemnation
Comments	The ventral surface (to the right) is particularly changed. The liver must also be rejected

11.33



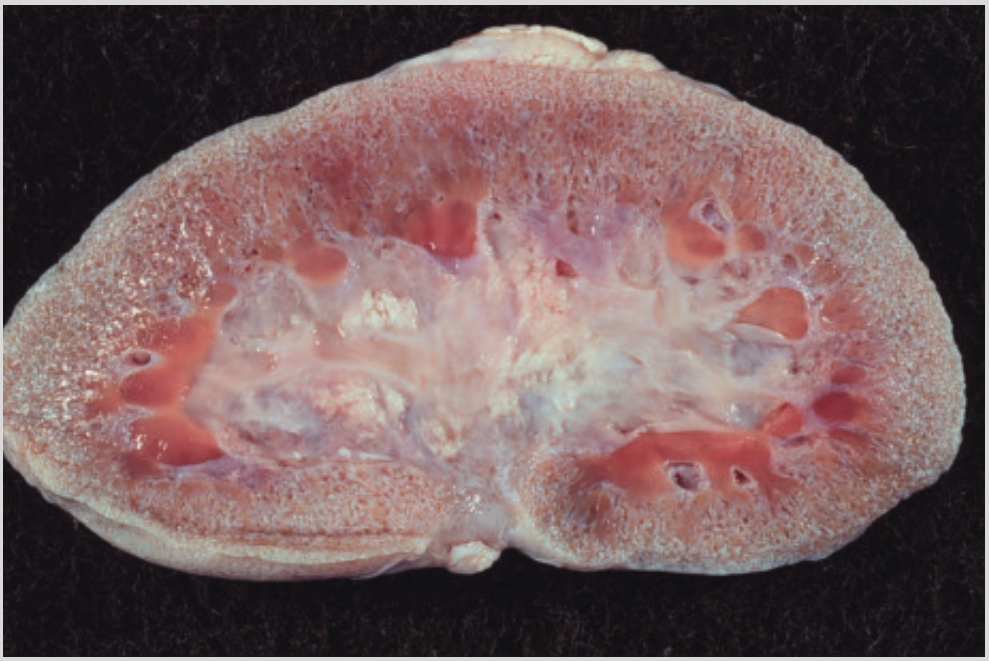
Animal species/Organ	Pig/Kidney
Lesion	Chronic, mycotoxic nephropathy (ochratoxicosis)
Scoring	Partial condemnation
Comments	Dorsal (upper) and ventral (lower) surface. The liver must also be rejected

11.34



Animal species/Organ	Pig/Kidney
Lesion	Chronic, mycotoxic nephropathy (ochratoxicosis)
Scoring	Partial condemnation
Comments	Pronounced secondary atrophy of the medulla. The liver must also be rejected

11.35



Animal species/Organ	Pig/Kidney
Lesion	Chronic, mycotoxic nephropathy (ochratoxicosis)
Scoring	Partial condemnation
Comments	High grade lesions. The liver must also be rejected

11.36



Animal species/Organ	Horse/Kidney
Lesion	Cholaemic nephrosis
Scoring	Partial condemnation
Comments	Icteric discolouration of the carcase necessitates total condemnation if it has not disappeared within 24 hours after slaughter

11.37



Animal species/Organ	Cattle/Kidney
Lesion	Amyloidosis
Scoring	Partial condemnation
Comments	The individual lobes press on each other

11.38



Animal species/Organ	Cattle/Kidney
Lesion	Amyloidosis
Scoring	Partial condemnation
Comments	Note the golden-brown cut surface

11.39



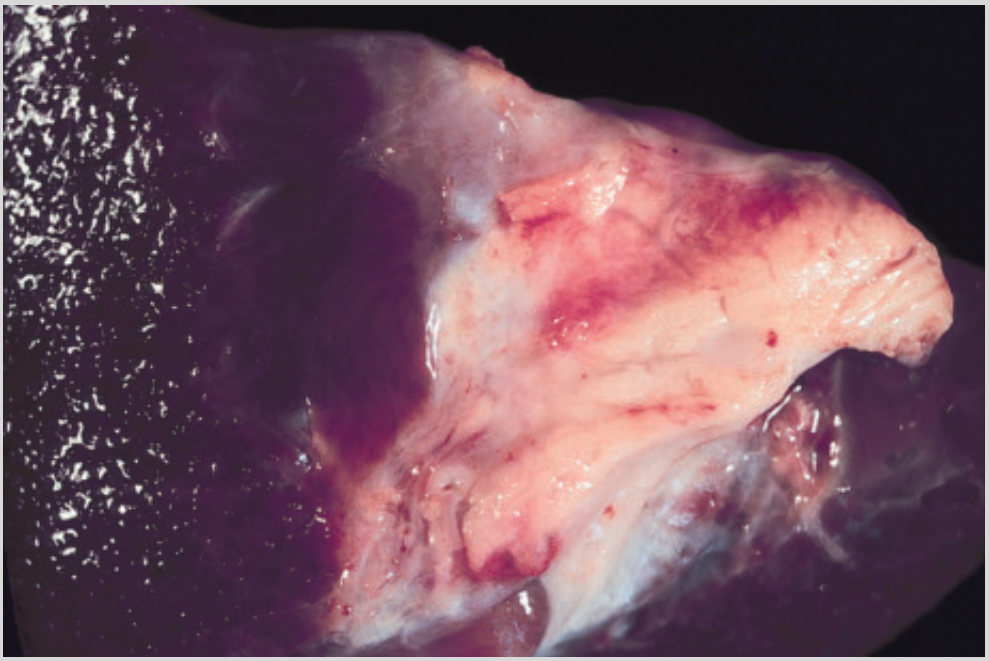
Animal species/Organ	Cattle/Kidney
Lesion	Amyloidosis
Scoring	Partial condemnation
Comments	Close-up of the kidney in 11.38

11.40



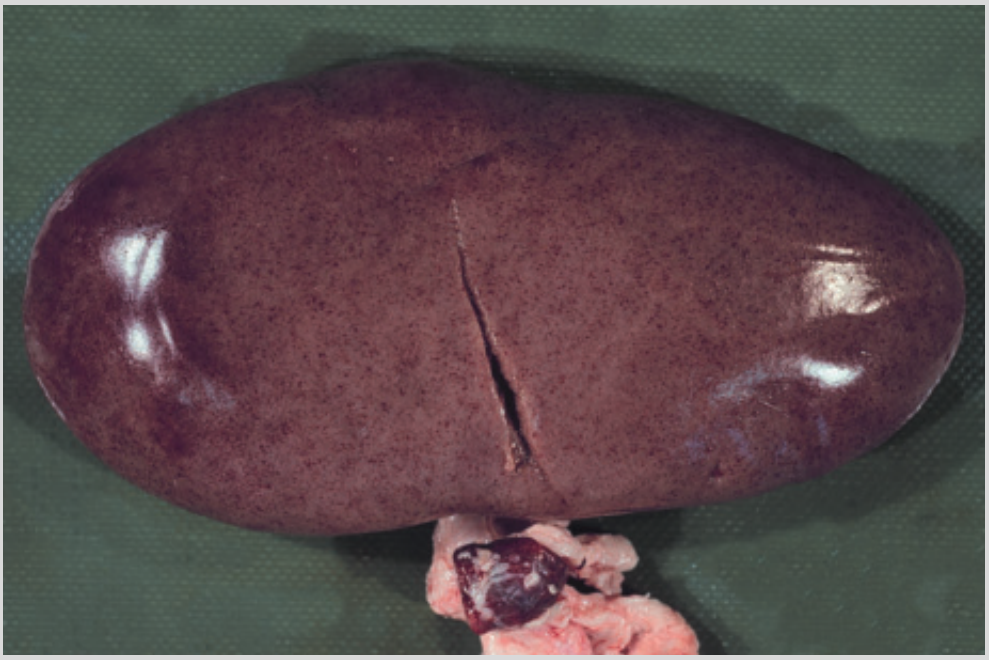
Animal species/Organ	Pig/Kidney
Lesion	Acute, immune-mediated glomerulonephritis
Scoring	Partial condemnation
Comments	The kidney is swollen and oedematous. Acute infectious glomerulonephritis necessitates total condemnation

11.41



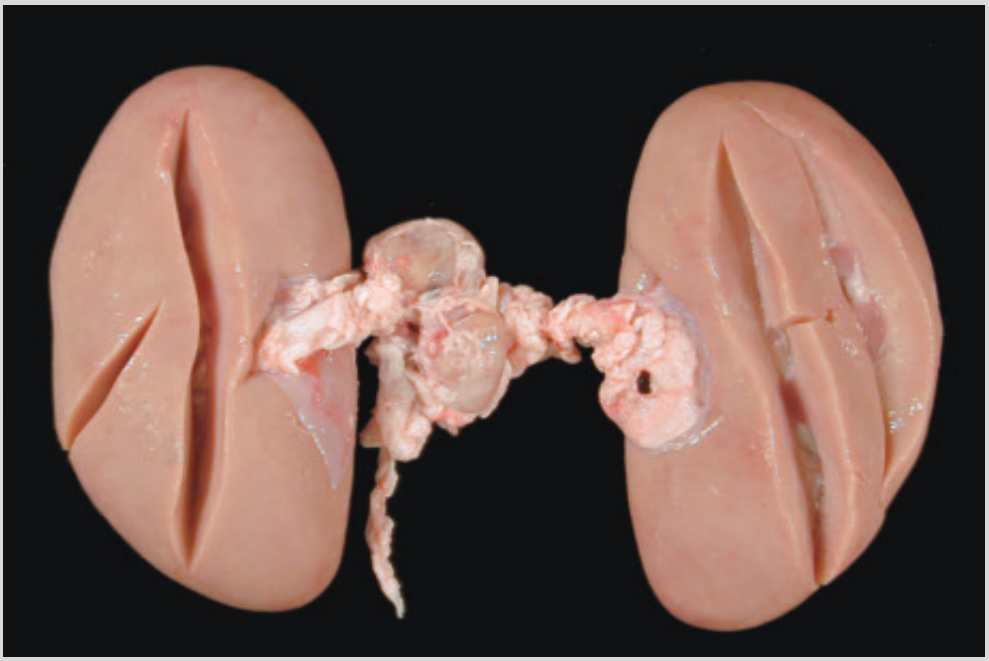
Animal species/Organ	Pig/Kidney
Lesion	Acute, immune-mediated glomerulonephritis
Scoring	Partial condemnation
Comments	Oedema can be seen on the cut surface and in the pelvis. Acute infectious glomerulonephritis necessitates total condemnation

11.42



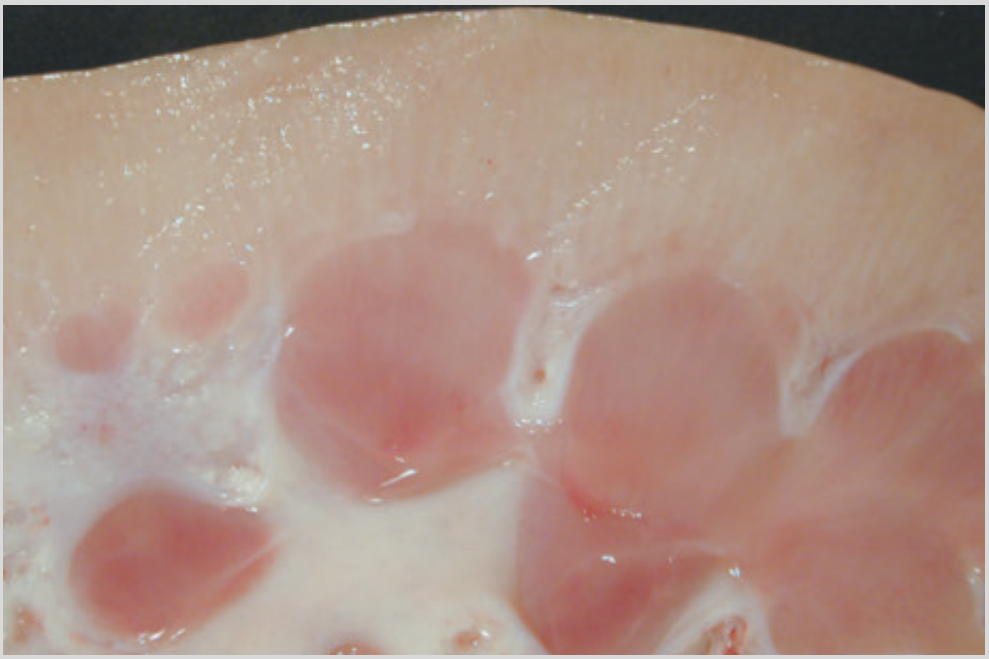
Animal species/Organ	Pig/Kidney
Lesion	Subacute, immune-mediated glomerulonephritis
Scoring	Partial condemnation
Comments	The kidney is somewhat swollen and the site of petechial haemorrhages

11.43



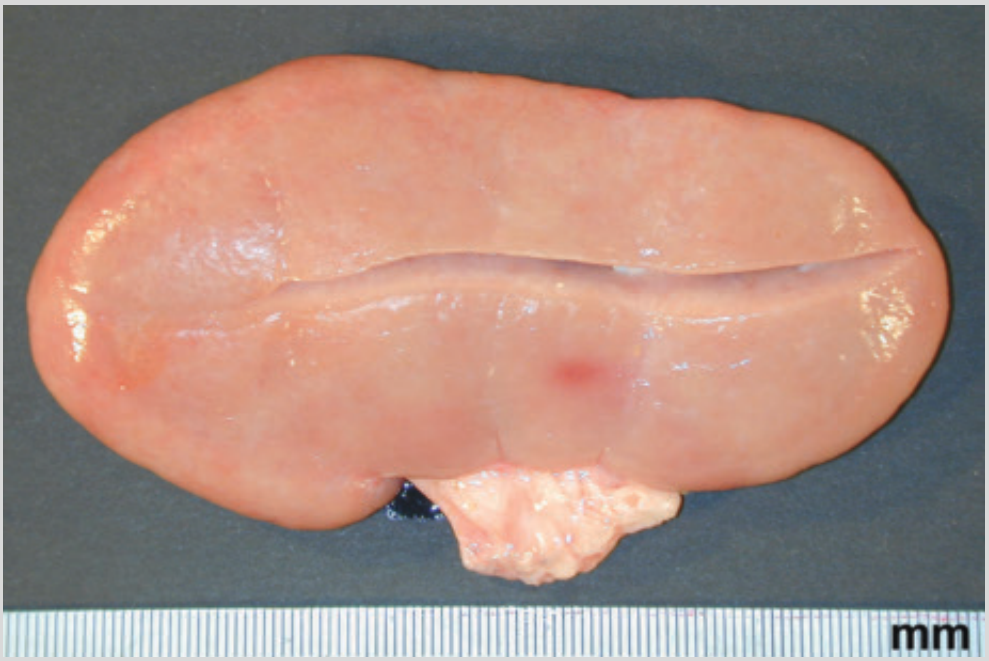
Animal species/Organ	Pig/Kidney
Lesion	Chronic, immune-mediated glomerulonephritis
Scoring	Partial condemnation
Comments	Note the enlarged renal lymph nodes

11.44



Animal species/Organ	Pig/Kidney
Lesion	Chronic, immune-mediated glomerulonephritis
Scoring	Partial condemnation
Comments	The cortex is the site of fibrosis

11.45



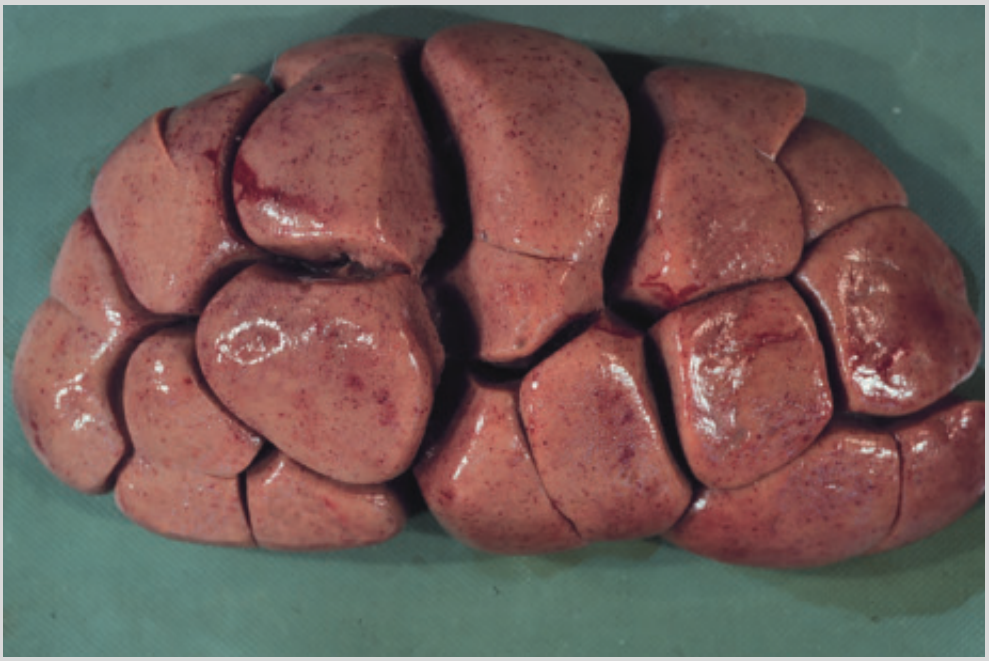
Animal species/Organ	Pig/Kidney
Lesion	Chronic, immune-mediated glomerulonephritis
Scoring	Partial condemnation
Comments	The kidney has shrunk and is indented

11.46



Animal species/Organ	Pig/Kidney
Lesion	Chronic, immune-mediated glomerulonephritis
Scoring	Partial condemnation
Comments	Cut surface from the kidney in 11.45

11.47



Animal species/Organ	Cattle/Kidney
Lesion	Chronic, immune-mediated glomerulonephritis
Scoring	Partial condemnation
Comments	Petechial haemorrhage can be seen, and the kidney is slightly swollen

11.48



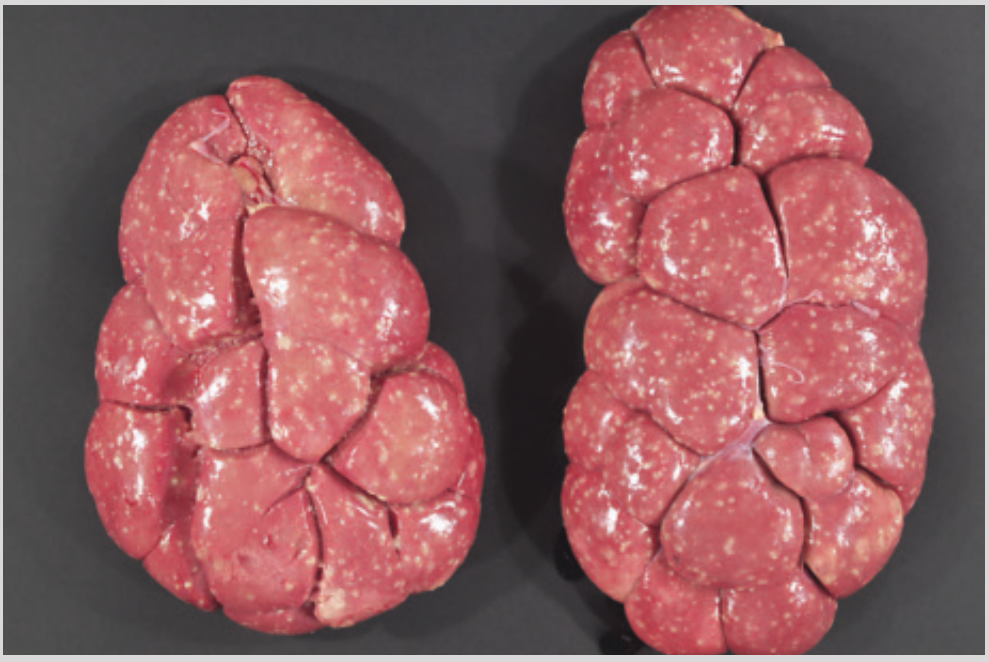
Animal species/Organ	Cattle/Kidney
Lesion	Chronic, immune-mediated glomerulonephritis
Scoring	Partial condemnation
Comments	Cut surface from the kidney in 11.47

11.49



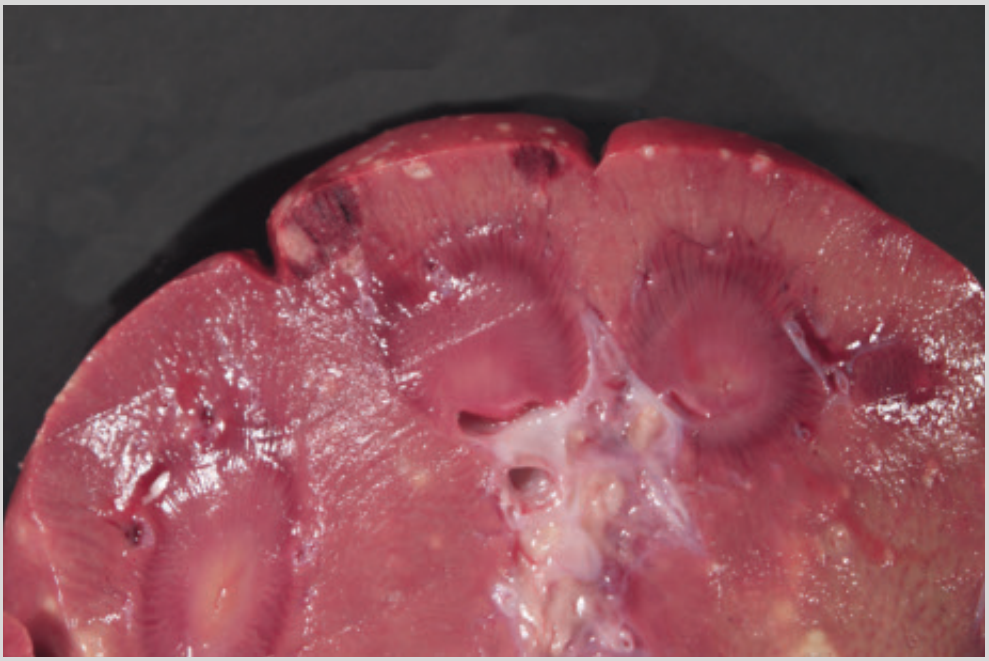
Animal species/Organ	Cattle/Kidney
Lesion	Chronic, immune-mediated glomerulonephritis
Scoring	Partial condemnation
Comments	The lesions can resemble amyloidosis, but the kidney is not enlarged

11.50



Animal species/Organ	Cattle/Kidney
Lesion	Chronic, embolic nephritis with abscess formation with poorly-defined lesions
Scoring	Total condemnation
Comments	Cases of only limited, chronic lesions without complications are approved for deboning

11.51



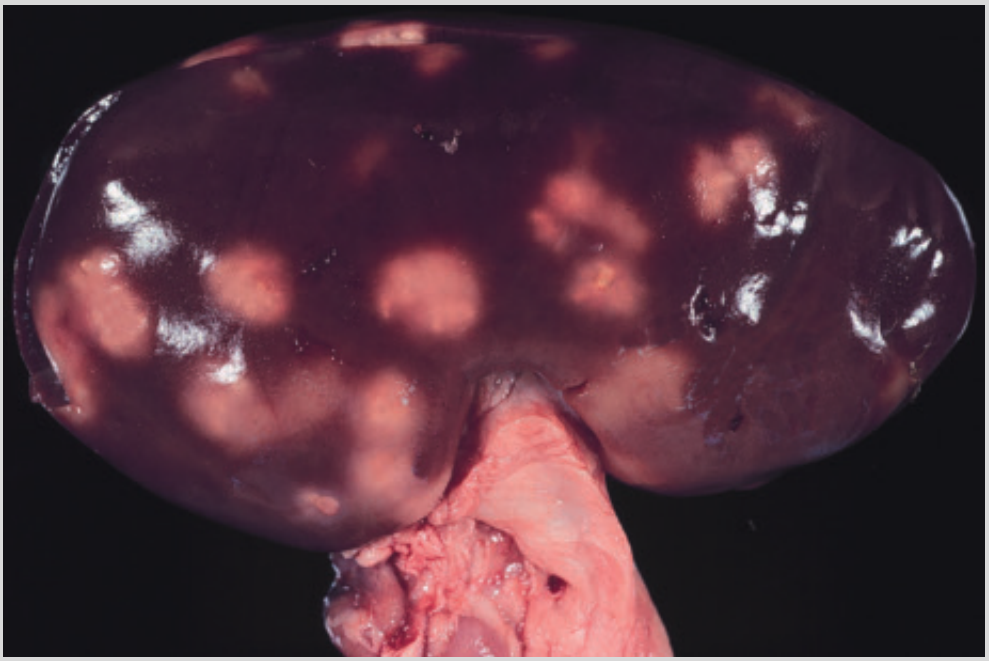
Animal species/Organ	Cattle/Kidney
Lesion	Chronic, embolic nephritis with abscess formation with acute, haemorrhagic infarctions
Scoring	Total condemnation
Comments	Cut surface from one kidney in 11.50 The poorly defined lesions and the haemorrhagic infarctions necessitate total condemnation

11.52



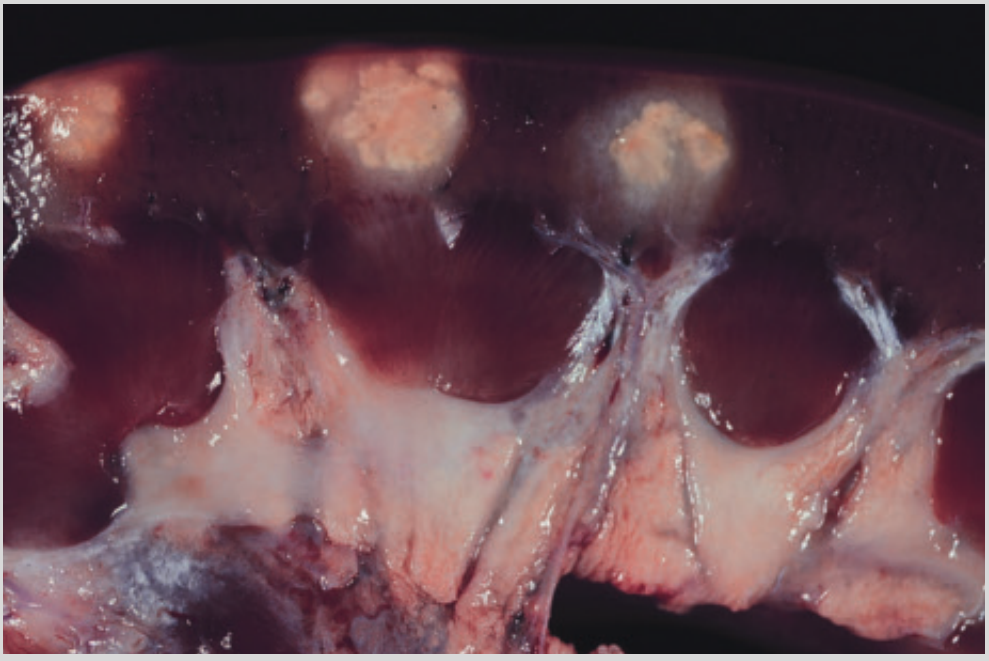
Animal species/Organ	Pig/Kidney
Lesion	Chronic, focal, nephritis with abscess formation
Scoring	Approved for deboning if embolic; otherwise rejection of the affected parts
Comments	Solitary abscess in one of the poles

11.53



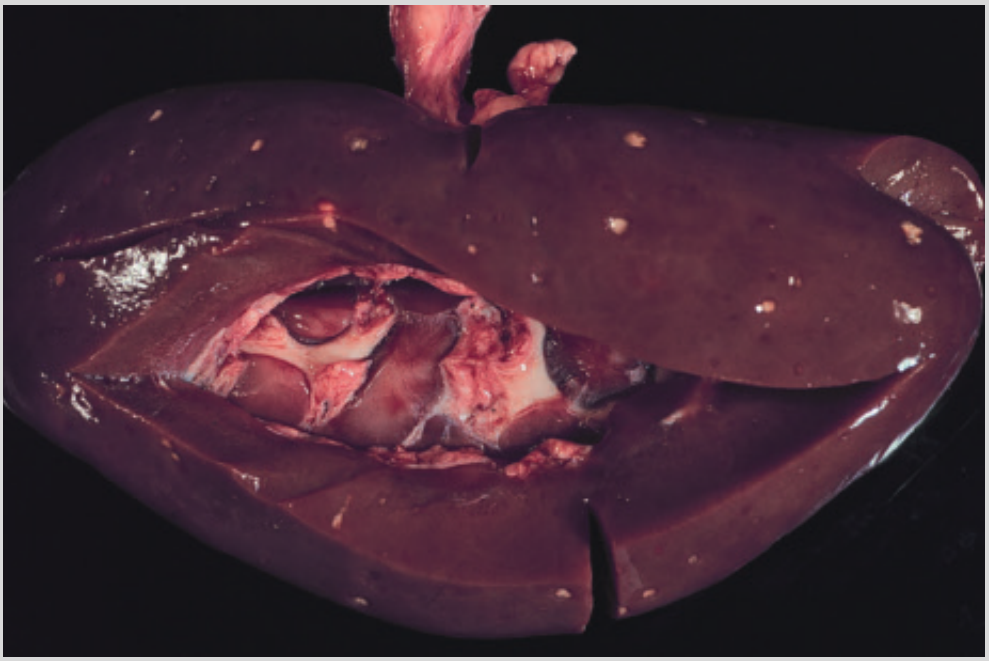
Animal species/Organ	Pig/Kidney
Lesion	Chronic, embolic, nephritis with abscess formation
Scoring	Approved for deboning
Comments	The lesions are well-defined

11.54



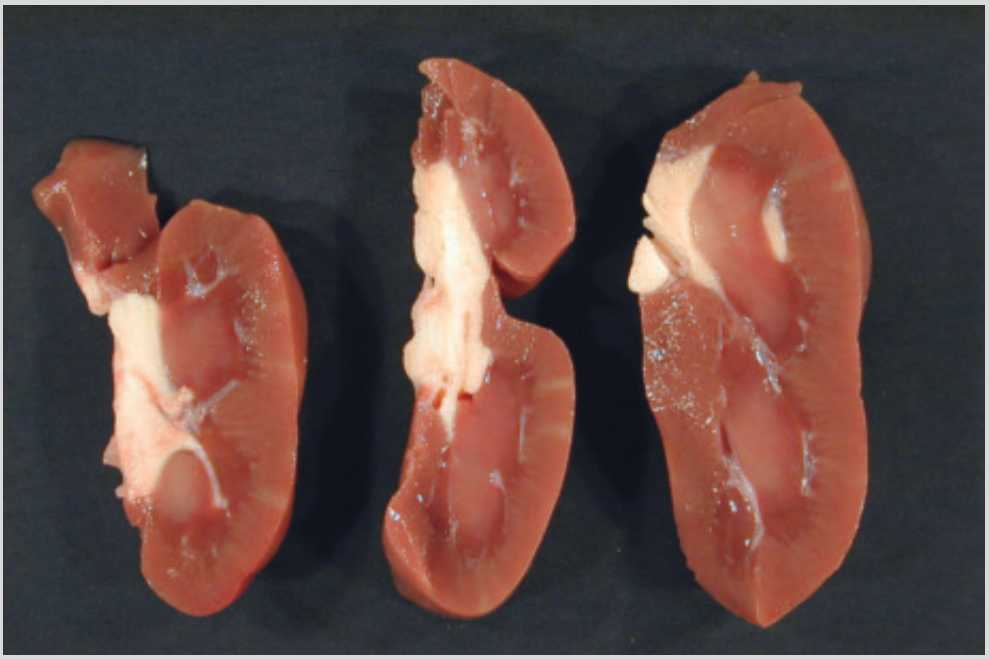
Animal species/Organ	Pig/Kidney
Lesion	Chronic, embolic, nephritis with abscess formation
Scoring	Approved for deboning
Comments	Cut surface from the kidney in 11.53

11.55



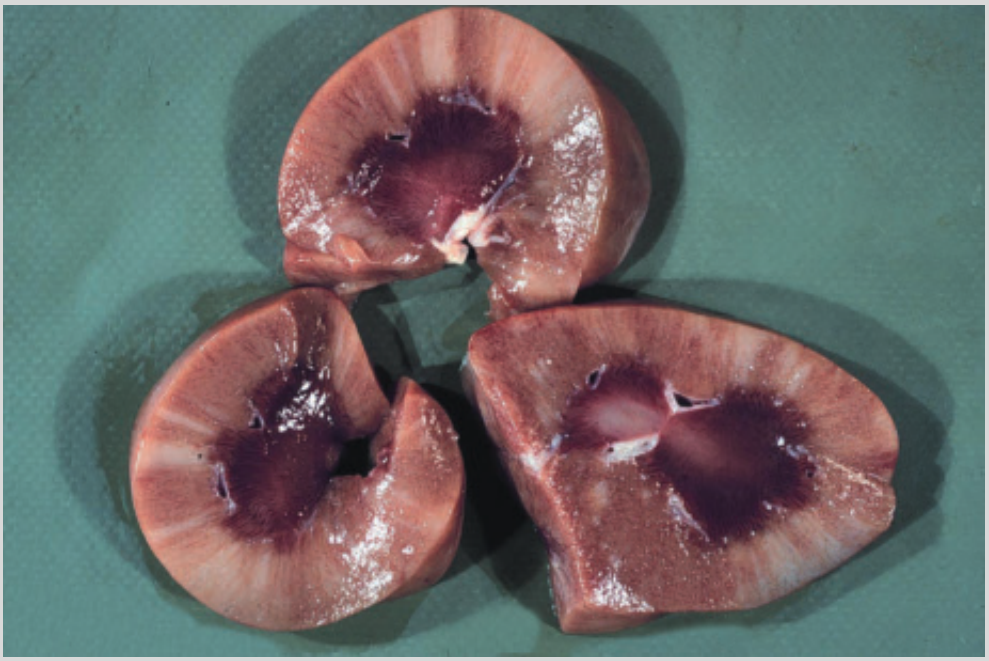
Animal species/Organ	Pig/Kidney
Lesion	Chronic, embolic, verminous, granulomatous nephritis
Scoring	Partial condemnation
Comments	The lesions are due to aberrant migration of parasites

11.56



Animal species/Organ	Cattle/Kidney
Lesion	Chronic, interstitial nephritis
Scoring	Partial condemnation
Comments	Mild lesions

11.57



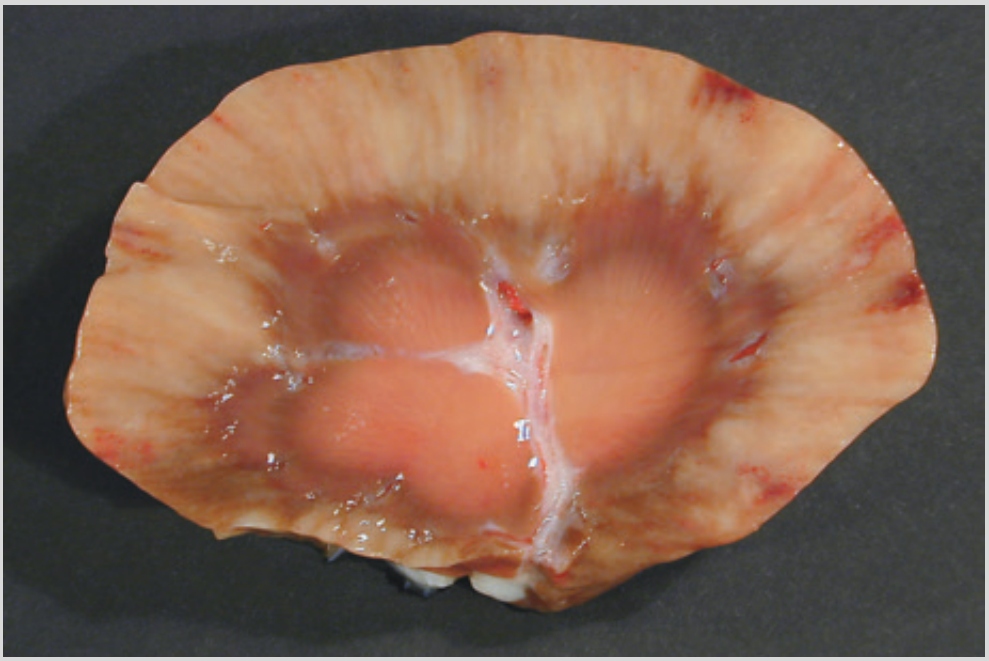
Animal species/Organ	Cattle/Kidney
Lesion:	Chronic, interstitial nephritis
Scoring	Partial condemnation
Comments	Moderate lesions

11.58



Animal species/Organ	Cattle/Kidney
Lesion	Chronic, interstitial nephritis
Scoring	Partial condemnation
Comments	Severe lesions

11.59



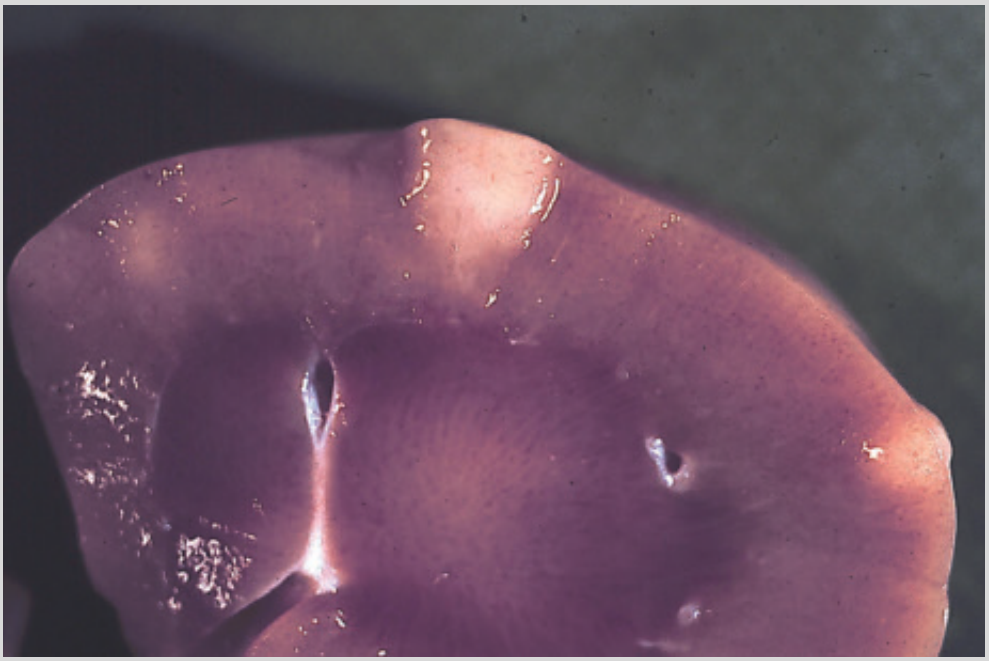
Animal species/Organ	Cattle/Kidney
Lesion:	Chronic, interstitial nephritis
Scoring	Partial condemnation
Comments	Same kidney as in 11.58

11.60



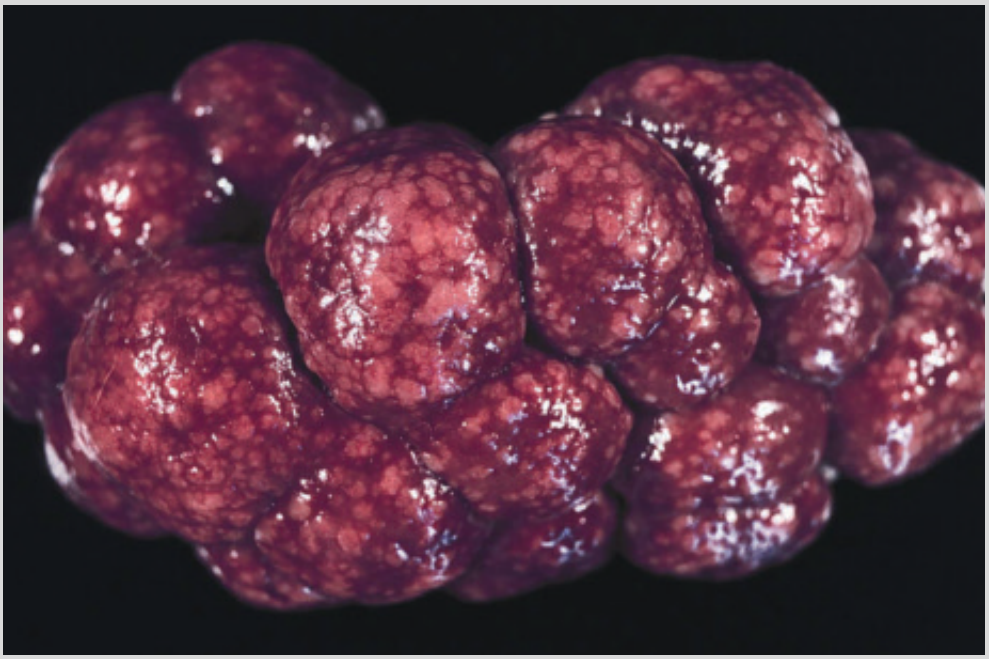
Animal species/Organ	Cattle/Kidney
Lesion	Chronic, interstitial nephritis
Scoring	Partial condemnation
Comments	Note the resemblance to tumours

11.61



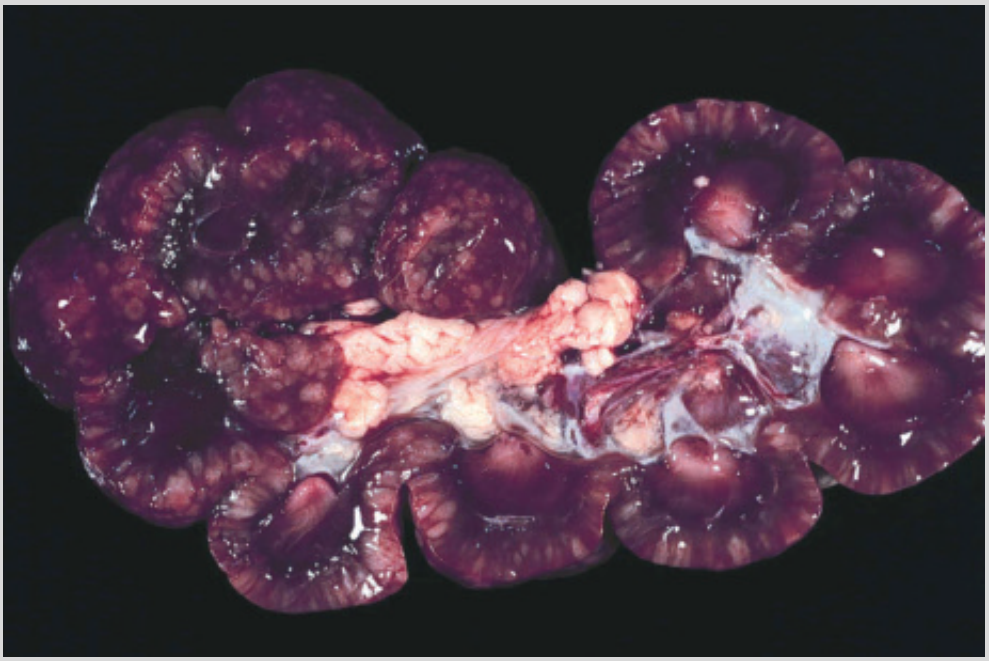
Animal species/Organ	Cattle/Kidney
Lesion	Chronic, interstitial nephritis
Scoring	Partial condemnation
Comments	Cut surface from the kidney in 11.60

11.62



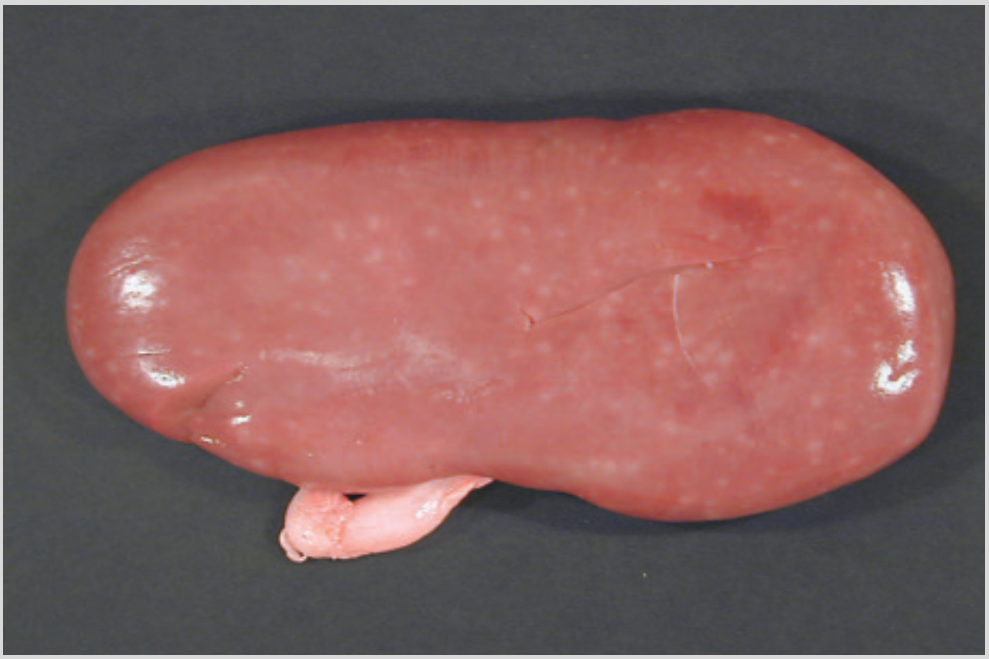
Animal species/Organ	Cattle/Kidney
Lesion	Chronic, interstitial nephritis (“white spotted kidney”)
Scoring	Partial condemnation
Comments	Disseminated white lesions which project above the surface

11.63



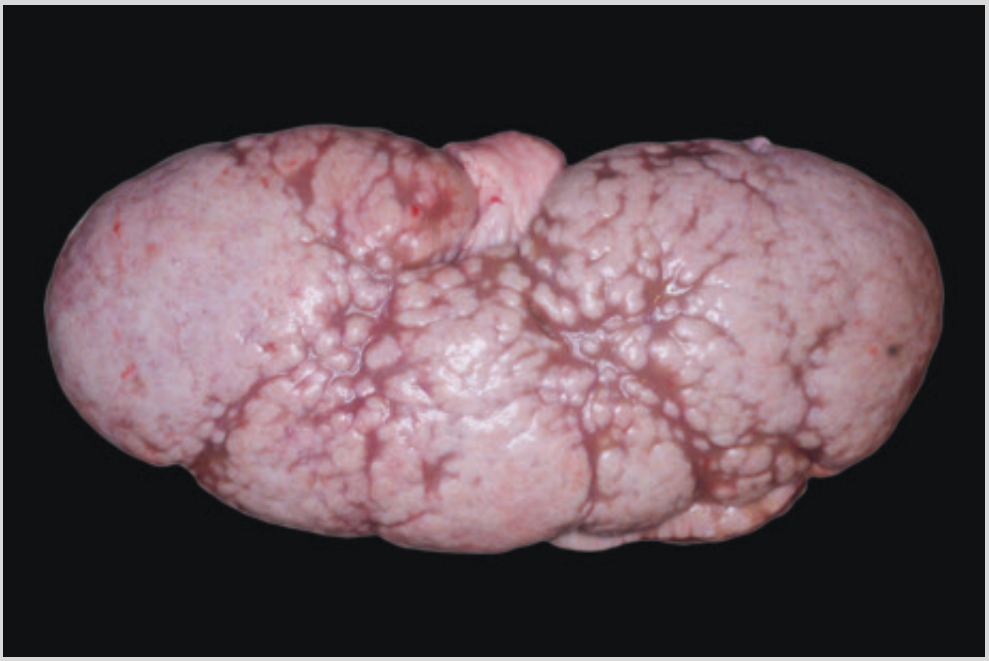
Animal species/Organ	Cattle/Kidney
Lesion	Chronic, interstitial nephritis (“white spotted kidney”)
Scoring	Partial condemnation
Comments	Same kidney as in 11.62

11.64



Animal species/Organ	Pig/Kidney
Lesion:	Chronic, interstitial nephritis
Scoring	Partial condemnation
Comments	Small, disseminated, white lesions

11.65



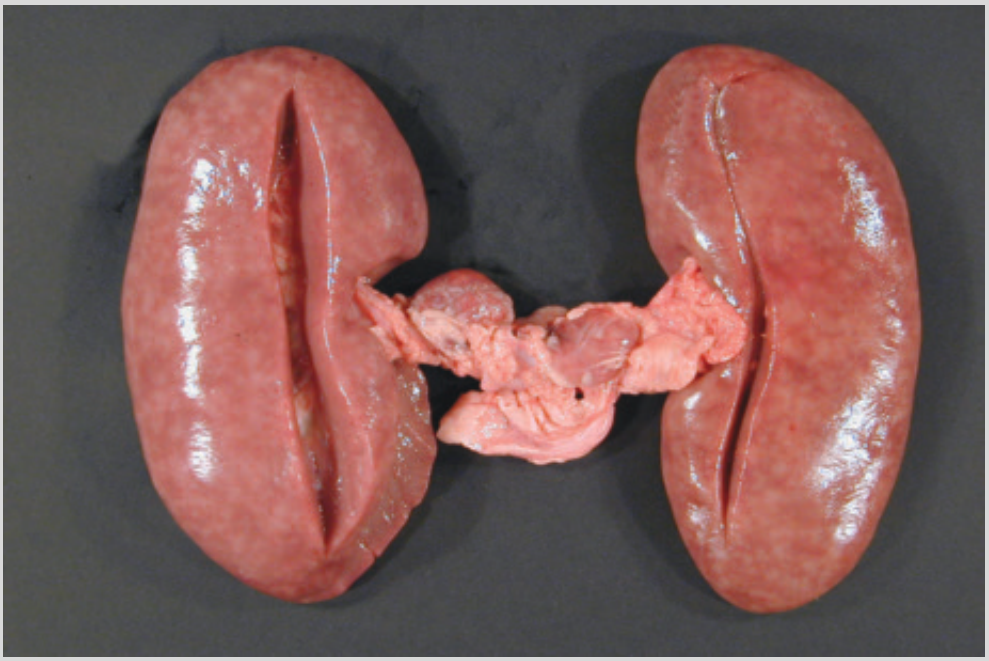
Animal species/Organ	Pig/Kidney
Lesion	Chronic, interstitial nephritis
Scoring	Partial condemnation
Comments	Severe lesions. Complications necessitate total condemnation

11.66



Animal species/Organ	Pig/Kidney
Lesion	Chronic, interstitial nephritis
Scoring	Partial condemnation
Comments	Same kidney as in 11.65

11.67



Animal species/Organ	Pig/Kidney
Lesion	Chronic, granulomatous, interstitial nephritis
Scoring	Partial condemnation
Comments	Due to infection with porcine circovirus type 2

11.68



Animal species/Organ	Pig/Kidney
Lesion	Chronic, granulomatous, interstitial nephritis
Scoring	Partial condemnation
Comments	Cut surface from a kidney in 11.67

11.69



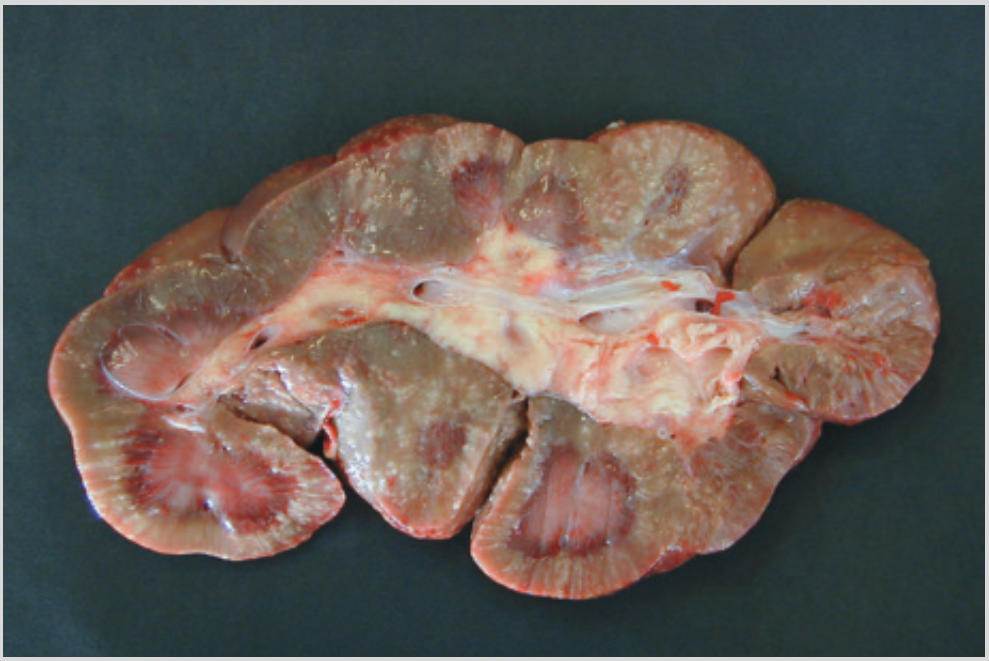
Animal species/Organ	Cattle/Kidney
Lesion	Chronic, granulomatous, interstitial nephritis
Scoring	Partial condemnation
Comments	The cause of the lesions is unknown

11.70



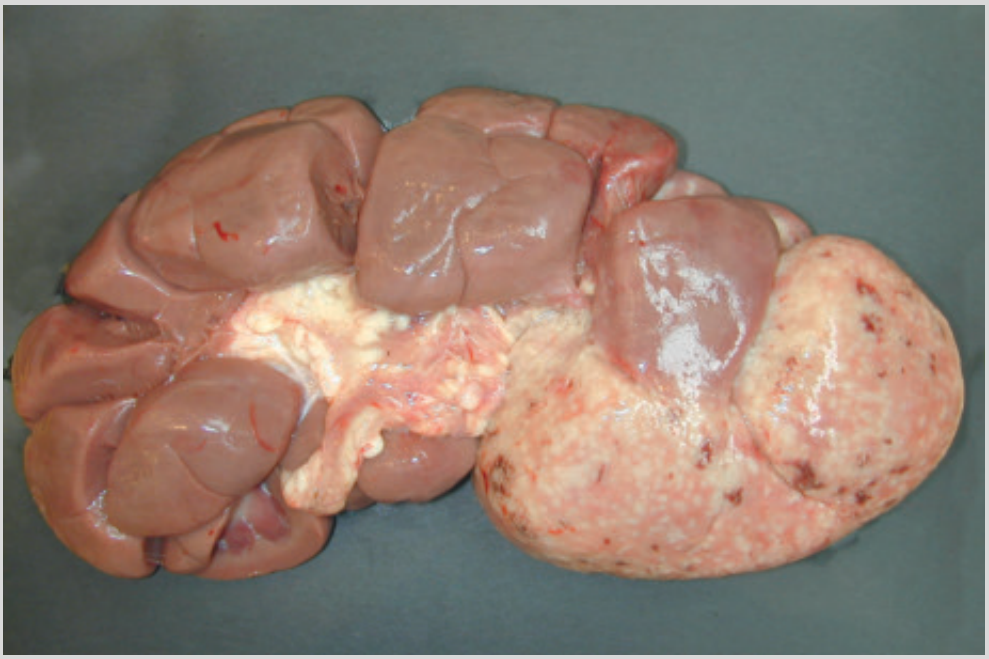
Animal species/Organ	Cattle/Kidney
Lesion	Acute, purulent pyelonephritis
Scoring	Partial condemnation
Comments	The lesions are due to *Escherichia coli*. Note the unaffected areas

11.71



Animal species/Organ	Cattle/Kidney
Lesion	Acute, purulent pyelonephritis
Scoring	Partial condemnation
Comments	Same kidney as in 11.70

11.72



Animal species/Organ	Cattle/Kidney
Lesion	Chronic, purulent pyelonephritis
Scoring	Partial condemnation
Comments	Note the sharp demarcation between grossly changed renal tissue and normal renal tissue

11.73



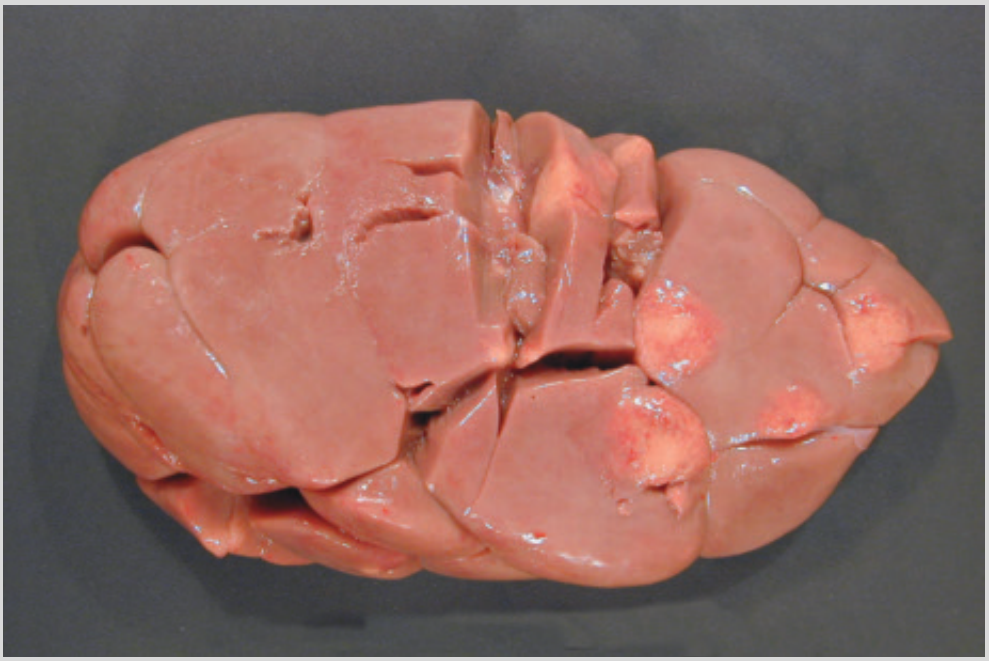
Animal species/Organ	Cattle/Kidney
Lesion	Chronic, purulent pyelonephritis
Scoring	Partial condemnation
Comments	Note the polar localisation

11.74



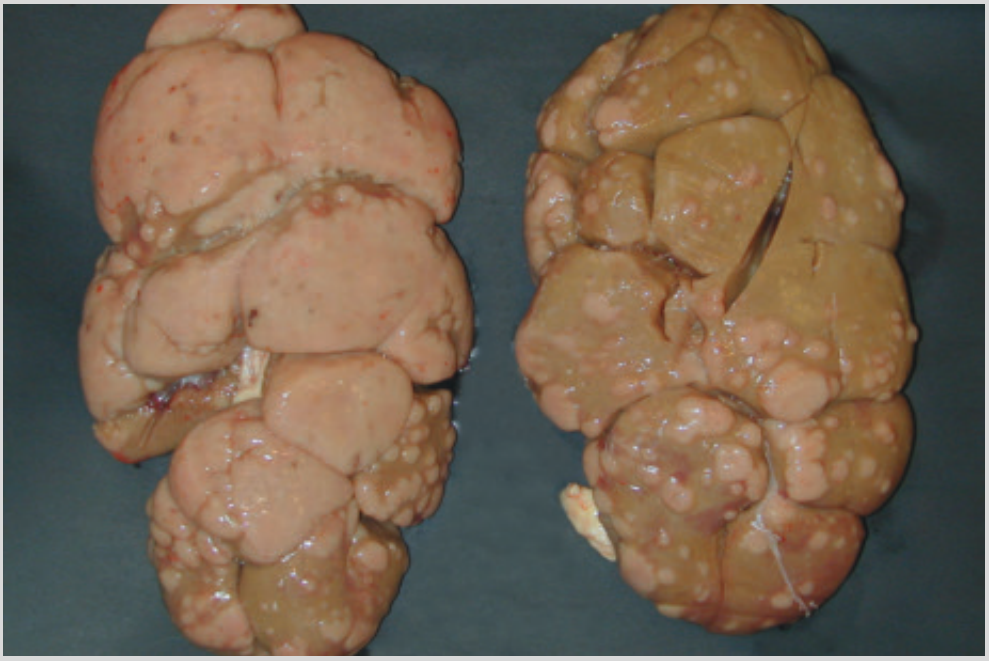
Animal species/Organ	Cattle/Kidney
Lesion	Chronic, purulent pyelonephritis
Scoring	Partial condemnation
Comments	Cut surface from the kidney in 11.73

11.75



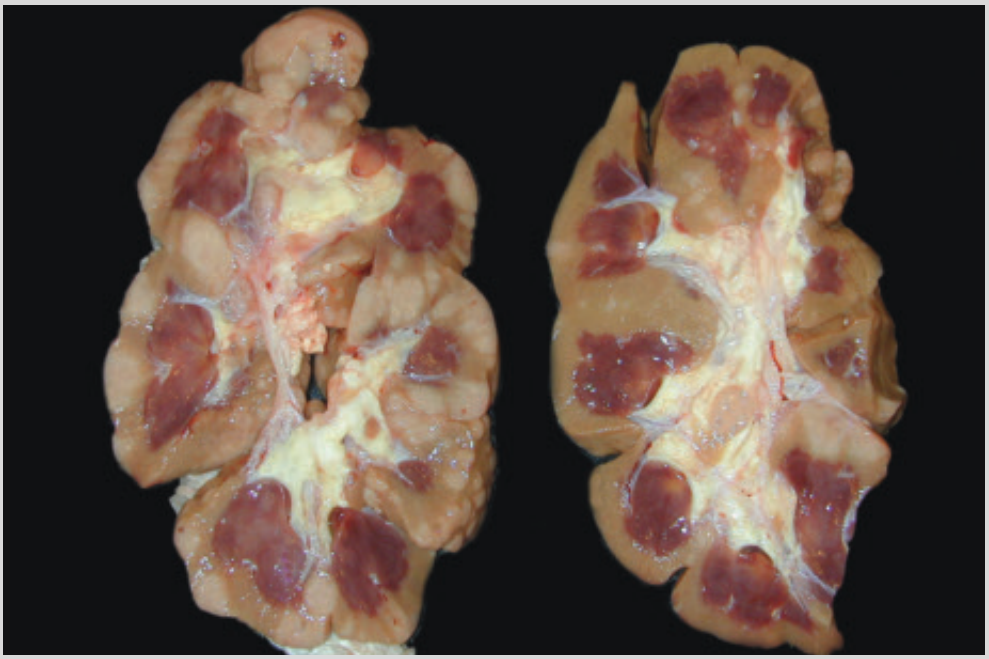
Animal species/Organ	Cattle/Kidney
Lesion	Chronic, purulent pyelonephritis
Scoring	Partial condemnation
Comments	Several areas with confluent lesions

11.76



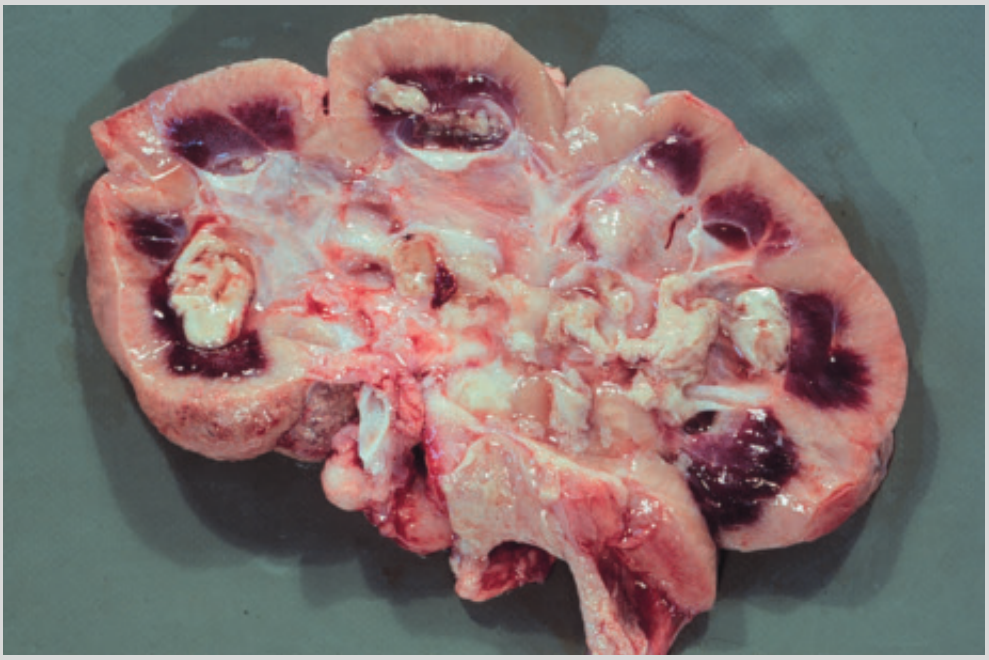
Animal species/Organ	Cattle/Kidney
Lesion	Chronic, non-purulent pyelonephritis
Scoring	Partial condemnation
Comments	Note the irregular distribution of the lesions

11.77



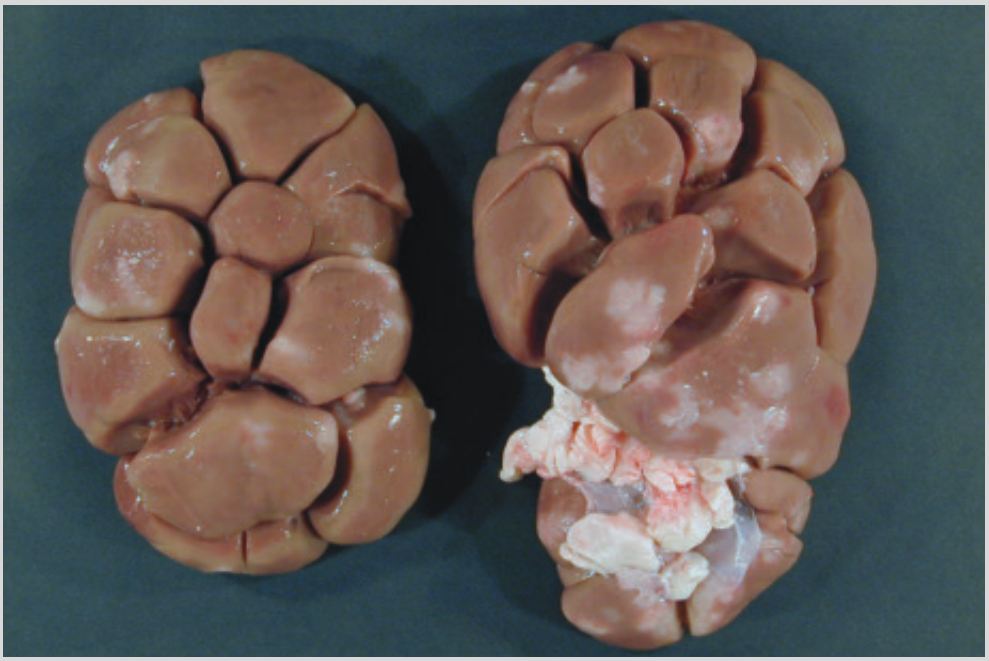
Animal species/Organ	Cattle/Kidney
Lesion	Chronic, non-purulent pyelonephritis
Scoring	Partial condemnation
Comments	Same kidneys as in 11.76

11.78



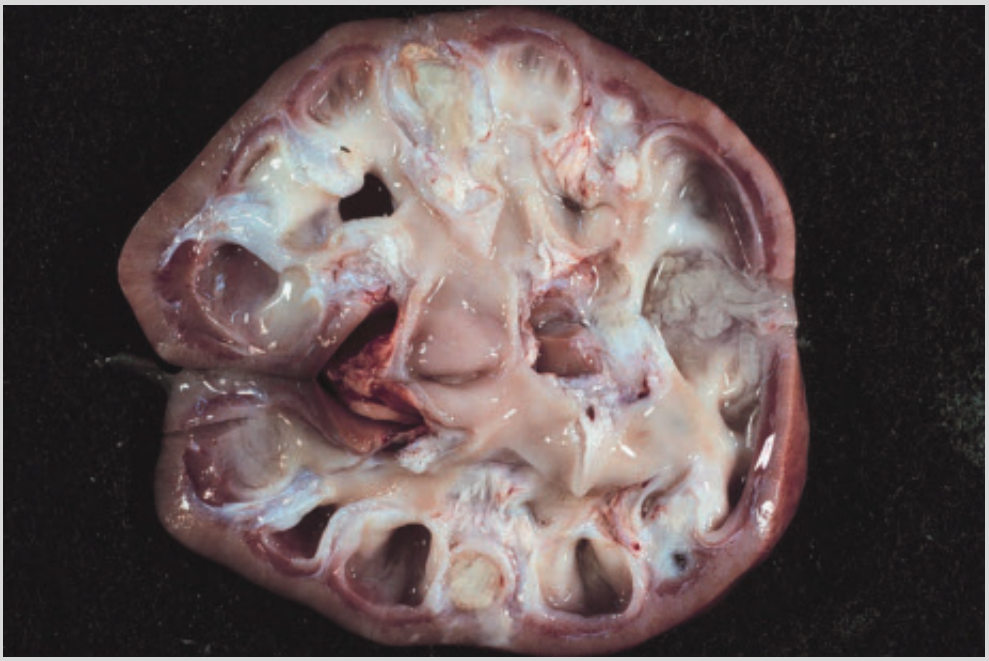
Animal species/Organ	Cattle/Kidney
Lesion	Chronic, purulent pyelonephritis
Scoring	Partial condemnation
Comments	Pus-filled calyces. The parenchyma is also changed

11.79



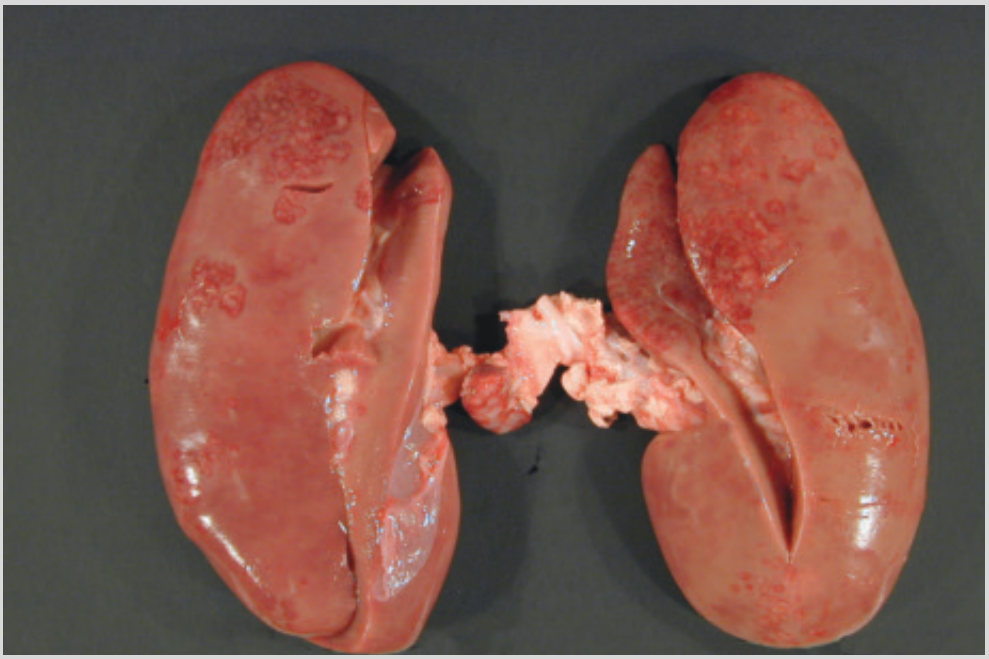
Animal species/Organ	Cattle/Kidney
Lesion	Chronic, non-purulent pyelonephritis
Scoring	Partial condemnation
Comments	Can be confused with neoplasms (see 11.108)

11.80



Animal species/Organ	Pig/Kidney
Lesion	Chronic, purulent pyelonephritis
Scoring	Partial condemnation
Comments	Hydronephrosis is also present

11.81



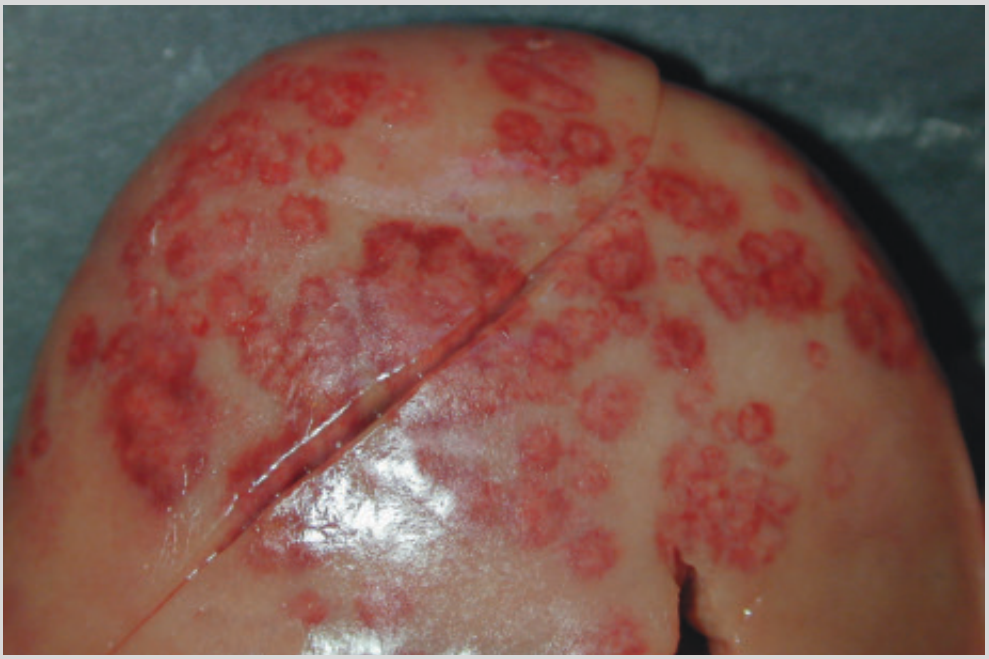
Animal species/Organ	Pig/Kidney
Lesion	Acute, leukolymphocytic pyelonephritis
Scoring	Partial condemnation
Comments	The characteristic lesions with predominantly polar localisation

11.82



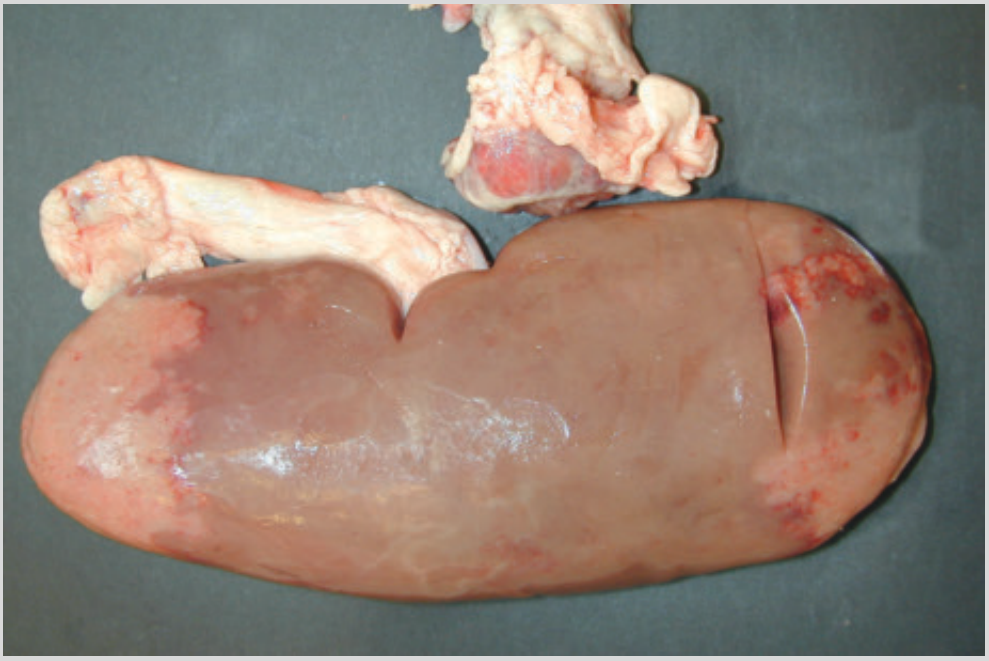
Animal species/Organ	Pig/Kidney
Lesion	Acute, leukolymphocytic pyelonephritis
Scoring	Partial condemnation
Comments	Longitudinal section from a kidney in 11.81

11.83



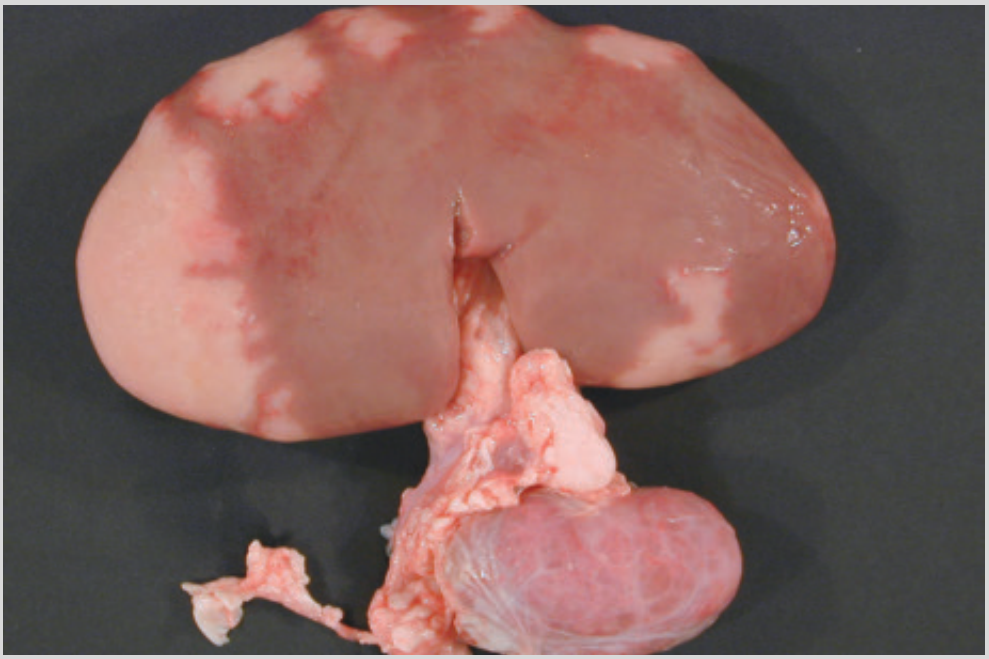
Animal species/Organ	Pig/Kidney
Lesion	Acute, leukolymphocytic pyelonephritis
Scoring	Partial condemnation
Comments	Close-up of the characteristic lesions

11.84



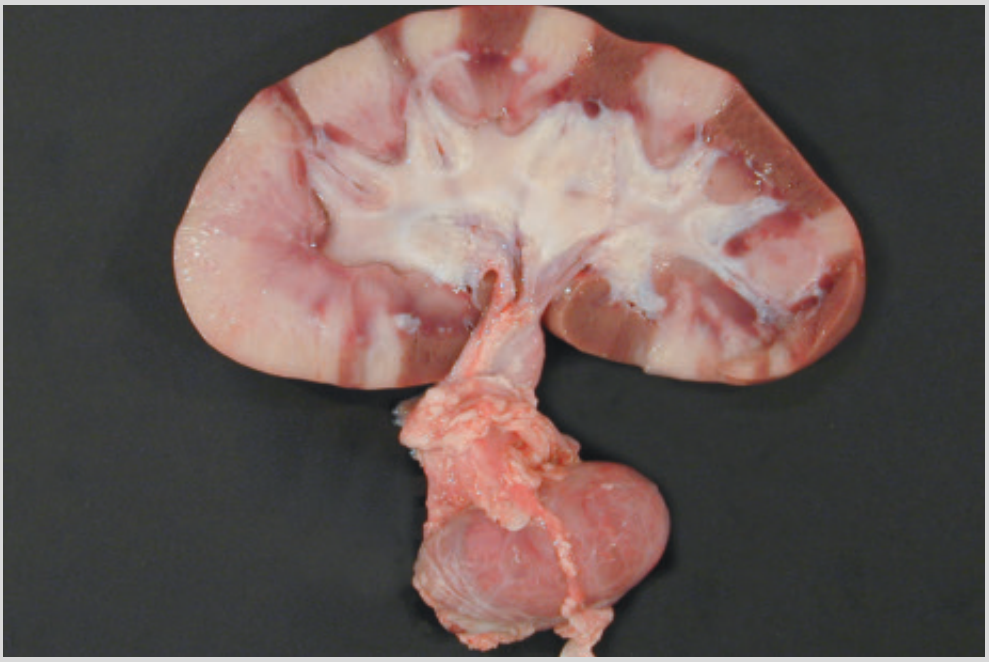
Animal species/Organ	Pig/Kidney
Lesion	Chronic leukolymphocytic pyelonephritis
Scoring	Partial condemnation
Comments	Predominantly chronic lesions with individual acute lesions

11.85



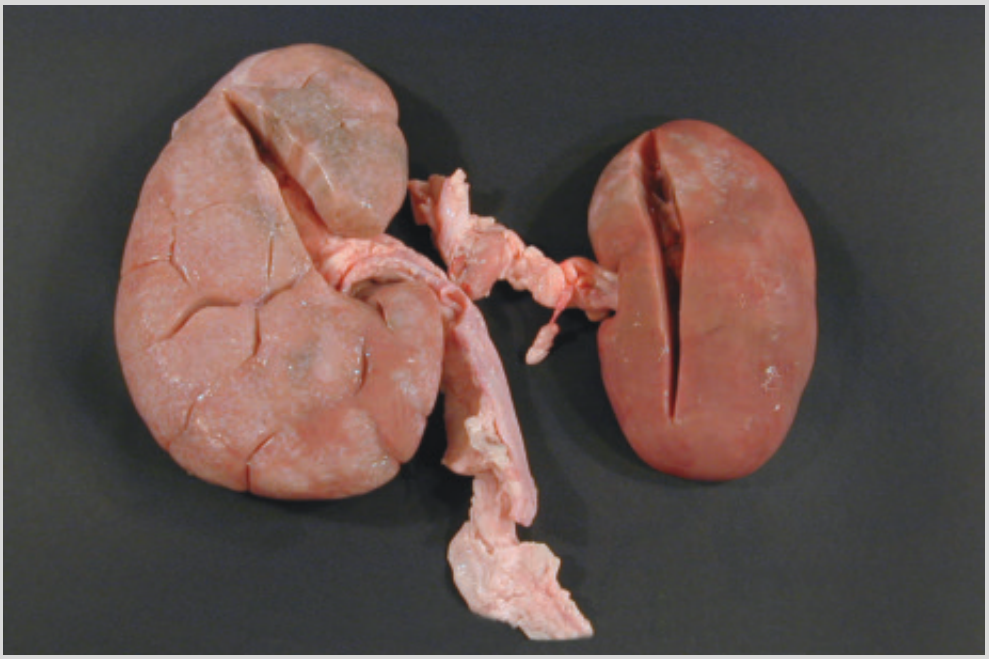
Animal species/Organ	Pig/Kidney
Lesion	Chronic, non-purulent pyelonephritis
Scoring	Partial condemnation
Comments	Grossly enlarged renal lymph node

11.86



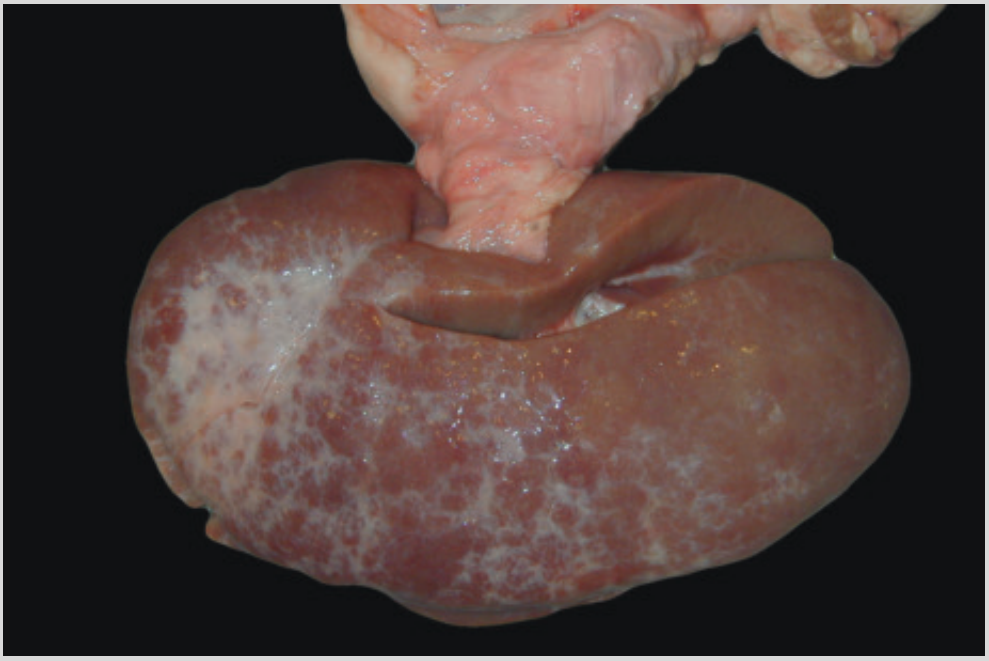
Animal species/Organ	Pig/Kidney
Lesion	Chronic, non-purulent pyelonephritis
Scoring	Partial condemnation
Comments	Same kidney as in 11.85. Note the lobar distribution of the lesions

11.87



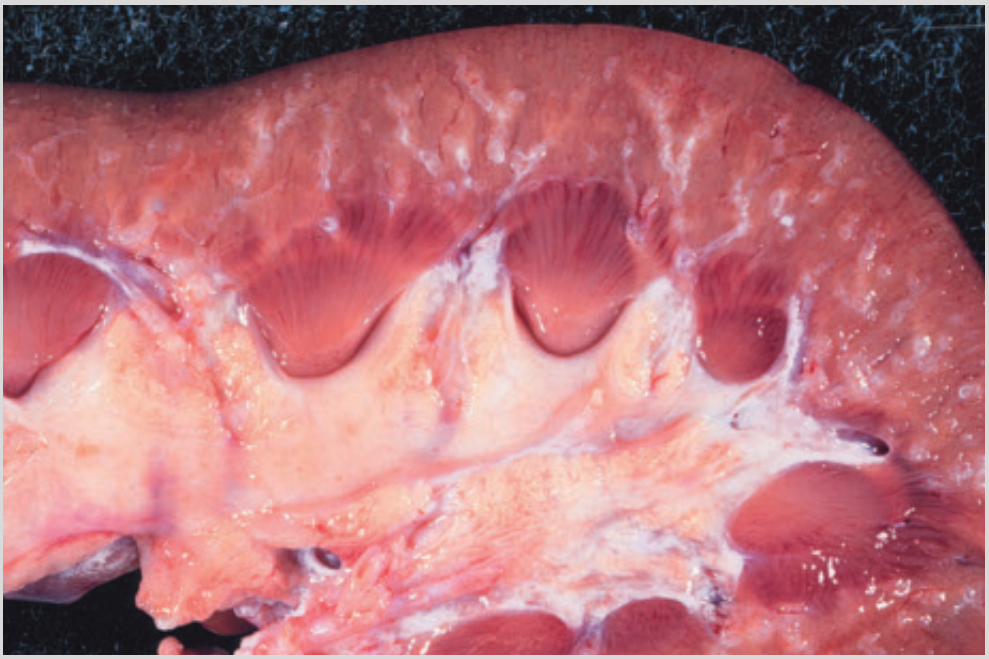
Animal species/Organ	Pig/Kidney
Lesion	Chronic, fibrotic pyelonephritis and unilateral, persistent, foetal lobe division
Scoring	Partial condemnation
Comments	The inflammatory lesions are presumably secondary to impaired urine outflow

11.88



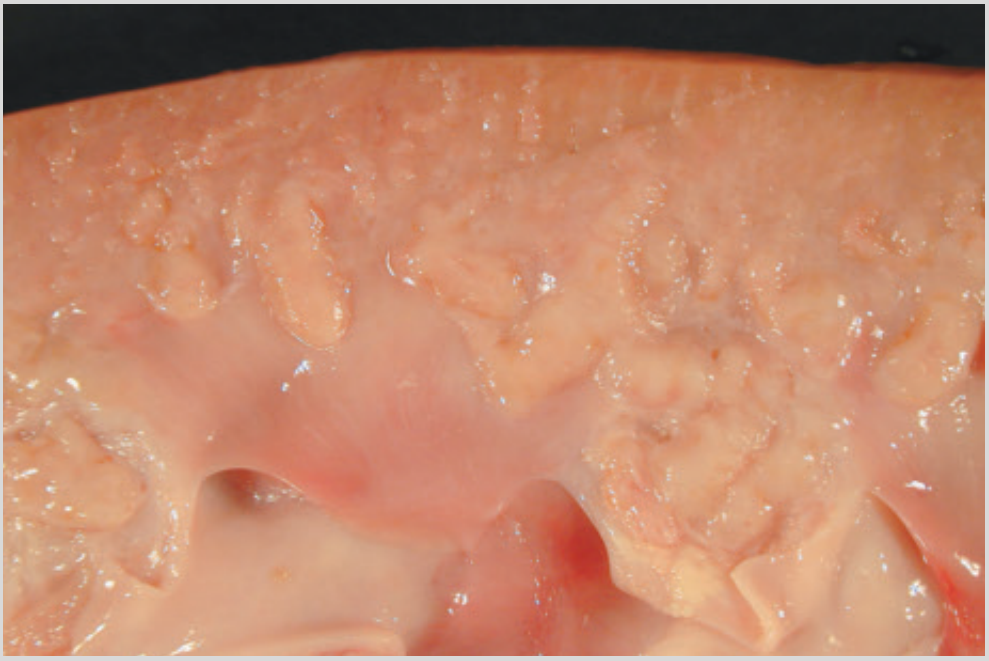
Animal species/Organ	Pig/Kidney
Lesion	Chronic, fibrotic pyelonephritis
Scoring	Partial condemnation
Comments	Multiple, partially confluent cicatrices can be seen on the surface of the kidney

11.89



Animal species/Organ	Pig/Kidney
Lesion	Polyarteritis nodosa
Scoring	Partial condemnation
Comments	Moderate lesions

11.90



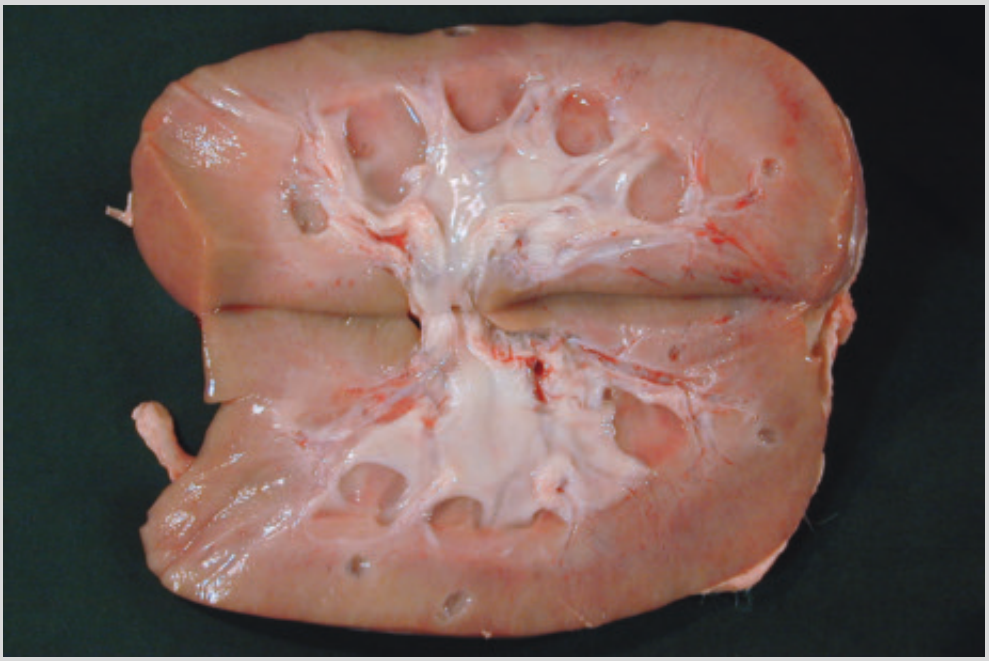
Animal species/Organ	Pig/Kidney
Lesion	Polyarteritis nodosa
Scoring	Partial condemnation
Comments	Severe lesions

11.91



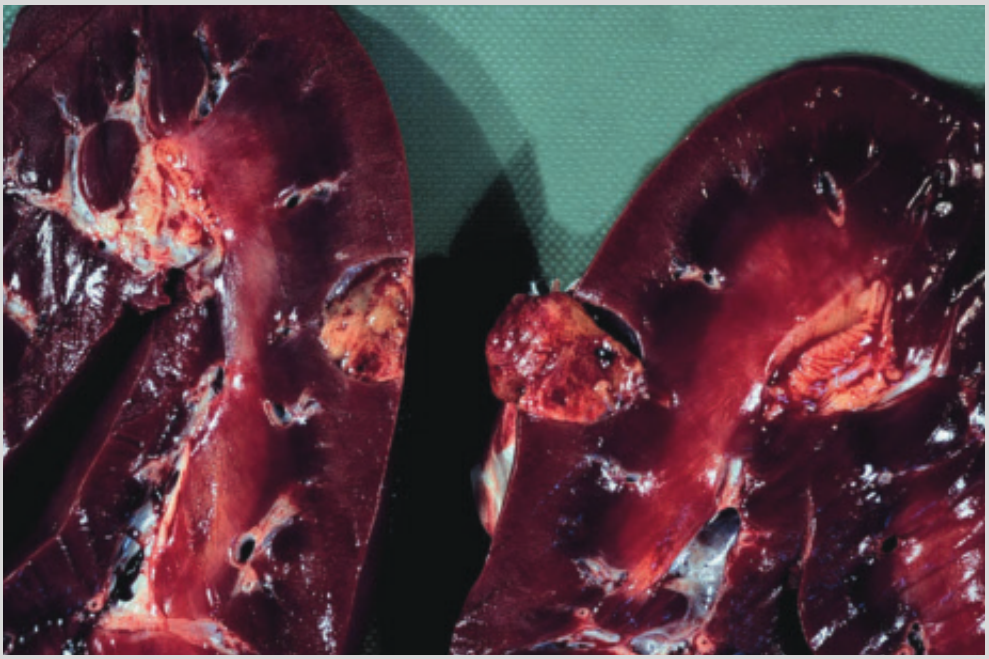
Animal species/Organ	Pig/Kidney
Lesion	Diffuse fibrosis (“end-stage kidney”)
Scoring	Partial condemnation
Comments	Uraemia is a frequent complication and always necessitates total condemnation

11.92



Animal species/Organ	Pig/Kidney
Lesion	Diffuse fibrosis (“end-stage kidney”)
Scoring	Partial condemnation
Comments	Cortical fibrosis, atrophy, and cysts

11.93



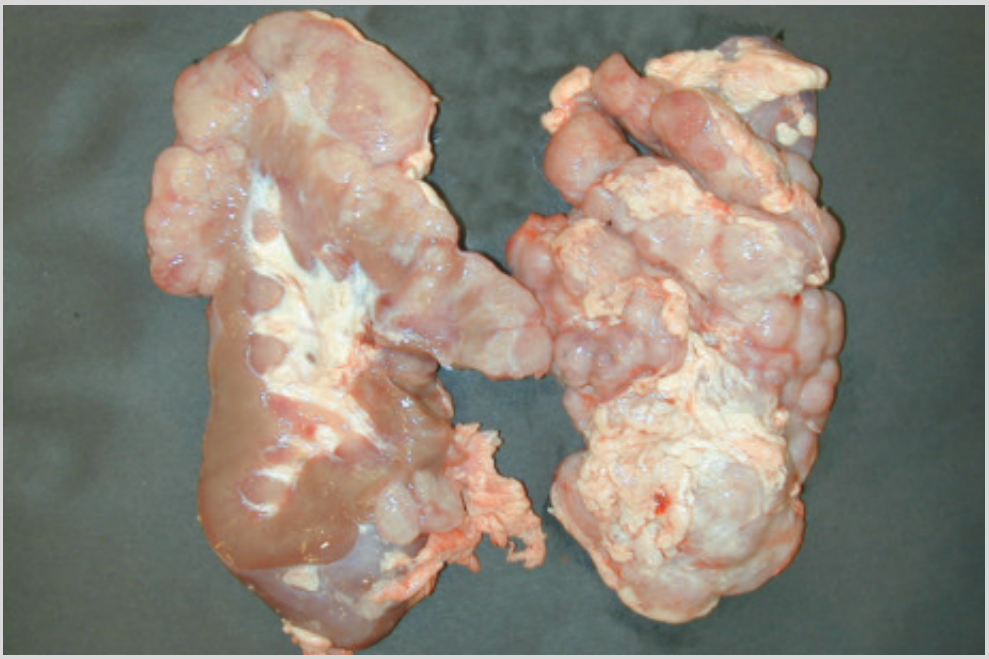
Animal species/Organ	Horse/Kidney
Lesion	Adenoma
Scoring	Partial condemnation
Comments	The tumour is well demarcated

11.94



Animal species/Organ	Pig/Kidney
Lesion	Nephroblastoma
Scoring	Partial condemnation
Comments	Nephroblastomas localise frequently to the poles

11.95



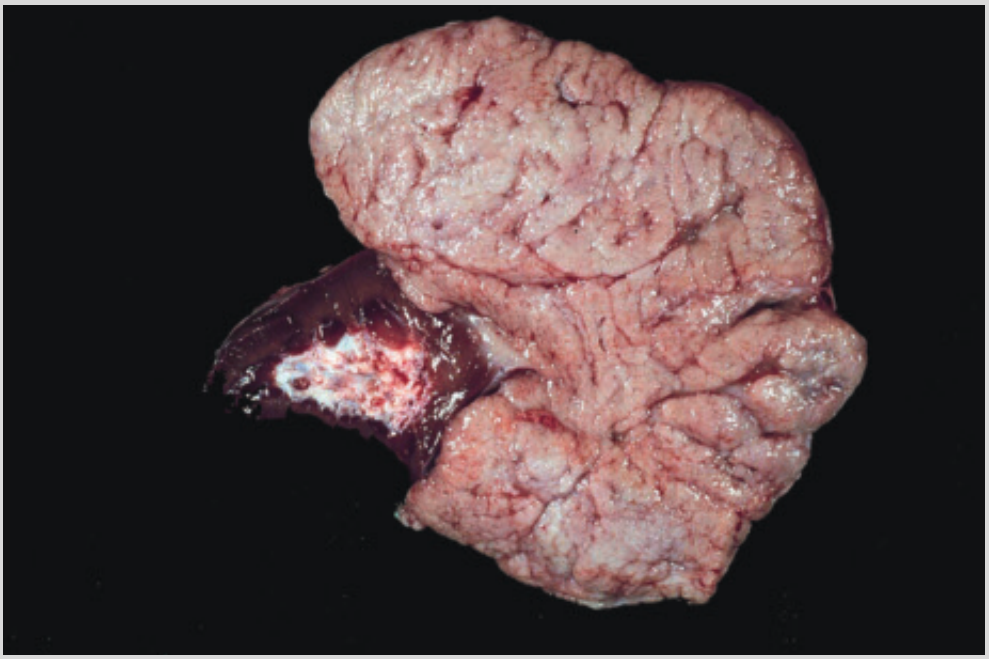
Animal species/Organ	Pig/Kidney
Lesion	Nephroblastoma
Scoring	Partial condemnation
Comments	Nephroblastomas are often multicentric

11.96



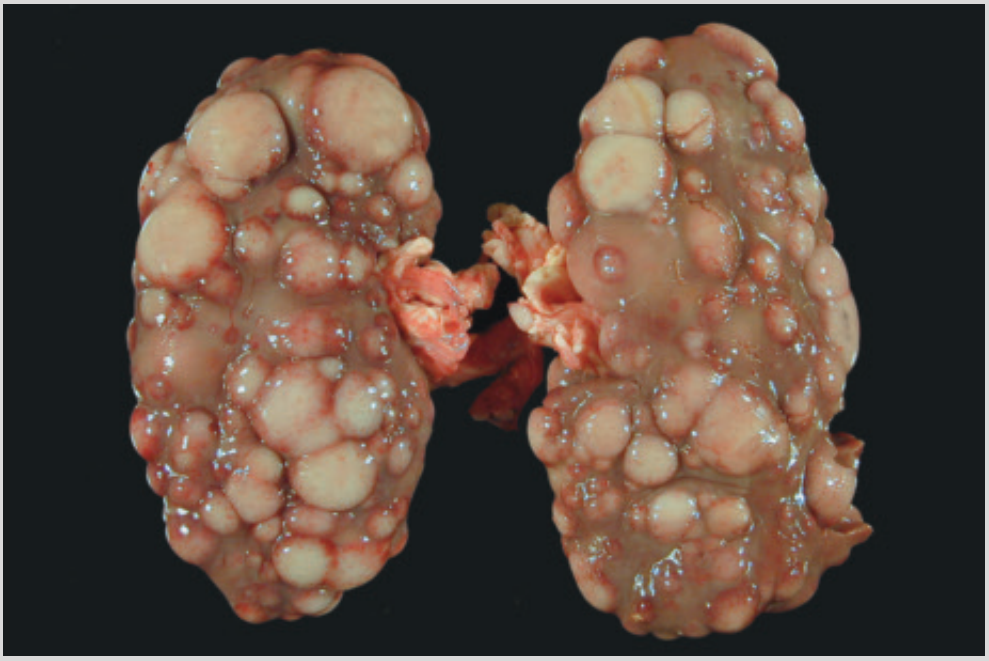
Animal species/Organ	Pig/Kidney
Lesion	Nephroblastoma
Scoring	Partial condemnation
Comments	Growth into the pelvis can cause hydronephrosis

11.97



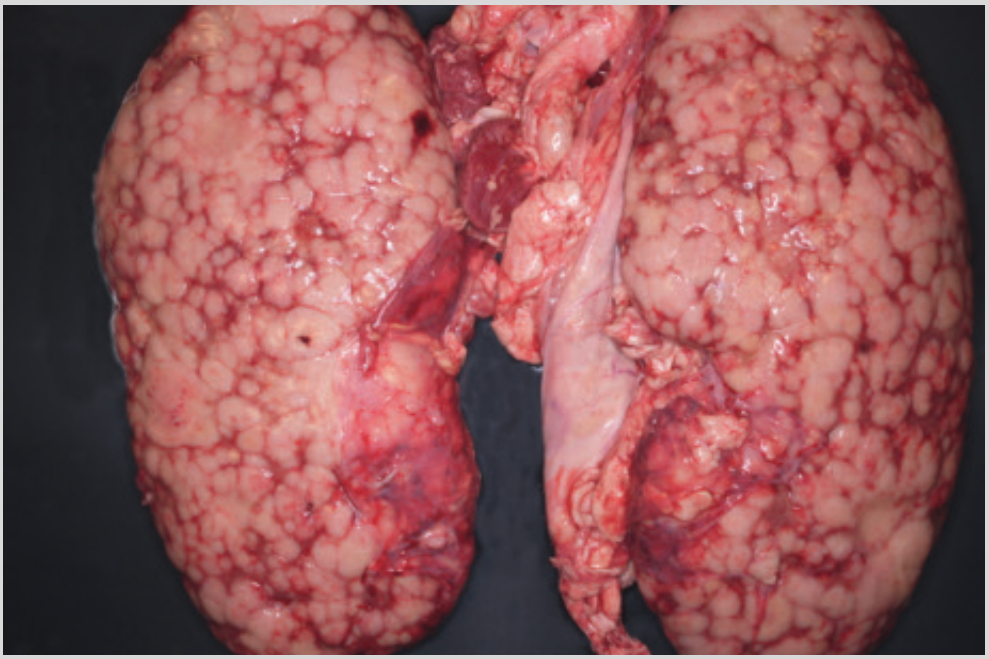
Animal species/Organ	Pig/Kidney
Lesion	Nephroblastoma
Scoring	Partial condemnation
Comments	Note the characteristic lobation

11.98



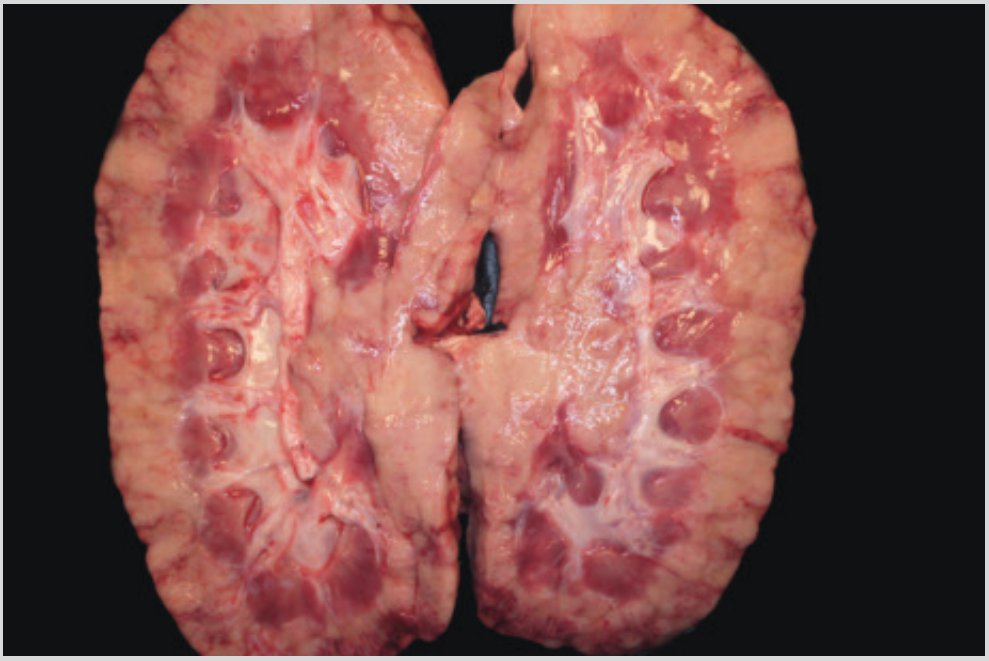
Animal species/Organ	Pig/Kidney
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Disseminated lesions of varying sizes. Note the haemorrhages

11.99



Animal species/Organ	Pig/Kidney
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Note the extensive haemorrhage

11.100



Animal species/Organ	Pig/Kidney
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Same kidneys as in 11.99

11.101



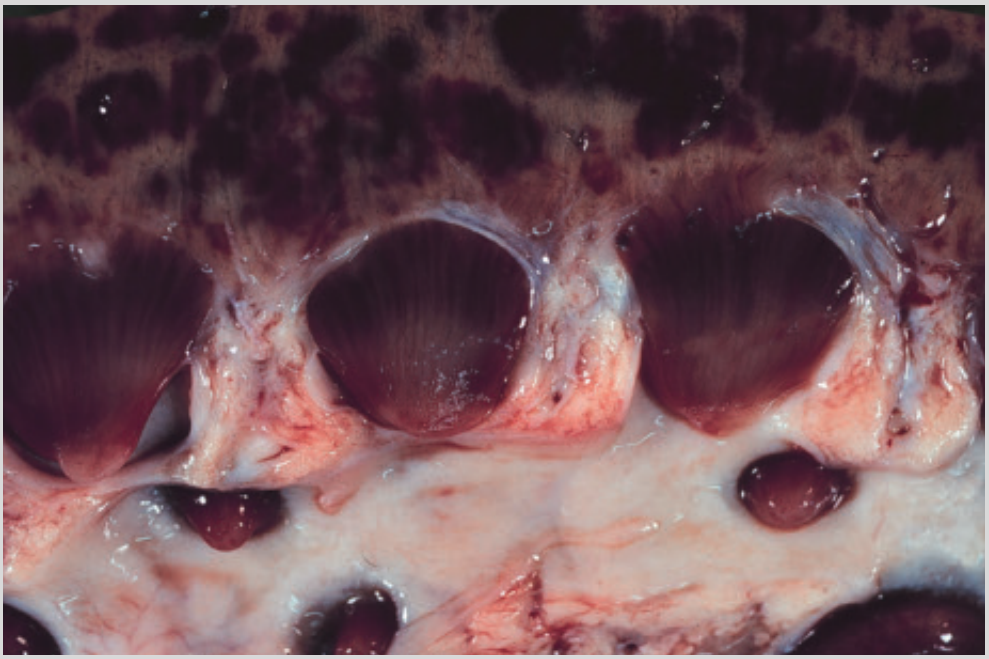
Animal species/Organ	Pig/Kidney
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Normal renal tissue cannot be detected

11.102



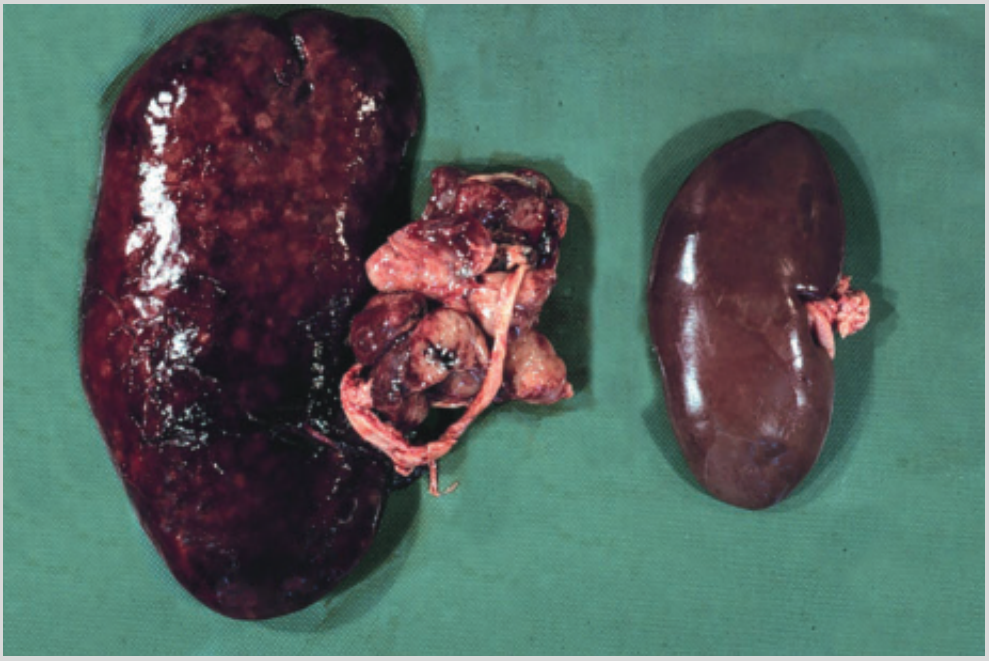
Animal species/Organ	Pig/Kidney
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Tumour infiltration of the entire cortex. Grossly enlarged renal lymph nodes

11.103



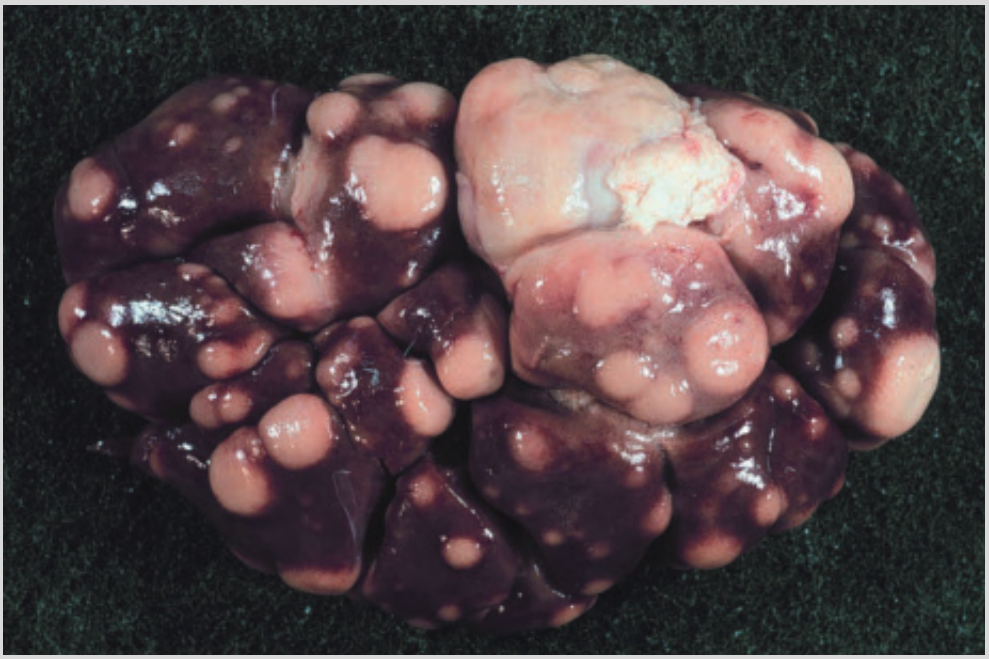
Animal species/Organ	Pig/Kidney
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Tumour infiltration of the entire cortex. Extensive haemorrhages

11.104



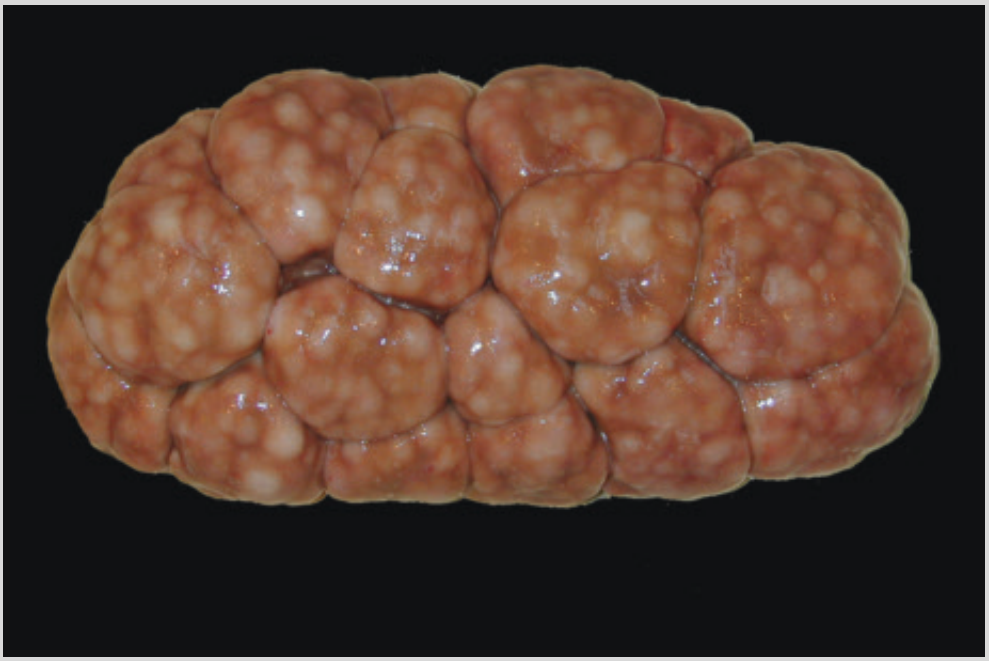
Animal species/Organ	Pig/Kidney
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Diffuse tumour infiltration. Severely enlarged renal lymph nodes. Normal kidney on the right

11.105



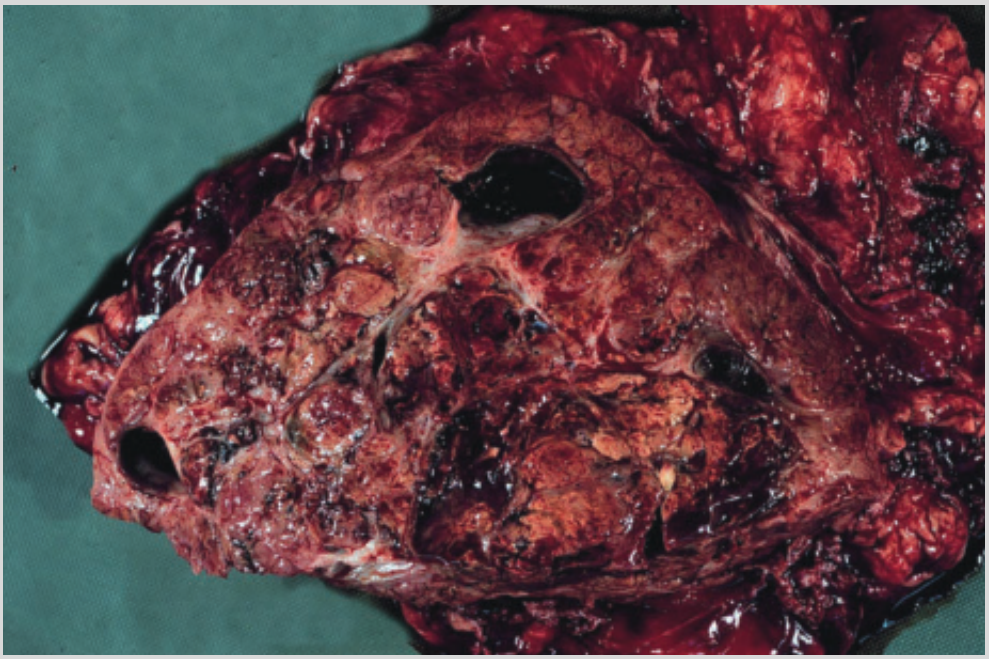
Animal species/Organ	Cattle/Kidney
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Lesions of varying sizes. Normal renal tissue between the lesions

11.106



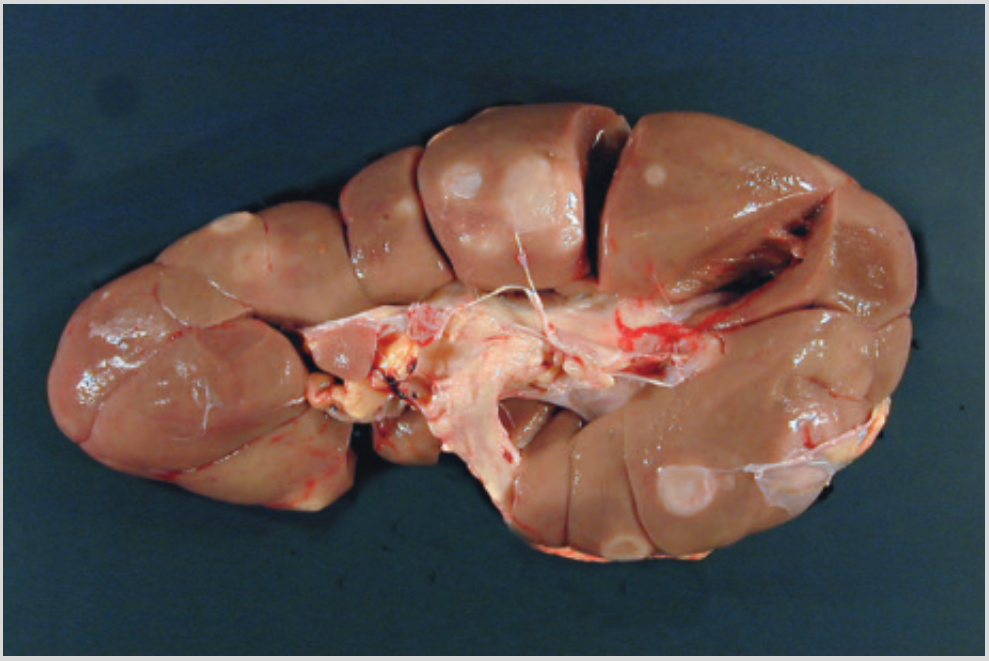
Animal species/Organ	Cattle/Kidney
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Disseminated, homogeneous lesions. Normal renal tissue cannot be detected

11.107



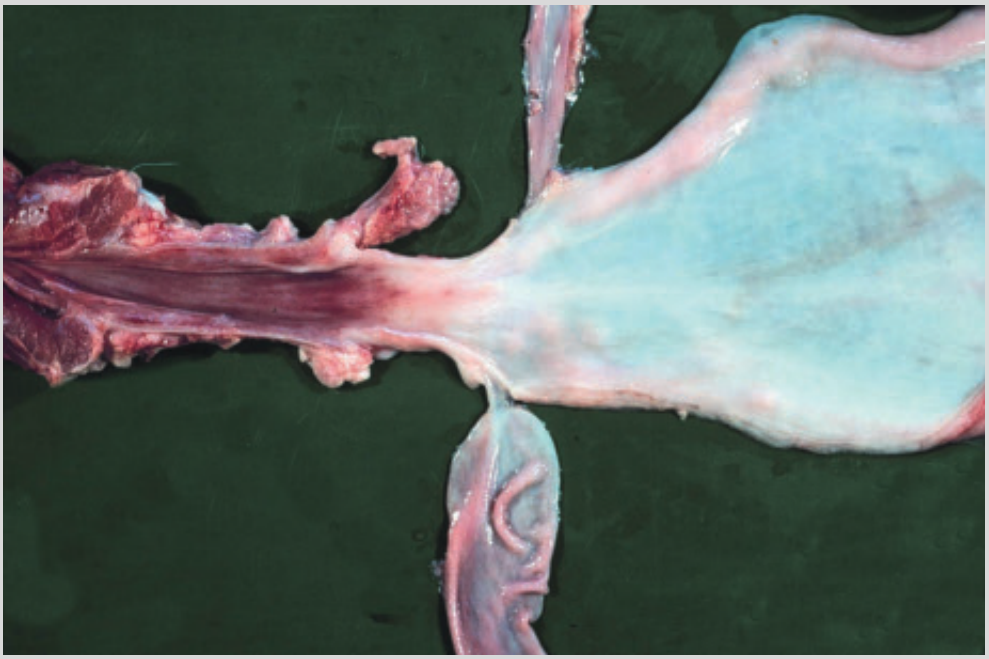
Animal species/Organ	Cattle/Kidney
Lesion	Carcinoma
Scoring	Total condemnation
Comments	Extensive haemorrhage and necrosis is seen

11.108



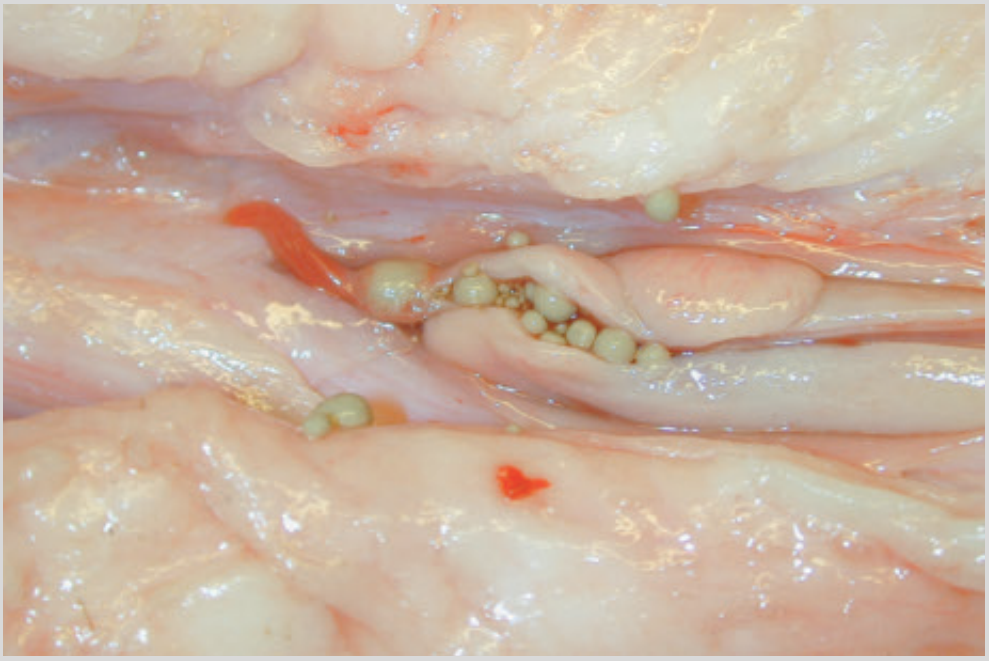
Animal species/Organ	Cattle/Kidney
Lesion	Metastatic carcinoma
Scoring	Total condemnation
Comments	This is probably metastasis from a uterine carcinoma

11.109



Animal species/Organ	Cattle/Bladder and ureters
Lesion	Constriction of the ureter with proximal hydroureter
Scoring	Partial condemnation
Comments	Congenital lesions

11.110



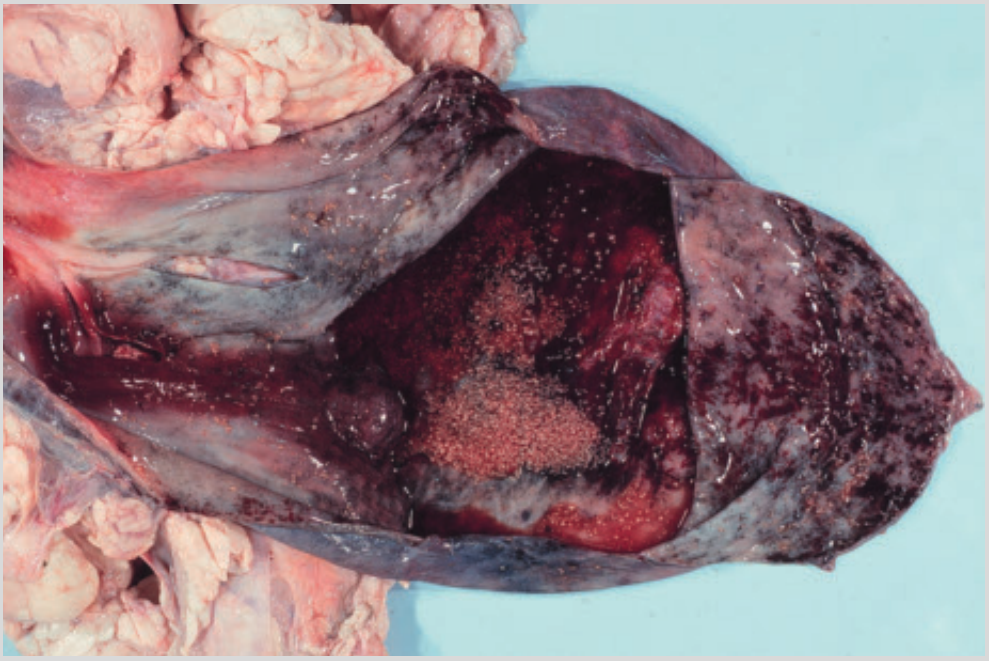
Animal species/Organ	Ram/Penis
Lesion	Urolithiasis
Scoring	Partial condemnation
Comments	The urethra has been cut open

11.111



Animal species/Organ	Pig/Bladder
Lesion	Urolithiasis
Scoring	Partial condemnation
Comments	Secondary hypertrophy of the muscles

11.112



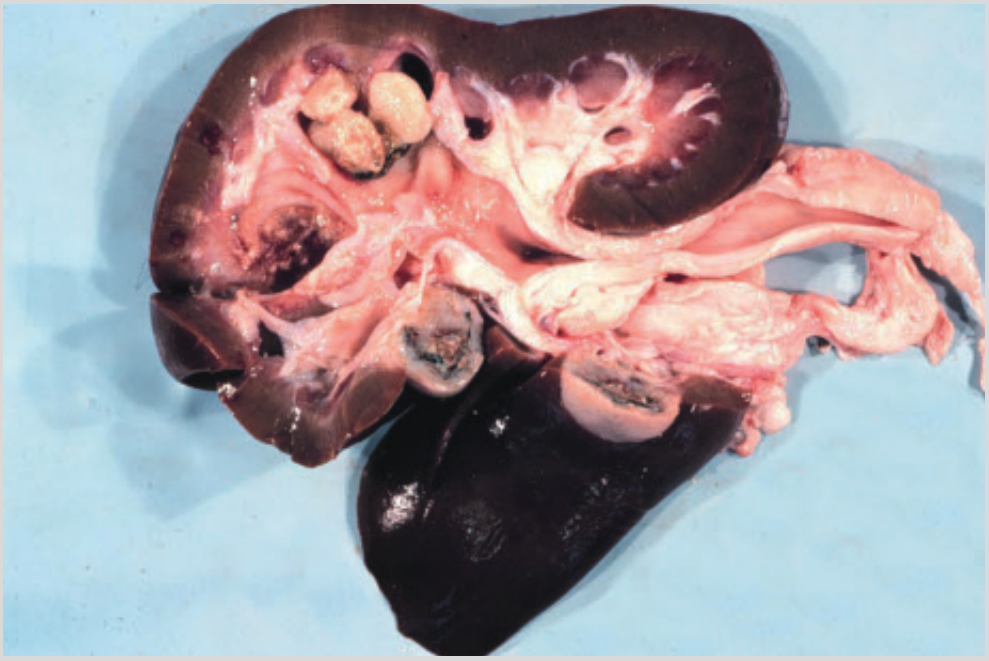
Animal species/Organ	Cattle/Bladder
Lesion	Urolithiasis and haemorrhagic urocystitis
Scoring	Partial condemnation
Comments	Circulatory disturbances are the result of blockage of the urethra

11.113



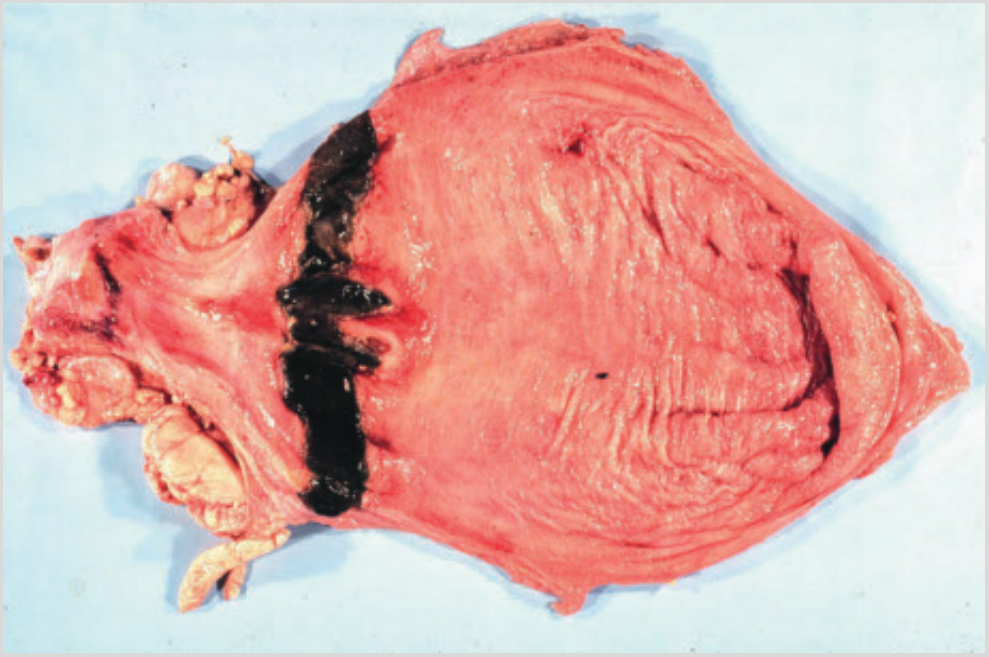
Animal species/Organ	Cattle/Kidney
Lesion	Nephrolithiasis
Scoring	Partial condemnation
Comments	Nephrolithiasis can cause hydronephrosis

11.114



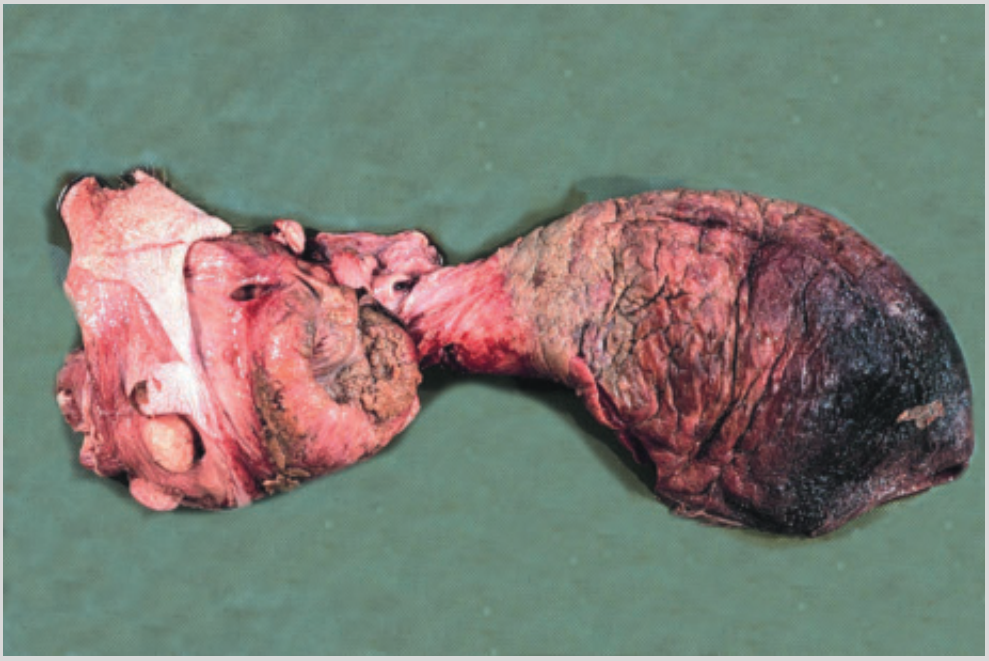
Animal species/Organ	Pig/Kidney
Lesion	Nephrolithiasis
Scoring	Partial condemnation
Comments	Nephrolithiasis is seen particularly in female animals

11.115



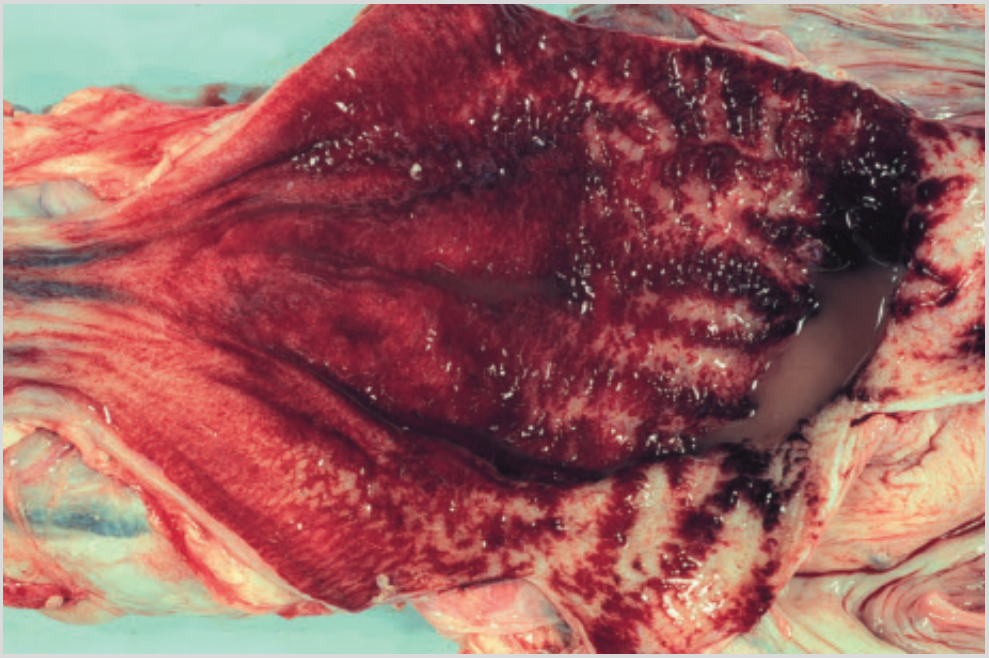
Animal species/Organ	Cattle/Bladder
Lesion	Segmental necrosis of the mucous membrane
Scoring	Partial condemnation
Comments	Compression injury occurred at calving

11.116



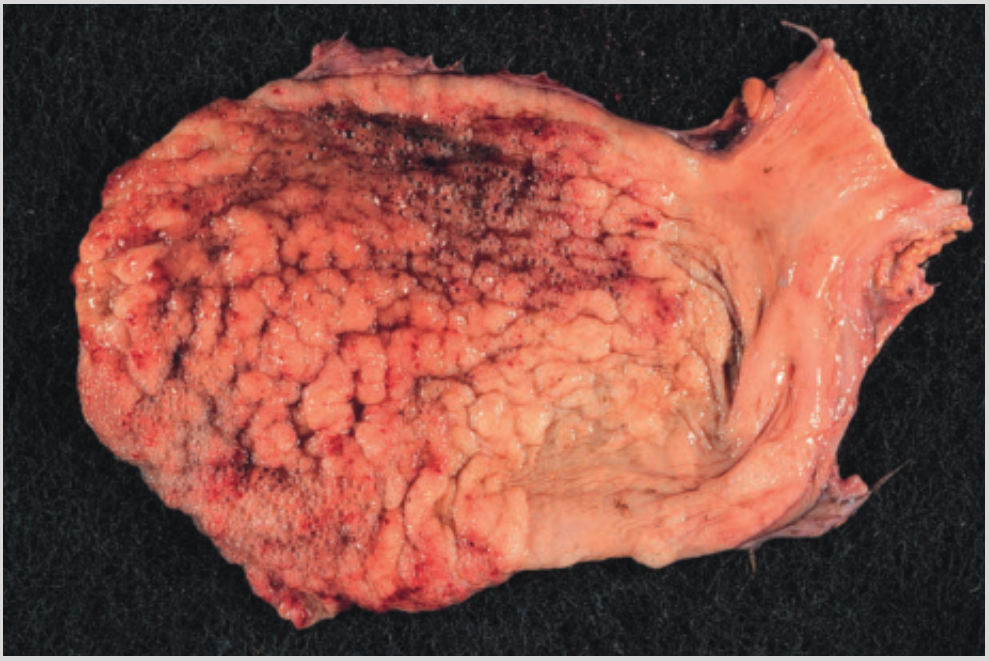
Animal species/Organ	Pig/Bladder
Lesion	Prolapse without eversion
Scoring	Partial condemnation
Comments	Occurred secondary to rupture of the birth canal

11.117



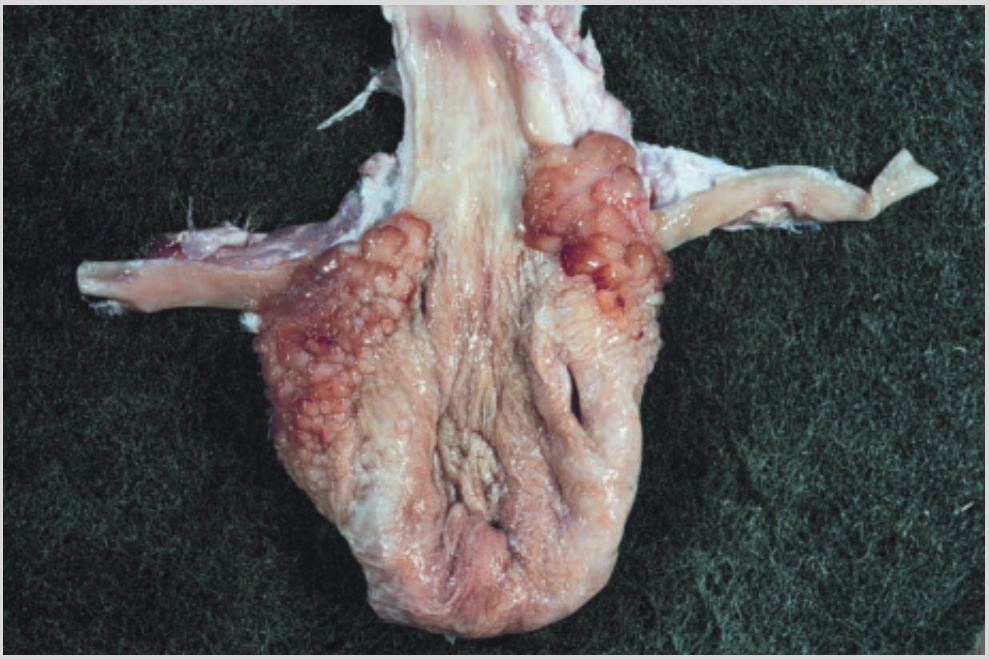
Animal species/Organ	Cattle/Bladder
Lesion	Acute urocystitis
Scoring	Partial condemnation
Comments	Oedema and haemorrhage in the mucous membrane

11.118



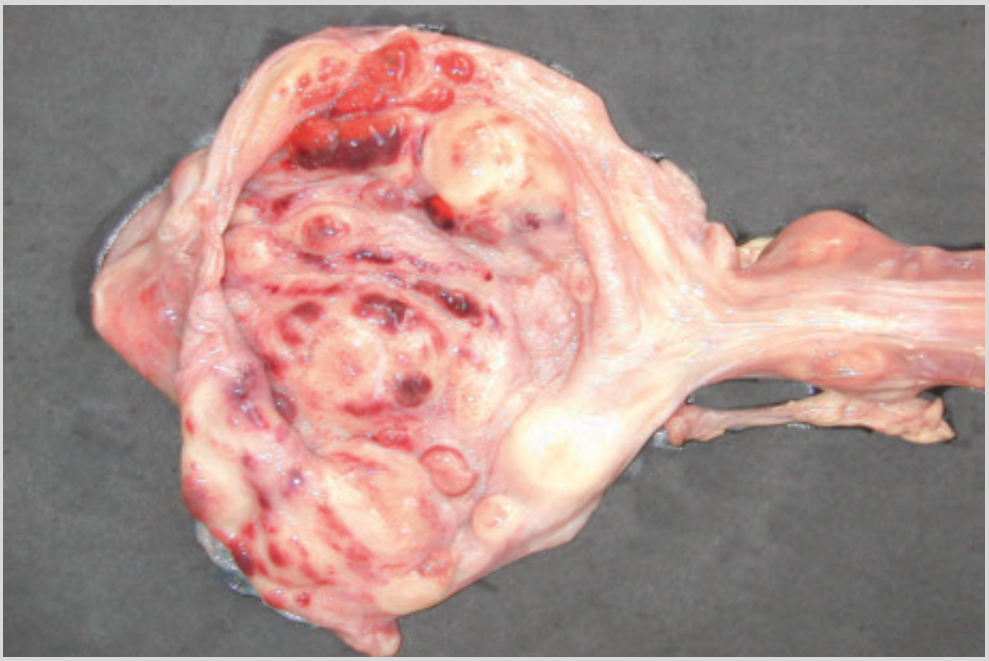
Animal species/Organ	Horse/Bladder
Lesion	Chronic urocystitis
Scoring	Partial condemnation
Comments	Grossly thickened mucous membrane

11.119



Animal species/Organ	Cattle/Bladder
Lesion	Polypoid cystitis
Scoring	Partial condemnation
Comments	Often gives rise to hydroureter and hydronephrosis

11.120



Animal species/Organ	Pig/Bladder
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Tumour infiltrations with extensive haemorrhage

12 Reproductive Systems

Introduction p. 435
Developmental anomalies p. 435
Endometritis p. 435
Retained foetus and placenta p. 436
Uterine prolapse, rupture, and torsion p. 437
Hydrops p. 437
Orchitis and epididymitis p. 438
Neoplasms p. 438

Introduction

The lesions of significance in the reproductive systems are primarily those found in the female reproductive system. Even though a large number of reproductive system developmental anomalies occur, particularly in the female, the vast majority of lesions in the reproductive system are associated with pregnancy or the period after parturition.

Developmental anomalies [12.01 – 12.08]

In finisher pigs, developmental anomalies that are observed regularly include hermaphrodites (the presence of tissues from both gonads in the same individual); pseudohermaphrodites (one type of gonad together with the opposite/partial opposite external and internal genitalia); hydrosalpinx in gilts; cysts in the Wolffian duct system; and double uterus, cervix and vagina in finisher pigs and heifers. In cattle, holoacardius amorphous is seen regularly as a twin malformation. Disturbed development of the genitals is frequently found in heifers that are born as a twin to a bull calf ("freemartin"). Developmental anomalies within the uterus such as adventitial placentation is seen rarely. Other than cryptorchidism, in which the undescended testicle will be hypoplastic, macroscopically detectable developmental anomalies are seen only rarely in the male reproductive system.

Endometritis [12.09 – 12.22]

In acute endometritis, the endometrium is hyperaemic, and is thickened due to oedema. The exudate can range from serofibrinous to serohaemorrhagic to fibrinous/purulent; the endometrial membrane can also be necrotic. In some cases, the entire uterine wall will be involved in the inflammation process, whereby fibrin can be detected on the serosal lining (perimetritis). Oedema and haemorrhage can also be seen in the connective tis-

sue of the pelvic cavity and in the broad ligaments (parametritis). Acute endometritis, regardless of the characteristics of the lesion and exudate, necessitates total condemnation. In cases of inflammation of the serosal lining, scoring must be based on the rules for peritonitis. Chronic endometritis, whether or not accompanied by uterine pus accumulation (pyometra) necessitates partial condemnation, but only in the absence of complications. Pyometra is generally an afebrile condition. In pigs, hermaphroditism and pseudohermaphroditism are often associated with pyometra or are accompanied by cystic endometrial hyperplasia. Pyometra can be confused with hydrometra and/or mucometra. The latter two conditions necessitate partial condemnation. Inflammation of the cervix and vagina are scored generally as for the uterus. Pyosalpinx, whether alone or in conjunction with pyometra, is seen most frequently in gilts. At meat inspection, pyosalpinx is scored as for pyometra. In pyometra in cows, particular attention must be paid to the phenomenon of Stockfleth's laminitis, which is a relatively frequent complication to severe suppurative inflammatory conditions (see Chapter 14).

Retained foetus and placenta [12.23 – 12.27]

Dead foetuses retained in the uterus can either undergo mummification or maceration. A third type of change, putrefaction, is included under maceration. The placenta (the foetal part of the placenta and foetal membranes) is retained in all cases, together with retention of the foetus in the uterus. Particularly in cows after apparently normal calving, there can be retention of the placenta. At meat inspection, scoring of the retained placenta always follows the rules for retained foetuses and any associated affection of the uterus. In a retained placenta, infection will develop within hours, followed by a subsequent development of endometritis. Scoring of any accompanying endometritis follows the rules for endometritis, and the presence of complications (e.g. sepsis or intoxication). Unconditional approval may be given in cases of recent, uncomplicated parturition or abortion.

At foetal mummification, the dead foetus will be dry because the amniotic and atlantoic fluids and fluid in the foetal tissues are reabsorbed. This means that the covered skeletal parts typically appear encased in a leathery, dark, and dry mass which is comprised of the dried skin and soft tissue. Characteristically, the contours of the cranial bones in particular are clearly visible in a mummified foetus. The presence of a mummified foetus is not associated with pyogenic infection, and the condition is therefore not accompanied by endometritis. The pregnant animal is normally not affected by the condition. There is no putrid odour when opening a uterus containing a mummified foetus. In contrast, there is always pyogenic infection at maceration of a foetus, which is accompanied by endometritis. The infection can occur as a result of haematogenous spread, or as an ascending infection via an open cervix. After the maceration process all soft tissues and skeletal tissues will be present in a pus-containing and foul-smelling fluid. The presence of a macerated foetus does usually not affect the pregnant animal's general health. A particular type of maceration is putrefaction of the foetus. The condition is normally seen only in foetuses which die in connection to parturition that has commenced, but which then stops (interrupted parturition). The putrefied foetus is often infected with

air-producing *Clostridium* spp., with subsequent rapid development of emphysema. The foetus will appear bloated and emphysematous; the hair layer will be loose or detached in large areas; and the muscles have a "cooked" appearance and stink.

As noted, chronic endometritis, whether accompanied by pus accumulation in the uterus (pyometra) or the presence of macerated or mummified foetuses necessitates partial condemnation conditional on the absence of signs of complications, e.g. sepsis or intoxication. Because the putrefied foetus, in contrast to mummified or macerated foetuses, frequently affects the pregnant animal significantly in the form of intoxication, with a high risk of developing sepsis, findings of putrefied foetuses will in practice almost always necessitate total condemnation of the foetus and pregnant animal.

Uterine prolapse, rupture, and torsion [12.28 – 12.30]

Both uterine prolapse and rupture of the uterus occur occasionally in connection with parturition. In cases of uterine prolapse, serious circulatory impairment occurs rapidly and the exposed uterine endometrium will be traumatised and become infected. At meat inspection, uterine prolapse necessitates partial condemnation unless acute endometritis or other complications, such as shock due to loss of blood caused by tearing of the uterine arteries, are present. Scoring of vaginal prolapse is the same as for uterine prolapse. It should be noted that animals with prolapses are not allowed to be transported for slaughter. The presence of these complications necessitate total condemnation. Onset and development of endometritis can trigger sepsis. Rupture of the uterus may occur when repositioning a uterine prolapse, when assisting at parturition, or due to foetal maceration. Because uterine rupture either occurs in connection with an open parturition canal or foetal maceration, the injury will result in peritonitis. At meat inspection, an acute, uninfected rupture will usually only give rise to partial condemnation. In contrast, scoring of an infected rupture will be based on the type of inflammation (acute versus chronic endometritis) and any associated peritonitis.

Torsion of the uterus requires that the uterus is not empty (e.g. the presence of a foetus or pyometra). If the contents is a foetus, the torsion will often lead to foetal death, and scoring will comply with that noted under "Retained foetus and placenta". If, on the other hand, the torsion involves a pus-containing uterus (which is very rare) scoring is based on that for endometritis (see p. 435).

Hydrops

The syndrome hydrops includes hydrallantois and hydramnion. The condition, which is non-infectious, often has a chronic course with significant fluid accumulation in the allantoic sac and/or amnionic sac. During development of hydropsy, the pregnant animal will become emaciated. At meat inspection hydropsy alone and without complications necessitates partial condemnation with rejection of the uterus and contents. The presence of complications necessitates total condemnation.

Orchitis and epididymitis [12.31 – 12.40]

Inflammation in the testicles (orchitis) and epididymides (epididymitis) is only to be considered as an incidental finding in connection with meat inspection in areas free of brucellosis. Previously, when brucellosis was widespread in Denmark, lesions were sometimes found in the seminal vesicles, testicles and epidydmides particularly in bulls. In particular, necrotising orchitis accompanied by caseous changes or purulent confluence is typical in bulls with brucellosis. In Denmark, brucellosis occasionally occurs in outdoor pigs, where the infection (*Brucella suis,* type 2) has probably been transferred from hares, in which orchitis can develop in connection with the infection. Similarly to bulls, infected boars will also have lesions in the testicles, epididymides, and seminal vesicles. The lesions in pigs are very similar to those in bulls, but one characteristic is that the lesions in the testicles and epididymmides in pigs can be multiple rather than one confluent mass. Findings of necrotic, caseous and/or purulent orchitis and epididymitis should always raise the suspicion of brucellosis. Suspected cases must be notified to the authorities because brucellosis is listed as a notifiable disease in Denmark. Even though Brucella bacteria may cause lesions in other organs, the typical localisation is in the reproductive system. In cows, brucellosis is sometimes referred to as "contagious abortion".

Inflammatory conditions in the testicles and epididymides are generally very rare in slaughter animals and are in most cases due to ascending infections with *Trueperella pyogenes* and *Pseudomonas* spp. At meat inspection, it is important to decide whether this is a local, ascending infection or, for example, orchitis with abscess formation due to a pyaemic condition. In the absence of complications, locally occurring infection and inflammation in the ureters, bladder, or urethra together with e.g. orchitis necessitate partial condemnation. A pyaemic condition which is associated only with chronic, well-defined lesions necessitates approval for deboning. The same applies to pyaemic lesions in the ovaries.

Testiculan torsion (actually torsion of the funicula) is seen occasionally, particularly in boars. The condition most often occurs during transport to the slaughterhouse, and typically represents acute lesions (infarctions), which necessitate partial condemnation.

Neoplasms [12.41 – 12.71]

Neoplasms in the reproductive systems occur most frequently in females. One of the most common neoplasms, particularly in older cows, is carcinomas originating from the uterine glands. The neoplasm often grows infiltratively in the uterus, and the uterine changes are therefore not often the initial basis for diagnosis. Instead, the presence of neoplasms is typically diagnosed by the presence of metastases in various organs, particularly implantation metastases on the peritoneum and spread to the regional lymph nodes. Typical carcinoma-related changes such as fibrosis and necrosis are seen in the primary tumour in the uterus and in the metastases. The lesions appear as pale, grey-yellowish, firm processes with a partially confluent central area. Lung metastases from uterine carcinomas in particular comprise a differential diagnostics problem with

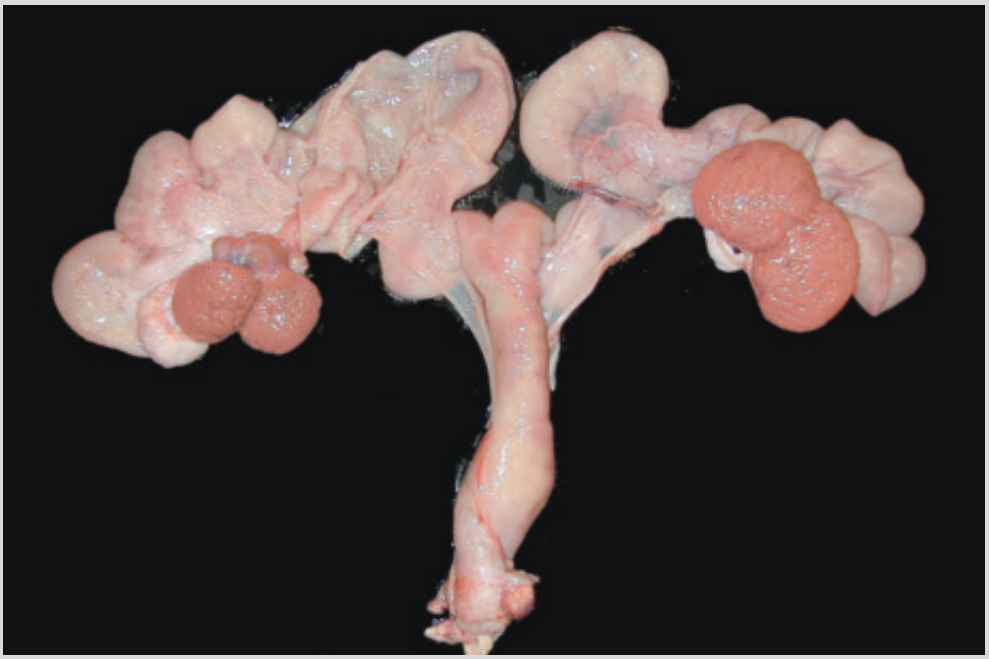
regard to granulomatous and pyogranulomatous lung lesions. In particular in pyogranulomatous lung lesions (lung actinomycosis and actinobacillosis), it is important to demonstrate that pus can be pressed from the cut surface of the lesions. If uterine carcinoma metastases are suspected, the diagnosis can normally be confirmed by an extended investigation that includes slicing the uterus and lymph nodes. Findings of uterine carcinoma always necessitates total condemnation. However, the presence of well-defined, chronic, embolic (disseminated) actinomycotic and actinobacillous lesions can result in approval for deboning. If the latter have originated aerogenically (bronchopneumonia), the scoring is partial condemnation.

Ovarian tumours are relatively rare in slaughter animals. Granulosa cell tumours, occur occasionally particularly in cows and mares, with more or less concomitant theca cell neoplasia. These are often true granulosa-theca cell tumours. They often present as very large (20-30 cm in diameter) round neoplasms, which can be massive, cystic or polycystic with bloody content. The surface is generally smooth. Granulosa-theca cell tumours are only very rarely malignant in slaughter animals, and their presence thus often necessitates partial condemnation. Teratomas, which originate from various cell layers (mesenchyme and epithelial tissue), occur extremely rarely in slaughter animals. This neoplasm can originate not only in the ovaries but also in the testicles in male animals. They are characterised by containing various types of tissues (skin, hair, connective tissue, nerve tissue, bone, cartilage, etc.). In slaughter animals, teratomas are normally benign and scoring in the vast majority of cases will be partial condemnation. If they are malignant, implantation metastases will generally be found on the peritoneum. Although ovarian tumours occur only rarely in sows, the most frequent are ovarian haemangiomas. These neoplasms, which are smooth on the surface and have a brown to red colour on the cut surface, originate from the endothelial cells in the ovarian blood vessels. This neoplasm rarely occurs bilaterally. Haemangiomas are often difficult to distinguish from vascular hamartomas in the ovaries, where the latter is a vessel-related developmental anomaly with subsequent vascular conglomeration. Differentiating between ovarian haemangiomas and vascular hamartomas is not significant because both necessitate partial condemnation of the affected ovary. Ovarian cysts, haemorrhagic cysts, and torsion of the ovaries can be confused with neoplasms. Cysts and haemorrhage in the ovaries as well as ovarian torsion necessitate partial condemnation.

Metastasis to the female genitals occurs particularly frequently in connection with lymphosarcomas. Lymphosarcoma infiltration can occur in both the uterine wall (in particular in enzootic leukosis in cattle) and in the ovaries.

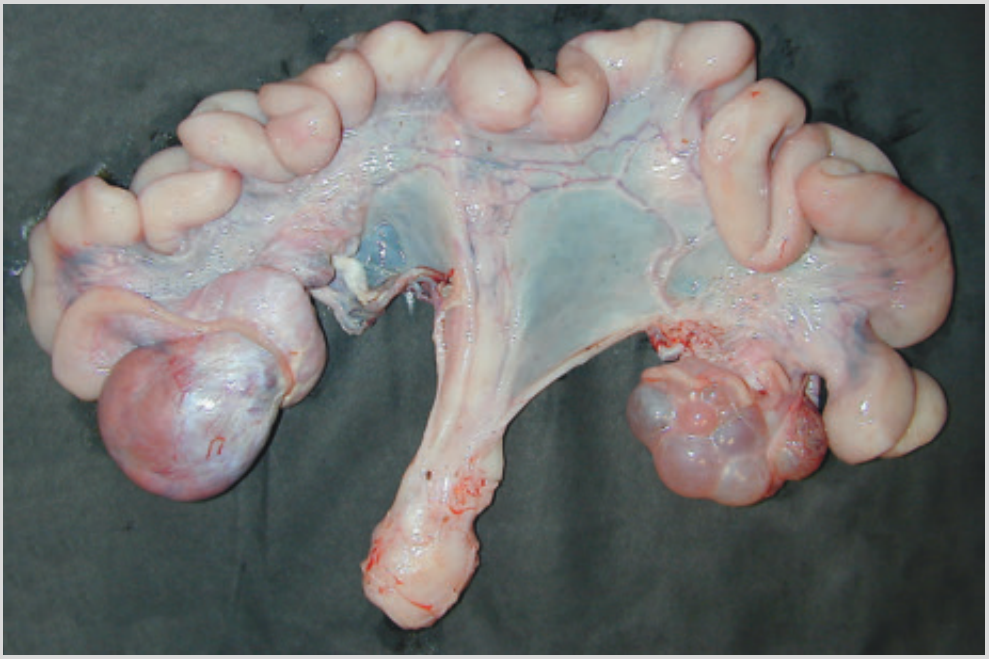
In stallions, carcinoma in the penis is a relatively frequent malignant neoplasm. The carcinoma is most frequently localised to the glans penis and grows infiltratively. Metastasis occurs particularly to the regional lymph nodes. Penis carcinomas, which are often fibrous, hyperkeratotic, and ulcerative always necessitate total condemnation. Papillomas localised to the penis occur quite frequently and particularly in bull calves and young bulls. The wart-like growths are benign, and their presence necessitates partial condemnation. In very rare cases, papillomas can also be found on the outer female genitals.

12.01



Animal species/Organ	Pig/Reproductive systems
Lesion	Hermaphrodite with ovotestis
Scoring	Partial condemnation
Comments	If the meat has an odour of boar, the carcase must be boar stamped

12.02



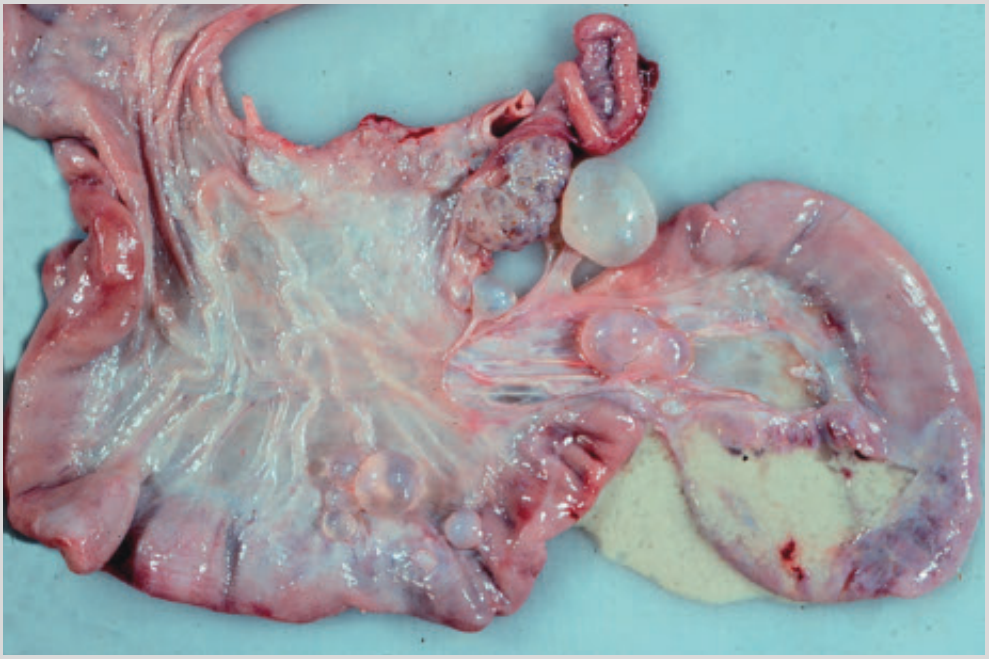
Animal species/Organ	Pig/Reproductive systems
Lesion	Hermaphrodite (lateral)
Scoring	Partial condemnation
Comments	If the meat has an odour of boar, the carcase must be boar stamped

12.03



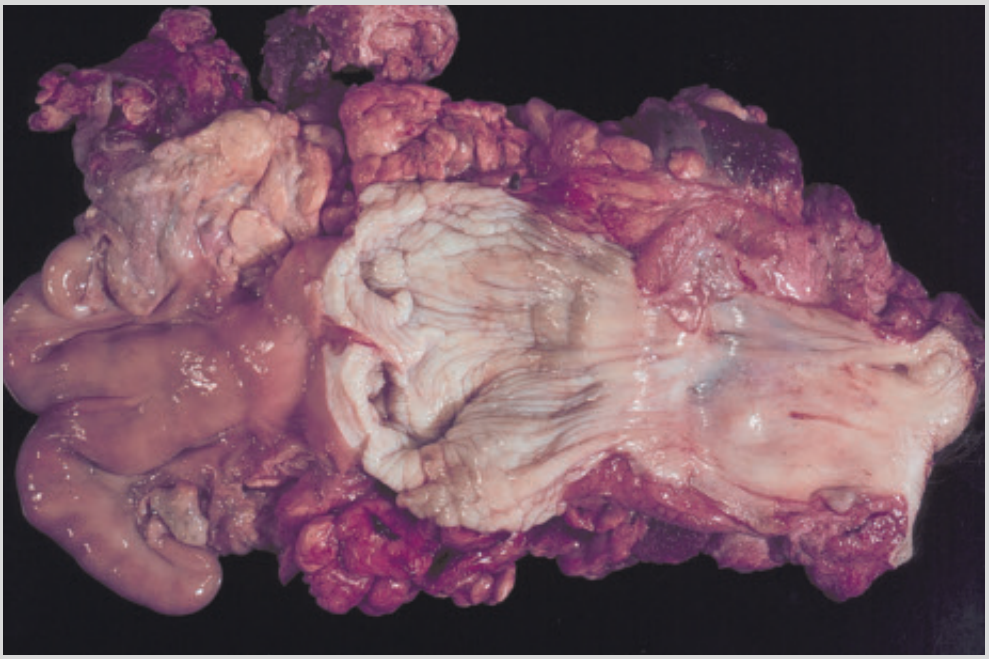
Animal species/Organ	Pig/Ovaries with salpinx
Lesion	Hydrosalpinx
Scoring	Partial condemnation
Comments	Is a relatively frequent cause of infertility in gilts

12.04



Animal species/Organ	Pig/Uterus
Lesion	Pyometra and cystic Wolffian ducts
Scoring	Partial condemnation
Comments	Cysts in the Wolffian ducts most often have no reproductive significance

12.05



Animal species/Organ	Cattle/Female reproductive organs (vagina and cervix have been cut open)
Lesion	Double cervix
Scoring	Partial condemnation
Comments	A relatively rare condition

12.06



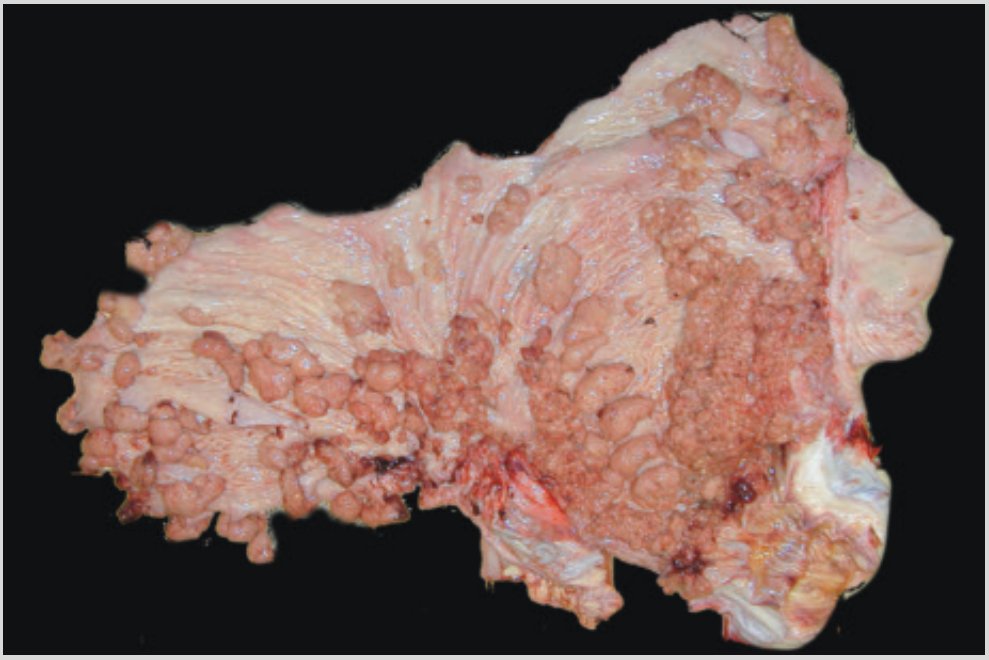
Animal species/Organ	Cattle/Twin foetus
Lesion	Holoacardius amorphous
Scoring	Total condemnation of the “foetus”
Comments	The second twin was well-developed and without lesions

12.07



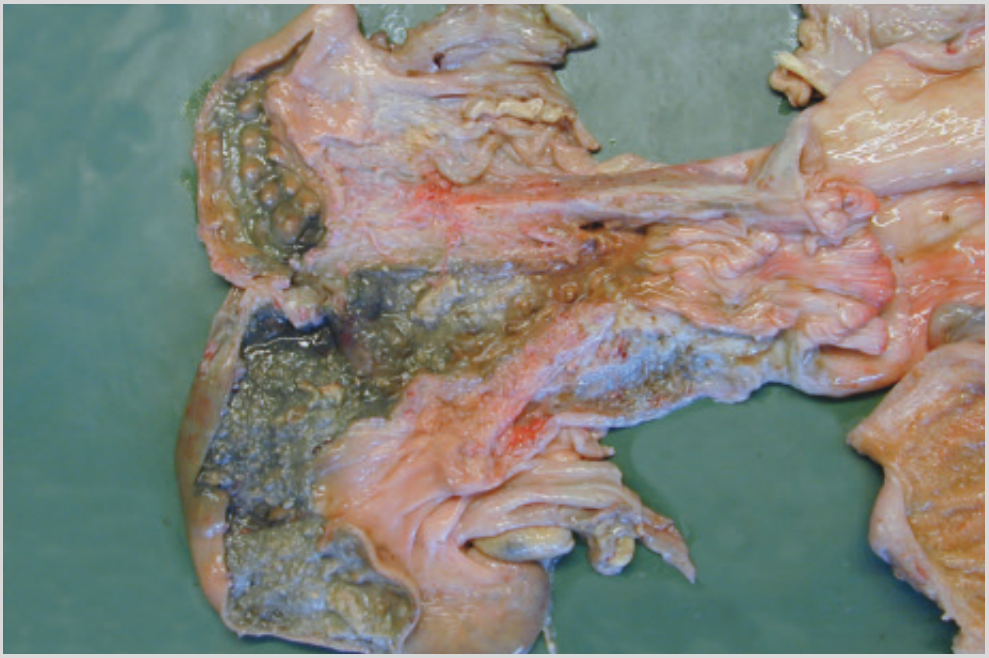
Animal species/Organ	Cattle/Female reproductive system
Lesion	Segmental aplasia of uterus and hypoplastic ovaries
Scoring	Partial condemnation
Comments	The speciment originates from a so-called “freemartin”

12.08



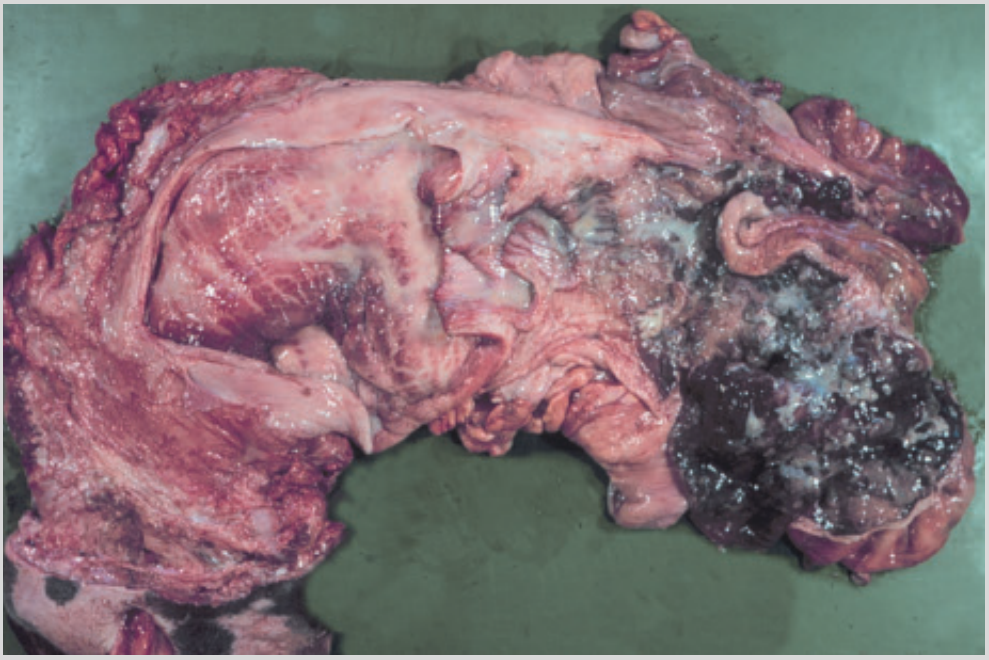
Animal species/Organ	Cattle/Uterus (opened)
Lesion	Adventitial placentation
Scoring	Partial condemnation
Comments	A relatively rare condition

12.09



Animal species/Organ	Cattle/Uterus (opened)
Lesion	Chronic, diffuse, purulent endometritis
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

12.10



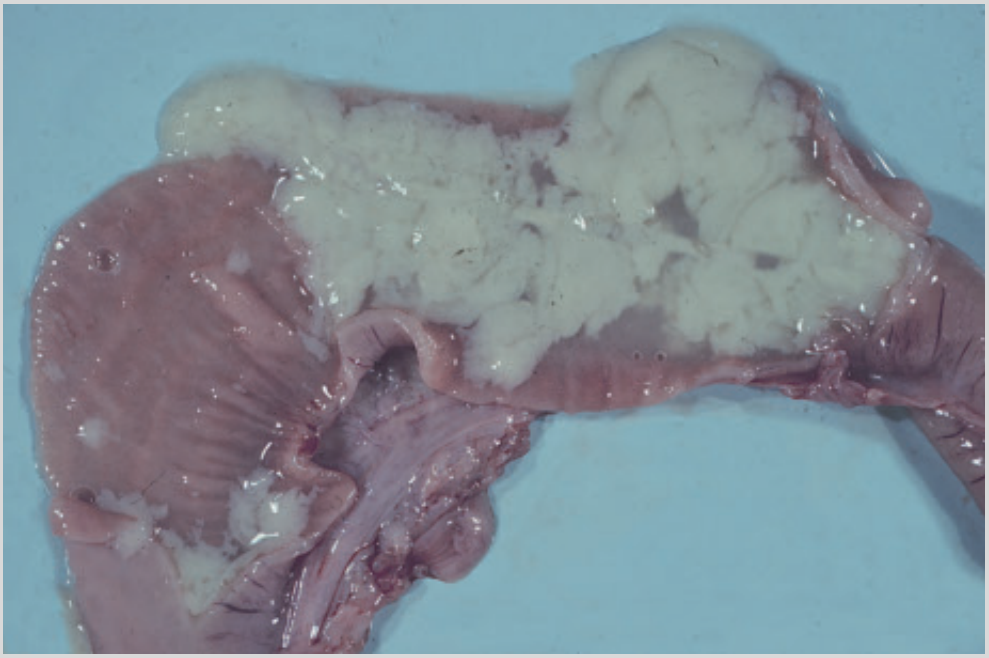
Animal species/Organ	Cattle/Vagina, cervix, and uterus (opened)
Lesion	Chronic, diffuse endometritis, and cervicitis
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

12.11



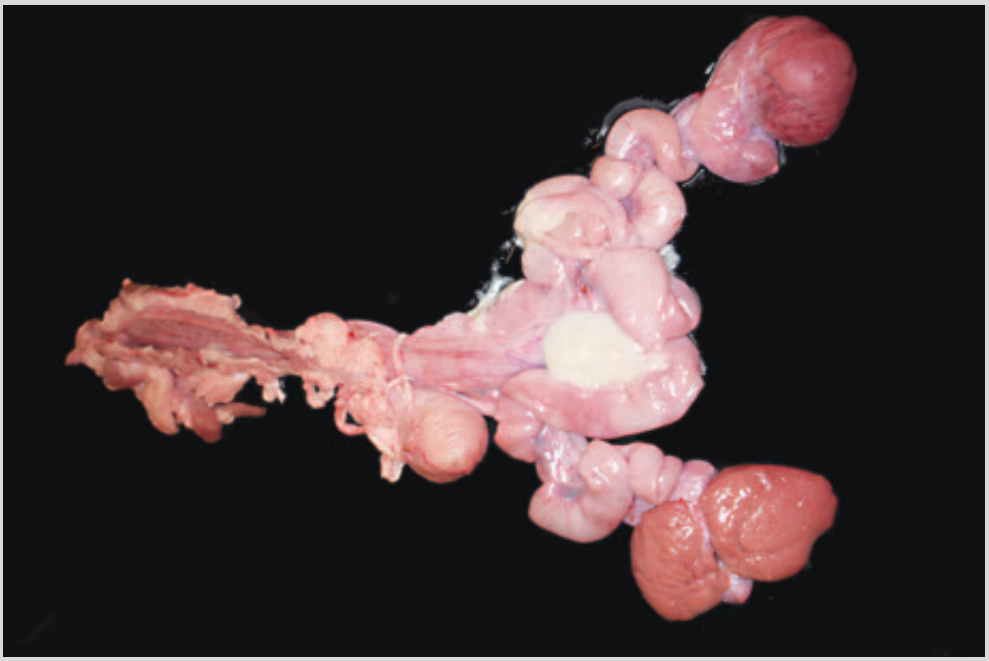
Animal species/Organ	Cattle/Uterus (opened)
Lesion	Chronic pyometra
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

12.12



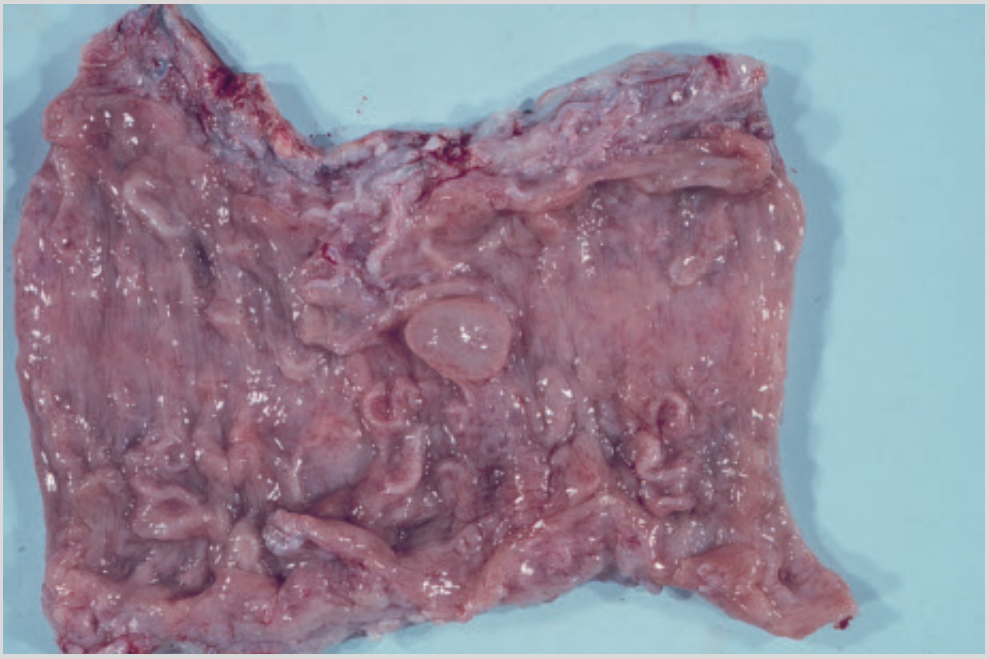
Animal species/Organ	Pig/Uterus (opened)
Lesion	Chronic pyometra
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

12.13



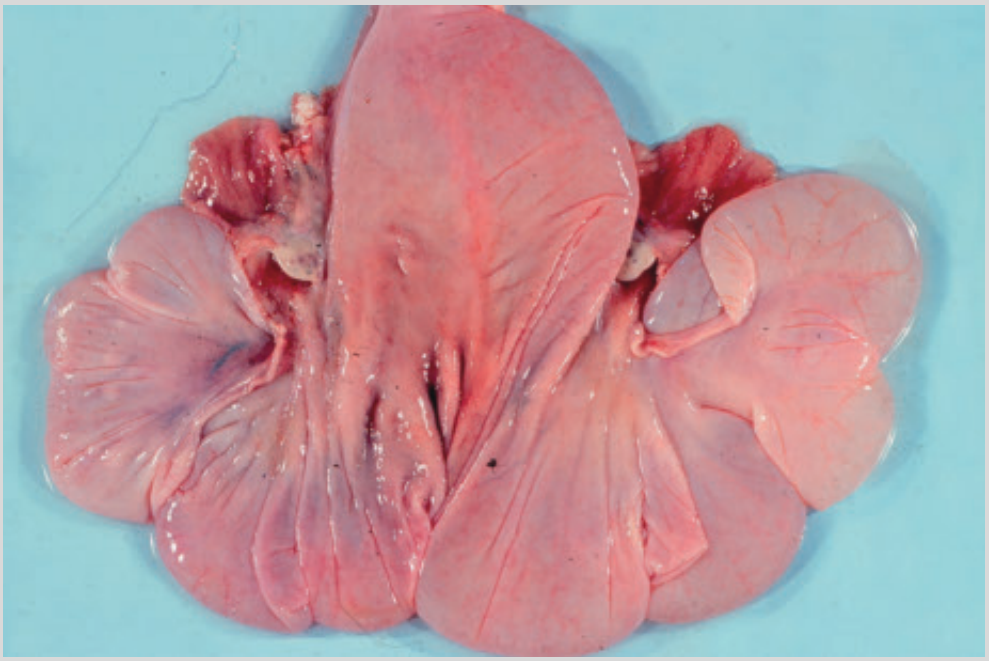
Animal species/Organ	Pig/Reproductive systems
Lesion	Chronic pyometra in pseudohermaphrodite (male)
Scoring	Partial condemnation
Comments	Pyometra occurs frequently in pseudohermaphrodites

12.14



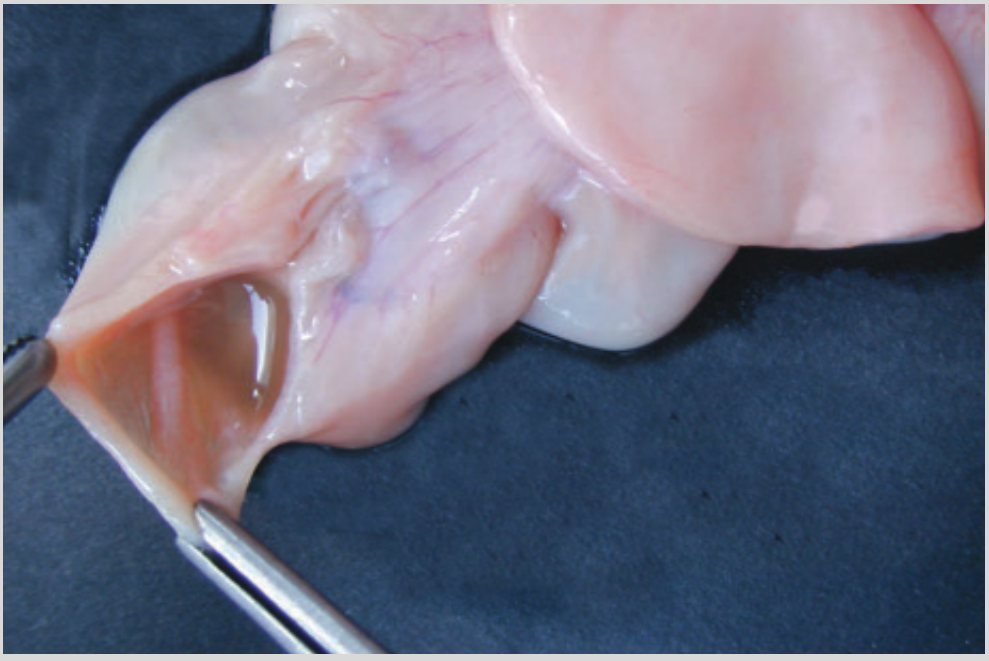
Animal species/Organ	Pig/Uterus (opened)
Lesion	Cystic endometrial hyperplasia
Scoring	Partial condemnation
Comments	An incidental finding

12.15



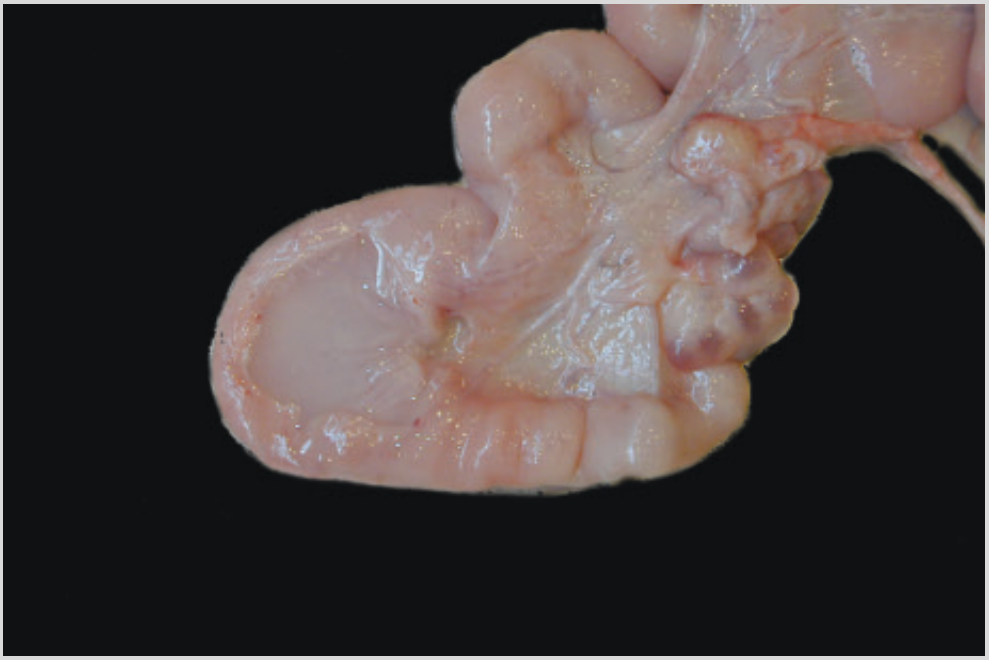
Animal species/Organ	Pig/Uterus
Lesion	Hydrometra
Scoring	Partial condemnation
Comments	Contents comprised of an aqueous secretion

12.16



Animal species/Organ	Pig/Uterus (opened)
Lesion	Hydrometra
Scoring	Partial condemnation
Comments	The content is transparent

12.17



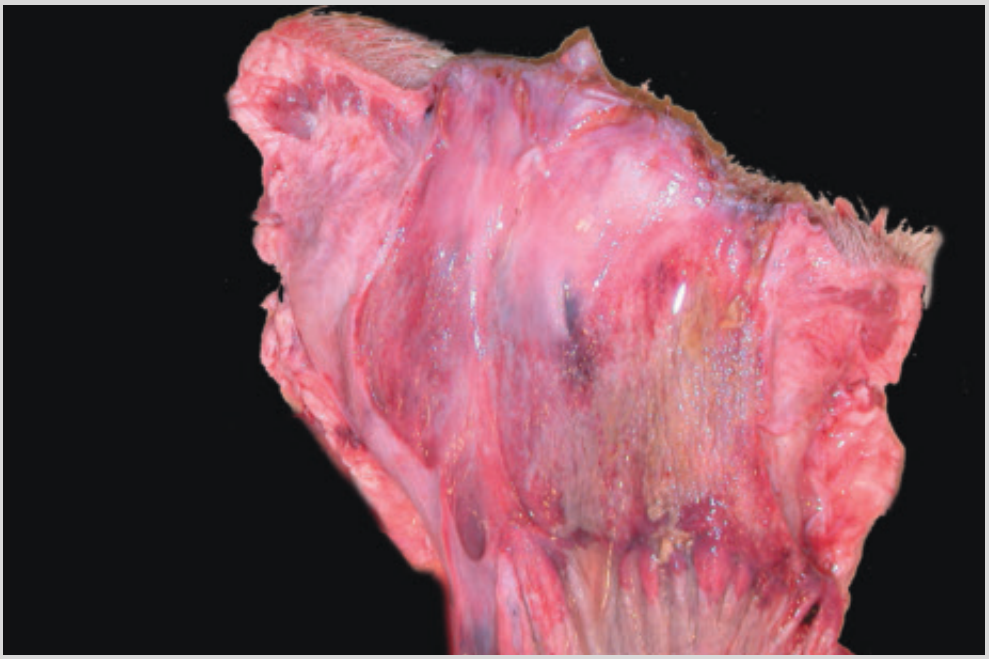
Animal species/Organ	Pig/Uterus (opened)
Lesion	Mucometra
Scoring	Partial condemnation
Comments	The content is semi-transparent and can be drawn into threads

12.18



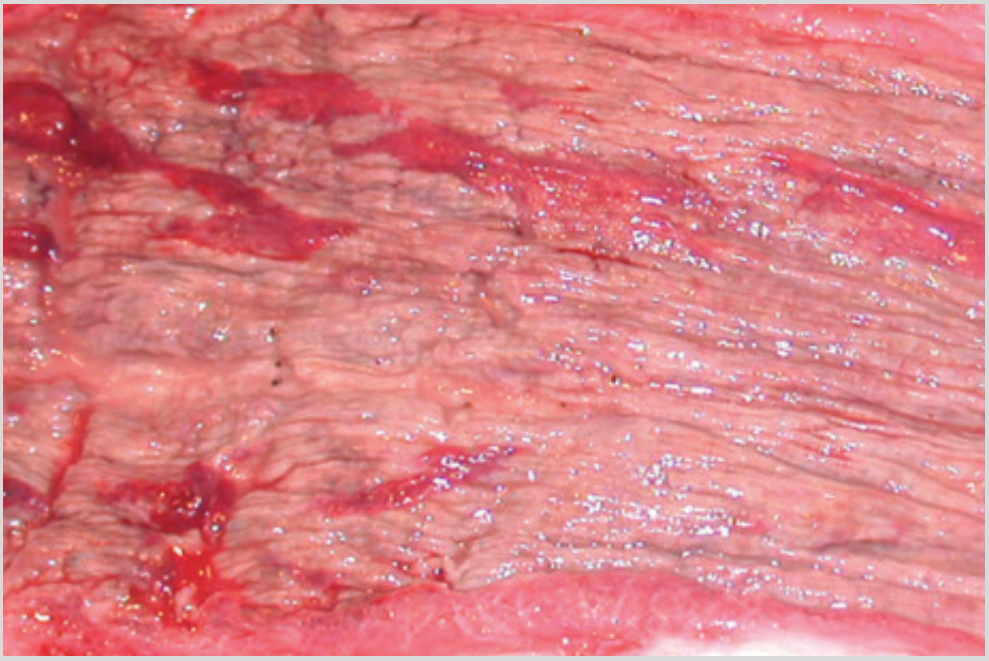
Animal species/Organ	Cattle/Vagina (opened)
Lesion	Acute, diphtheroid vaginitis
Scoring	Partial condemnation
Comments	The condition occurs typically after dystocia in connection with parturition

12.19



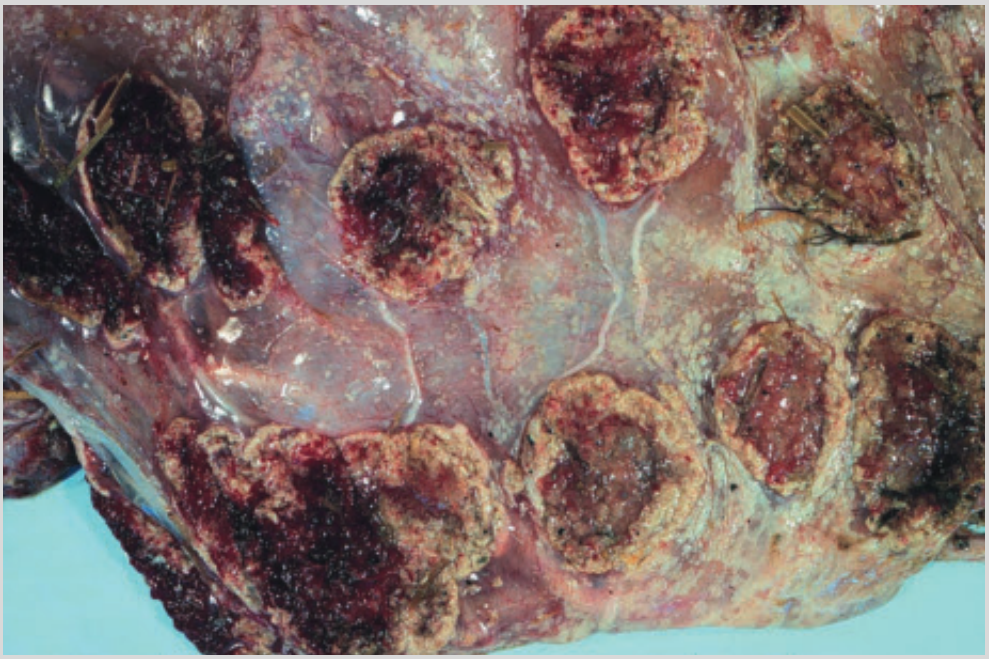
Animal species/Organ	Cattle/Vestibulum and vagina (opened)
Lesion	Chronic, diphtheroid vestibulitis, and vaginitis
Scoring	Partial condemnation
Comments	The condition occurs frequently in the early puerperal period

12.20



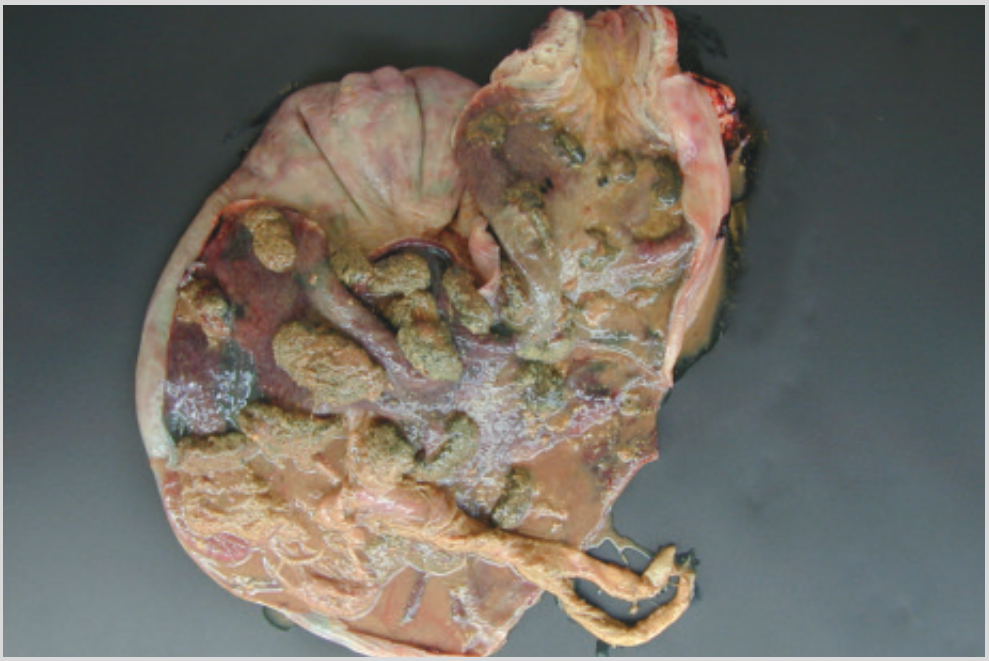
Animal species/Organ	Pig/Vagina and cervix
Lesion	Chronic, diphtheroid vaginitis, and cervicitis
Scoring	Partial condemnation
Comments	Occurred in connection with parturition

12.21



Animal species/Organ	Cattle/Placenta
Lesion	Chronic, necrotising placentitis
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

12.22



Animal species/Organ	Cattle/Uterus (opened)
Lesion	Chronic, purulent endometritis with retention of placenta (retentio secundinarum)
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

12.23



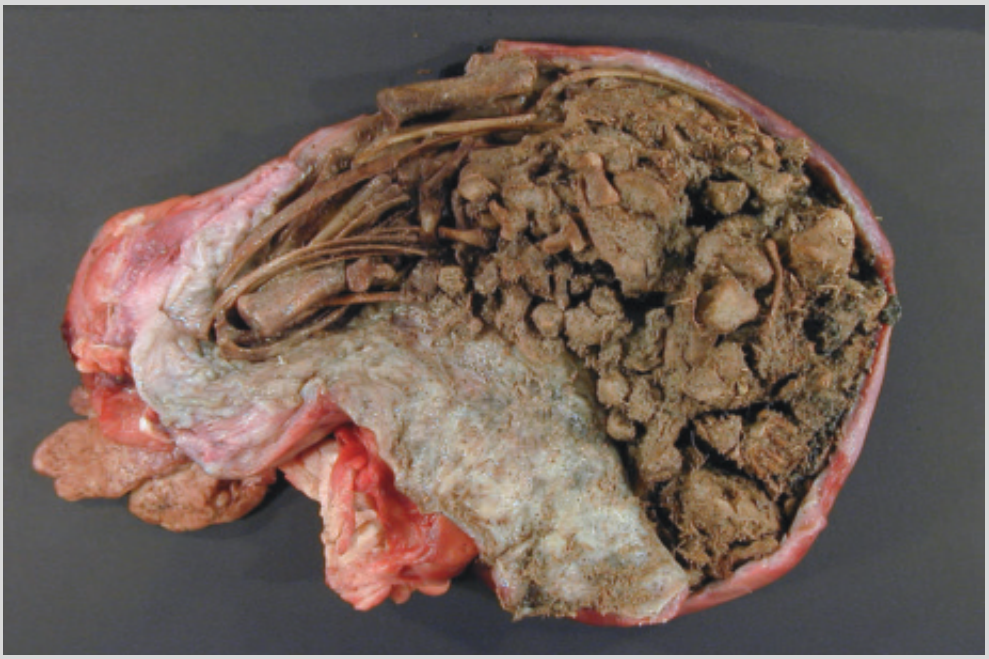
Animal species/Organ	Cattle/Uterus (opened)
Lesion	Foetal mummification
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

12.24



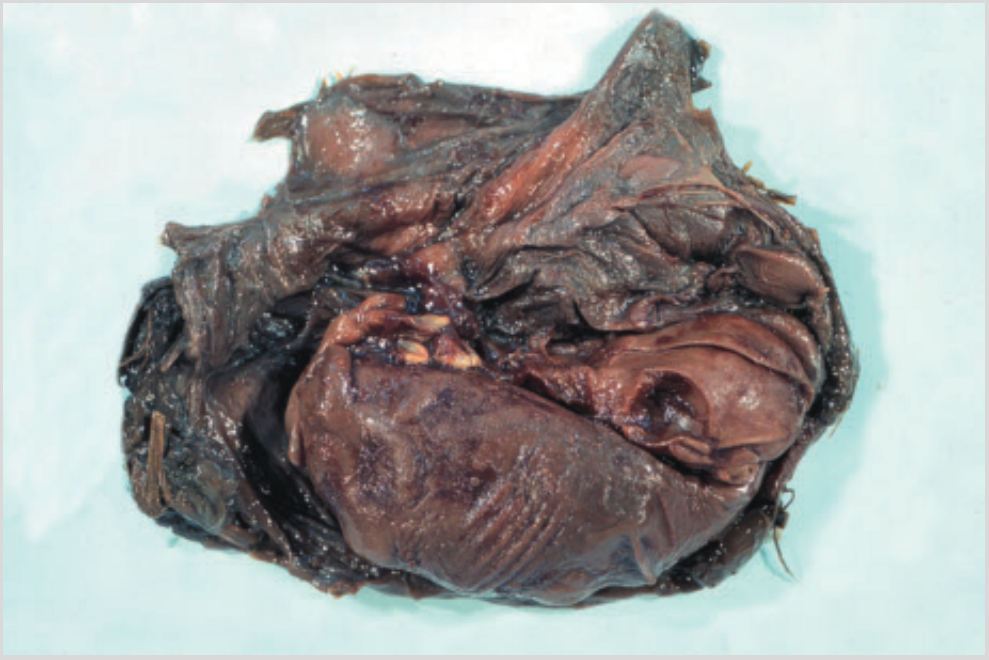
Animal species/Organ	Pig/Uterus (opened)
Lesion	Foetal maceration accompanied by chronic, purulent endometritis
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

12.25



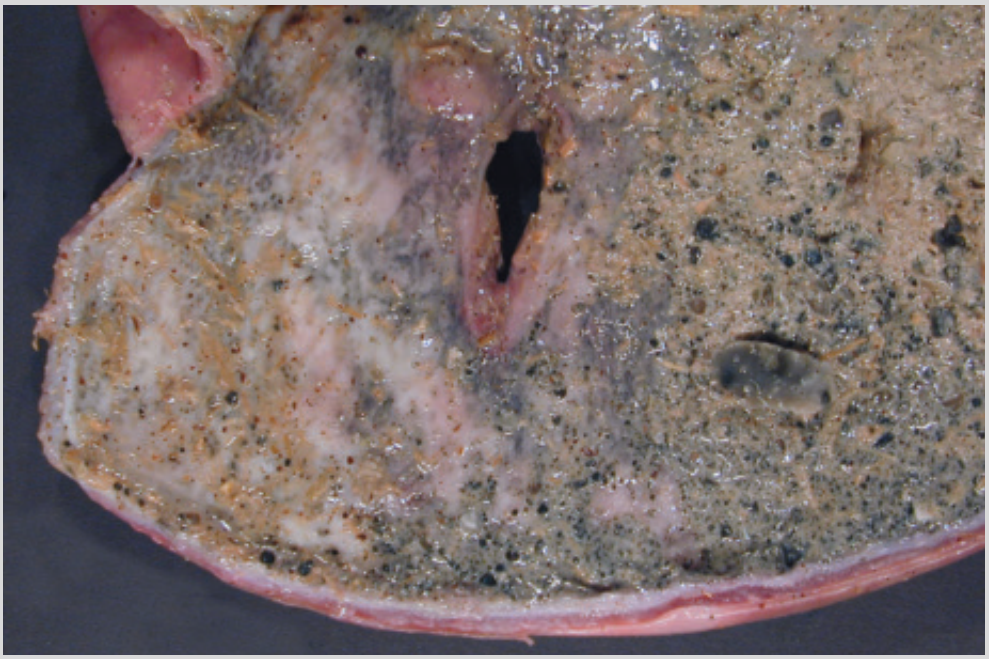
Animal species/Organ	Cattle/Uterus (opened)
Lesion	Foetal maceration accompanied by chronic, fibrotic, endometritis
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

12.26



Animal species/Organ	Cattle/Uterus (opened)
Lesion	Foetal maceration
Scoring	Partial condemnation
Comments	The condition is typically foul-smelling

12.27



Animal species/Organ	Cattle/Uterus (opened)
Lesion	Chronic, purulent, necrotising endometritis (uterus contained a macerated foetus)
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

12.28



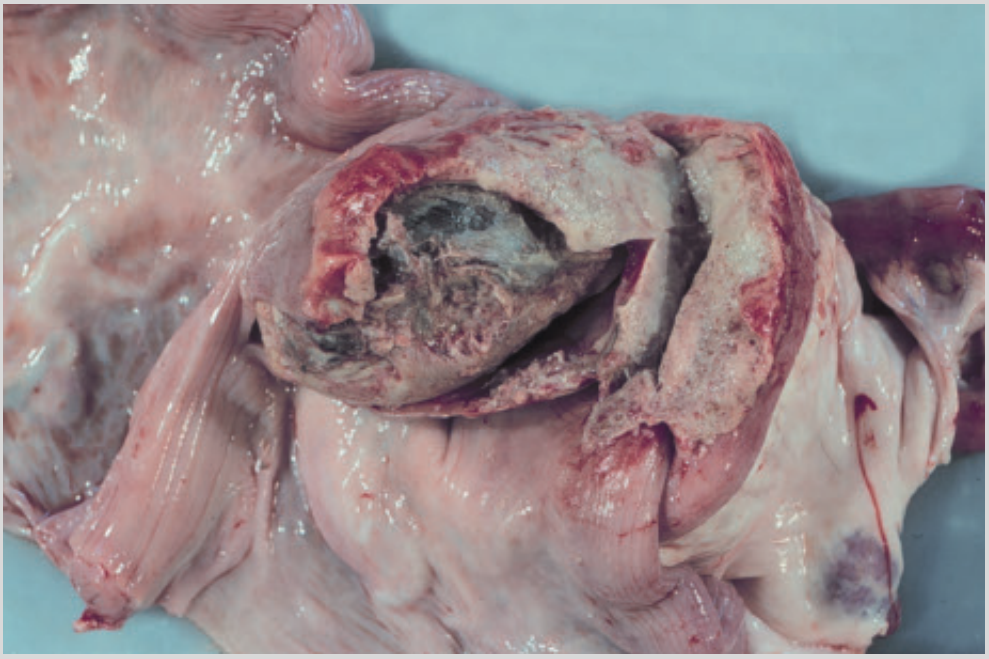
Animal species/Organ	Cattle/Rectum and vagina
Lesion	Acute vaginal and rectal prolapse with circulatory impairment and necrosis
Scoring	Total condemnation
Comments	Any suspected breach of the Animal Welfare laws must be notified

12.29



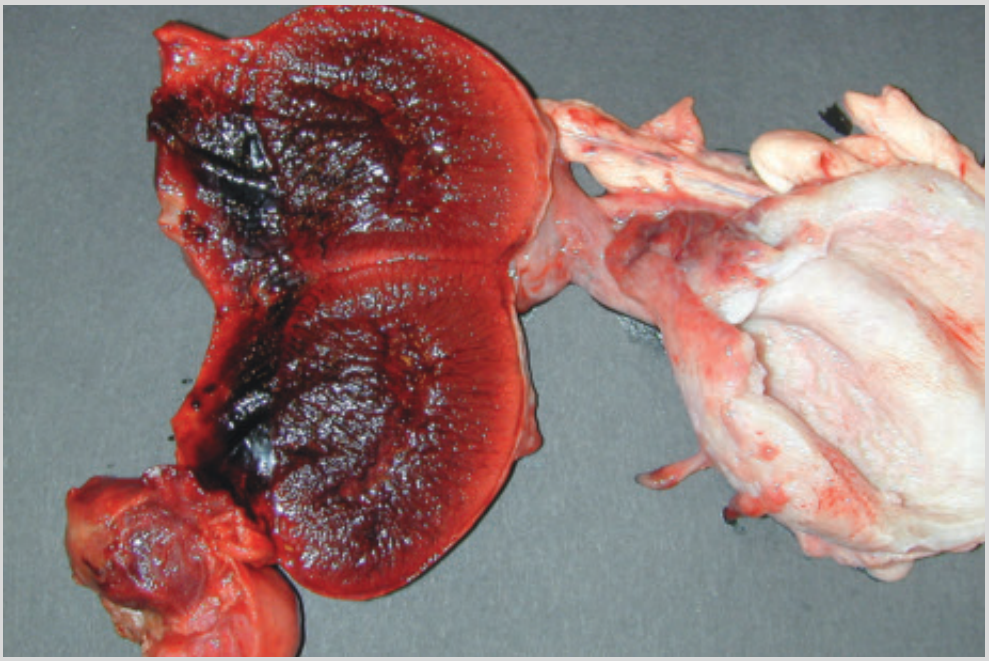
Animal species/Organ	Pig/Rectum and vagina
Lesion	Acute vaginal and rectal prolapse with necrosis of mucous membranes
Scoring	Total condemnation
Comments	Any suspected breach of the Animal Welfare laws must be notified

12.30



Animal species/Organ	Pig/Uterus
Lesion	Uterus rupture with acute, localised perimetritis
Scoring	Partial condemnation
Comments	The presence of widespread acute, diffuse peritonitis or other complications necessitates total condemnation

12.31



Animal species/Organ	Pig/Testicle (cut through)
Lesion	Testicle torsion
Scoring	Partial condemnation
Comments	Occurs typically in connection with transport

12.32



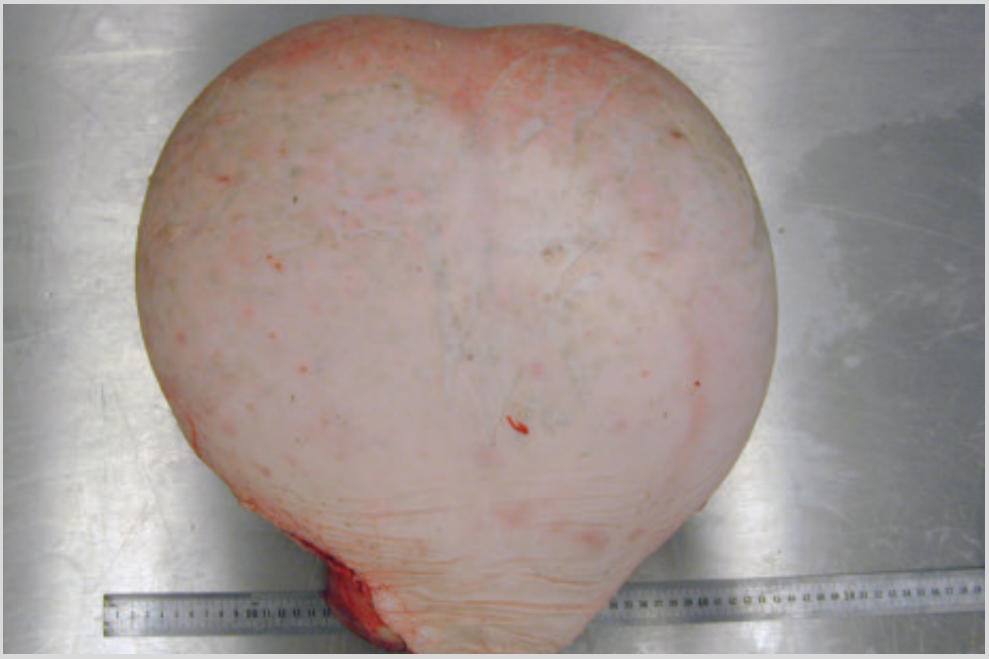
Animal species/Organ	Cattle/Testicle (cut through)
Lesion	Chronic, necrotising orchitis and fibrous periorchitis
Scoring	Partial condemnation
Comments	Brucellosis must always be considered as a cause of necrotising orchitis

12.33



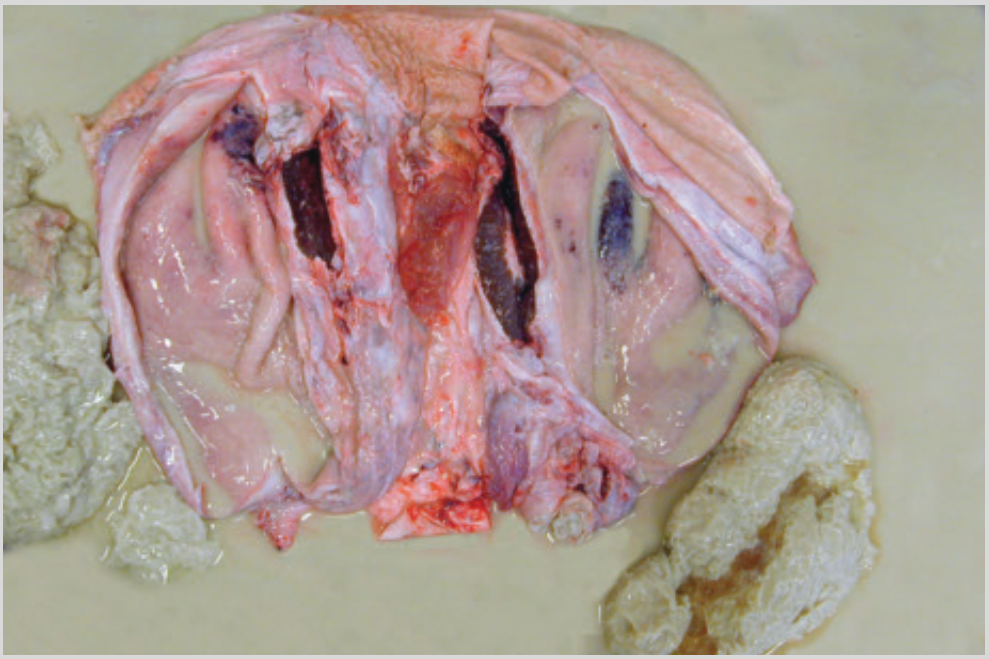
Animal species/Organ	Pig/Testicle
Lesion	Chronic, embolic, pyonecrotising orchitis
Scoring	Approved for deboning
Comments	Brucellosis. Acute cases necessitate total condemnation

12.34



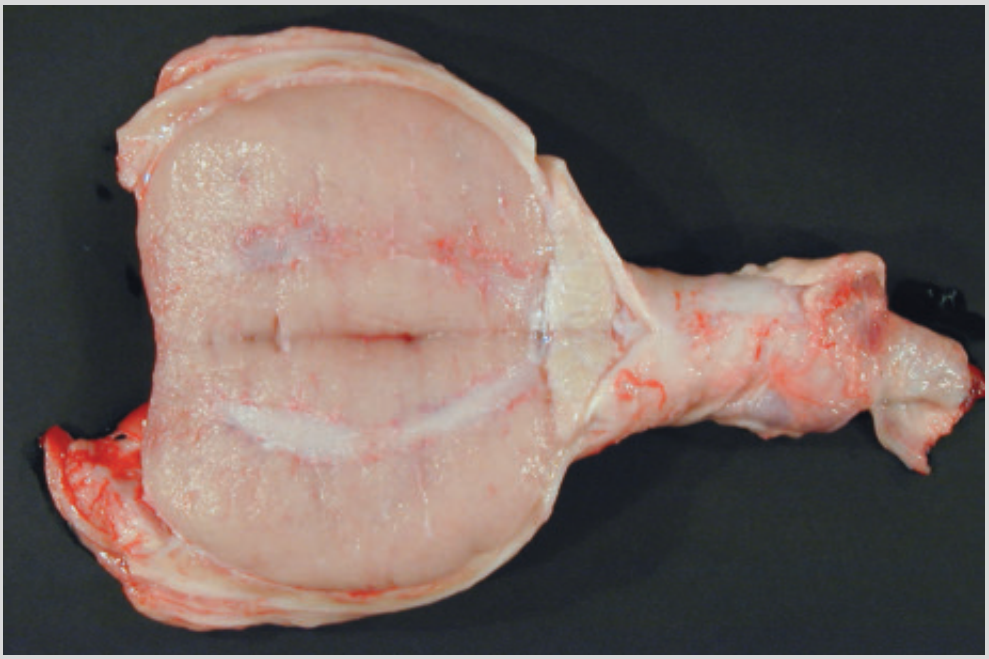
Animal species/Organ	Pig/Scrotum
Lesion	The scrotum is the site of severe symmetrical swelling
Scoring	Based on the cause of the swelling (see 12.35)
Comments	The cause may be found by cutting through the scrotum

12.35



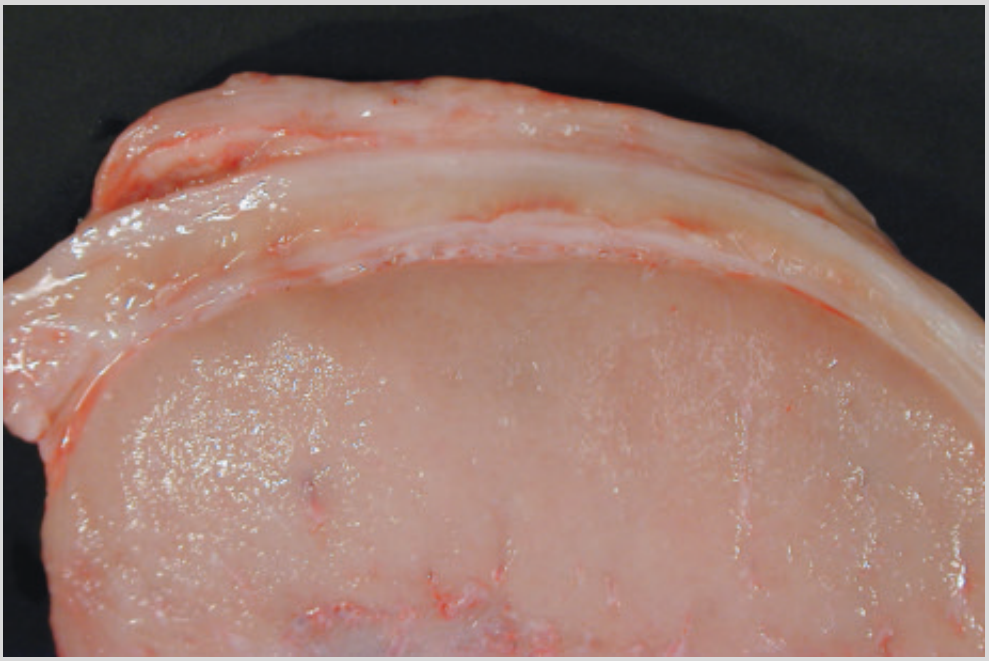
Animal species/Organ	Pig/Scrotum (same as 12.34)
Lesion	Chronic, purulent periorchitis
Scoring	Partial condemnation
Comments	The condition occurs typically in connection with purulent peritonitis

12.36



Animal species/Organ	Pig/Testicle
Lesion	Chronic, adhesive periorchitis
Scoring	Partial condemnation
Comments	An incidental finding in connection with, e.g. chronic, diffuse peritonitis

12.37



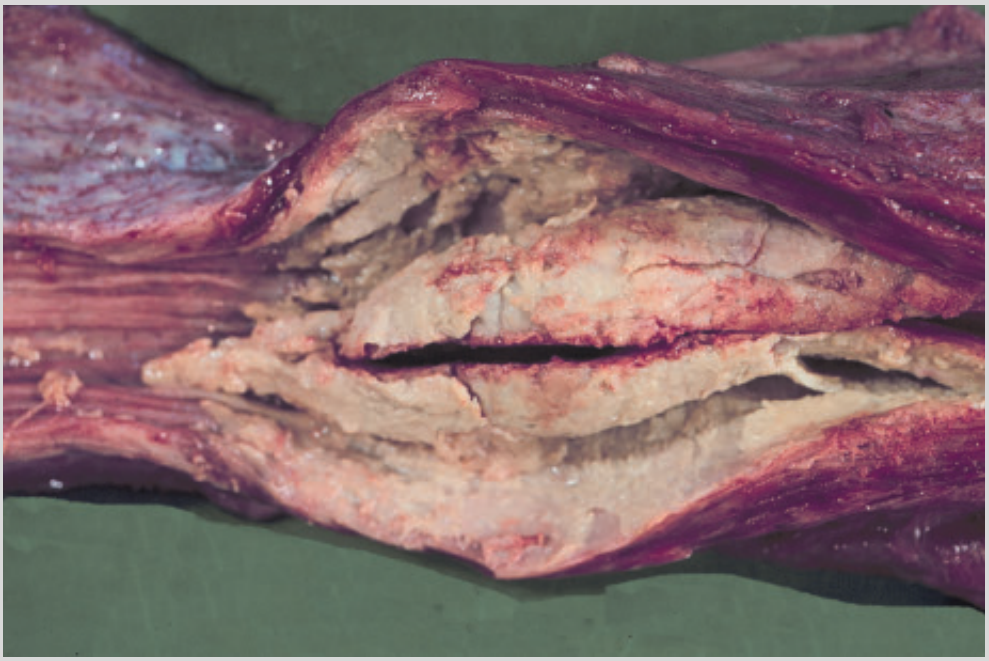
Animal species/Organ	Pig/Testicle (close-up of 12.36)
Lesion	Chronic, adhesive periorchitis
Scoring	Partial condemnation
Comments	An incidental finding in connection with, e.g. chronic, diffuse peritonitis

12.38



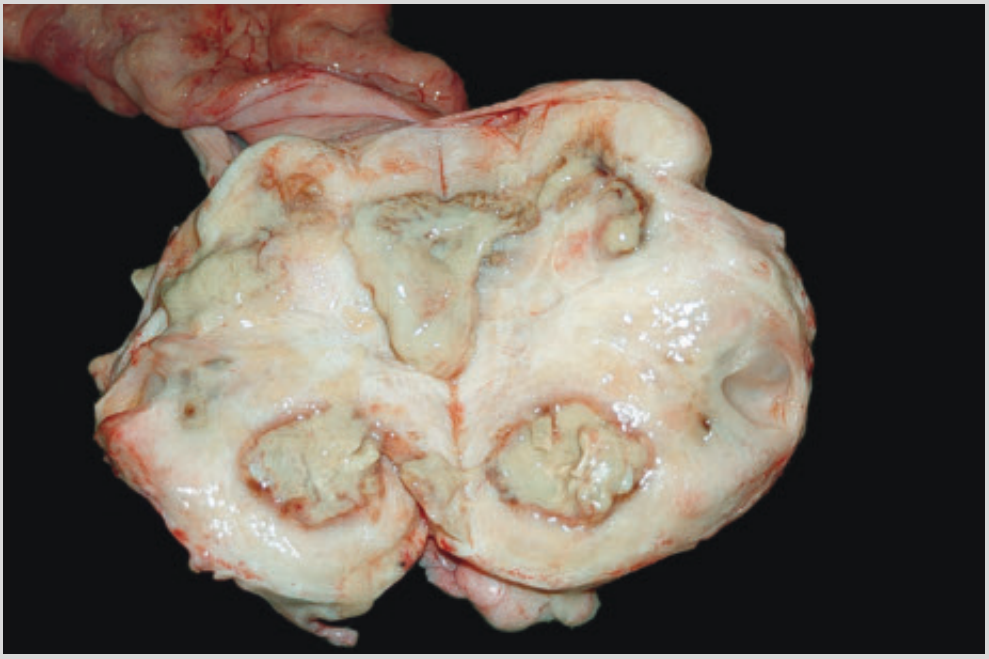
Animal species/Organ	Horse/Testicle and epididymis
Lesion	Chronic, seropurulent epididymitis
Scoring	Partial condemnation
Comments	Probably due to an ascending infection

12.39



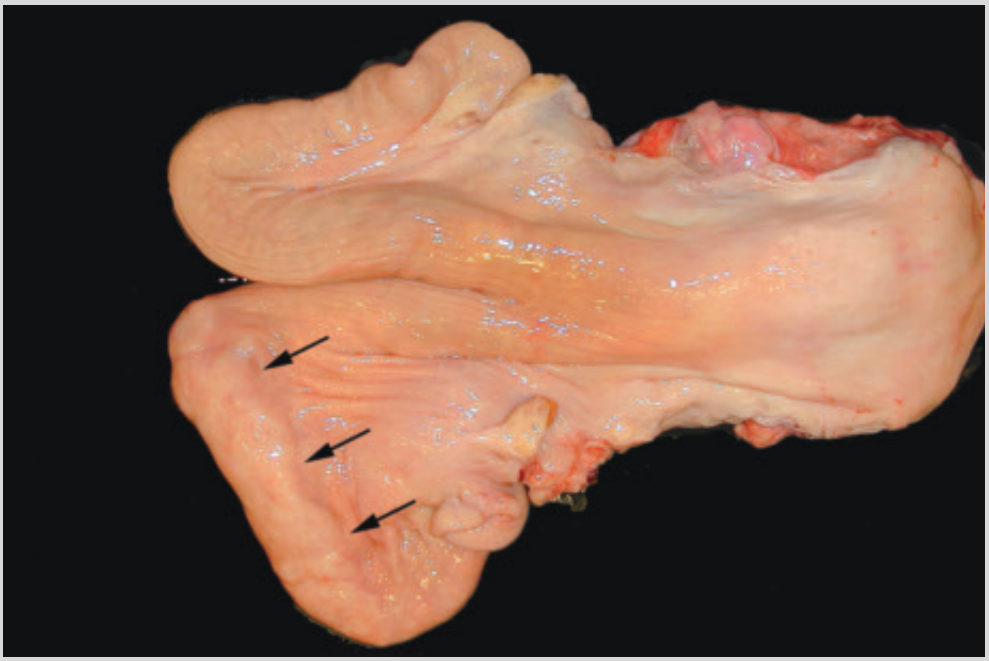
Animal species/Organ	Cattle/Preputium (cut through) and glans penis
Lesion	Chronic, purulent balanoposthitis
Scoring	Partial condemnation
Comments	An incidental finding

12.40



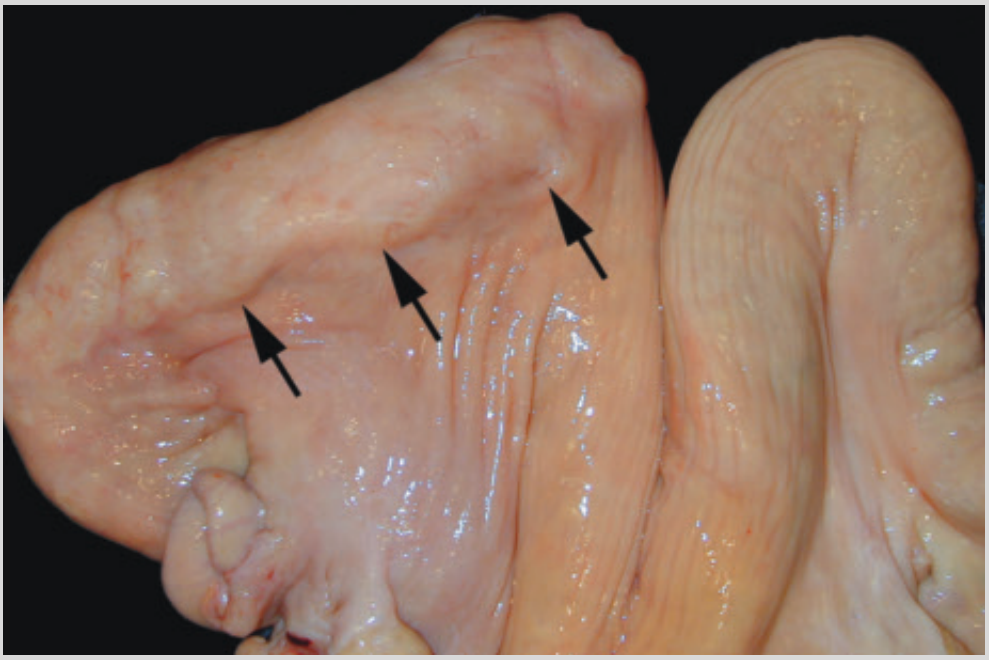
Animal species/Organ	Horse/Ovary (cut through)
Lesion	Chronic oophoritis with abscess formation
Scoring	Partial condemnation
Comments	If the condition is a result of pyemia, approval can be given for deboning

12.41



Animal species/Organ	Cattle/Uterus
Lesion	Carcinoma with thickening of uterine wall (→) due to invasive growth
Scoring	Total condemnation
Comments	The lesions in the uterine wall are often of limited distribution

12.42



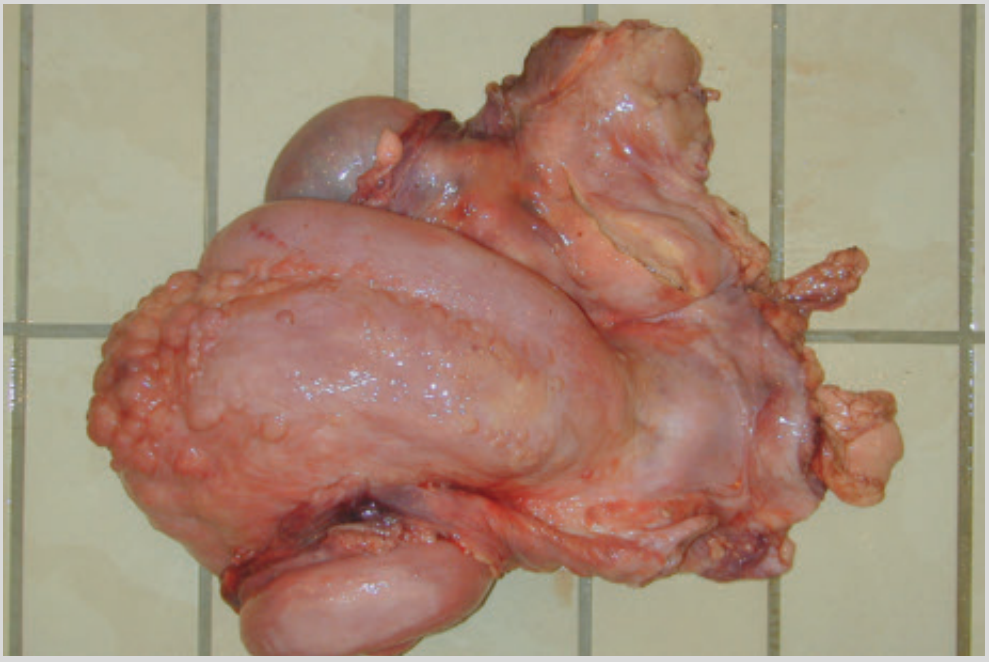
Animal species/Organ	Cattle/Uterus (close-up of 12.41)
Lesion	Carcinoma with thickening of uterine wall (→) due to invasive growth
Scoring	Total condemnation
Comments	The lesions in the uterine wall are often discreet (see 12.41)

12.43



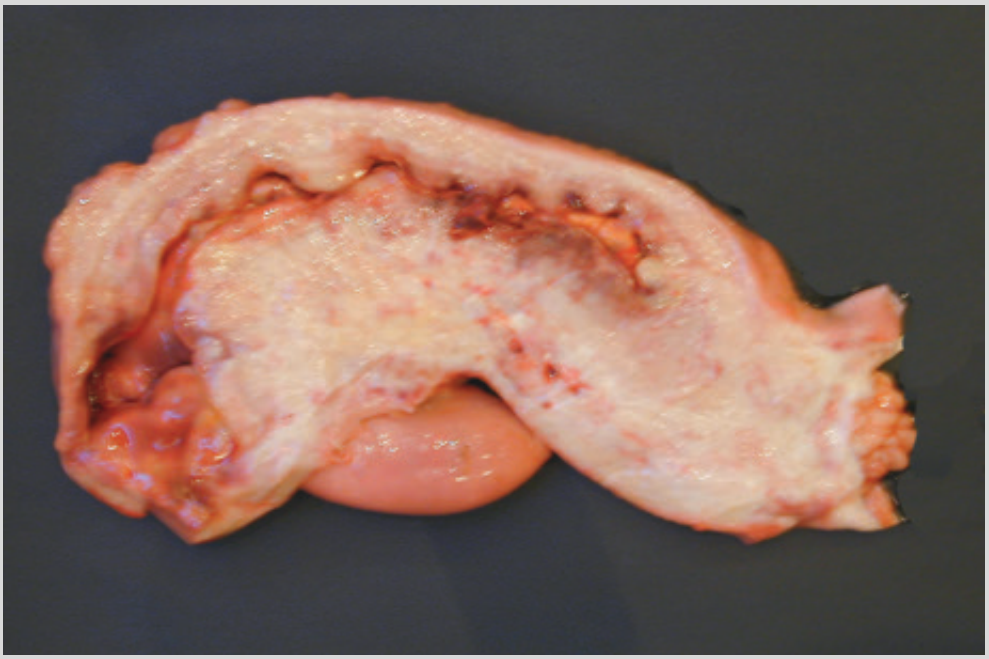
Animal species/Organ	Cattle/Uterus (opened)
Lesion	Carcinoma with invasive growth into the wall
Scoring	Total condemnation
Comments	The lesions in the uterine wall are often discreet (see 12.41)

12.44



Animal species/Organ	Cattle/Uterus
Lesion	Carcinoma with new growth on the surface
Scoring	Total condemnation
Comments	Growth through the uterine wall is rarely seen

12.45



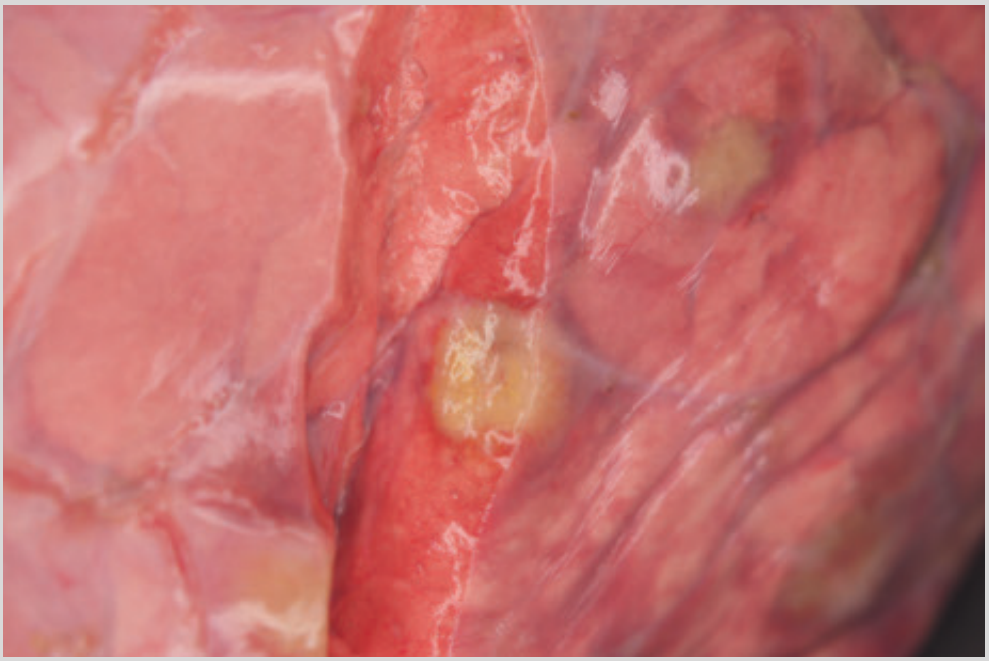
Animal species/Organ	Cattle/Uterus
Lesion	Carcinoma with invasive growth into the wall
Scoring	Total condemnation
Comments	Suspicion of uterine carcinoma is often based on findings of metastases

12.46



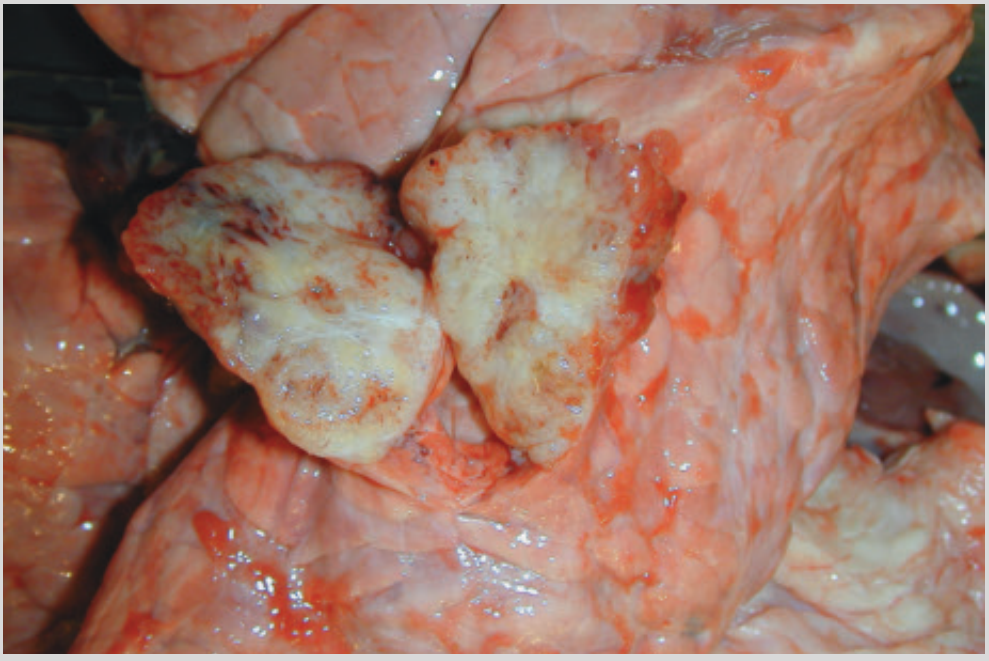
Animal species/Organ	Cattle/Lung
Lesion	Metastases from uterine carcinoma
Scoring	Total condemnation
Comments	The metastases are typically yellowish in colour

12.47



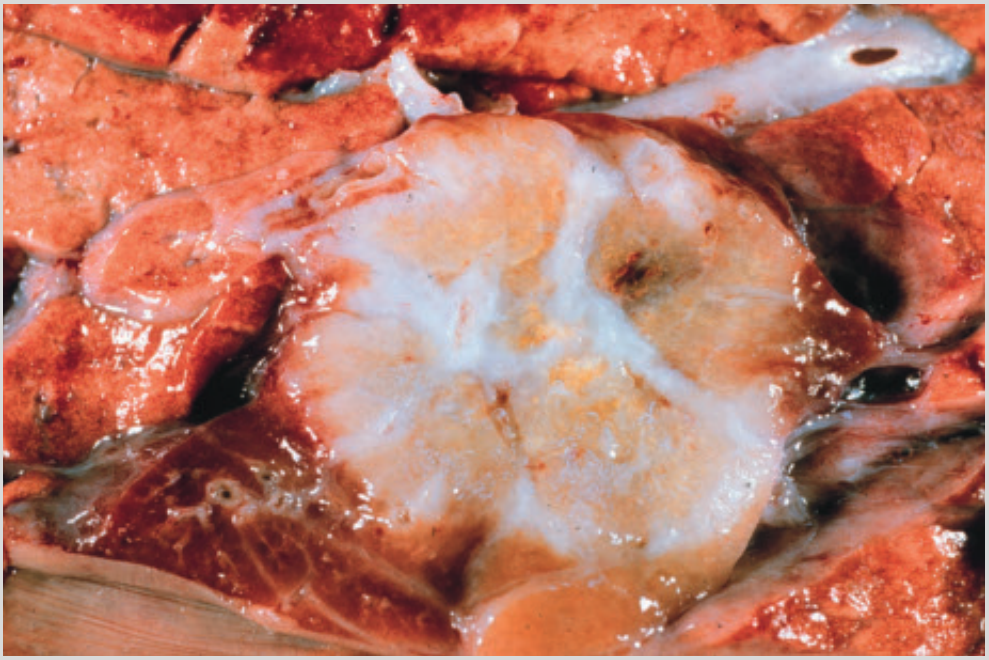
Animal species/Organ	Cattle/Lung
Lesion	Metastases from uterine carcinoma
Scoring	Total condemnation
Comments	The metastases are typically yellowish in colour

12.48



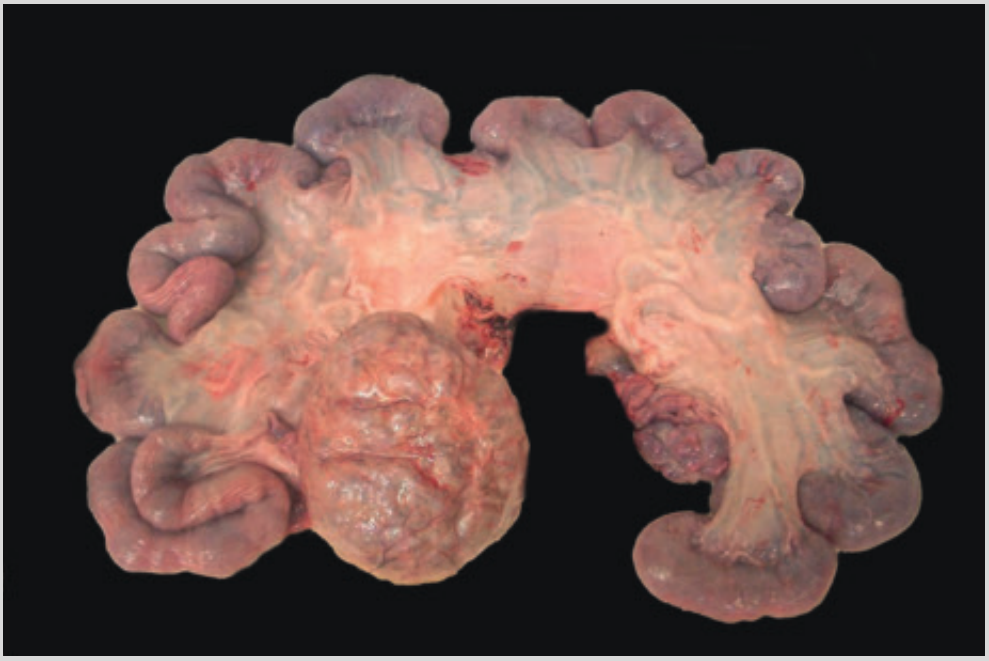
Animal species/Organ	Cattle/Lung
Lesion	Metastases from uterine carcinoma
Scoring	Total condemnation
Comments	The metastases are often accompanied by fibrosis and necrosis

12.49



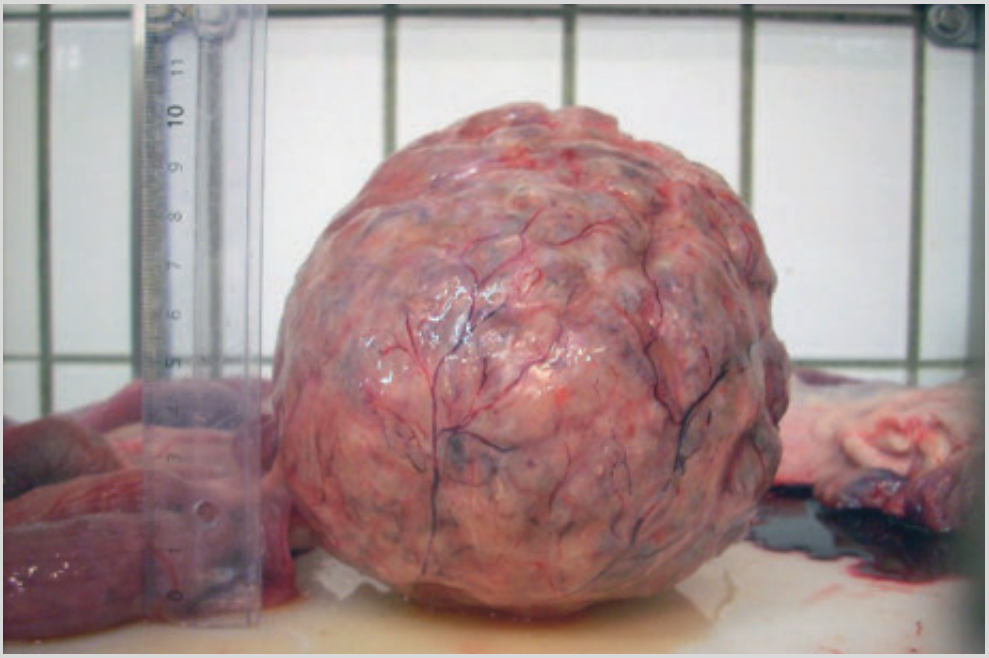
Animal species/Organ	Cattle/Lung
Lesion	Metastases from uterine carcinoma
Scoring	Total condemnation
Comments	The metastases are often accompanied by fibrosis and necrosis

12.50



Animal species/Organ	Pig/Ovary
Lesion	Granulosa-theca cell tumour
Scoring	Partial condemnation
Comments	A rare ovarian tumour in pigs

12.51



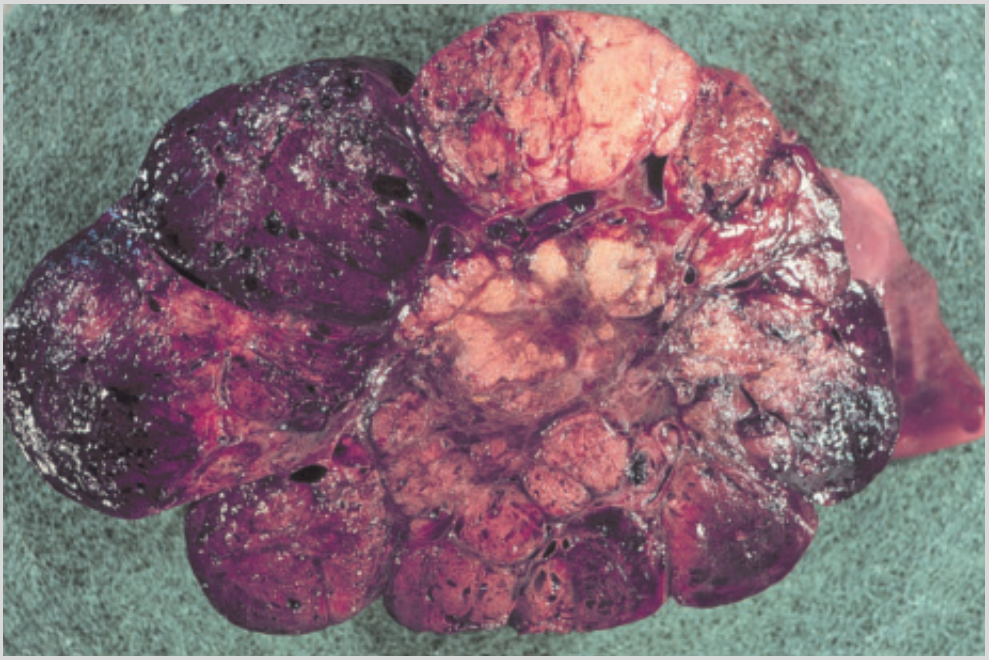
Animal species/Organ	Pig/Ovary
Lesion	Granulosa-theca cell tumour
Scoring	Partial condemnation
Comments	The neoplasm has a characteristic smooth surface

12.52



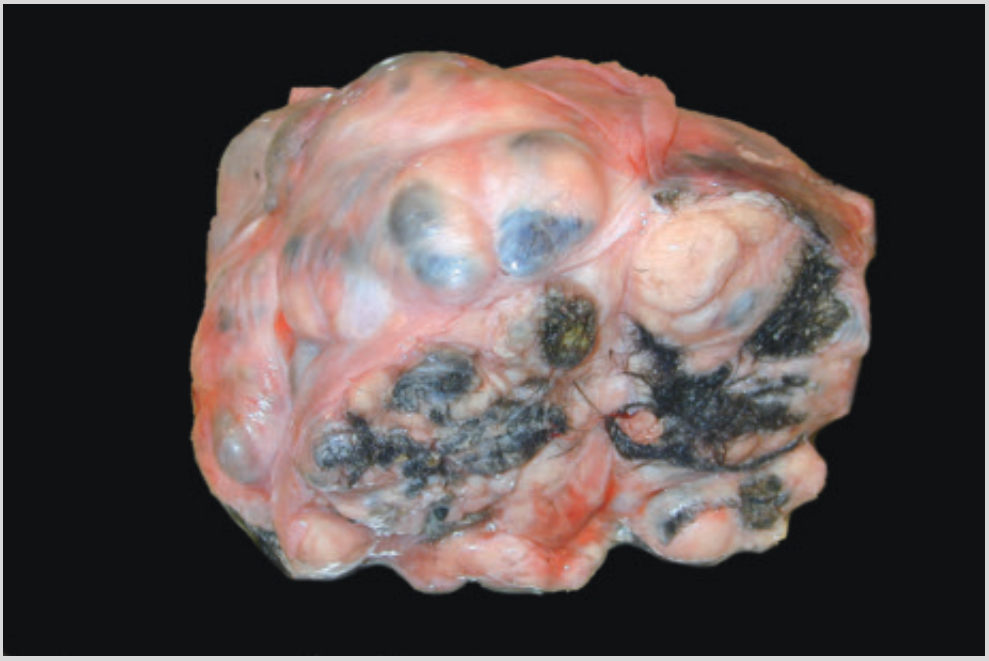
Animal species/Organ	Cattle/Ovary
Lesion	Granulosa-theca cell tumour
Scoring	Partial condemnation
Comments	In slaughter animals granulosa-theca cell tumours are most often benign

12.53



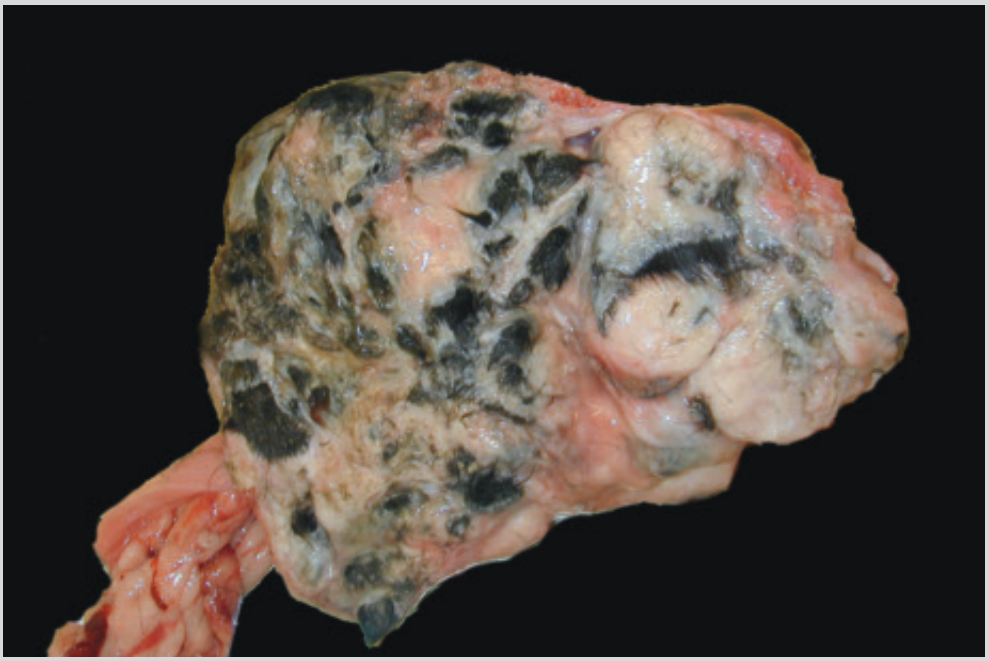
Animal species/Organ	Cattle/Ovary (cut through) (close-up of 12.43)
Lesion	Granulosa-theca cell tumour
Scoring	Partial condemnation
Comments	In slaughter animals granulosa-theca cell tumours are most often benign

12.54



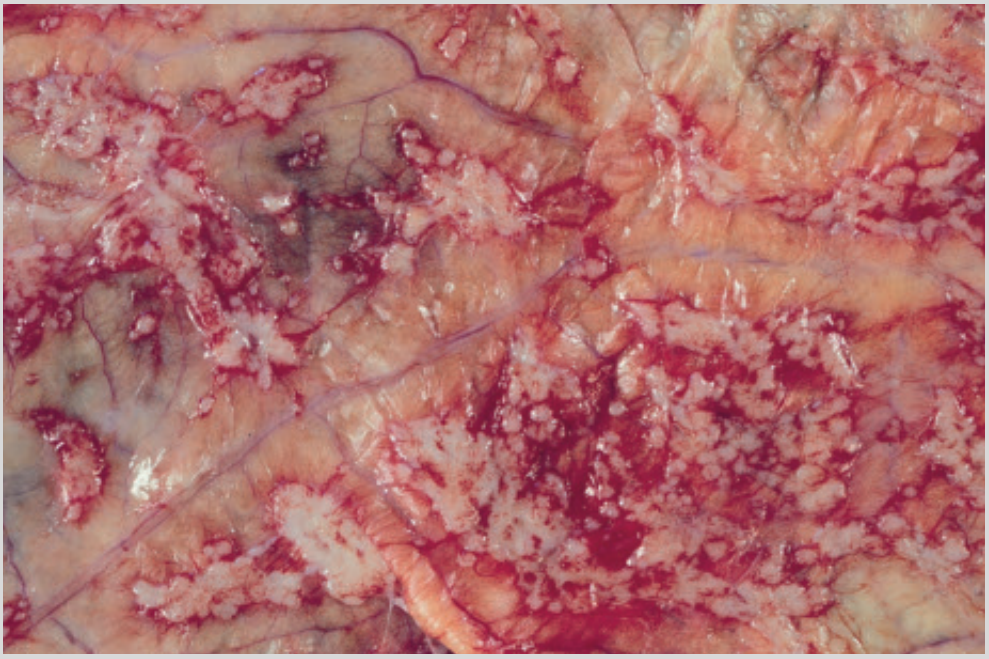
Animal species/Organ	Pig/Ovary
Lesion	Teratoma
Scoring	Partial condemnation
Comments	Teratomas occur rarely in slaughter animals and are most often benign

12.55



Animal species/Organ	Pig/Ovary (cut through)
Lesion	Teratoma
Scoring	Partial condemnation
Comments	In male animals teratomas can be present in the testicles

12.56



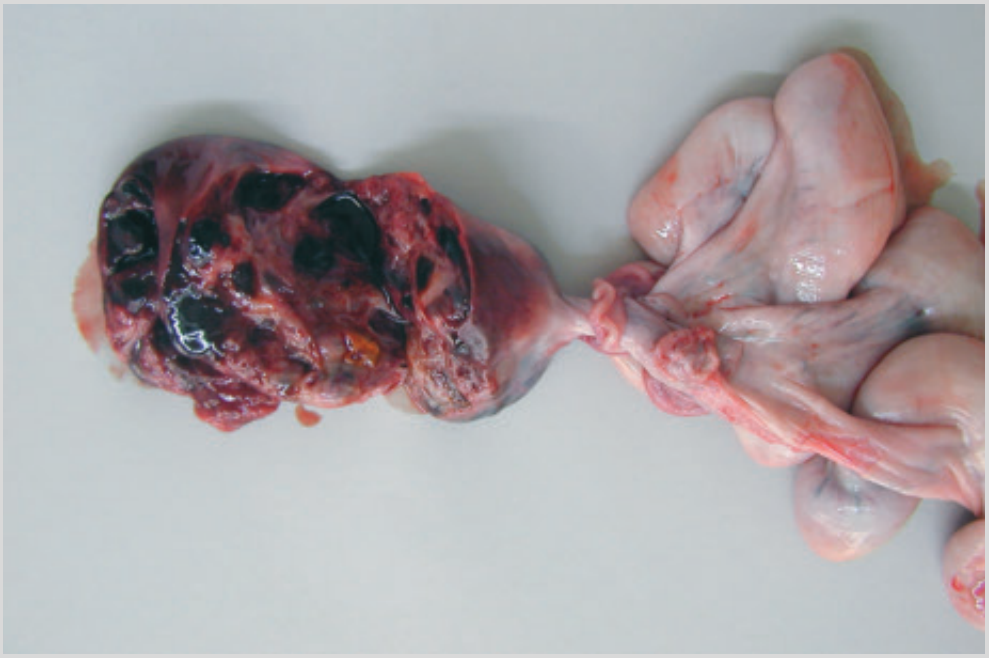
Animal species/Organ	Cattle/Peritoneum
Lesion	Implantation metastases from ovarian tumour (carcinoma)
Scoring	Total condemnation
Comments	Metastases are always a sign of malignancy

12.57



Animal species/Organ	Pig/Ovary
Lesion	Vascular hamartoma
Scoring	Partial condemnation
Comments	This is a developmental anomaly

12.58



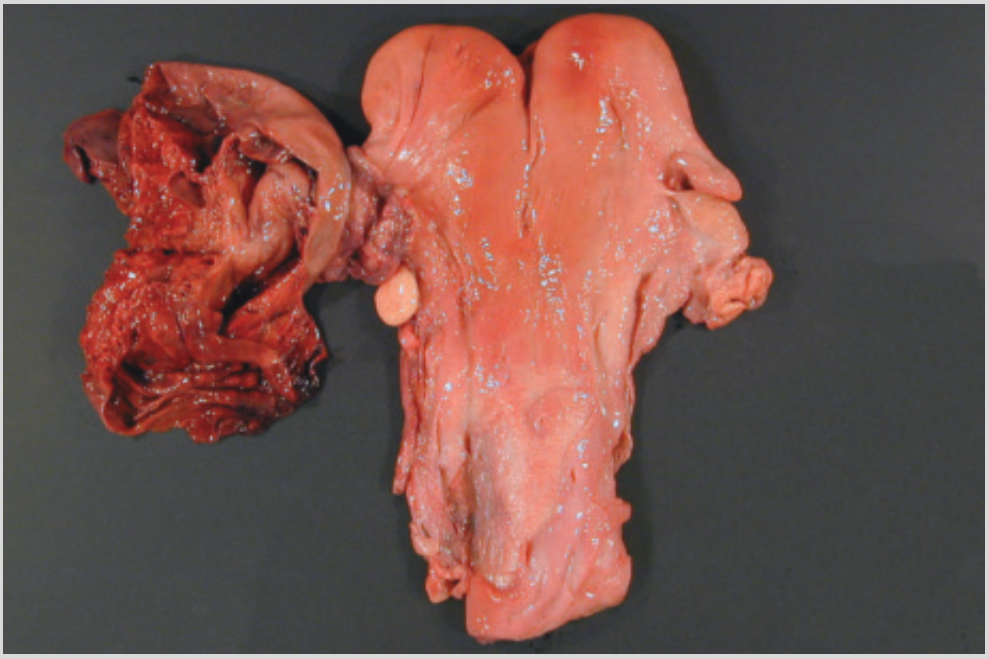
Animal species/Organ	Pig/Ovary
Lesion	Haemangioma
Scoring	Partial condemnation
Comments	The most frequent ovarian tumour in sows

12.59



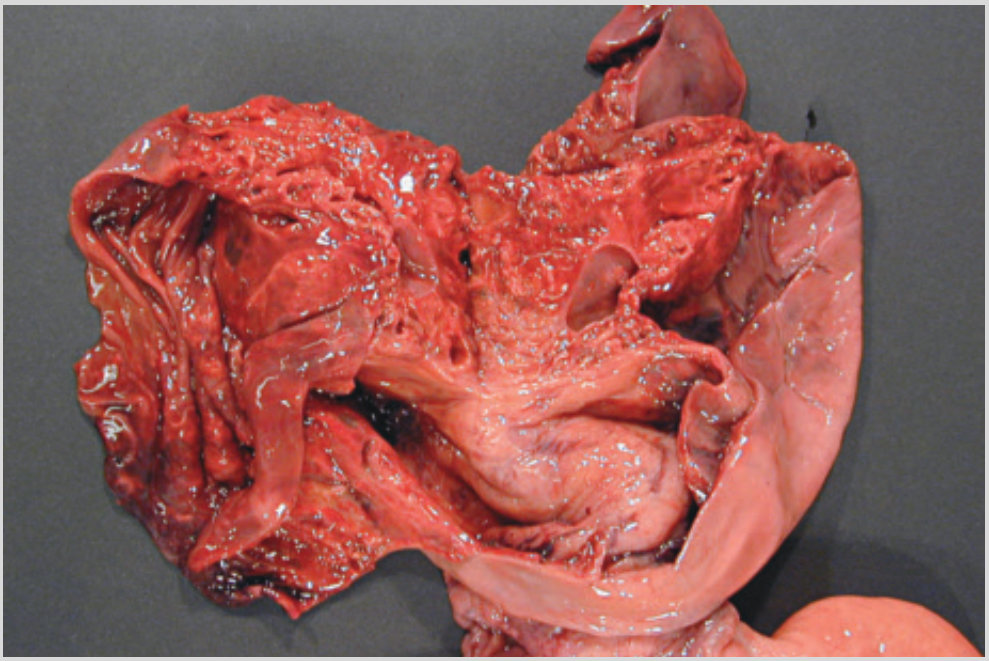
Animal species/Organ	Pig/Ovary (close-up of 12.58)
Lesion	Haemangioma
Scoring	Partial condemnation
Comments	The most frequent ovarian tumour in sows

12.60



Animal species/Organ	Cattle/Uterus and ovaries
Lesion	Haemorrhagic ovarian cysts
Scoring	Partial condemnation
Comments	An incidental finding

12.61



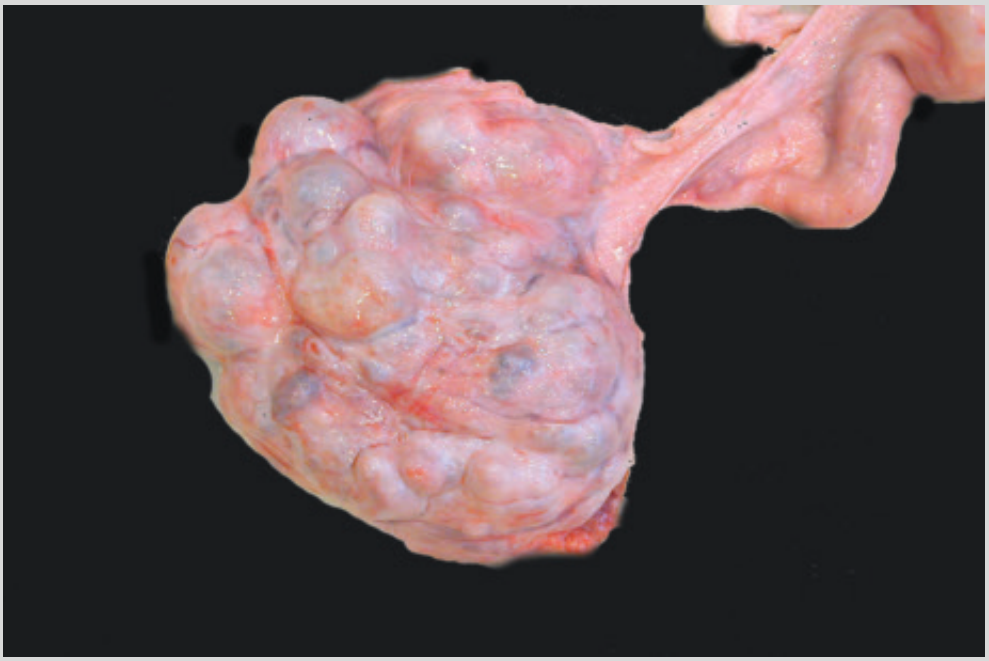
Animal species/Organ	Cattle/Ovary
Lesion	Haemorrhagic ovarian cysts (close-up of 12.60)
Scoring	Partial condemnation
Comments	An incidental finding

12.62



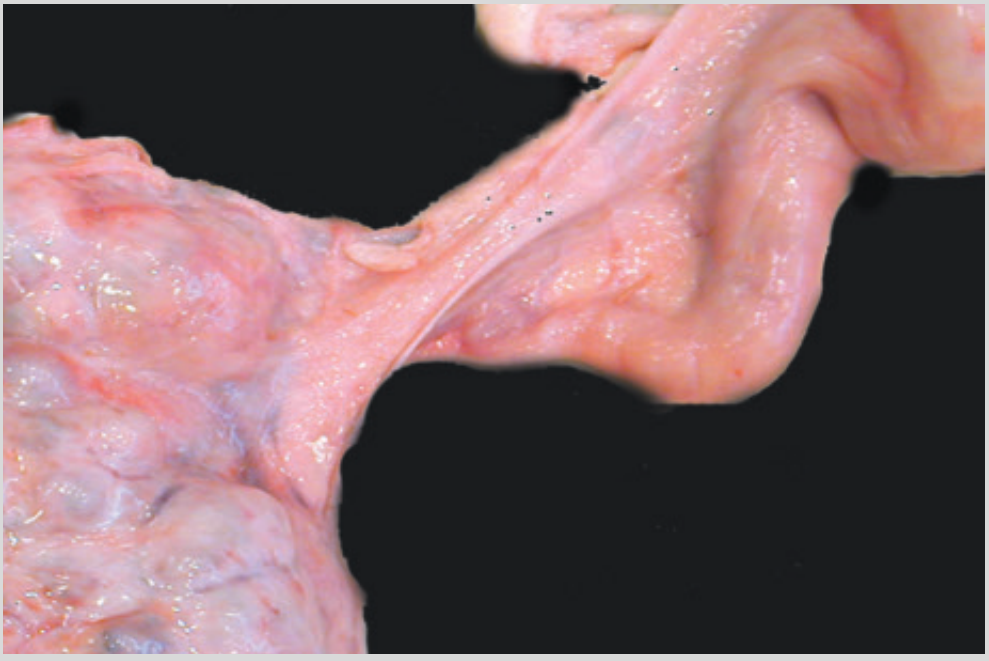
Animal species/Organ	Cattle/Ovary
Lesion	Haemorrhagic cyst
Scoring	Partial condemnation
Comments	An incidental finding

12.63



Animal species/Organ	Pig/Ovary
Lesion	Polycystic ovary
Scoring	Partial condemnation
Comments	An incidental finding

12.64



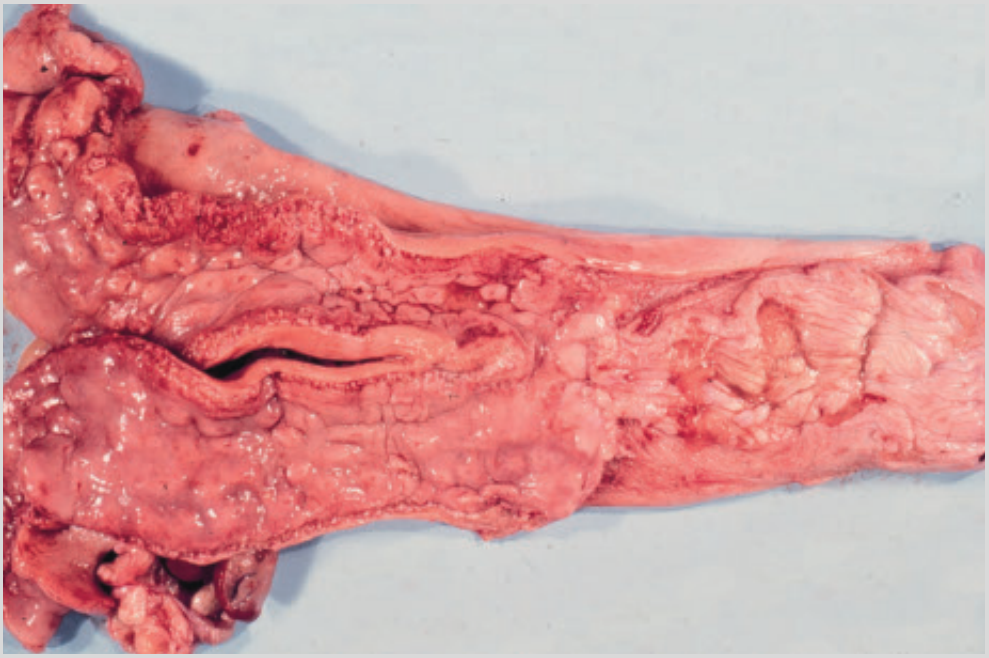
Animal species/Organ	Pig/Ovary (same organ as in 12.63)
Lesion	Polycystic ovary
Scoring	Partial condemnation
Comments	An incidental finding, with concomitant hydrosalpinx

12.65



Animal species/Organ	Pig/Ovaries and Uterus
Lesion	Ovarian torsion, unilateral
Scoring	Partial condemnation
Comments	Extremely rare condition

12.66



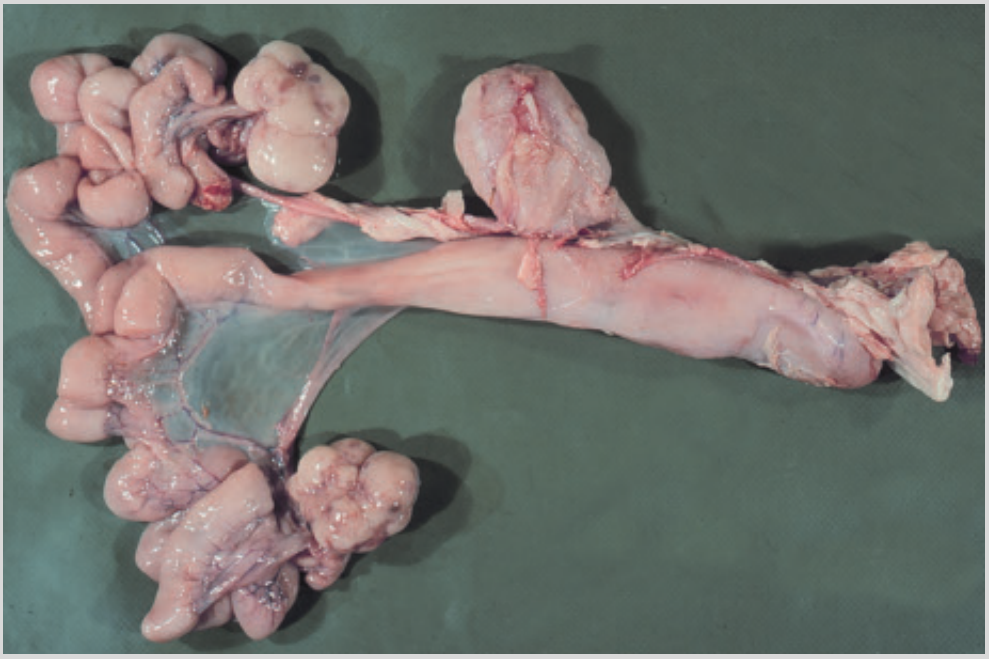
Animal species/Organ	Cattle/Uterus (opened)
Lesion	Diffuse lymphosarcoma
Scoring	Total condemnation
Comments	Predilection site in enzootic leukosis

12.67



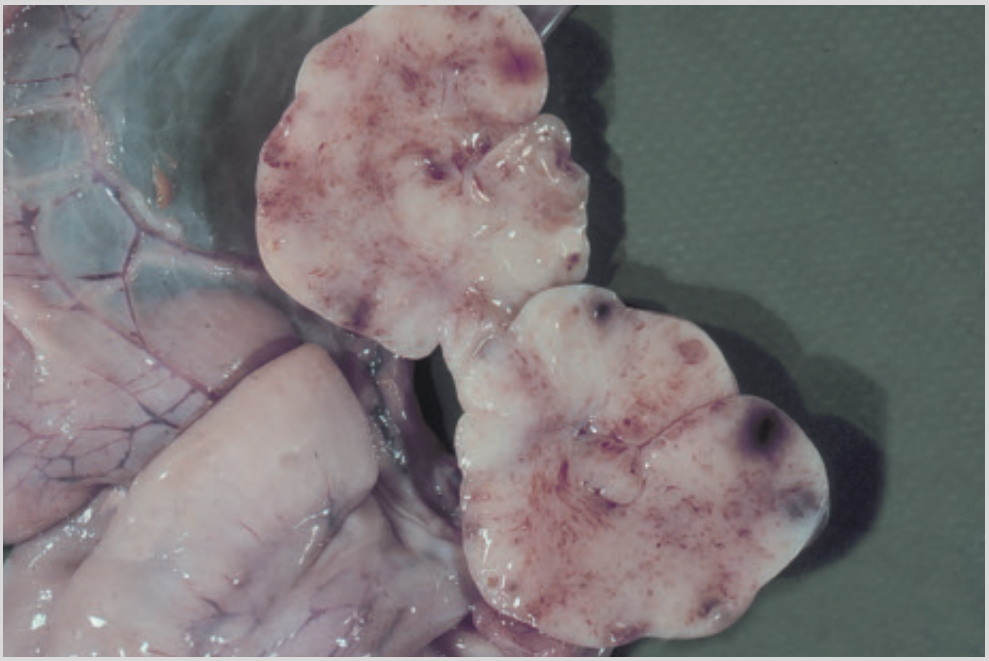
Animal species/Organ	Cattle/Uterus (opened)
Lesion	Nodular lymphosarcoma
Scoring	Total condemnation
Comments	Predilection site in enzootic leukosis

12.68



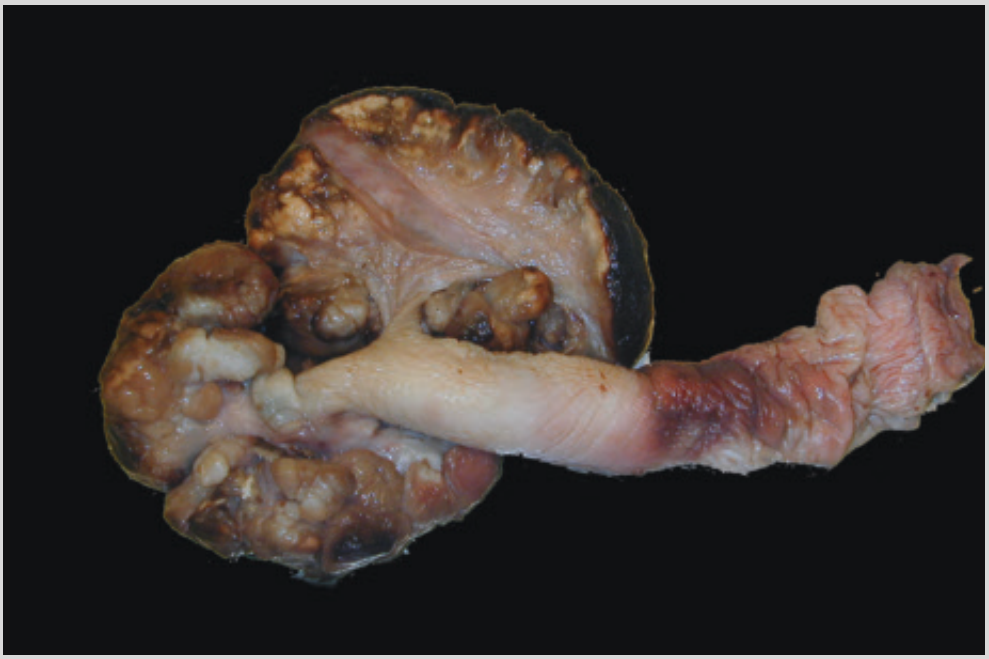
Animal species/Organ	Pig/Reproductive systems
Lesion	Ovarian lymphosarcoma
Scoring	Total condemnation
Comments	Rare localisation

12.69



Animal species/Organ	Pig/Ovary (cut through) (same preparation as in 12.68)
Lesion	Ovarian lymphosarcoma
Scoring	Total condemnation
Comments	Rare localisation

12.70



Animal species/Organ	Cattle/Glans penis
Lesion	Papilloma
Scoring	Partial condemnation
Comments	This is a benign condition

12.71



Animal species/Organ	Cattle/Glans penis
Lesion	Papillomas
Scoring	Partial condemnation
Comments	This is a benign condition

13 Mammary Glands

Introduction p. 477
Mastitis p. 477
Pigmentation of mammary glands in pigs p. 478
Udder oedema p. 478
Infections in udder and teat skin p. 478

Introduction

Mastitis is the most common and economically most significant lesion in the mammary glands of slaughter animals, and frequently has consequences at meat inspection. Mastitis is very common in cattle and pigs, and is less frequent in sheep and goats. It is estimated that the one-year mastitis incidence-rate in dairy cows is about 40%. In addition, a considerable number of animals with chronic mastitis are sent for slaughter due to reduced milk yield.

Mastitis [13.01 – 13.15]

The vast majority of mastitis cases occur via ascending infection through the teat canal. Some develop after percutaneous infection (particularly in pigs), and a few are haematogenous. Udder tuberculosis in cattle is a haematogenous infection and is not discussed further here, instead please refer to Chapter 20.

Necrotising mastitis, typically induced by *Staphylococcus aureus* or coliform bacteria, occurs in cattle. A similar condition occurs in sheep and goats which is typically caused by *S. aureus, Mannheimia haemolytica* or *Pasteurella multocida.* Necrotising mastitis in pigs occurs rarely. *S. aureus*-induced acute, necrotising mastitis in cattle is associated not only with lesions in the mammary tissue, but also necrosis and dark colouring of the udder skin. Necrotising mastitis caused by coliform bacteria in cattle does usually not involve the udder skin and, in the acute stage, is characterised by haemorrhage and fibrin exudation. Regardless of the aetiology, hyperplasia is seen in the draining lymph nodes. Sepsis often occurs in conjunction with acute necrotising mastitis. Meat inspection scoring of septic mastitis and acute necrotising mastitis is total condemnation.

Catarrhal, purulent and abscess forming mastitis occurs in all slaughter animals and is most frequently caused by streptococci, *S. aureus*, coliform bacteria or *Trueperella pyogenes*. Changes in milk can be seen in both the acute and chronic stages, includ-

ing milk containing precipitations or pus. Depending on the aetiology and the animal species, the chronic stages may also present with chronic purulent cisternitis and galactophoritis with polyp formation and peripheral fibrosis; chronic fibrosing mastitis; or chronic abscess-forming mastitis. In the chronic stages of necrotising mastitis, demarcation, sequestration and encapsulation of the necrotic tissue is seen. Hyperplasia of the draining lymph nodes is present in both acute and chronic lesions. Meat inspection scoring of the above lesions is partial condemnation, whereas complications (including toxaemia) necessitate total condemnation.

Pyogranulomatous mastitis occurs in cattle and pigs and is caused by *S. aureus*, *Actinomyces bovis, Actinobacillus lignieresii* and *T. pyogenes*. The tissue in the mammary gland appears fibrous with several small or just visible yellow pyogranulomatous foci; or the fibrous tissue contains larger abscesses up to 10 cm in diameter or more. In sows in particular, the udder skin becomes nodular in the chronic stages of the infection which is caused by the extensive connective tissue formation combined with development of large, often pedunculated, abscesses. These lesions necessitate partial condemnation. The presence of any complications necessitates total condemnation.

Pigmentation of mammary glands in pigs [13.16]

In sows, dark pigmentation of the mammary gland tissue may be seen. This is due to accumulation of melanin-containing cells in the connective tissue streaks of the mammary fatty tissue which confers a dark, net-like structure to the lesion. The lesion may also assume a star-like shape. Scoring of mammary pigmentation is partial condemnation. Please refer to Chapter 21 for a detailed discussion of melanosis.

Udder oedema [13.17]

Udder oedema which has occurred in connection with parturition necessitates partial condemnation. When udder oedema occurs in connection with other lesions, scoring is based on the primary cause. Generalised oedema always necessitates total condemnation.

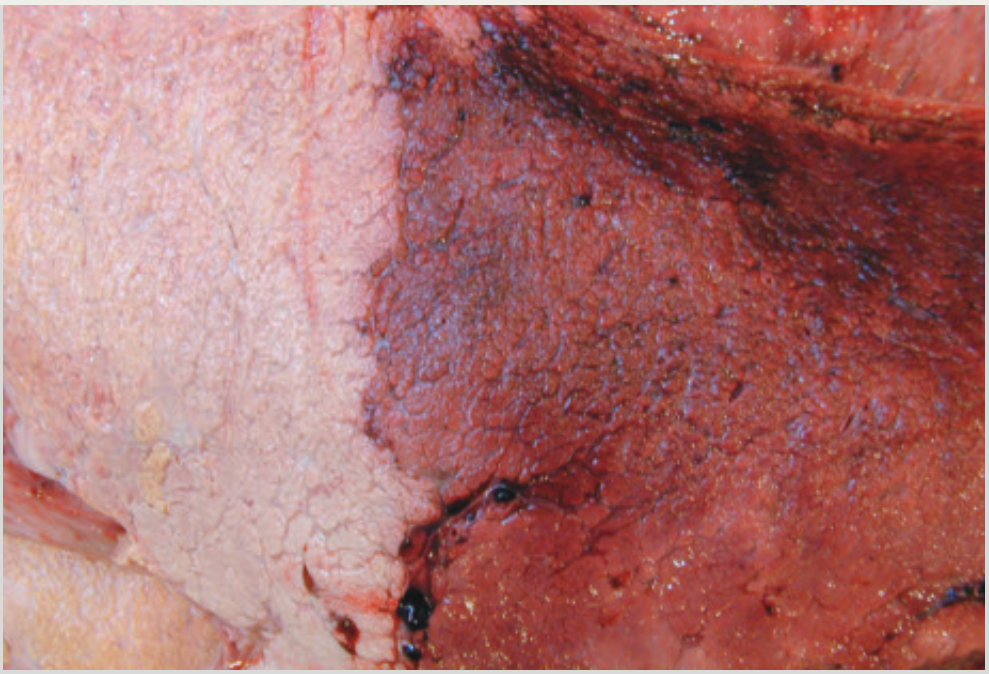
Infections in udder and teat skin [13.18 – 13.20]

Wounds, including teat damage, which may become secondarily infected with bacteria, and various viral infections occur occasionally in the skin of the udder and teats. The infections can result in development of mastitis. Papillomatosis is seen particularly in young animals (see Chapter 16). Bovine herpes mammillitis causes necrotising and ulcerating, 1-3 cm, or even larger, lesions in cattle. Pseudocowpox occurs frequently in older cows with pustules and ulcers which heal from the centre producing characteristic circular or horse-shoe shaped lesions. Contagious pustular dermatitis (contagious ecthyma or orf) may be seen in sheep and goats. Both pseudocowpox and contagious ecthyma virus can infect humans. On areas of thin skin, including the udder and teats, stephanofilariasis may be seen in cattle (see Chapter 16). The lesions are caused by *Stephanofilaria stilesi* and other filaria species, which inhabit the dermis and subcutis,

where they lay eggs. The microfilariae cause lesions which attract the flies that act as vectors. Meat inspection scoring is rejection of the udder in all cases.

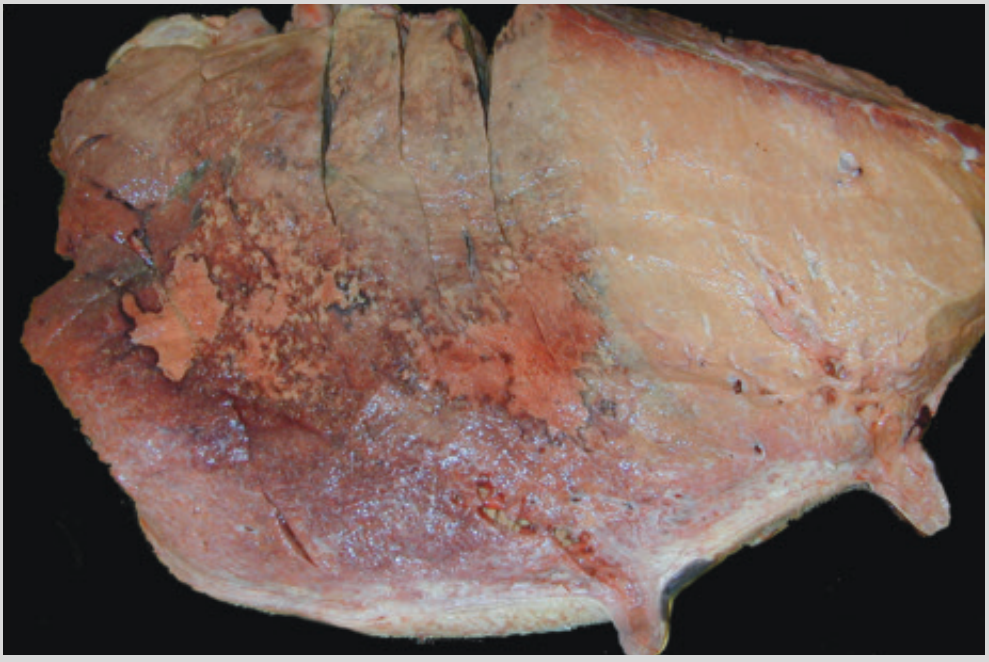
In sows, pyogranulomatous udder lesions which seems to affect the mammary glandular tissue (mastitis) generally only affect the skin.

13.01



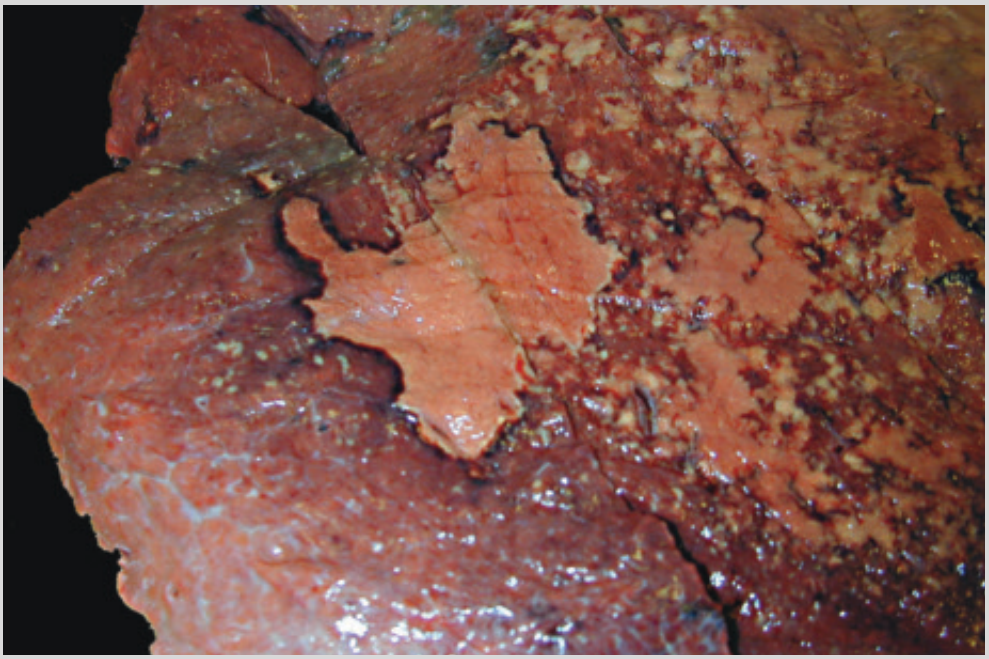
Animal species/Organ	Cattle/Mammary gland
Lesion	Acute, haemorrhagic, necrotising mastitis
Scoring	Total condemnation
Comments	There is a sharp demarcation between affected tissue (on the right) and normal tissue (on the left)

13.02



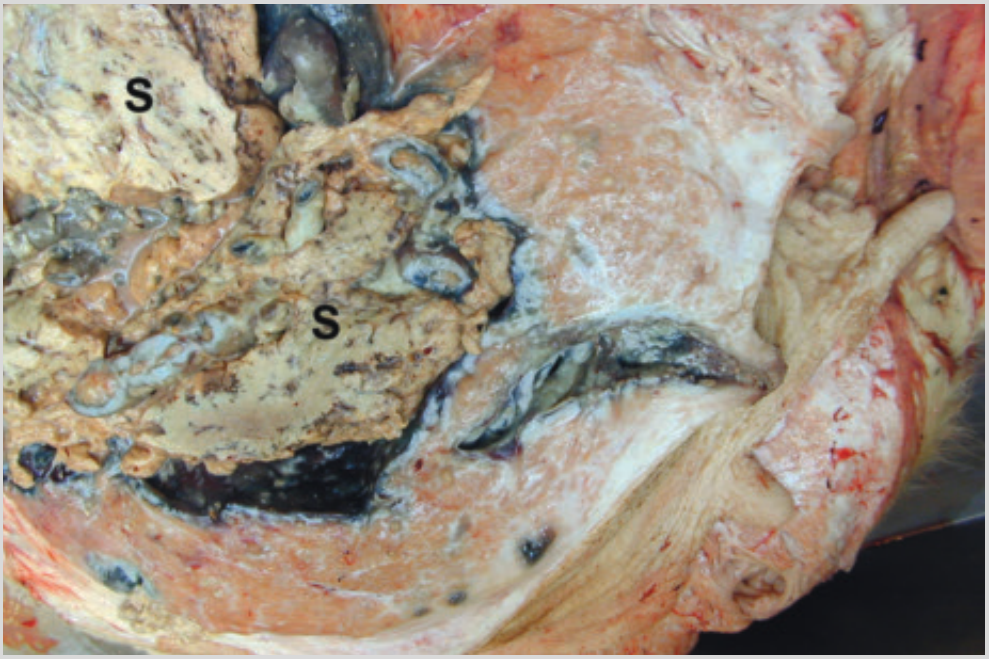
Animal species/Organ	Cattle/Mammary gland; the same udder as in 13.03
Lesion	Acute, necrotising mastitis
Scoring	Total condemnation
Comments	Necrotic areas are seen in tissue that is affected by hyperaemia

13.03



Animal species/Organ	Cattle/Mammary gland; detail of 13.02
Lesion	Acute, necrotising mastitis
Scoring	Total condemnation
Comments	Note the peripheral, haemorrhagic border zone

13.04



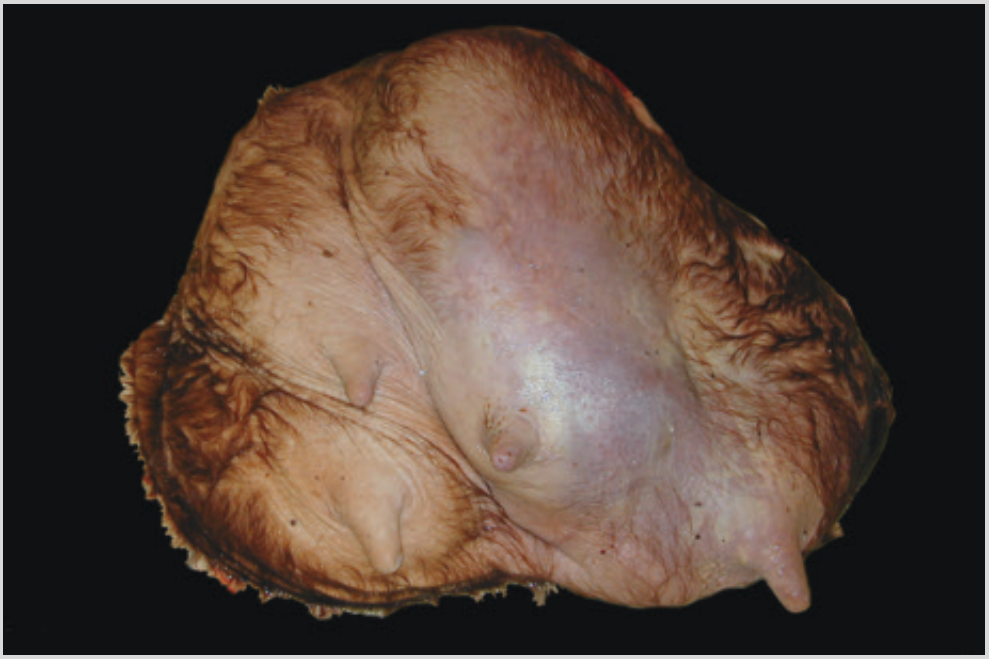
Animal species/Organ	Cattle/Mammary gland; the same udder as in 13.05
Lesion	Chronic, sequestrating mastitis
Scoring	Partial condemnation
Comments	The sequestrum (S) is located in a cavity surrounded by granulation tissue with pseudomelanosis

13.05



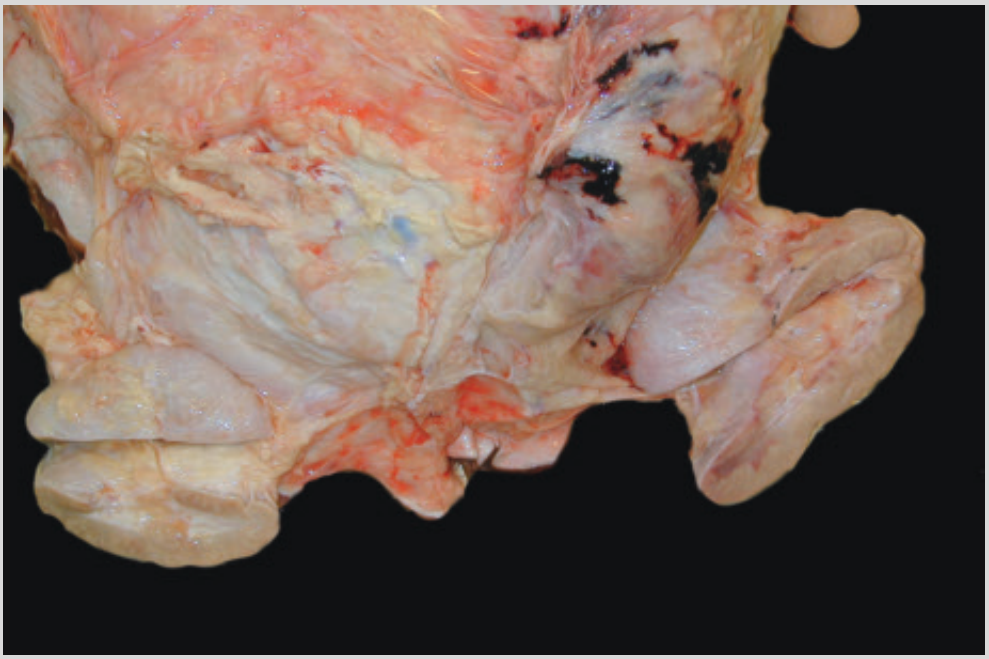
Animal species/Organ	Cattle/Mammary gland; detail of 13.04
Lesion	Cut section of a mammary gland sequestrum
Scoring	Partial condemnation
Comments	The structure of the mammary tissue can be recognised in the sequestrum

13.06



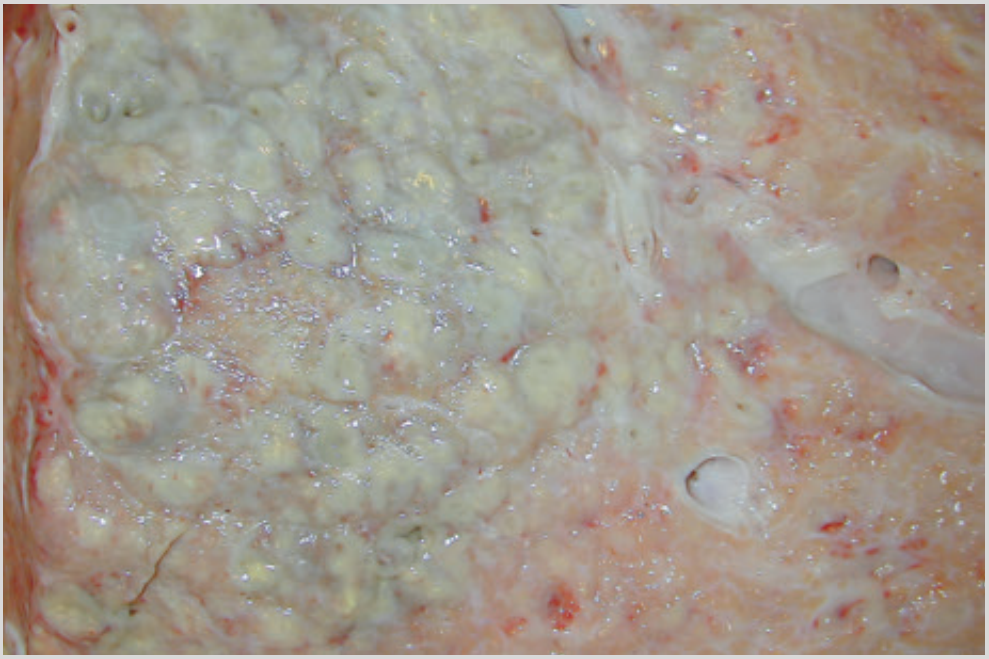
Animal species/Organ	Cattle/Mammary gland
Lesion	Swollen right rear gland (chronic mastitis was identified after incision in the mammary tissue)
Scoring	Partial condemnation
Comments	In cattle, the rearmost mammary glands lie closer together than the foremost

13.07



Animal species/Organ	Cattle/Mammary gland
Lesion	Hyperplasia of the right mammary lymph node (chronic mastitis identified after incision in the mammary tissue)
Scoring	Partial condemnation
Comments	In cattle, the mammary lymph nodes are located caudodorsally to the rearmost glands

13.08



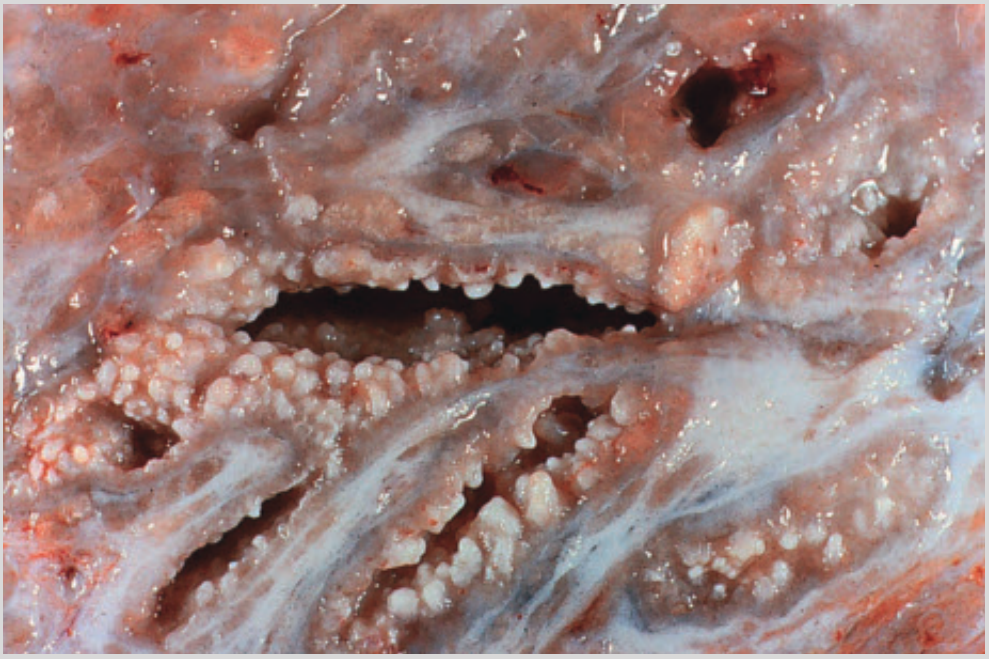
Animal species/Organ	Cattle/Mammary gland
Lesion	Chronic abscess-forming mastitis
Scoring	Partial condemnation
Comments	Aggregated chronic abscesses can be seen to the left

13.09



Animal species/Organ	Cattle/Mammary gland
Lesion	Chronic, purulent cisternitis, and chronic, fibrous mastitis
Scoring	Partial condemnation
Comments	Mastitis and cisternitis are inflammations in the secretory tissue and lactiferous sinus, respectively

13.10



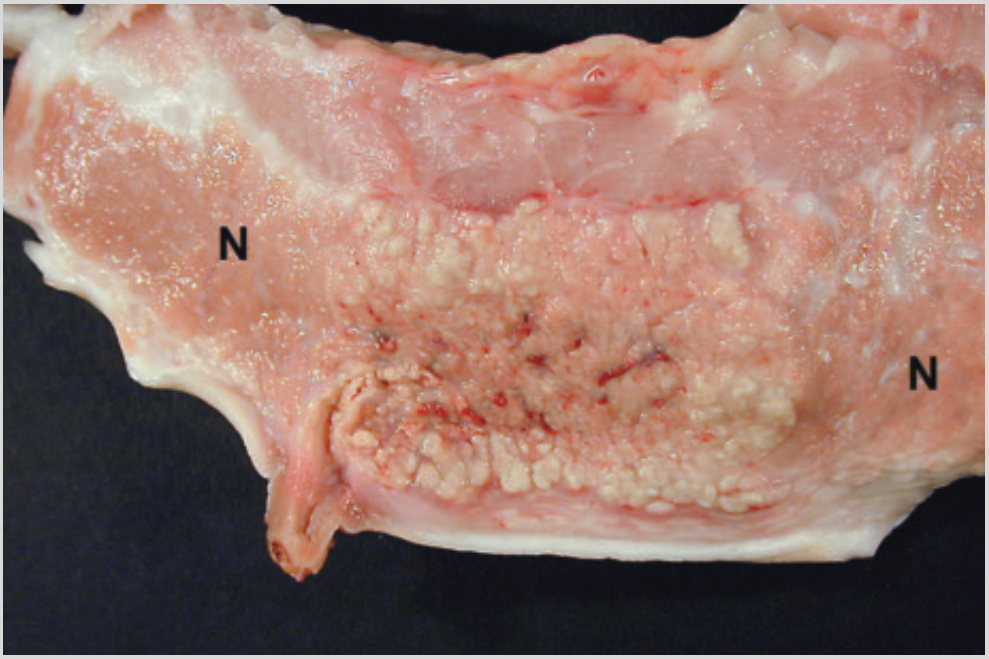
Animal species/Organ	Cattle/Mammary gland
Lesion	Chronic, polypous galactophoritis (inflammation of the milk ducts)
Scoring	Partial condemnation
Comments	The surface of the polyps is covered with hyperplastic or metaplastic epithelium

13.11



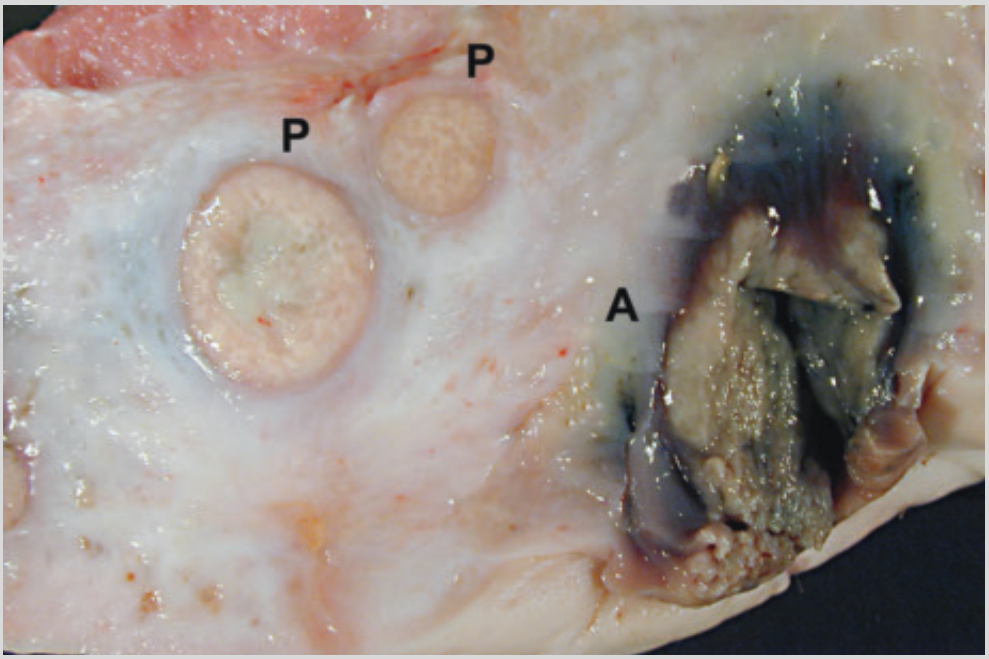
Animal species/Organ	Pig/Mammary gland
Lesion	Swollen rearmost mammary glands (chronic mastitis and dermatitis demonstrated after incision in the glands)
Scoring	Partial condemnation
Comments	The lesion is pedunculated with wounds and fistulas

13.12



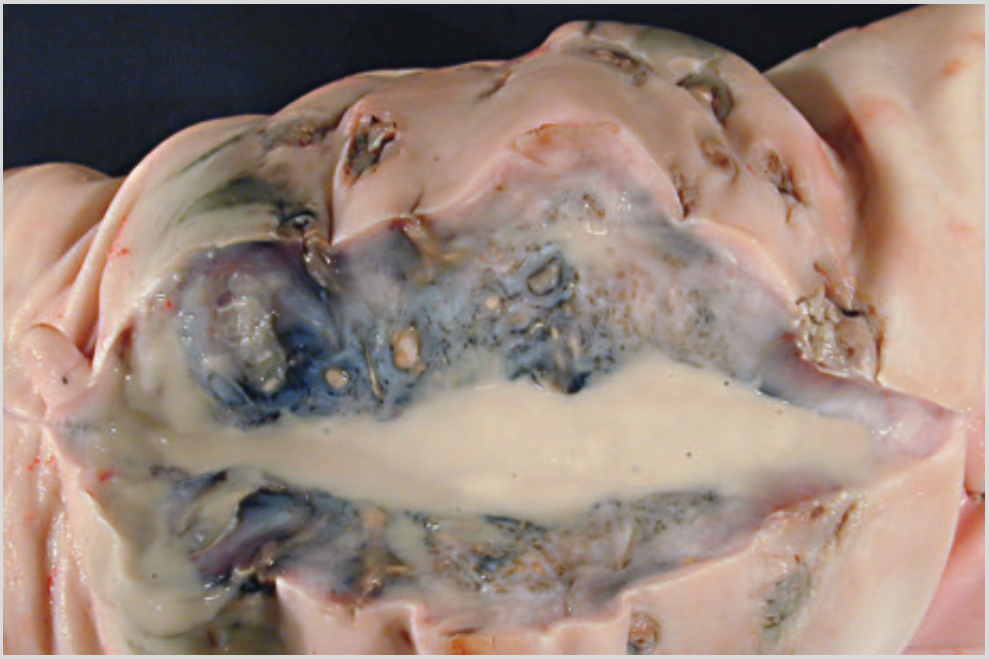
Animal species/Organ	Pig/Mammary gland
Lesion	Chronic, purulent mastitis (the purulent exudate is difficult to recognise)
Scoring	Partial condemnation
Comments	Normal mammary tissue (N) surrounds the inflamed mammary tissue

13.13



Animal species/Organ	Pig/Mammary gland
Lesion	Chronic, abscess-forming (A) and pyogranulomatous (P) dermatitis
Scoring	Partial condemnation
Comments	Dermatitis, and thus swelling, of the udder occurs very frequently particularly in sows, and is easily misdiagnosed as mastitis

13.14



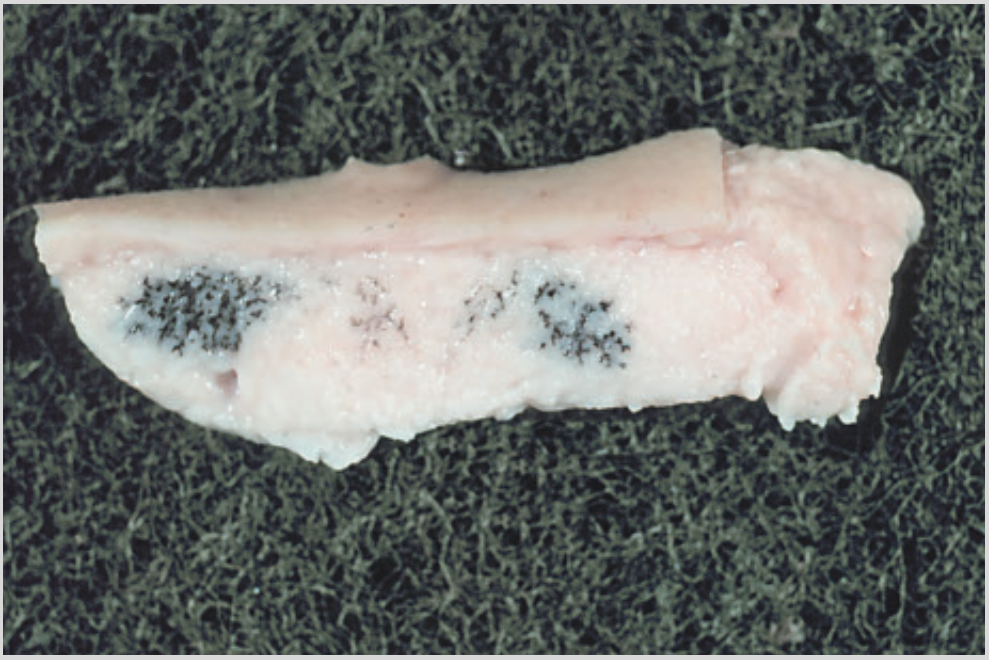
Animal species/Organ	Pig/Mammary gland
Lesion	Chronic abscess-forming dermatitis
Scoring	Partial condemnation
Comments	Numerous chronic abscesses are seen with fistulas and wounds on the surface; in sows, the lesion is easily misdiagnosed as mastitis

13.15



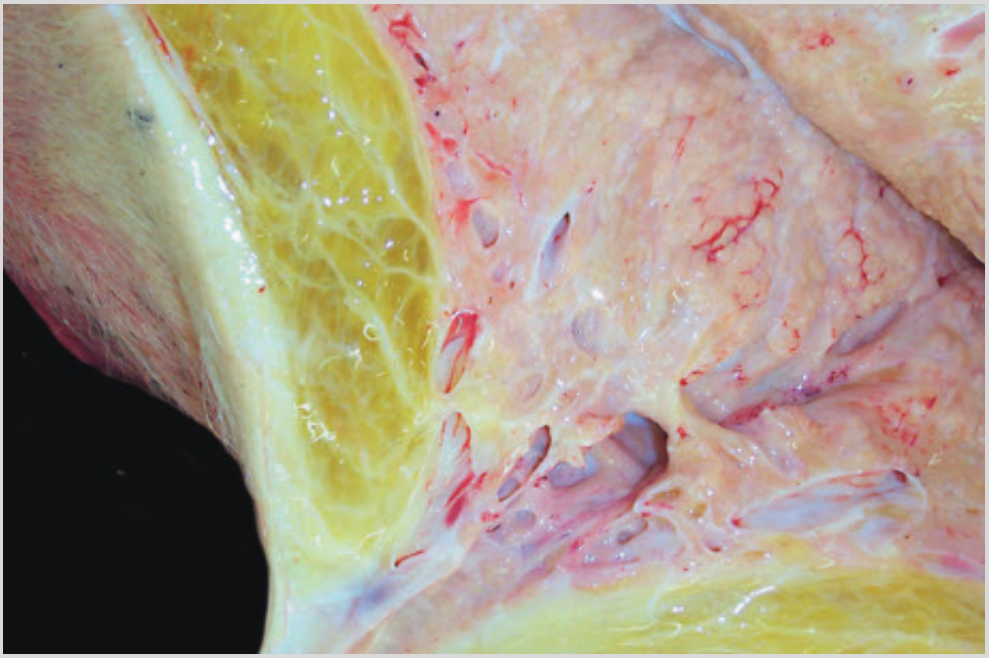
Animal species/Organ	Pig/Mammary gland
Lesion	Chronic, fibrosing and abscess-forming dermatitis
Scoring	Partial condemnation
Comments	In sows, the lesion is easily misdiagnosed as mastitis

13.16



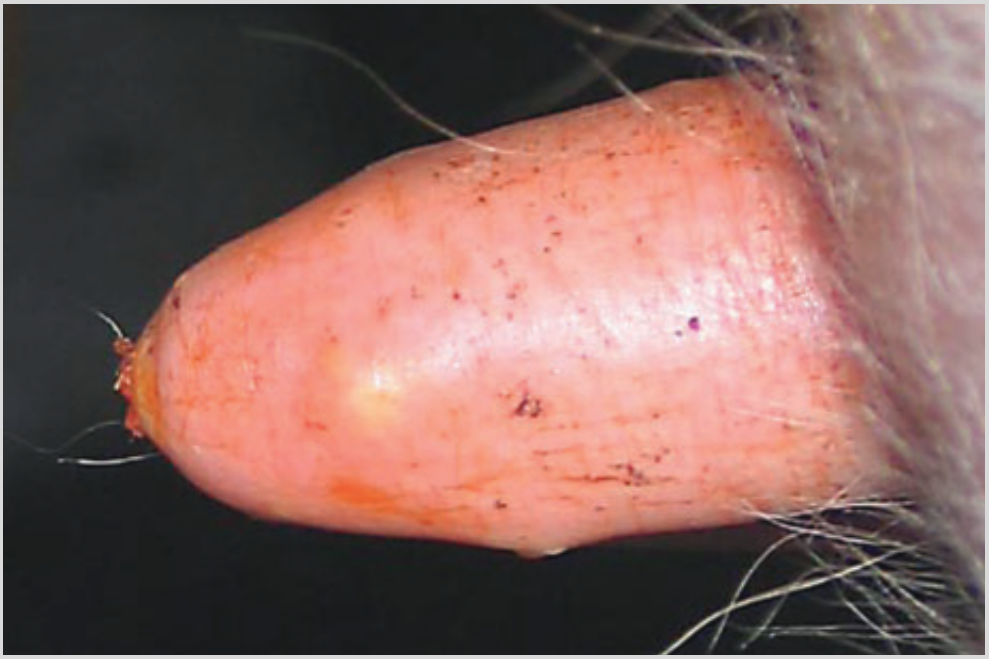
Animal species/Organ	Pig/Mammary gland
Lesion	Melanin pigmentation
Scoring	Partial condemnation
Comments	Melanin-containing cells in the connective tissue streaks of the mammary fatty tissue give net-like lesions

13.17



Animal species/Organ	Cattle/Mammary gland
Lesion	Subcutaneous oedema
Scoring	Partial condemnation if the lesion occurs in connection with calving
Comments	If the oedema is due to conditions other than calving, scoring is based on these

13.18



Animal species/Organ	Cattle/Teat
Lesion	Pustular mammillitis; mammillitis is an inflammation in the teat, but does not involve the cisterns
Scoring	Partial condemnation
Comments	The lesion represents the acute stage of pseudocowpox

13.19



Animal species/Organ	Cattle/Teat
Lesion	Chronic, ulcerative mammillitis; healing, horse-shoe shaped ulcer
Scoring	Partial condemnation
Comments	The lesion is characteristic for the chronic stage of pseudocowpox

13.20



Animal species/Organ	Cattle/Teat
Lesion	Chronic, ulcerative mammillitis; healing, horse-shoe shaped, confluent, ulcers
Scoring	Partial condemnation
Comments	The lesions are characteristic for the chronic stage of pseudocowpox

14 Skeletal System

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Osteomyelitis p. 493
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Arthrosis p. 497
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Introduction

In slaughter animals, the skeletal system is a common site of lesions. Inflammation localised to the bone marrow (osteomyelitis) and joint lesions in the form of arthritis and/or arthrosis are particularly frequent. Bone fractures are also relatively frequent findings at meat inspection. Today, due to highly intensive animal husbandry, slaughter animals rarely suffer from metabolic bone disorders. Nevertheless, great care must continue to be exercised at meat inspection with regard to metabolic bone conditions. As a consequence of intensive husbandry, very large herds of animals are often fed exactly the same diet. Improper feeding may therefore have very serious consequences for a large number of animals.

Developmental anomalies [14.01 – 14.06]

Malformations in the skeletal system are rarely found in slaughter animals. Nevertheless, certain ones do occur with a low frequency. This applies for example to supernumerary toes (polydactyly), fused toes (syndactyly), absent toes (adactyly), and cysts in the spinal vertebrae. Palatoschisis (cleft palate) is occasionally seen, particularly in newborn calves. One extremely rare malformation that may be seen in slaughter animals is double limbs (polymely). Deviations of the spinal column occur relatively frequently in slaughter animals: hunchback (kyphosis), downward curvature of the spine (lordosis) and sideways curvature of the spine (scoliosis). These spinal deviations can be congenital, but more frequently they are acquired defects that can occur in connection with metabolic disease, vertebral osteomyelitis, and fractures.

At meat inspection, malformation of the spine necessitates partial condemnation

of the affected parts; however, in cases of deviation of the spinal column due to other aetiology, judgement depends on the underlying cause.

Bone fractures [14.07 – 14.24]

Bone fractures can be classified in several ways. They can be covered by skin (closed), or the bones can have penetrated the skin (open). Based on the form of the fractures they can be incomplete (the bone fragments are still partially joined and do not completely traverse the width of the bone) or complete. In addition they can be classified as spiral, transverse, Y or comminuted (splintering) fractures depending on fracture lines. Separation at the growth plates (epiphyseal plates), so-called epiphysiolysis, is also considered to be a fracture. Epiphysiolysis is seen in growing animals, and in pigs (particularly gilts) most frequently in the epiphyseal plate of the femoral head, the ischial tuberosity, and the spinal column. In slaughter cattle, in which the condition is rarely seen, epiphysiolysis occurs typically in the proximal epiphyseal plates in the metacarpal or metatarsal bones. All forms of fractures can occur either as a result of external trauma (primary fractures), or reduced bone strength (secondary or pathologic fractures). At meat inspection it is important to determine whether fractures are primary or secondary fractures. Conditions that may cause secondary fractures include osteomyelitis, dyschondroplasia (particularly epiphysiolysis of the femoral head and ischial tuberosity in pigs), metabolic bone diseases, and neoplasms. Primary fractures are not uncommon in slaughter animals, and are a common cause of emergency slaughter. For forensic purposes, it is important to determine whether the fractures have occurred before or after collecting the animal (during transport to the slaughterhouse or at the slaughterhouse). Similarly, it is critical to differentiate between fractures occurring ante-mortem and post-mortem. Animals arriving for slaughter with a fracture in the limbs will generally display some degree of lameness. Because femoral and pelvic fractures can also occur in connection with shackling due to unfortunate occurences, it is essential to inspect the area around the fracture site with emphasis on the respective regional lymph nodes. Because fractures in slaughter animals are often comminuted, bone splinters will normally result in considerable laceration of the surrounding soft tissues, with subsequent blood resorption in the regional lymph nodes. Identification of healed fractures is facilitated by sawing suspect bones in the sagittal direction, whereby separation of the original contours often becomes clearly visible. Chronic fractures will often be present as localised bone thickening due to callus formation. This is seen relatively frequently on the pleural surface of the ribs. In these cases, several ribs will often be the site of fractures thus a number of thickened areas will be visible. In all circumstances, these findings in bones necessitate sawing the bone in order to exclude infections, including osteomyelitis due to pyaemia.

At meat inspection, the presence of open fractures older than 6 hours always necessitates total condemnation. Animals with open, non-infected fractures less than 6 hours old can be approved after partial condemnation with rejection of the affected area and associated lymph nodes. Similarly, non-infected, closed fractures, regardless of age, necessitate partial condemnation. When assessing infected fractures consideration must be given to whether 1) the infection is chronic and well-defined from the surroundings,

and 2) the infection has occurred as part of a pyaemic condition. If the infection is chronic and well-defined from the surroundings, and is not pyaemic, the judgement is partial condemnation. If on the other hand, the infection has occurred in connection with pyaemia, but is chronic and well-defined, the general rules for pyaemia apply, and approval is given for deboning. In all cases, non-defined infections in fractures, whether primary or secondary fractures, necessitate total condemnation. If secondary fractures are present, meat inspection must also take into consideration the primary cause of the reduced bone strength.

Osteomyelitis [14.25 – 14.63]

Inflammation localised exclusively in the bone tissue (osteitis) occurs rarely, because infection in the bone tissue will nearly always involve the periost (periostitis) or the bone marrow (osteomyelitis). Osteomyelitis is primarily due to bacterial infections, although it can also be caused by other microorganisms. In slaughter animals, infection in the bone marrow is in particular due to spread of pyogenic bacteria such as *Trueperella pyogenes*, *Staphylococcus aureus* and *Streptococcus* spp. Infection of the bone marrow can occur in several ways. The most important infection route is haematogenous spread of bacteria, but under special circumstances infection can occur via lymphatic spread or by direct invasion from the surroundings. In growing animals, the metaphysis area in particular is susceptible to osteomyelitis in cases of generalised spread of pyogenic bacteria via the blood (pyaemia). This is primarily due to the special vascular structures present in the metaphysis in growing animals, which are important in endochondral ossification (linear growth of the bone). At pyaemic spread of bacteria to the bone marrow, there will primarily be necrosis of the bone tissue. Later, the area undergoes purulent confluence, which is the reason why ostemyelitis often results in bone sequestration. Even though all metaphyses can be infected with bacteria, not all metaphyses seem to have the same susceptibility to osteomyelitis. Pyaemic osteomyelites are most prevalent in the costochondral area of the ribs, in the vertebrae (cervical, thoracic and lumbar), and the distal metaphyses in the humerus, radius, ulna, and femur.

In cases of osteomyelitis resulting from pyaemic spread, meat inspection must determine whether the lesion is separated from the surroundings by a fibrous capsule. Absence of a contineous fibrous capsule necessitates total condemnation; however, approval for deboning can be given if the lesion is completely encapsulated by a fibrous capsule.

In addition to osteomyelitis occurring as the result of systemic spread of pyogenic bacteria (pyaemia), the condition can also arise as a result of local haematogenous and/or lymphatic spread. The best known examples of these occur in connection with tail bite in pigs and "lumpy jaw" in cattle. In pigs with tail bite, the bacteria will typically be transported via the lymphatic system to the sacral lymph nodes in the pelvic cavity, from where there is a possibility for retrograde spread to the bones of the tail and pelvis, and to the os sacrum. Similarly, if bacteria are present in the venous blood from the tail region and in the afferent tail lymph vessels, retrograde spread is possible to the bones that they pass in the cranial direction. This is the reason why concomitant presence of osteomyelitis up to and including the os sacrum, including infections localised in the

sacral joint, and tail bite lesions is most probably the result of local haematogenous/lymphatic spread. At meat inspection, scoring in these cases necessitates partial condemnation, whereby the entire "pelvic region en bloc" is rejected.

Lumpy jaw in cattle is as a rule also due to local spread of *Actinomyces bovis*. In these cases, the bacteria spread lymphatically from small ulcers in the buccal cavity to the medullary cavity in the mandibles, where a characteristic progressive chronic pyogranulomatous osteomyelitis develops. As with other locally spread infections, local spread to the bone marrow necessitates partial condemnation.

Infections in the bone marrow may also occur through direct invasion. These invading osteomyelites are typically seen in deep skin and hoof lesions. Furthermore, purulent arthritis, if there is complete ulceration of the joint cartilage, can secondarily cause direct invasion of the epiphyseal medullary cavity. Lumpy jaw in cattle can also, in addition to resulting from local spread, occur by direct invasion from the buccal cavity. This is seen particularly if the infection spreads along loose teeth. At meat inspection, invasive osteomyelitis follows the general rules for local infections, which necessitate partial condemnation.

There are several common characteristics in osteomyelitis, regardless of the route of infection. In the chronic stages there is often periostal new bone formation around the infection site, and frequently there is fistulation rupture to the external or internal surfaces (e.g. skin surface at infection in the sternebrae or the distal ulnal metaphysis). From abscesses located in the thoracic and lumbar vertebrae, for example, there is often fistulation to the thoracic cavity or abdominal cavity, typically resulting in "secondary dissecting abscesses". When the primary focus is in the lumbar vertebrae in pigs, and particularly in sows, these secondary dissecting abscesses typically localise in the psoas muscle ("psoas abscesses"). From the vertebrae, fistulas can also open into the vertebral canal, potentially causing pressure on the spinal cord with subsequent paralysis. Fistulation to the spinal canal can also result in development of purulent meningitis. Because all osteomyelites are associated with lysis of the original bone tissue, all cases of osteomyelitis are a risk for developing secondary fractures (pathologic fractures). These are judged in accordance with the rules for infected fractures. Local spread to the surroundings can also be a sequela of osteomyelitis; this can be seen for example at erosion of the epiphyseal cartilage complex, by which the joint cavity can become infected giving rise to secondary arthritis.

Bone pigmentation [14.64 – 14.65]

In porphyria, porphyrin precursors (intermediate compounds in porphyrin synthesis) accumulate in teeth and bones, causing them to be reddish-brown. This is often an inherited condition in which enzyme defects result in non-formation of porphyrins, which are made up of 4 pyrrole rings. Because of the circulation of the photodynamic porphyrin precursors, affected animals will in addition to anaemia, also often develop secondary photosensitiation (see Chapter 16).

Rapidly growing animals treated with tetracyclines can acquire yellowish discolouration of teeth and bones.

Melanin can be seen in bones in the form of periostal melanosis, and at metastasis of melanocarcinomas. If melanosis maculosa occurs in other organs (e.g. lungs and liver), the animal must always be longitudinally split and the spinal area inspected for the presence of pigment deposits. At meat inspection, the presence of pigment deposits in bones always necessitates partial condemnation. Extensive distribution (as in porphyria) necessitates rejection of all bones (approved for deboning).

Melanocarcinomas can metastasise to all organs, including the skeletal system. At meat inspection, the presence of melanocarcinomas follows the general rules for malignant neoplasms, i.e. total condemnation.

Metabolic diseases [14.66 – 14.69]

Metabolic diseases of the skeletal system are relatively uncommon in livestock. Rachitis and osteomalacia, which are seen in growing and adult animals, respectively, is most often due to lack of vitamin D and/or insufficient phosphorous in feed. In rare cases, rachitis/osteomalacia may also be due to renal disease. In the growing animal, rachitis manifests as swollen epiphyses (all limb bones and the costochondral transition ("rachitic rosary")), because normal endochondral ossification does not occur in the growth zone. In both adult and growing animals, the bones appear soft due to lack of mineralisation during remodelling. The lack of mineralisation means that the affected animals often have deformed bones, collapse of joints and fractures. Osteomalacia is often accompanied by tendon rupture, particularly in cattle. This applies particularly to rupture of the Achilles tendon. Rachitis/osteomalacia is often accompanied by failure to thrive, emaciation, lowered resistance to infectious diseases (e.g. pneumonias), arthroses, and decubital lesions. If lack of vitamin D is pronounced, a hypocalcaemic condition may also occur in which a primary rachitis/osteomalacia could progress to osteodystrophia fibrosa. In osteodystrophia fibrosa there is formation of connective tissue in parallel with demineralisation of the bones. This phenomenon typically affects the bones of the head (mandibles and maxillae). Connective tissue formation contributes to thickening of the bones; deformations for example of the ribs; secondary fractures; and joint collapse. Because increased secretion of parathyroid hormone is central to development of osteodystrophia fibrosa, conditions other than secondary hypocalcaemia can also trigger the disease. This includes, for example, inadequate supply of calcium, excessive supply of phosphorous, renal diseases accompanied by deficient phosphorous excretion; deficient formation of active vitamin D (1, 25-dihydroxyvitamin D); and primary conditions in the parathyroid glands (hyperplasia and neoplasms). Deformation of the jaw bones means that the affected animals will often become emaciated, because they cannot chew and take up feed in sufficient quantities. The impaired ability to chew also means that the affected animals are susceptible to complications such as aspiration pneumonia. Conversely, increased bone formation can be seen with excessive supply of vitamin D.

At meat inspection, affected skeletal parts in the absence of complications are subject to partial condemnation (where the condition is systemic, approval for deboning is generally most appropriate). However, cases with complications such as emaciation necessitate total condemnation.

Arthritis [14.70 – 14.85]

Inflammation in joints are often infectious (septic). Aseptic arthritis typically occurs in connection with trauma to a joint (luxations and distortions), but also frequently secondary to arthroses. Aseptic arthritis can, in rare cases, also develop due to precipitation of immune complexes in the synovial membrane. Classic examples of aseptic arthritis secondary to arthroses in horses are "spavin" (chronic arthrosis in the tarsal joints) and "ring bone" (pastern and fetlock joint arthrosis with exostoses). Aseptic joint inflammation only has local significance and therefore necessitate partial condemnation.

If infectious arthritis is present, meat inspection must differentiate between acute and chronic cases, because acute cases always necessitate total condemnation. Chronic cases necessitate partial condemnation with rejection of the affected joints and associated lymph nodes, as a minimum. For cases of chronic arthritis in several joints, the most appropriate judgement is approval of the animal for deboning with rejection of all joints. Acute arthritis present with typical cardinal signs of inflammation in the synovial membrane, and the animal will often be found to be significantly lame at ante-mortem inspection. Intraarticular inflammation will always, to some extent, be accompanied by a periarticular reaction in the form of oedema, perhaps associated with cellulitis in the acute phase. Furthermore, the acutely inflamed joint will always contain increased amounts of synovial fluid possibly mixed with exudate (serous exudate, pus, fibrin or a mixture of these). However, it is important to note that the synovial fluid of normal joints, particularly in cattle, often contains small fibrin and fat plaques. Such aseptic fibrin plaques are seen particularly in cattle which have been transported and/or standing for a long period. Occasionally, aseptic arthritis with exudation of fibrin to the joint cavity (particularly in the tarsal joints) is seen in cattle with chronic purulent endometritis and mastitis. This phenomenon, which is clinically recognised as "Stockfleth's laminitis", is probably mediated via localisation of immune complexes in the synovial membrane, which via complement activation initiates the inflammatory reaction.

Joint infections resulting from penetrating wounds typically develop into purulent or necrotic arthritis. In the chronic stage of infectious serous and fibrinous arthritis, a typically proliferative condition appears in the synovial membrane occasionally together with a presentation of an opaque, serous and/or haemorrhagic exudate. This hyperplasia is often particularly pronounced in pigs infected with *Erysipelothrix rhusiopathiae*; the bright red proliferating synovial villi assume a paddle-shape and can be up to several centimeters long. In the chronic stage of joint infections caused by *Mycoplasma hyorhinis* and *M. hyosynoviae,* which also occurs frequently in pigs, hyperplasia of the synovial membrane is not as pronounced, and the membrane assumes a golden-brown colour due to accumulation of iron. Erosion and possibly ulceration of the joint cartilage occurs only rarely in chronic proliferative arthritis, and then only in the late stage. In contrast, purulent arthritis associated joint cartilage lesions are seen very frequently, because the enzymes released as part of the purulent inflammation break down the cartilage with subsequent development of secondary arthrosis. In all cases of chronic arthritis there is a risk for periarticular lesions in the form of fibrosis and new bone formation, often quite extensively. Similarly, destruction of the joint cartilage may cause intraarticular

fibrosis with fusion of the joint. Both the periarticular and the intraarticular fibrosis may cause joint stiffness (ankylosis).

Arthrosis [14.86 – 14.95]

Non-inflammatory cartilage injury occurs particularly in pigs, and occasionally in cattle. Such injuries which are covered by the umbrella term "arthrosis", can have many causes. In finisher pigs, arthroses in the form of cartilage thickening, cartilage deformation, and dissecting rupture of the cartilage are often expressions of the presence of osteochondrosis (dyschondroplasia). This condition is also known to occur in calves and foals. Arthrosis in older animals on the other hand is often due to joint instability, wear, trauma, or lack of joint lubrication. As with primary arthritis, a number of conditions can develop as a result of arthrosis such as cartilage ulceration with exposure of the subchondral bone tissue, intraarticular and periarticular osteophyte formation, and secondary hyperplastic synovitis. At meat inspection, arthrosis necessitates partial condemnation. It must be noted that a certain knowledge of arthrosis morphology is important in forensic cases and at differential diagnosis of erosive and ulcerative arthritis. In this regard, attention must thus be drawn to the presence of synovial pits (synovial grooves), which can easily be confused with arthrotic lesions. These are normally occurring cartilage-free pits on the surface of the joints. Fully-formed pits are covered by connective tissue, and often stretch down into the subchondral bone tissue. There is some variation in pit development, location, shape, and extent in the individual joints, but they always occur with a high degree of symmetry.

Tendovaginitis [14.96 – 14.97]

As with arthritis, tendovaginitis can be either infectious or non-infectious (aseptic). Very often, infectious arthritis and infectious tendovaginitis will occur simultaneously, because both localisations are due to primary synovitis. The reaction in infectious tendovaginitis also parallels arthritis with regard to the synovial reaction (oedema, hyperaemia, and hyperplasia) and exudate type (fibrinous – serofibrinous – purulent), which reflects the aetiology. The healing process for infectious tendovaginitis is also the same as that for infectious arthritis. At meat inspection, scoring of arthritis and tendovaginitis is therefore similar. In chronic purulent tendovaginitis there is often fibrous adhesion between the tendon sheath and the tendon.

As with aseptic arthritis, aseptic tendovaginitis also occurs most frequently in cattle. In "Stockfleth's laminitis", the tendovaginal reaction is typically seen at the same time around the deep flexor tendons on all four limbs.

Luxations and distortions [14.98 – 14.99]

Joint displacement (luxations), dislocations (subluxations), and distorsions will generally only have local significance at meat inspection. In the acute stage, luxations which can be total or partial will present with varying degrees of haemorrhage and laceration in

the periarticular tissue. Chronic cases often present with a certain degree of arthrotic changes in the joint cartilage, secondary arthritis, and periarticular fibrosis with subsequent thickening of the joint capsule. Similar lesions may also occur in chronic distortions; however, the lesions at luxation will be more pronounced.

For forensic purposes, it is essential to be able to differentiate between luxations and distortions occurring in connection with shackling up prior to bleeding, and other incidents. It is also important to be aware that luxations and distortions can occur during transport to slaughter. Particularly in pigs the ligament of the head of the femur and also partially the joint capsule of the hip joint can rupture in connection with shackling up. Thus the joint cavity and to varying extents the periarticular soft tissues will be the site of acute haemorrhage.

Luxations and distortions that have caused intraarticular and/or periarticular lesions (haemorrhage, oedema, laceration, arthrotic lesions, and fibrosis) necessitate partial condemnation of the affected areas.

Neoplasms and bone proliferation [14.100 – 14.110]

In slaughter animals, neoplasms localised to the skeletal system are quite rare. Fibromas with ossification can occur in the maxillary bones in horses and cattle. They manifest as large nodules with varying degrees of mineralisation. Even though the lesions are destructive, these are benign neoplasms, which necessitate partial condemnation. Neoplasms of chondroid (chondromas) or osteogenic (osteomas) originating in the flat bones of the cranium are seen rarely. These neoplasms are benign, slow growing, and never give rise to metastases. Chondromas can cause thinning of underlying bone tissue. Malignant neoplasms such as chondrosarcomas and osteosarcomas are seen very rarely in slaughter animals. If present, they will typically proliferate destructively and metastasise. The destructive growth may cause secondary fractures, which can also be seen at the site of secondary neoplasms (metastases) in the skeletal system. Chondrosarcomas occur, even though very rarely, in the ribs and sternum in sheep. Malignant neoplasms (both primary and secondary) in the skeletal system necessitate, as do all other malignant neoplasms, total condemnation.

Non-neoplastic bone proliferation is regularly seen on bone surfaces. When the new bone is nodular it is called exostoses or osteophytes. If the formations are localised to the attachment of tendons and ligaments, they are called enthesophytes. A further characteristic is the visible bone proliferation at the surface of bones in connection with fracture healing, chronic arthritis and arthrosis (bone surfaces adjacent to joints), and in chronic osteomyelitis. At meat inspection, judgement of non-neoplastic bone proliferation is based on the primary cause, but the new formations themselves must always be rejected.

14.01



Animal species/Organ	Cattle/Distal part of the foreleg
Lesion	Supernumerary toes (polydactyly)
Scoring	Partial condemnation
Comments	Polydactyly is a relatively rare congenital defect

14.02



Animal species/Organ	Cattle/Distal part of the foreleg
Lesion	Toe is absent (adactyly)
Scoring	Partial condemnation
Comments	Rarely occurring congenital defect

14.03



Animal species/Organ	Cattle/Thoracic vertebrae
Lesion	Bone cyst
Scoring	Partial condemnation
Comments	Cysts in bones can be congenital or acquired

14.04



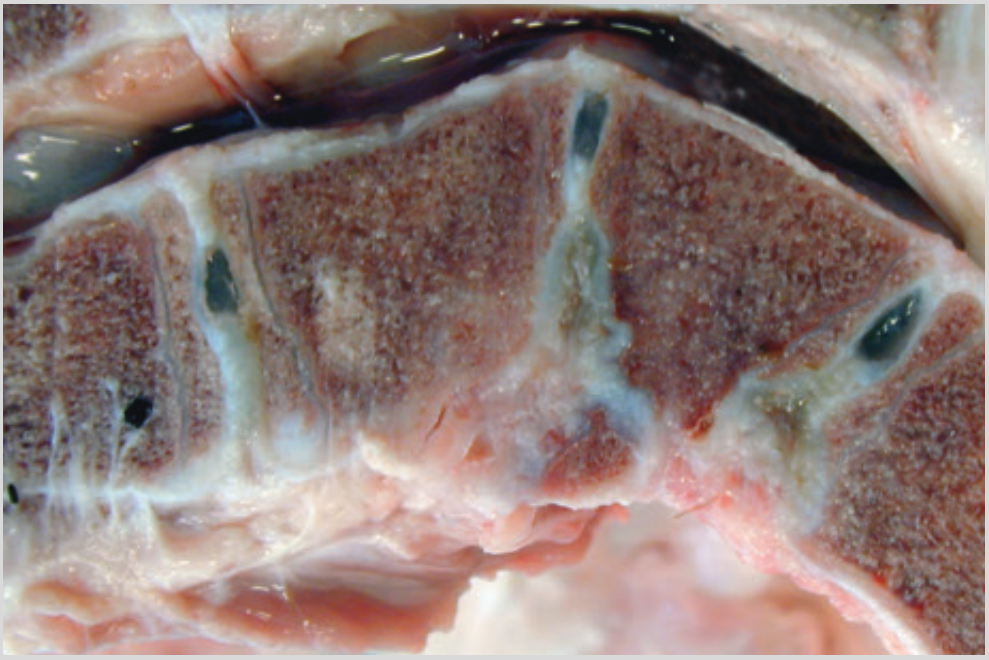
Animal species/Organ	Cattle/Thoracic vertebrae (close-up of 14.03)
Lesion	Bone cyst
Scoring	Partial condemnation
Comments	Cysts in bones can have many origins

14.05



Animal species/Organ	Cattle/Buccal cavity
Lesion	Cleft palate (palatoschisis)
Scoring	Partial condemnation
Comments	Cleft palate occurs relatively frequently in calves

14.06



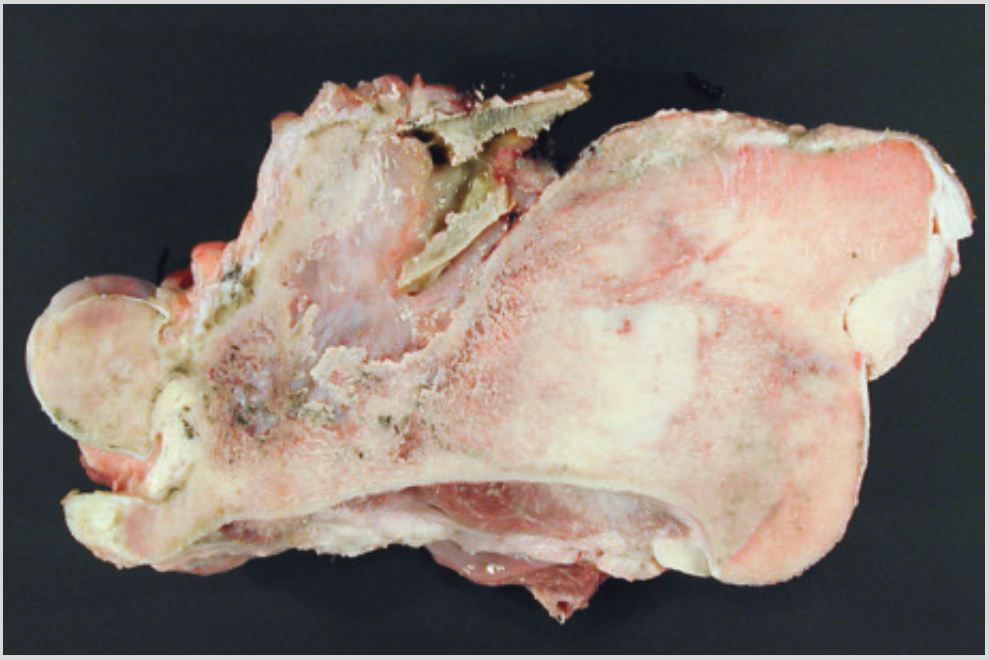
Animal species/Organ	Pig/Thoracic vertebrae
Lesion	Hunchback (kyphosis) due to formation of hemivertebrae
Scoring	Partial condemnation
Comments	The condition occurs relatively frequently in pigs

14.07



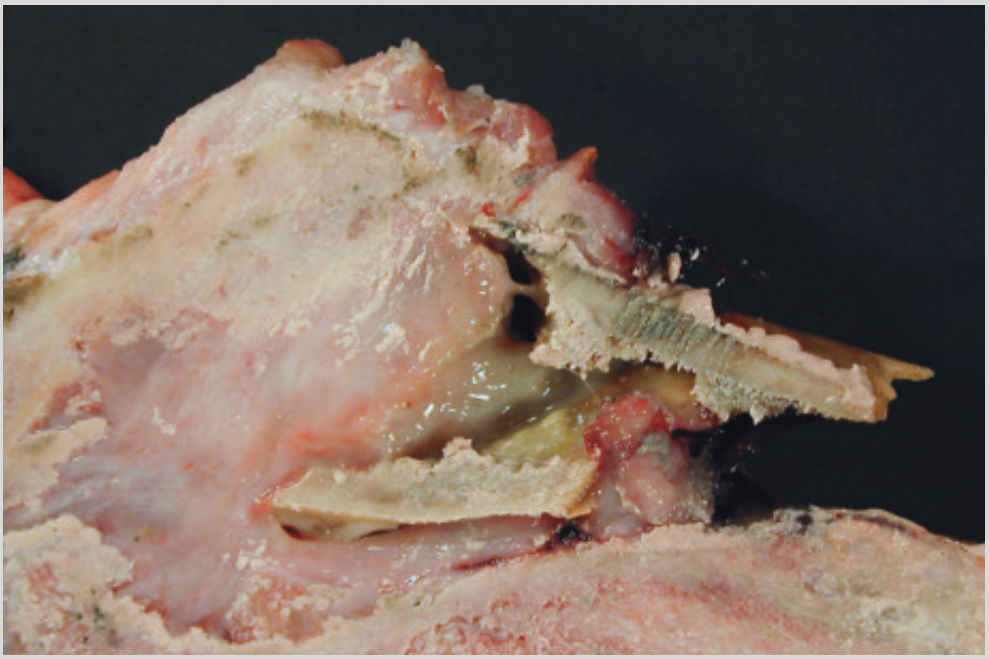
Animal species/Organ	Cattle/Humerus
Lesion	Open, chronic, comminuted fracture
Scoring	Total condemnation
Comments	Any suspected breach of the Animal Welfare laws must be notified

14.08



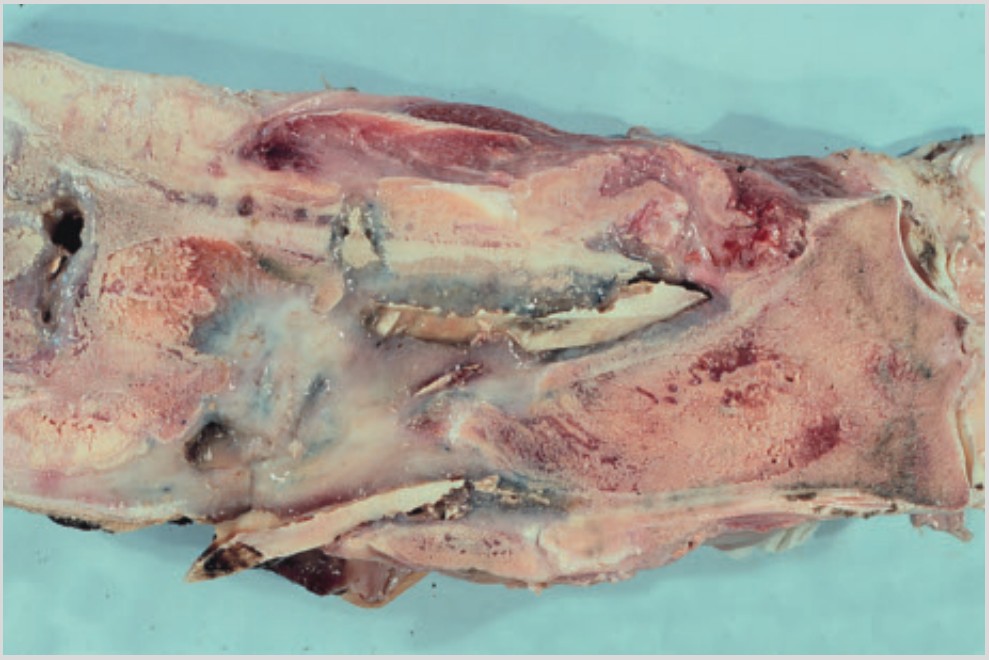
Animal species/Organ	Cattle/Humerus
Lesion	Open, infected, chronic, comminuted fracture
Scoring	Total condemnation
Comments	Any suspected breach of the Animal Welfare laws must be notified

14.09



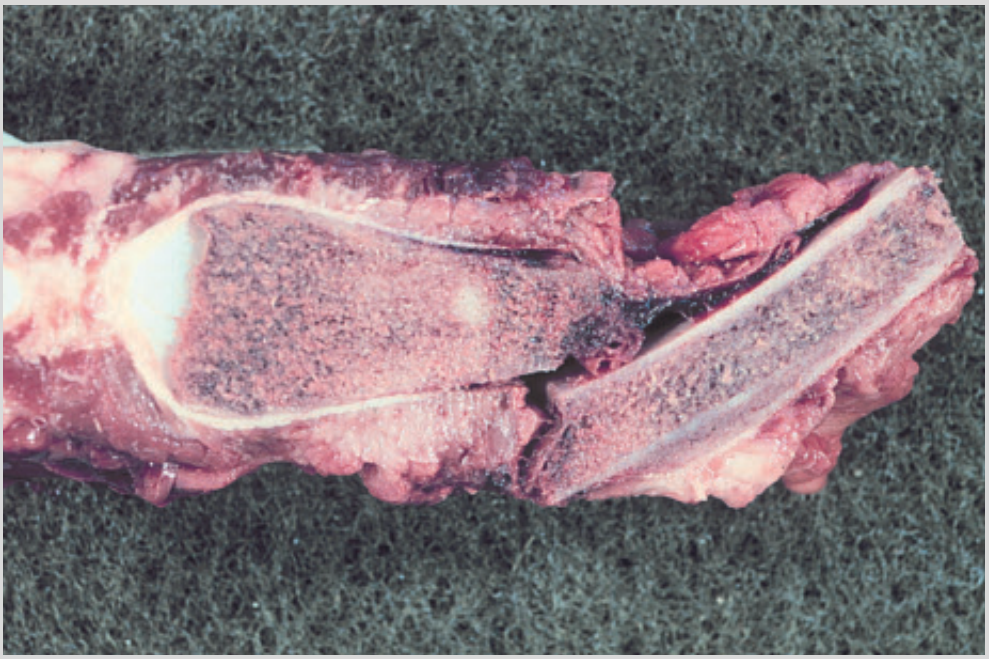
Animal species/Organ	Cattle/Humerus (close-up of 14.08)
Lesion	Open, infected, chronic, comminuted fracture
Scoring	Total condemnation
Comments	Any suspected breach of the Animal Welfare laws must be notified

14.10



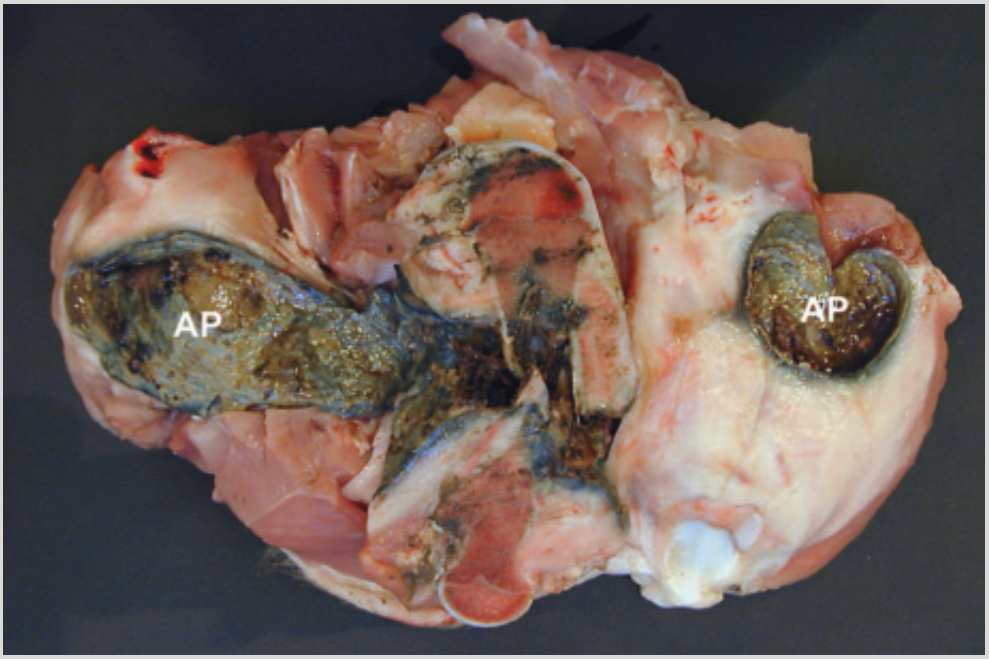
Animal species/Organ	Cattle/Tibia
Lesion	Open, infected, chronic, comminuted fracture
Scoring	Total condemnation
Comments	Any suspected breach of the Animal Welfare laws must be notified

14.11



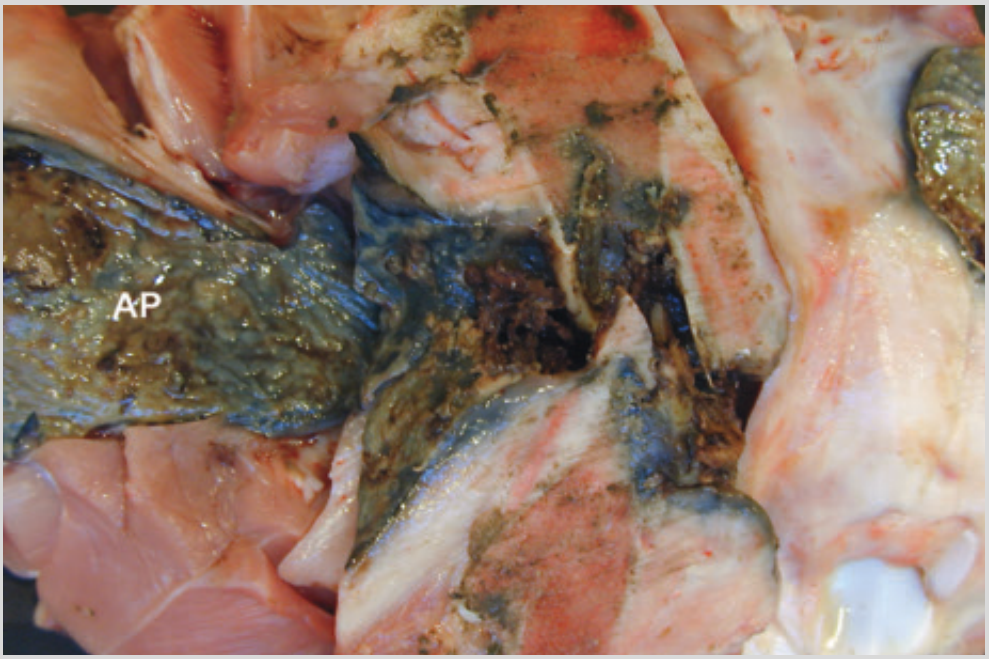
Animal species/Organ	Cattle/Rib
Lesion	Acute, complete transverse fracture
Scoring	Partial condemnation
Comments	Note haemorrhage around the fracture site

14.12



Animal species/Organ	Pig/Femur
Lesion	Chronic, infected, comminuted fracture with peripheral abscess formation (AP)
Scoring	Approved for deboning
Comments	Non-encapsulated, infected fractures necessitate total condemnation

14.13



Animal species/Organ	Pig/Femur (close-up of 14.12)
Lesion	Chronic, infected, comminuted fracture with peripheral abscess formation (AP)
Scoring	Approved for deboning
Comments	Non-encapsulated, infected fractures necessitate total condemnation

14.14



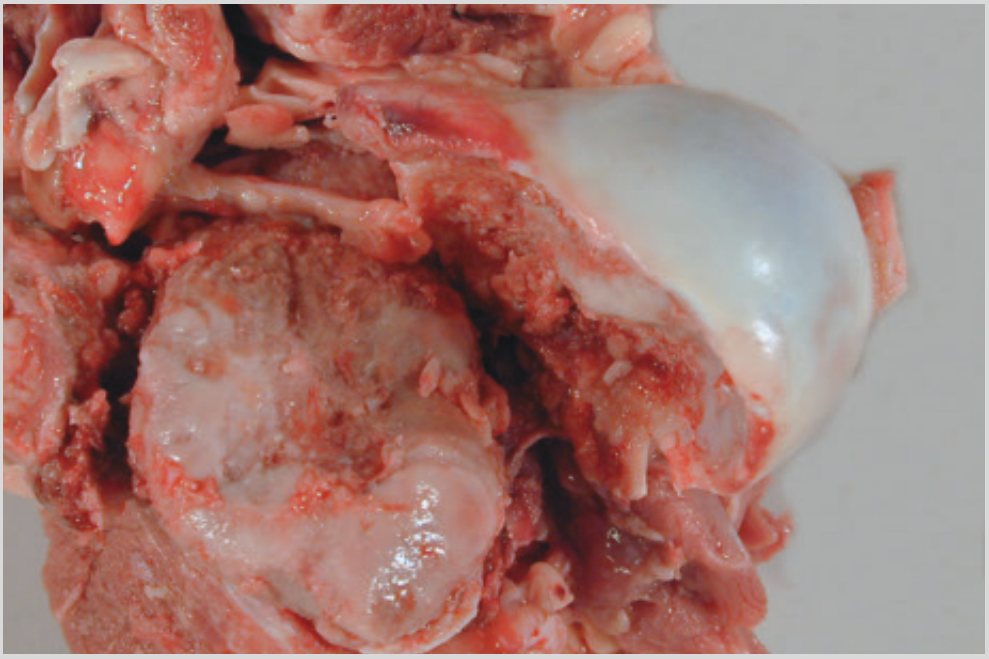
Animal species/Organ	Pig/Entire animal
Lesion	Sitting in the "dog-sitting posture"
Scoring	Follows the primary condition
Comments	This posture is seen in proximal femoral epiphysiolysis and muscle injury

14.15



Animal species/Organ	Pig/Hip joint
Lesion	Chronic, proximal femoral epiphysiolysis
Scoring	Partial condemnation
Comments	Occurs typically secondary to disturbed endochondral ossification

14.16



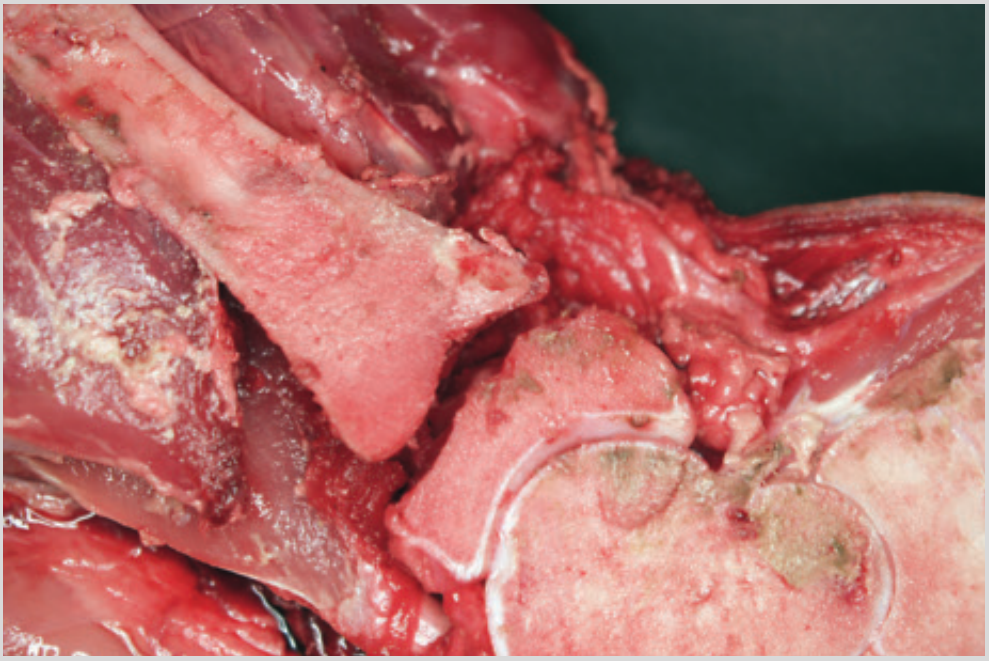
Animal species/Organ	Pig/Proximal part of femur
Lesion	Chronic, proximal femoral epiphysiolysis
Scoring	Partial condemnation
Comments	Occurs typically secondary to disturbed endochondral ossification

14.17



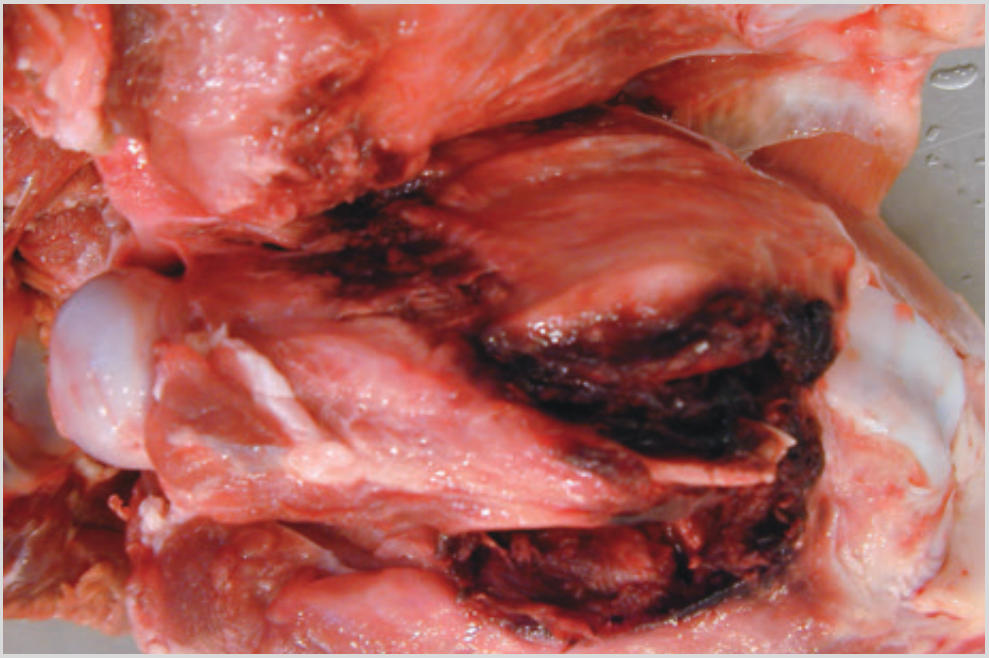
Animal species/Organ	Pig/Vertebrae
Lesion	Acute epiphysiolysis
Scoring	Partial condemnation
Comments	The spinal vertebra is deformed

14.18



Animal species/Organ	Cattle/Tibia
Lesion	Acute epiphysiolysis of the distal epiphysis
Scoring	Partial condemnation
Comments	Occurs typically secondary to disturbed endochondral ossification

14.19



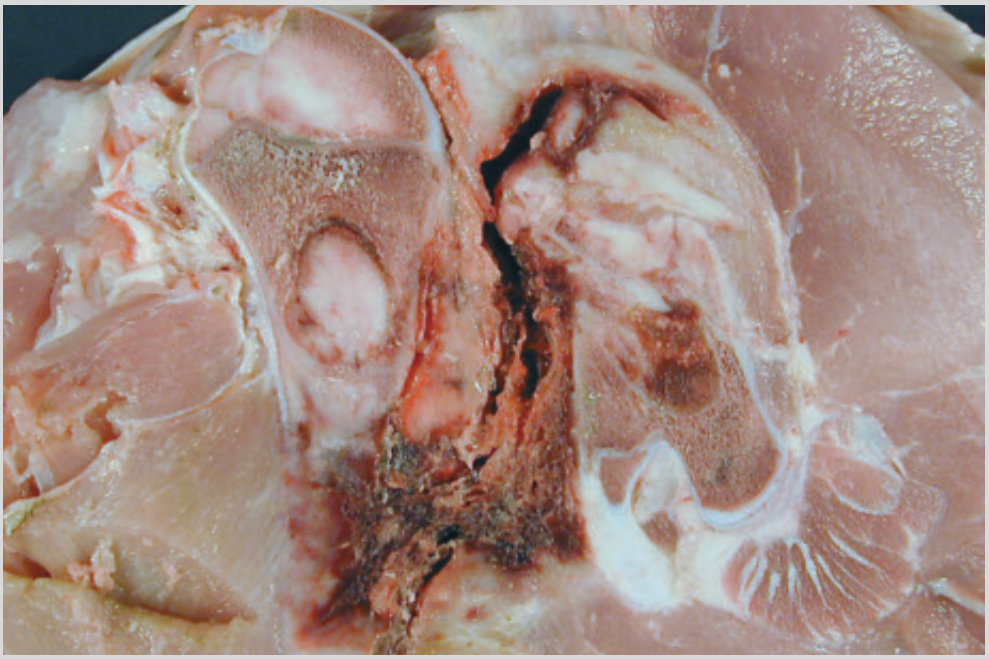
Animal species/Organ	Pig/Femur
Lesion	Chronic, complete fracture
Scoring	Partial condemnation
Comments	Note connective tissue growth around the fracture site

14.20



Animal species/Organ	Pig/Femur
Lesion	Chronic, complete fracture
Scoring	Partial condemnation
Comments	Newly-formed bone tissue (hard callus) is present between the bone parts

14.21



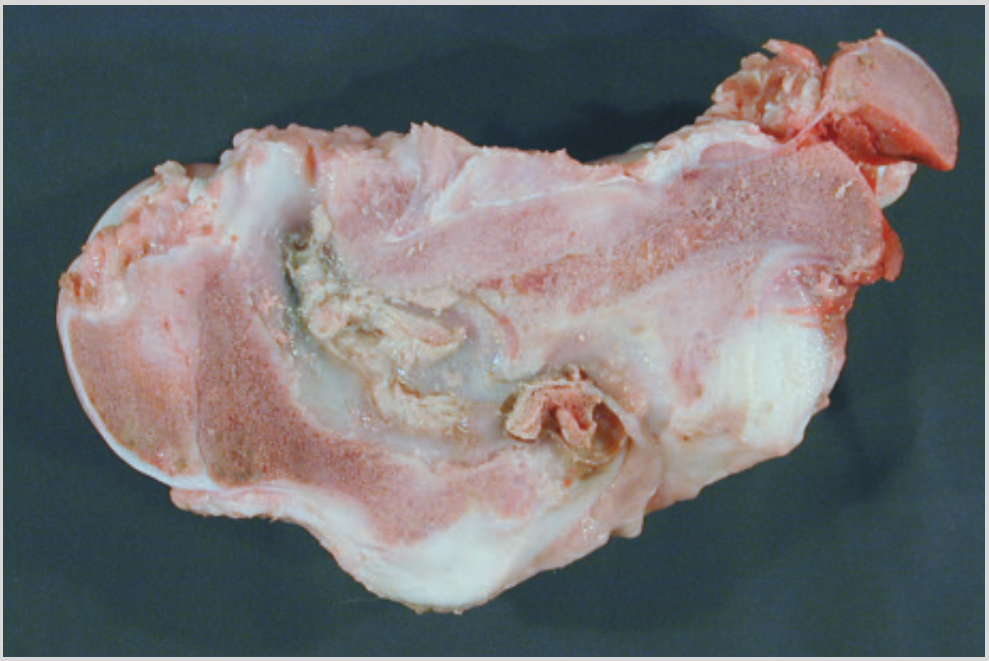
Animal species/Organ	Pig/Femur (detail of 14.20)
Lesion	Chronic, complete fracture
Scoring	Partial condemnation
Comments	Newly-formed bone tissue (hard callus) is present between the bone parts

14.22



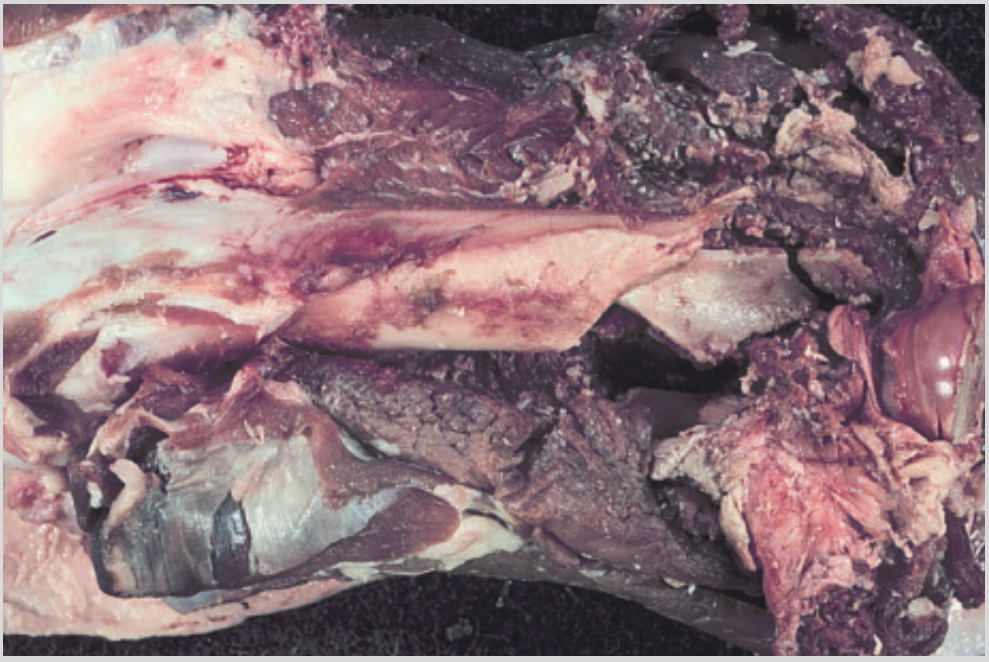
Animal species/Organ	Pig/Tibia
Lesion	Chronic, comminuted fracture
Scoring	Partial condemnation
Comments	Newly-formed fibrous tissue (soft callus) is present between the bone fragments

14.23



Animal species/Organ	Pig/Femur
Lesion	Chronic, complete fracture and purulent osteomyelitis
Scoring	Approved for deboning
Comments	Non-encapsulated osteomyelitic lesions necessitate total condemnation

14.24



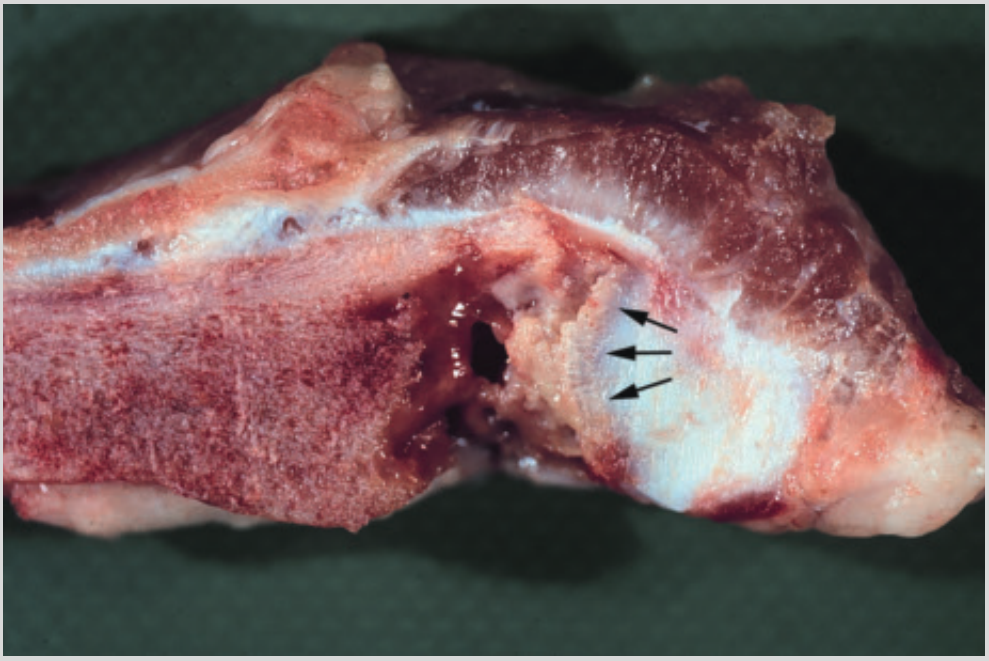
Animal species/Organ	Pig/Femur
Lesion	Comminuted fracture occurring post-mortem
Scoring	Partial condemnation
Comments	There is no haemorrhage at fracture sites occurring post-mortem

14.25



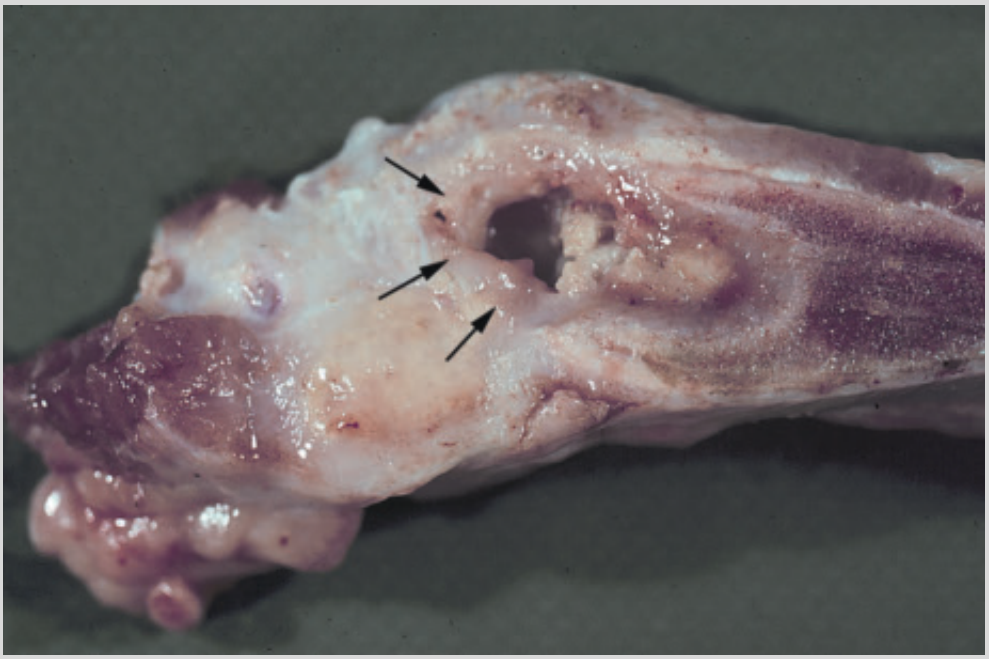
Animal species/Organ	Pig/Rib
Lesion	Chronic, purulent osteomyelitis (the lesion is not encapsulated towards the cartilage (→))
Scoring	Total condemnation
Comments	Approval could have been given for deboning if the lesion had been encapsulated

14.26



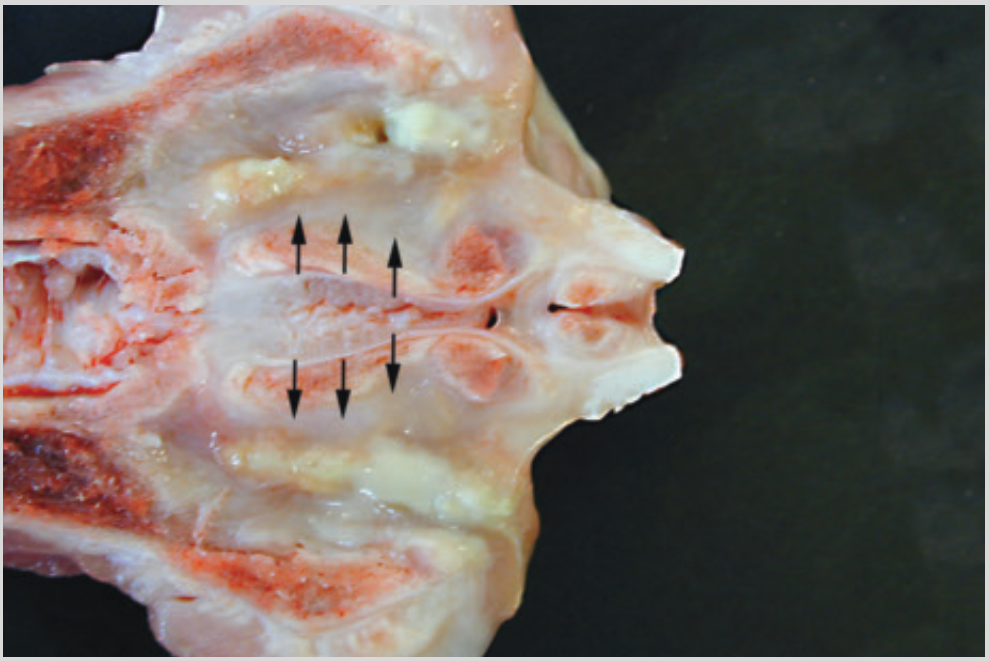
Animal species/Organ	Pig/Rib
Lesion	Chronic, purulent osteomyelitis (the lesion is not encapsulated towards the cartilage (→))
Scoring	Total condemnation
Comments	Approval could have been given for deboning if the lesion had been encapsulated

14.27



Animal species/Organ	Pig/Rib
Lesion	Chronic, purulent osteomyelitis (the lesion is encapsulated towards the cartilage (→))
Scoring	Approved for deboning
Comments	Findings of non-encapsulated lesions necessitate total condemnation

14.28



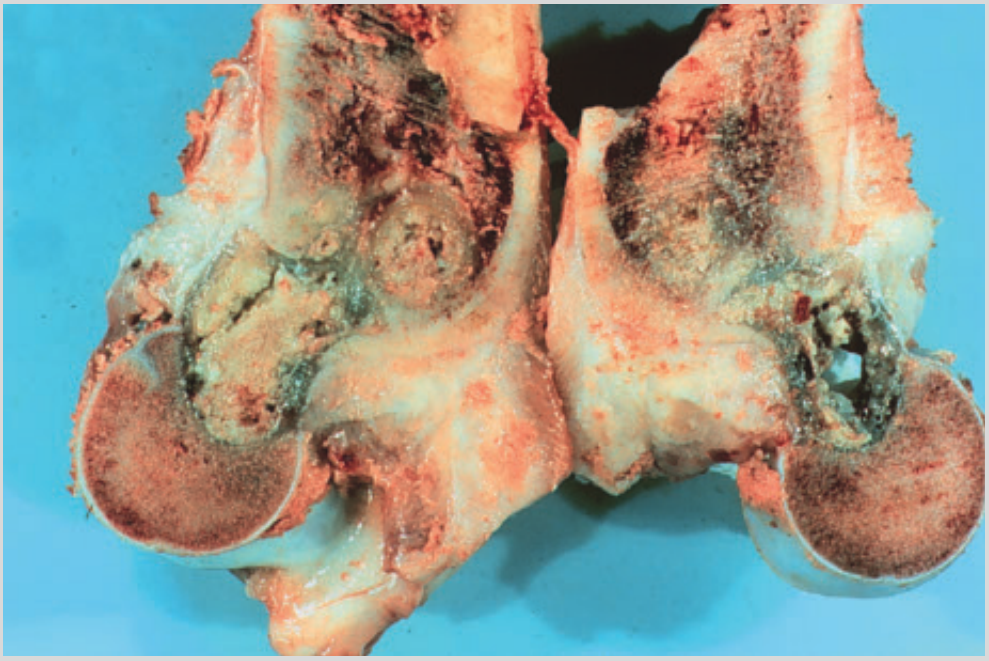
Animal species/Organ	Pig/Rib (sagittal split with presentation of both halves)
Lesion	Chronic, purulent osteomyelitis (the lesion is encapsulated towards the cartilage (→))
Scoring	Approved for deboning
Comments	Findings of non-encapsulated lesions necessitate total condemnation

14.29



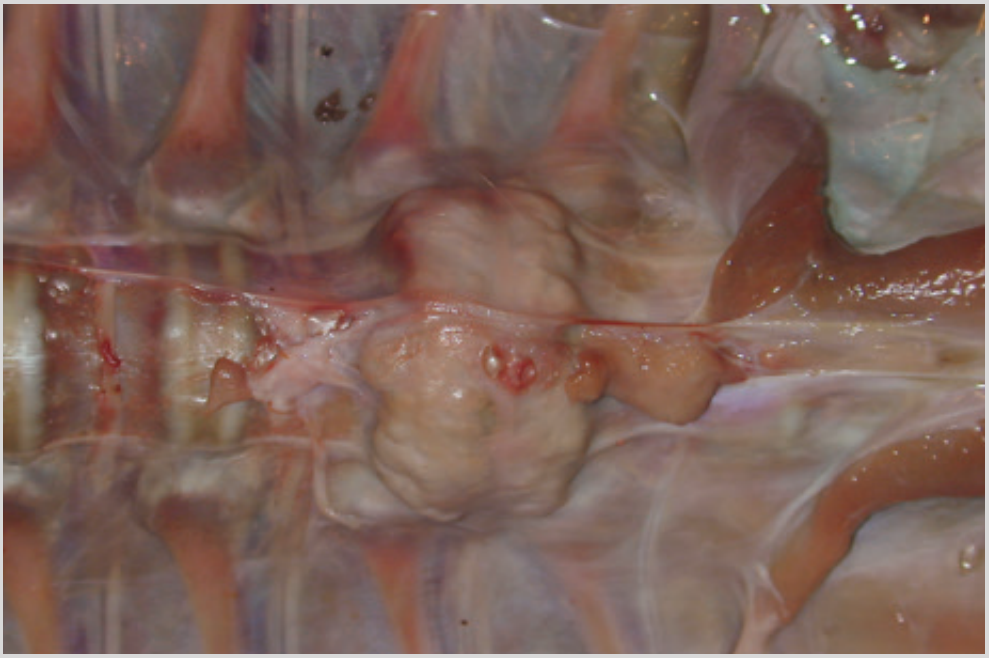
Animal species/Organ	Cattle/Rib
Lesion	Chronic, purulent osteomyelitis (the lesion is completely encapsulated)
Scoring	Approved for deboning
Comments	Findings of non-encapsulated lesions necessitate total condemnation

14.30



Animal species/Organ	Pig/Humerus
Lesion	Chronic, purulent, osteomylitis with sequestra formation (metaphysitis)
Scoring	Approved for deboning
Comments	Findings of non-encapsulated lesions necessitate total condemnation

14.31



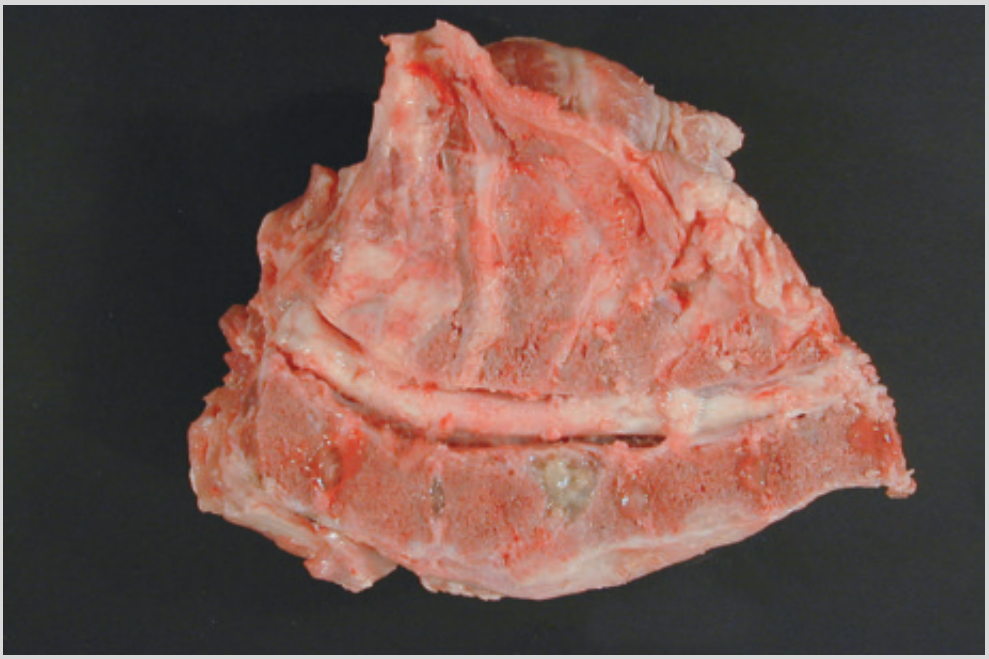
Animal species/Organ	Pig/Thoracic vertebrae (see 14.32)
Lesion	Chronic, purulent discospondylitis and spondylosis
Scoring	Approved for deboning
Comments	Any thickening of a bone must always be sawn through

14.32



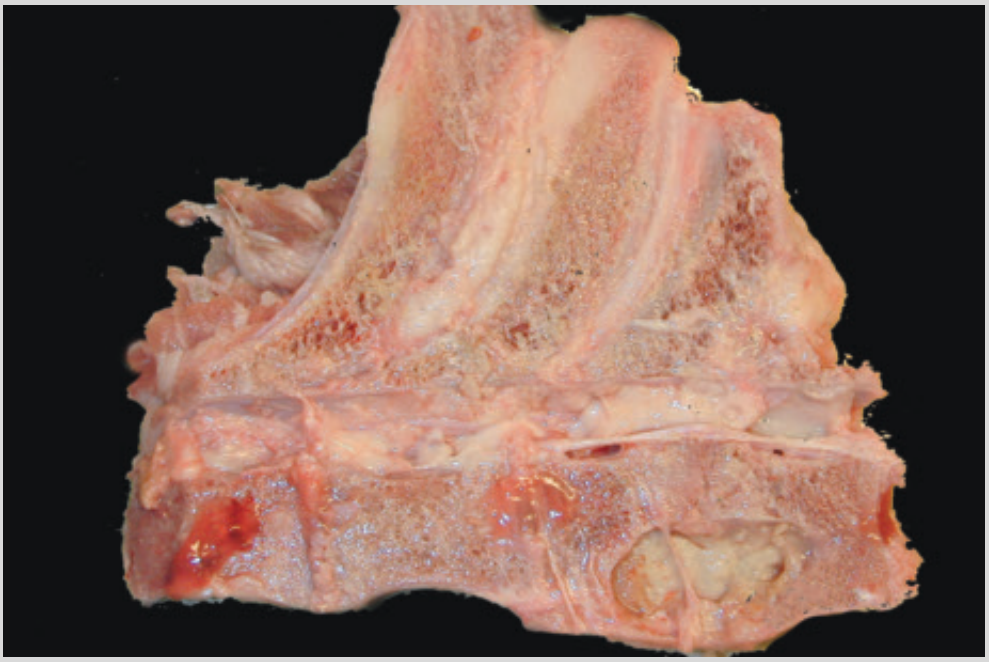
Animal species/Organ	Pig/Thoracic vertebrae (see 14.31)
Lesion	Chronic, purulent discospondylitis and spondylosis
Scoring	Approved for deboning
Comments	Any thickening of a bone must always be sawn through

14.33



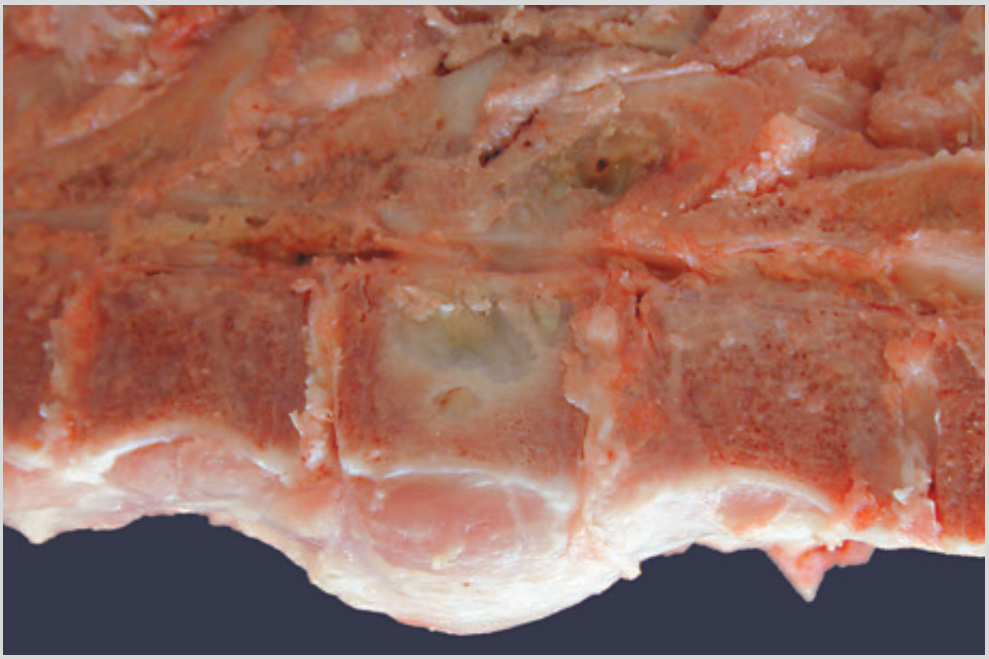
Animal species/Organ	Pig/Thoracic vertebrae
Lesion	Chronic, purulent osteomyelitis
Scoring	Approved for deboning
Comments	A non-encapsulated lesion necessitates total condemnation

14.34



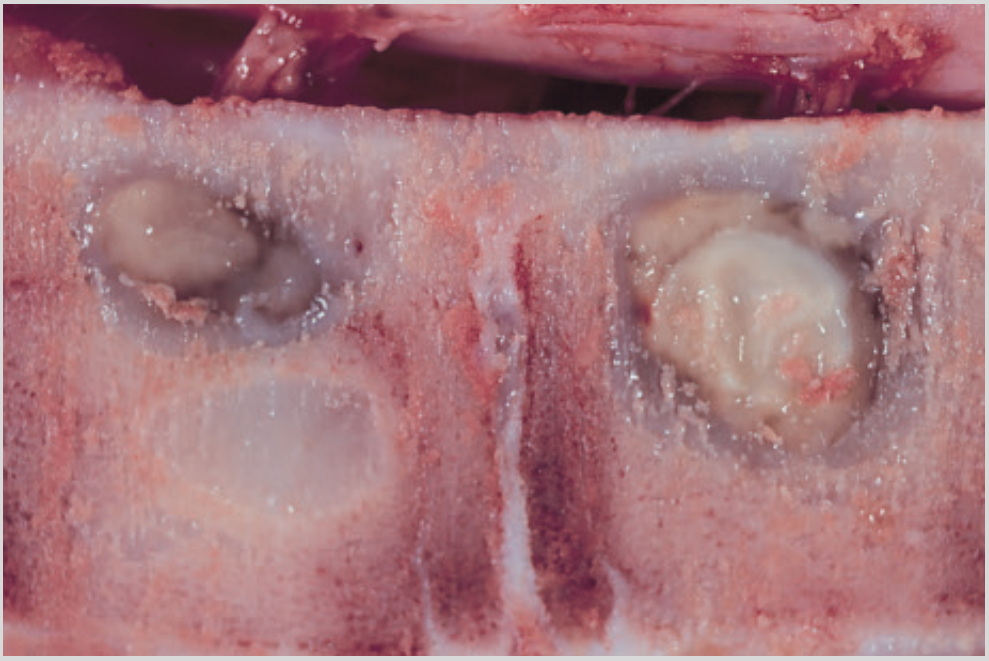
Animal species/Organ	Pig/Thoracic vertebrae
Lesion	Chronic, purulent osteomyelitis
Scoring	Approved for deboning
Comments	A non-encapsulated lesion necessitates total condemnation

14.35



Animal species/Organ	Pig/Vertebrae
Lesion	Chronic, purulent osteomyelitis with formation of a secondary dissecting abscess
Scoring	Approved for deboning
Comments	A non-encapsulated lesion necessitates total condemnation

14.36



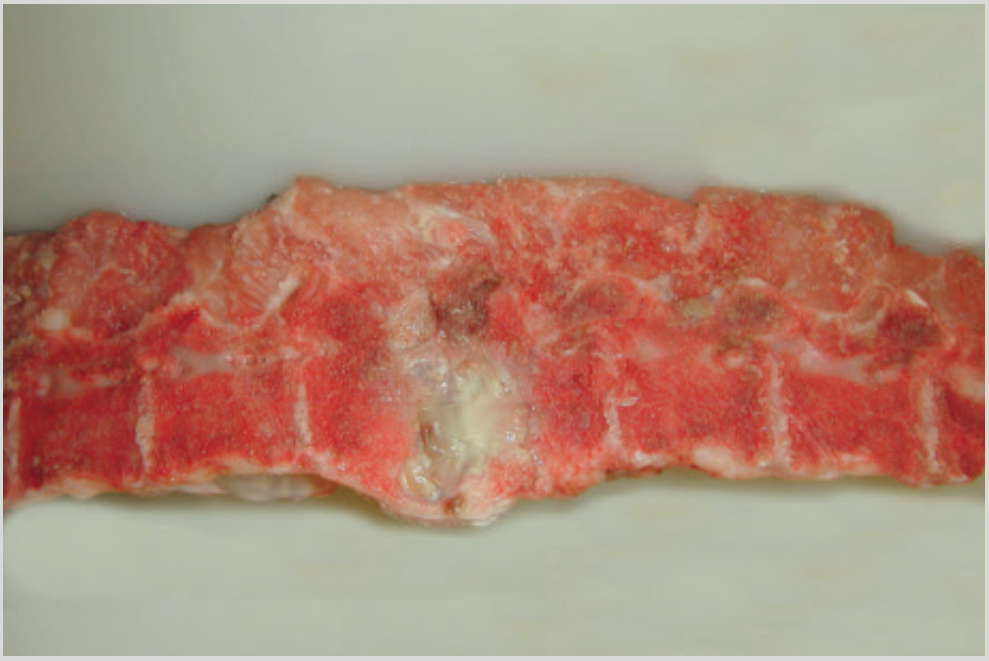
Animal species/Organ	Pig/Lumbar vertebrae
Lesion	Chronic, purulent osteomyelitis
Scoring	Approved for deboning
Comments	Non-encapsulated lesions necessitate total condemnation

14.37



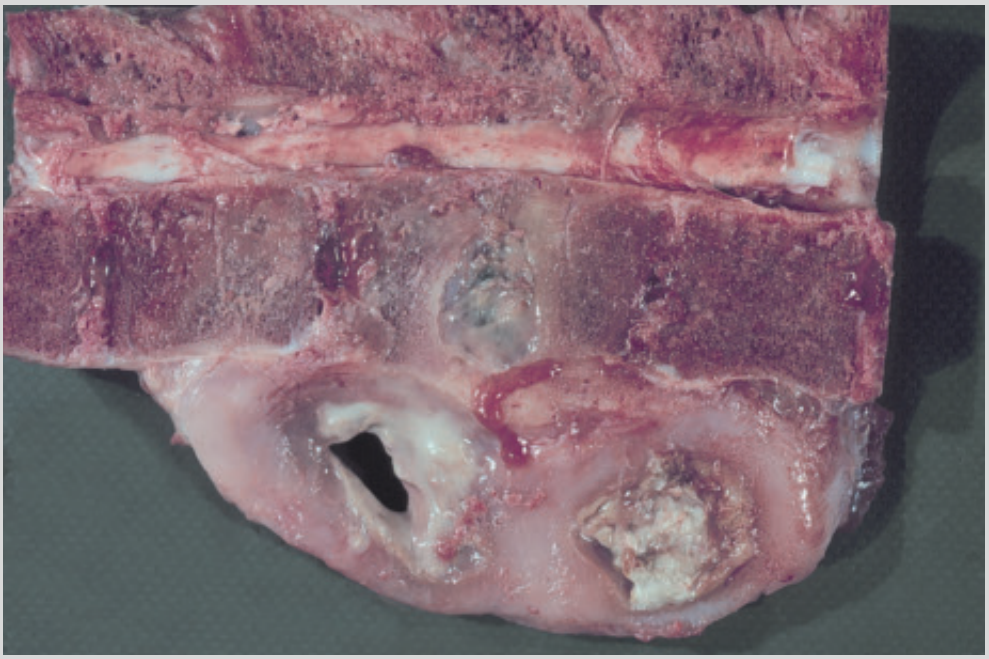
Animal species/Organ	Pig/Vertebrae
Lesion	Chronic, purulent discospondylitis and osteomylitis with sequestra formation
Scoring	Approved for deboning
Comments	A non-encapsulated lesion necessitates total condemnation

14.38



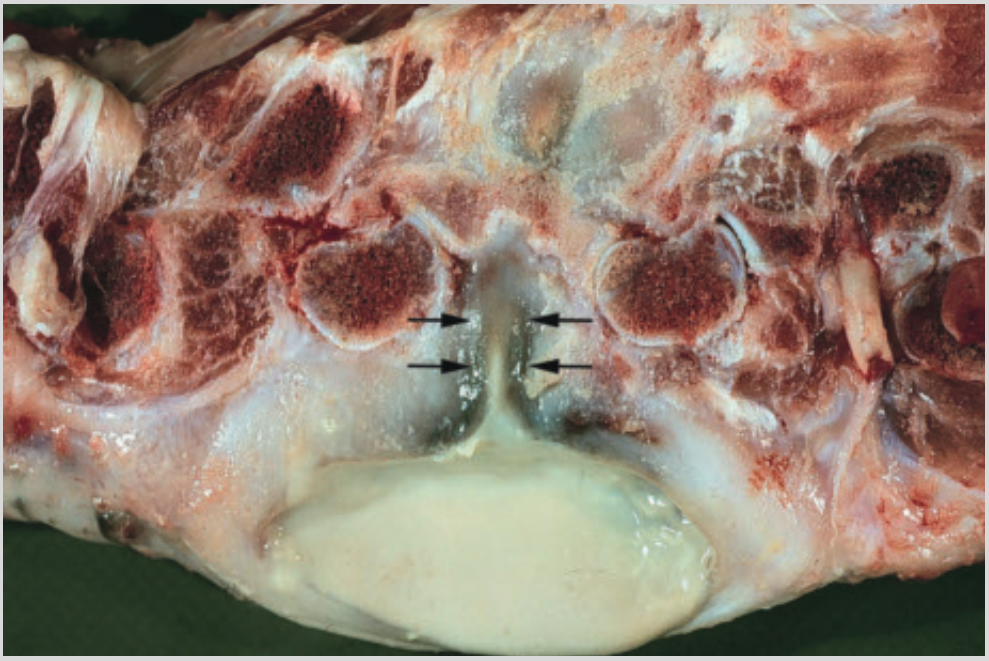
Animal species/Organ	Pig/Lumbar vertebrae
Lesion	Chronic, purulent discospondylitis and osteomyelitis
Scoring	Approved for deboning
Comments	A non-encapsulated lesion necessitates total condemnation

14.39



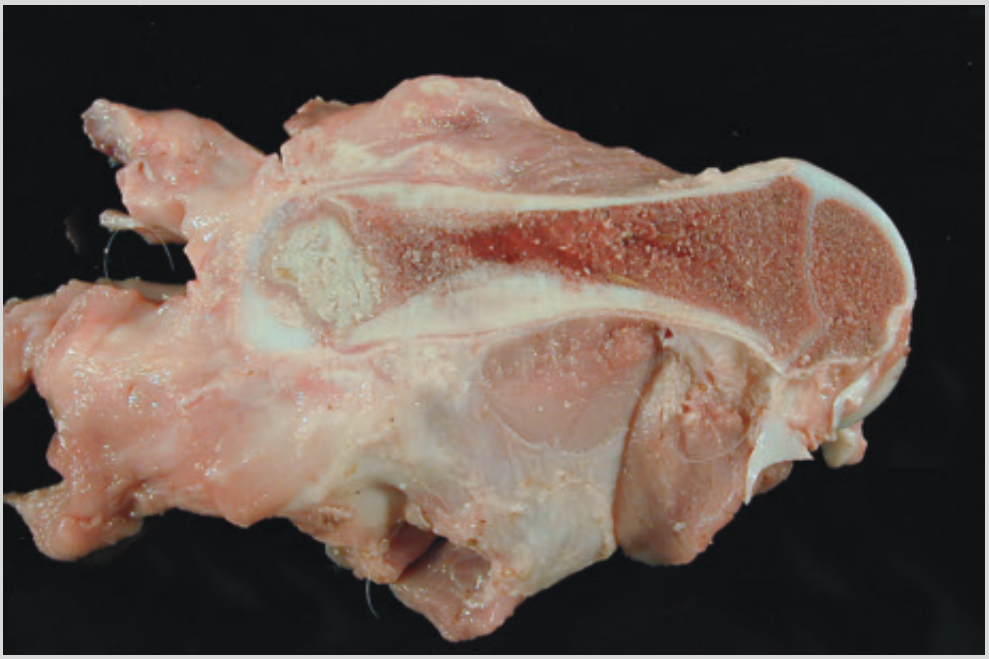
Animal species/Organ	Pig/Lumbar vertebrae
Lesion	Chronic, purulent discospondylitis with formation of secondary dissecting abscesses
Scoring	Approved for deboning
Comments	A non-encapsulated lesion necessitates total condemnation

14.40



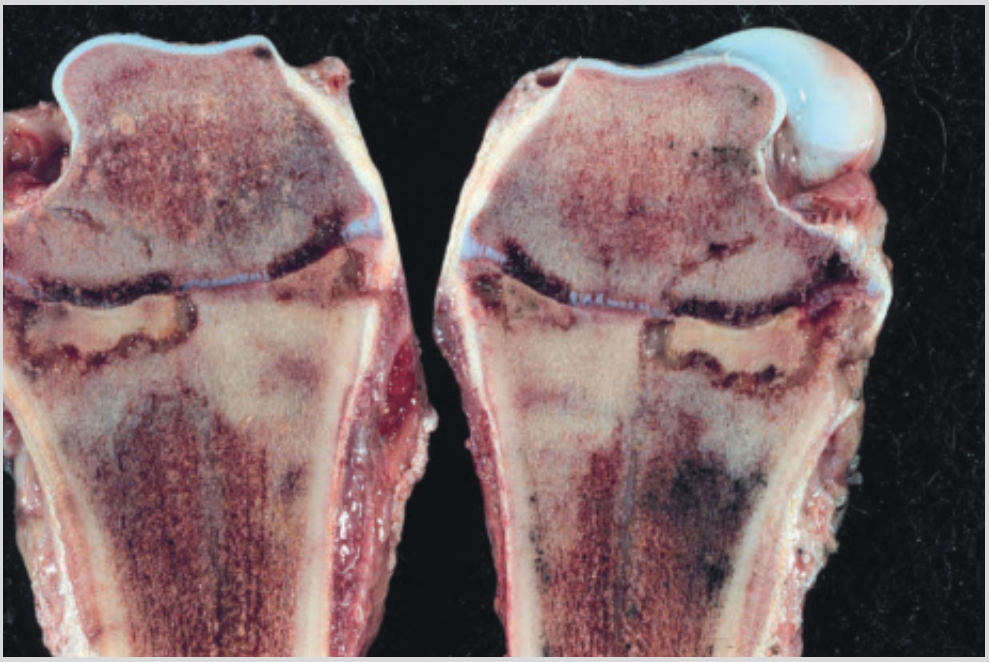
Animal species/Organ	Pig/Thoracic vertebrae (paramedial split)
Lesion	Chronic, purulent osteomyelitis with formation of a secondary dissecting abscess (tract (→))
Scoring	Approved for deboning
Comments	A non-encapsulated lesion necessitates total condemnation

14.41



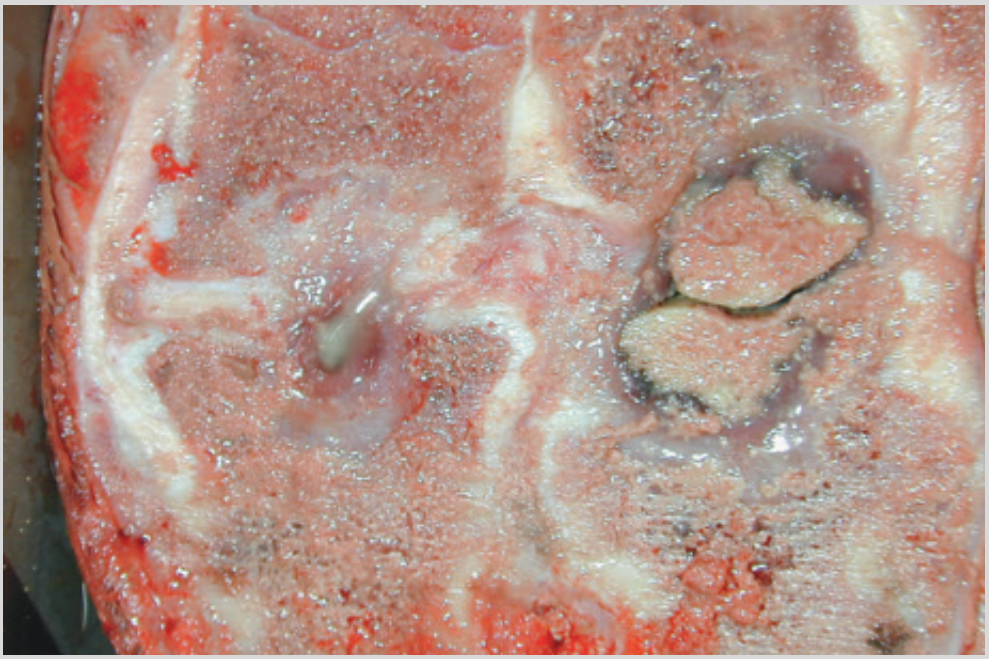
Animal species/Organ	Pig/Femur
Lesion	Chronic, purulent osteomyelitis
Scoring	Approved for deboning
Comments	A non-encapsulated lesion necessitates total condemnation

14.42



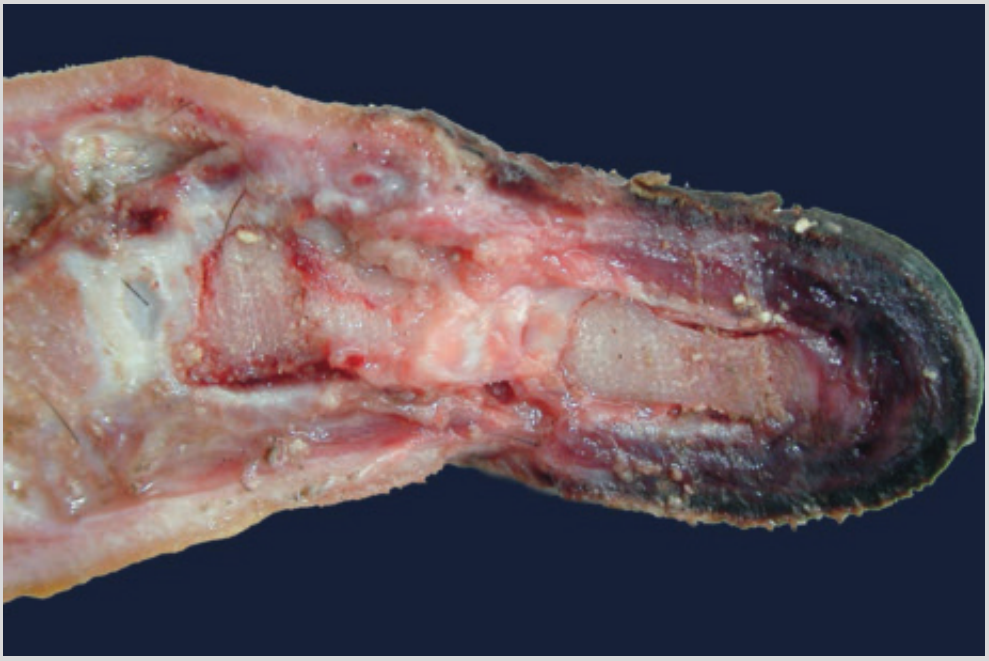
Animal species/Organ	Cattle/Femur
Lesion	Chronic, purulent, osteomylitis with sequestra formation
Scoring	Approved for deboning
Comments	A non-encapsulated lesion necessitates total condemnation

14.43



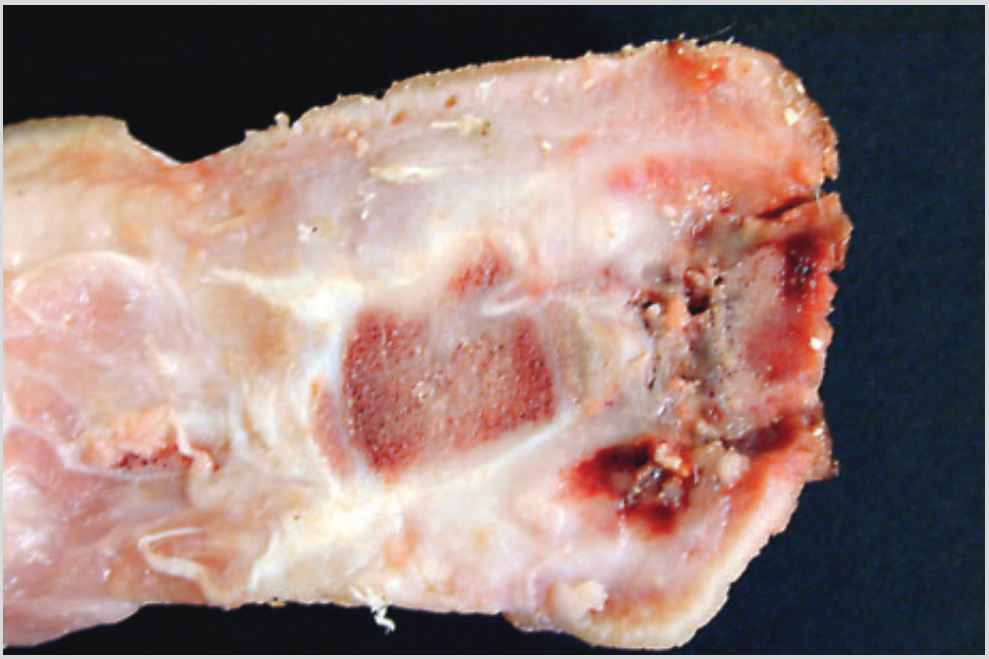
Animal species/Organ	Pig/Bones of the carpal joints
Lesion	Chronic, purulent, osteomylitis with sequestra formation
Scoring	Approved for deboning
Comments	Non-encapsulated lesions necessitate total condemnation

14.44



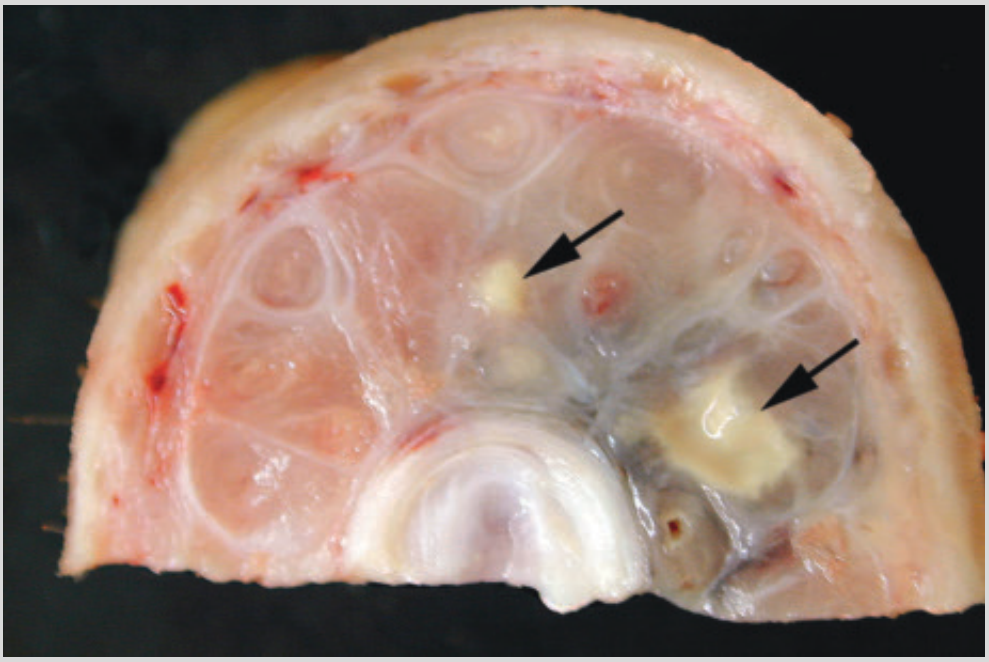
Animal species/Organ	Pig/Tail
Lesion	Gangrene of all structures in the peripheral part
Scoring	Partial condemnation
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

14.45



Animal species/Organ	Pig/Tail
Lesion	Chronic, epiphysitis with sequestra formation and discospondylitis
Scoring	Partial condemnation
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

14.46



Animal species/Organ	Pig/Tail (transverse section)
Lesion	Chronic, purulent rhabdomyositis (longitudinal fistula tract enclosed by fascia (→))
Scoring	Partial condemnation
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

14.47



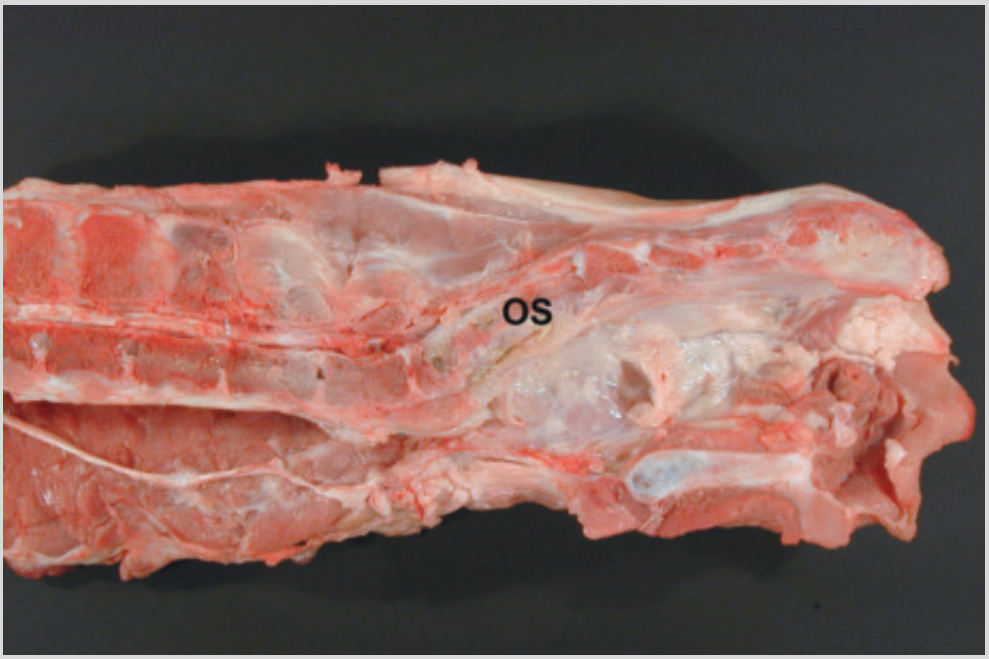
Animal species/Organ	Pig/Tail
Lesion	Fistula opening from underlying chronic, purulent discospondylitis
Scoring	Partial condemnation
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

14.48



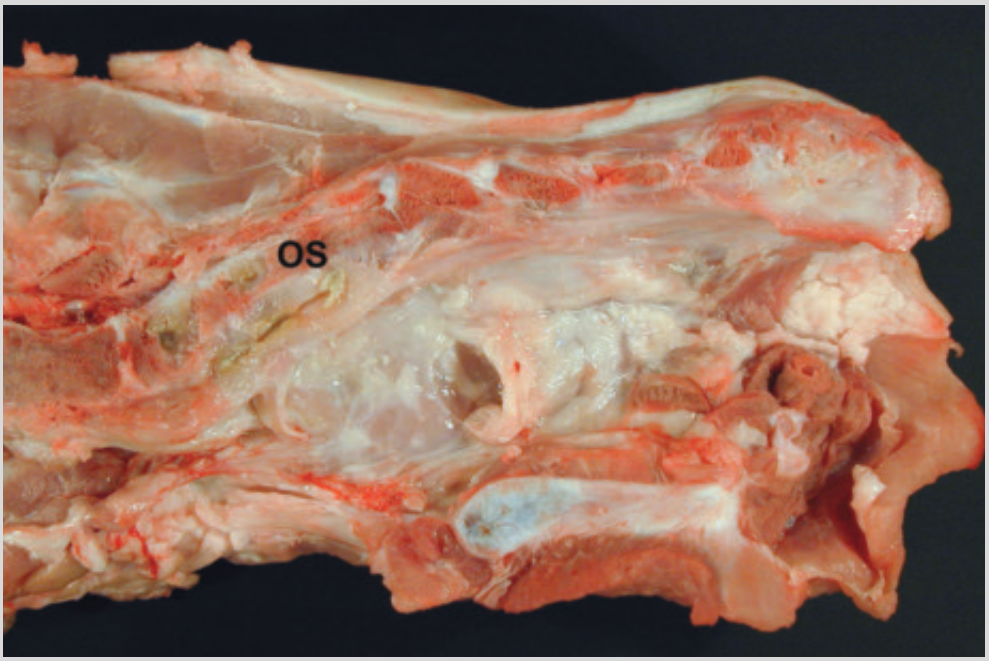
Animal species/Organ	Pig/Tail
Lesion	Chronic, purulent discospondylitis with sequestra formation
Scoring	Partial condemnation
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

14.49



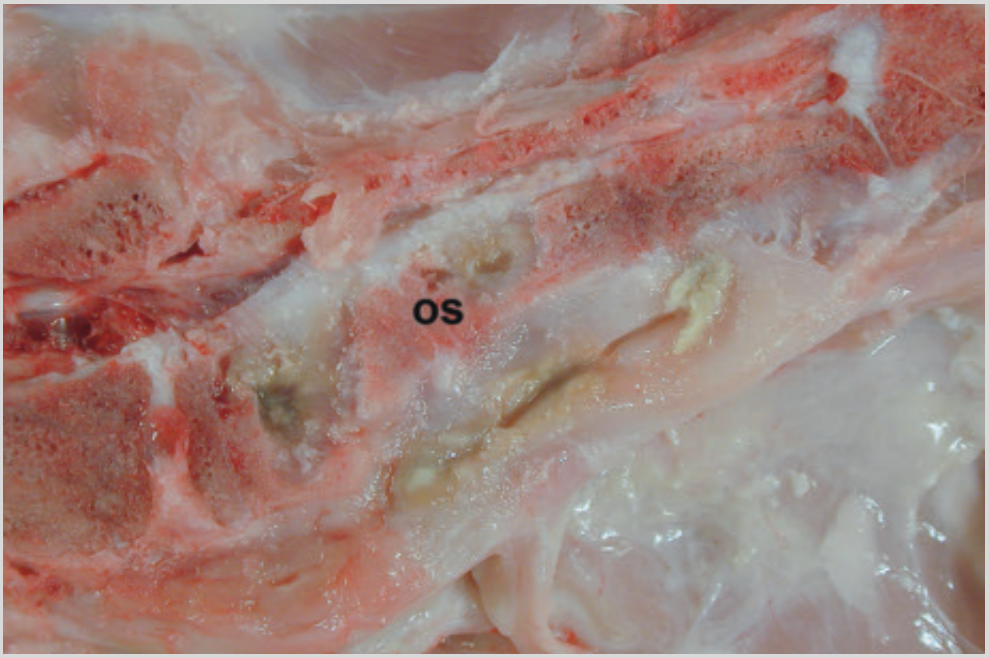
Animal species/Organ	Pig/Pelvic region en bloc
Lesion	Chronic, purulent osteomyelitis localised to the os sacrum (OS) with secondary dissecting abscess
Scoring	Rejection of the entire pelvic region if concomitant finding of tail lesion
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

14.50



Animal species/Organ	Pig/Pelvic region en bloc (close-up of 14.49)
Lesion	Chronic, purulent osteomyelitis localised to the os sacrum (OS) with secondary dissecting abscess
Scoring	Rejection of the entire pelvic region if concomitant finding of tail lesion
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

14.51



Animal species/Organ	Pig/Pelvic region en bloc (close-up of 14.50)
Lesion	Chronic, purulent osteomyelitis localised to the os sacrum (OS) with secondary dissecting abscess
Scoring	Rejection of the entire pelvic region if concomitant finding of tail lesion
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

14.52



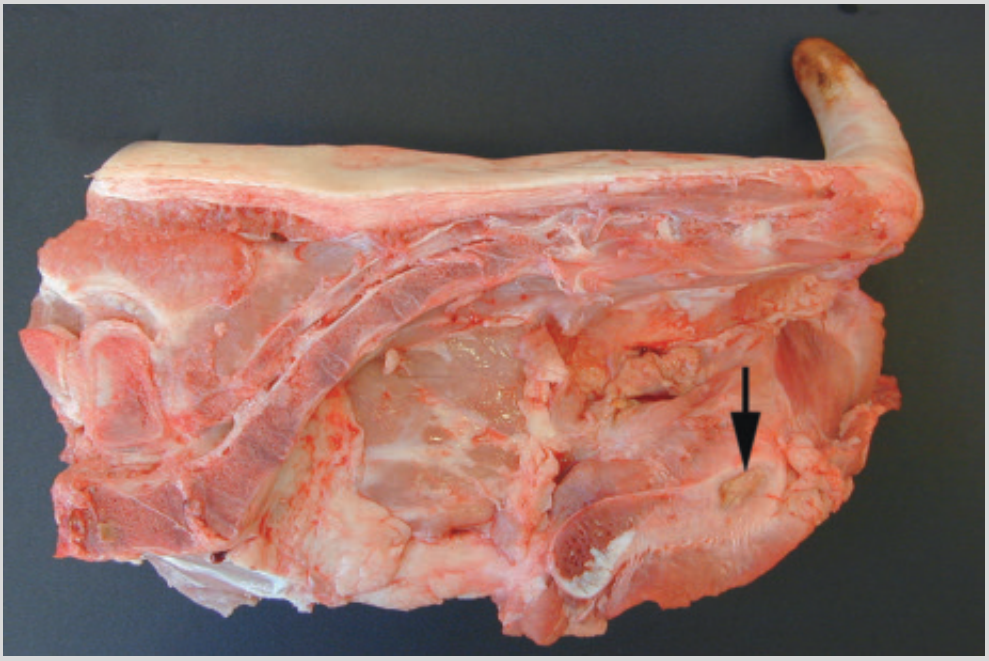
Animal species/Organ	Pig/Pelvic region en bloc
Lesion	Chronic, purulent osteomyelitis (→) with lateral abscess formation (----)
Scoring	Rejection of the entire pelvic region if concomitant finding of tail lesion
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

14.53



Animal species/Organ	Pig/Pelvic region en bloc
Lesion	Chronic, purulent osteomyelitis in the 1st tail bone
Scoring	Rejection of the entire pelvic region if concomitant finding of tail lesion
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

14.54



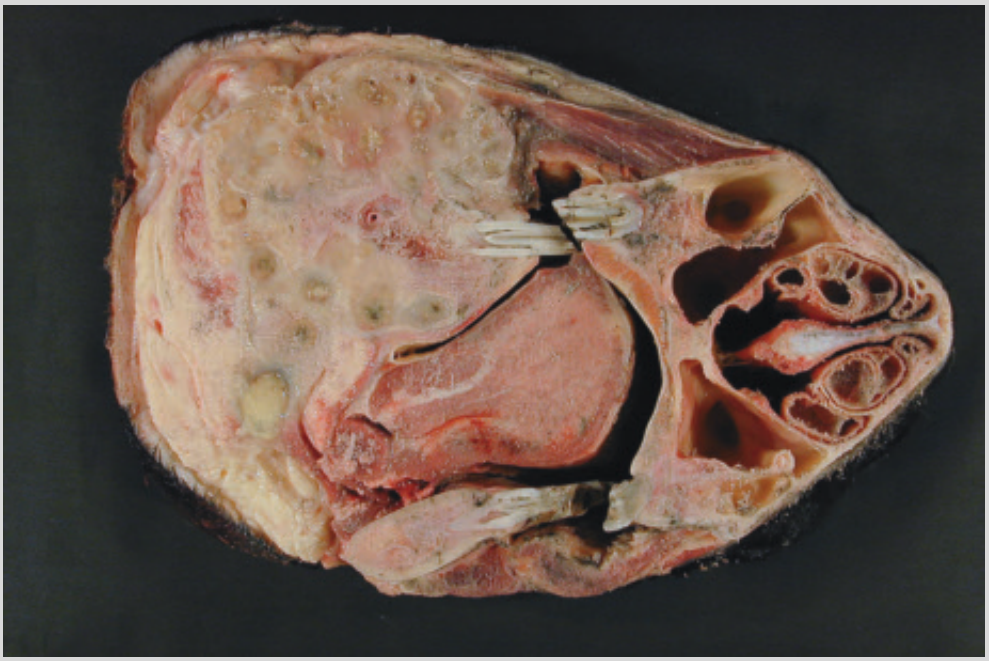
Animal species/Organ	Pig/Pelvic region en bloc
Lesion	Chronic, purulent osteomyelitis localised to the ischium (→)
Scoring	Concomitant presence of tail bite necessitates partial condemnation
Comments	Approved for deboning in the absence of tail lesions

14.55



Animal species/Organ	Pig/Pelvic region en bloc
Lesion	Chronic abscess
Scoring	Approved for deboning if it is a secondary dissecting abscess from the lumbar vertebrae
Comments	Judgement is rejection of the lymph node if the abscess originates from the lymph node

14.56



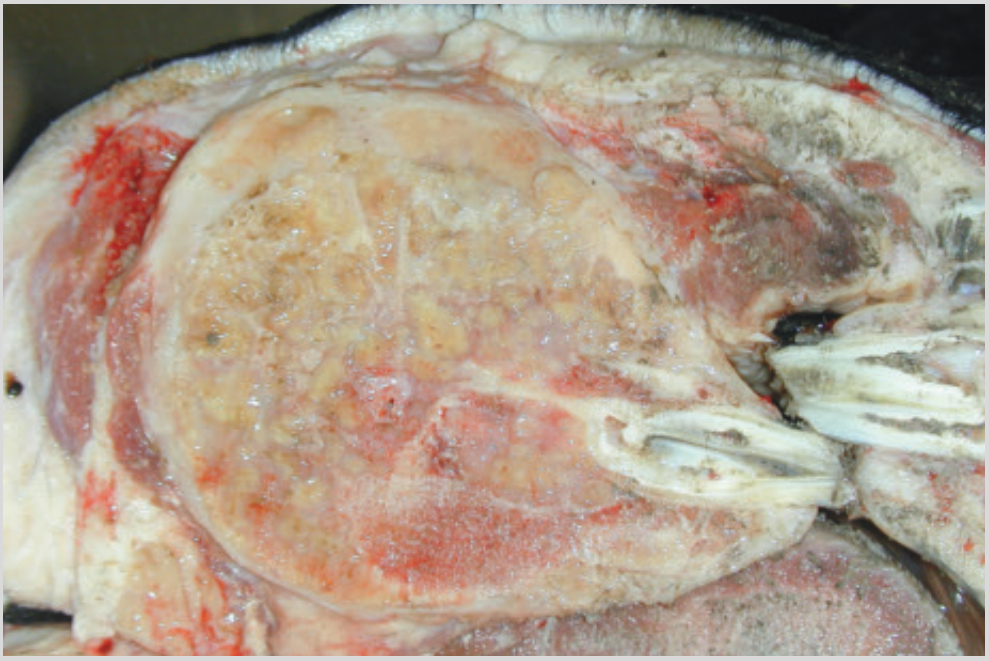
Animal species/Organ	Cattle/Head (transverse section)
Lesion	Chronic, pyogranulomatous osteomyelitis localised to the left mandible
Scoring	Partial condemnation
Comments	The lesion has occurred by spread from a buccal cavity lesion

14.57



Animal species/Organ	Cattle/Left mandible (transverse section) (close-up of 14.56)
Lesion	Chronic, pyogranulomatous osteomyelitis
Scoring	Partial condemnation
Comments	The lesion has occurred by spread from a buccal cavity lesion

14.58



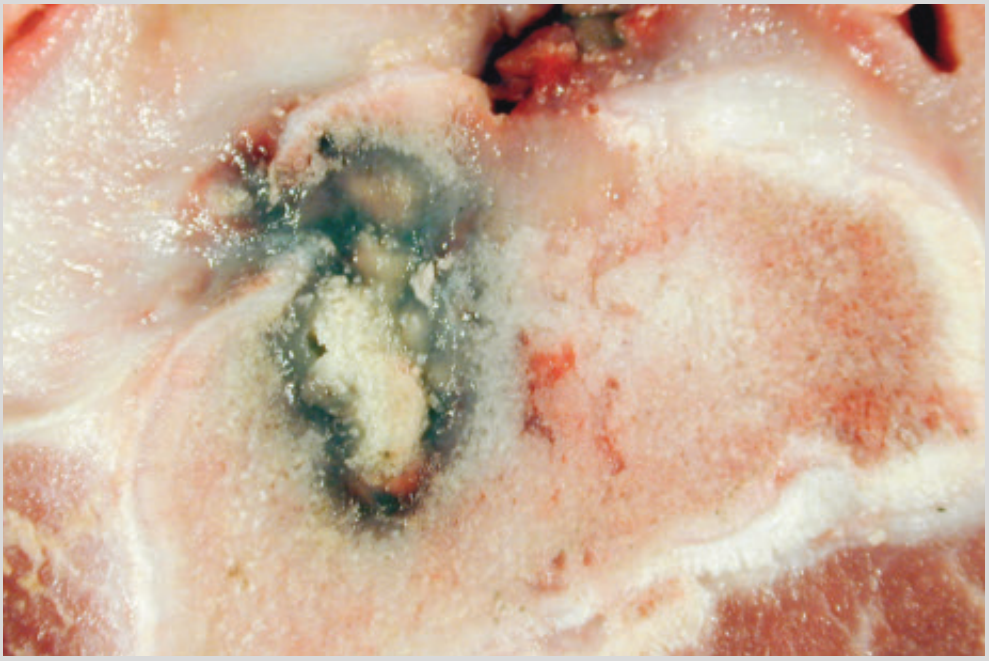
Animal species/Organ	Cattle/Mandible (transverse section)
Lesion	Chronic, pyogranulomatous osteomyelitis
Scoring	Partial condemnation
Comments	The lesion has occurred by spread from a buccal cavity lesion

14.59



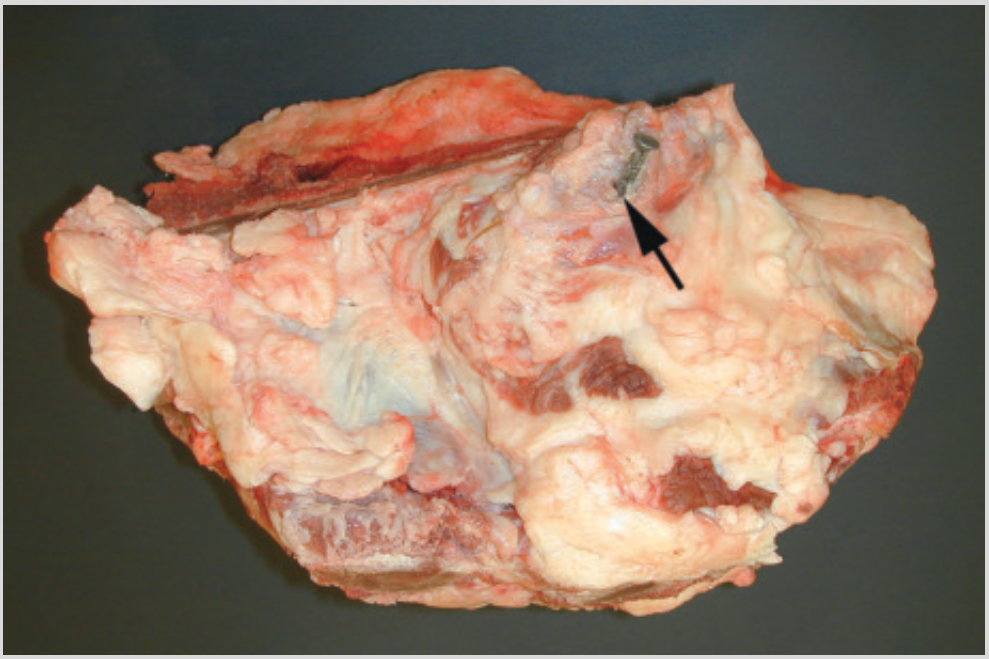
Animal species/Organ	Pig/Scapula with overlying ulceration (shoulder ulceration)
Lesion	Chronic osteomyelitis with sequestra formation
Scoring	Partial condemnation
Comments	The surrounding dark pigmentation is termed “pseudomelanosis”

14.60



Animal species/Organ	Pig/Scapula with overlying ulceration (shoulder ulceration) (close-up of 14.59)
Lesion	Chronic osteomyelitis with sequestra formation
Scoring	Partial condemnation
Comments	The surrounding dark pigmentation is called “pseudomelanosis”

14.61



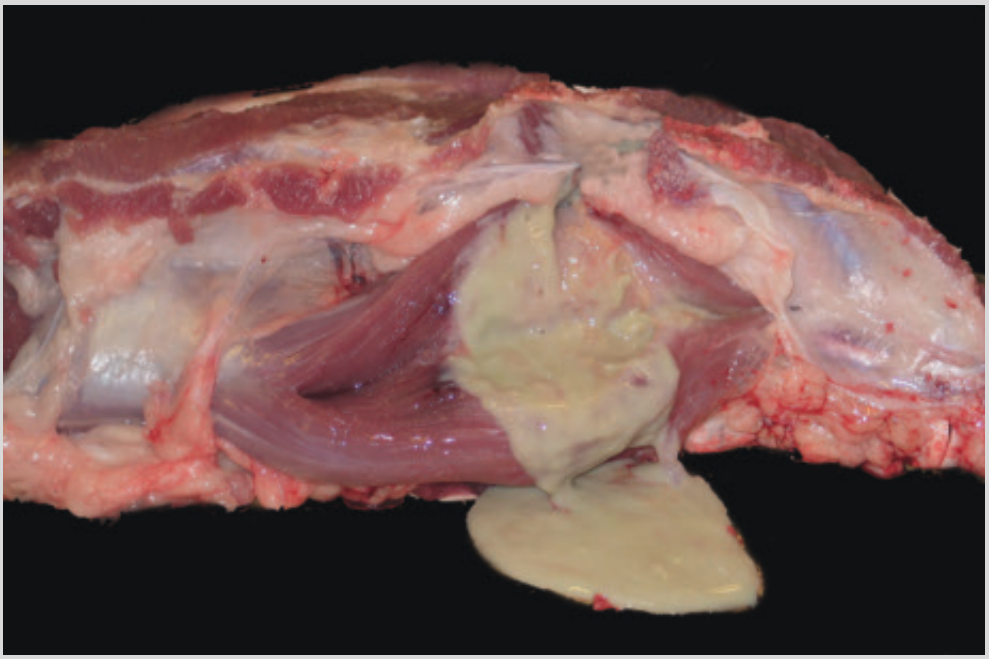
Animal species/Organ	Cattle/Sternum
Lesion	Chronic, traumatic (stainless steel spike), sclerotic and purulent osteomyelitis
Scoring	Partial condemnation
Comments	Purulent exudate can be seen at the spike head (→)

14.62



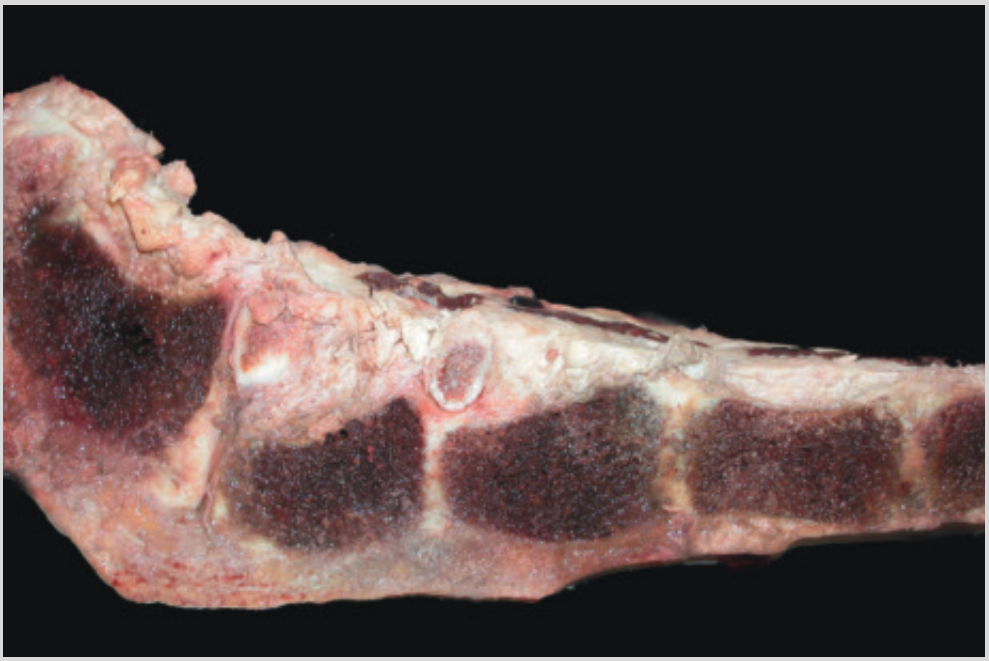
Animal species/Organ	Pig/Body
Lesion	Chronic, myositis with abscess formation (psoas muscle)
Scoring	Approved for deboning
Comments	The lesion is a result of a fistula originating from a chronic vertebral osteomyelitis

14.63



Animal species/Organ	Pig/Psoas muscle
Lesion	Chronic, myositis with abscess formation (secondary dissecting abscess formation from osteomyelitis)
Scoring	Approved for deboning
Comments	The lesion is a result of a fistula originating from a chronic vertebral osteomyelitis

14.64



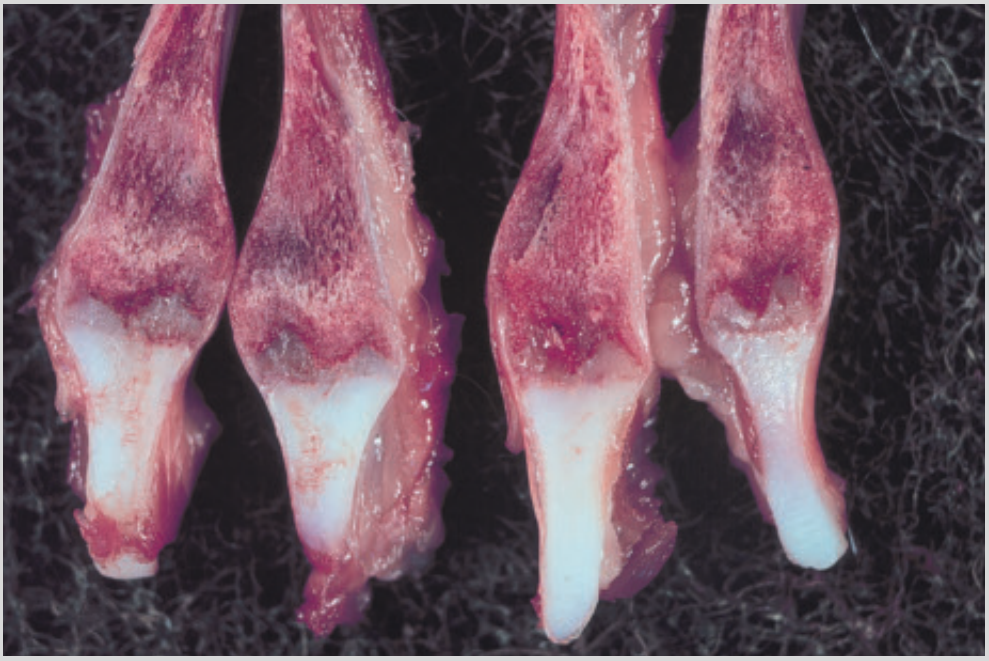
Animal species/Organ	Cattle/Sternum
Lesion	Porphyria
Scoring	Approved for deboning
Comments	Occurs only rarely

14.65



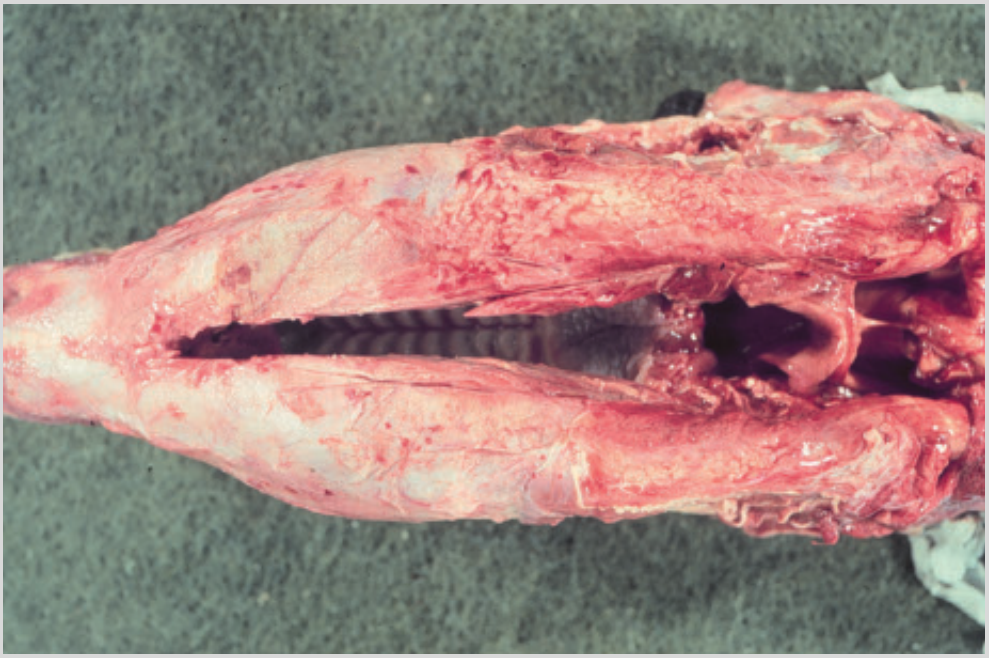
Animal species/Organ	Pig/Femur
Lesion	Porphyria
Scoring	Approved for deboning
Comments	Occurs only rarely

14.66



Animal species/Organ	Pig/Ribs
Lesion	Rachitic thickening at the transition from bone to cartilage (“rachitic rosary”)
Scoring	Partial condemnation
Comments	Approved for deboning if extensive lesions are present

14.67



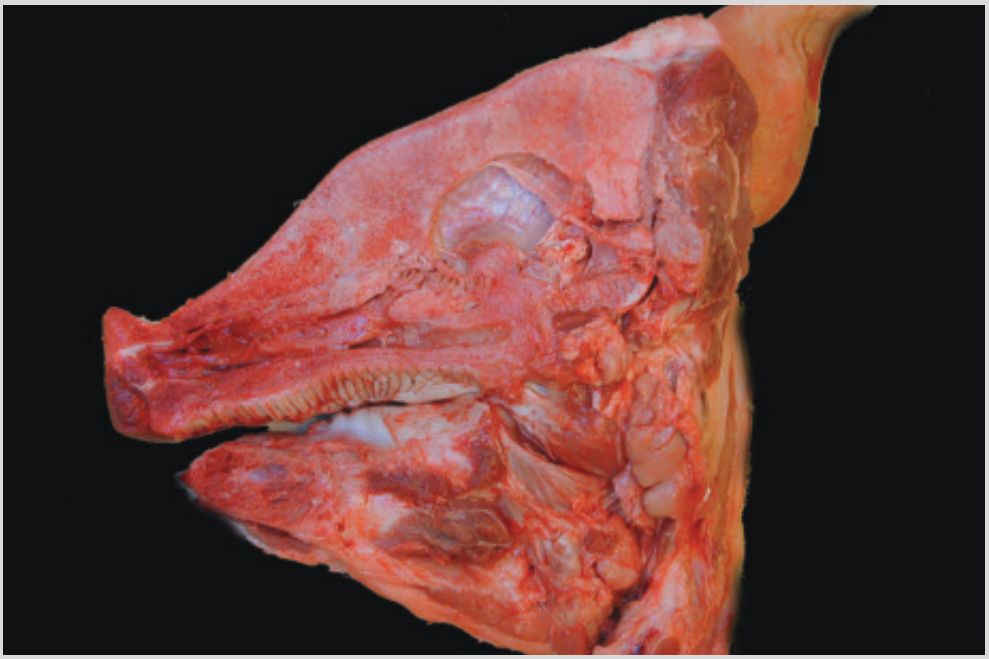
Animal species/Organ	Horse/Mandibles
Lesion	Osteodystrophia fibrosa
Scoring	Partial condemnation dependent however on the primary cause
Comments	Approved for deboning if extensive lesions are present

14.68



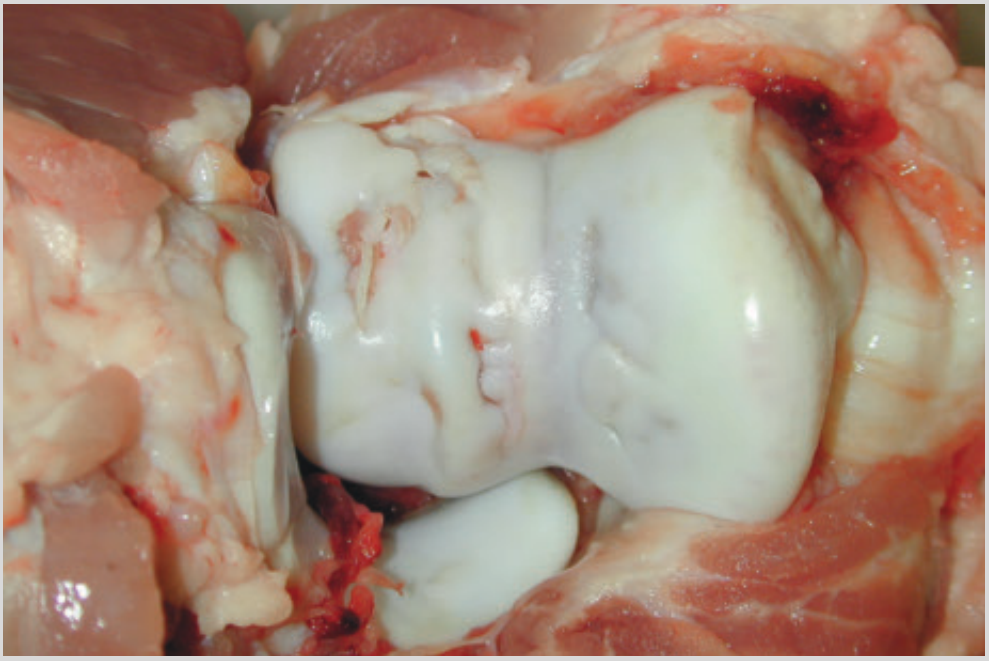
Animal species/Organ	Cattle/Sternum
Lesion	Osteosclerosis (increased bone formation) in the lower bone; the upper bone is normal
Scoring	Partial condemnation dependent however on the primary cause
Comments	Approved for deboning if extensive lesions are present

14.69



Animal species/Organ	Pig/Head
Lesion	Osteosclerosis (increased bone formation)
Scoring	Partial condemnation dependent however on the primary cause
Comments	Approved for deboning if extensive lesions are present

14.70



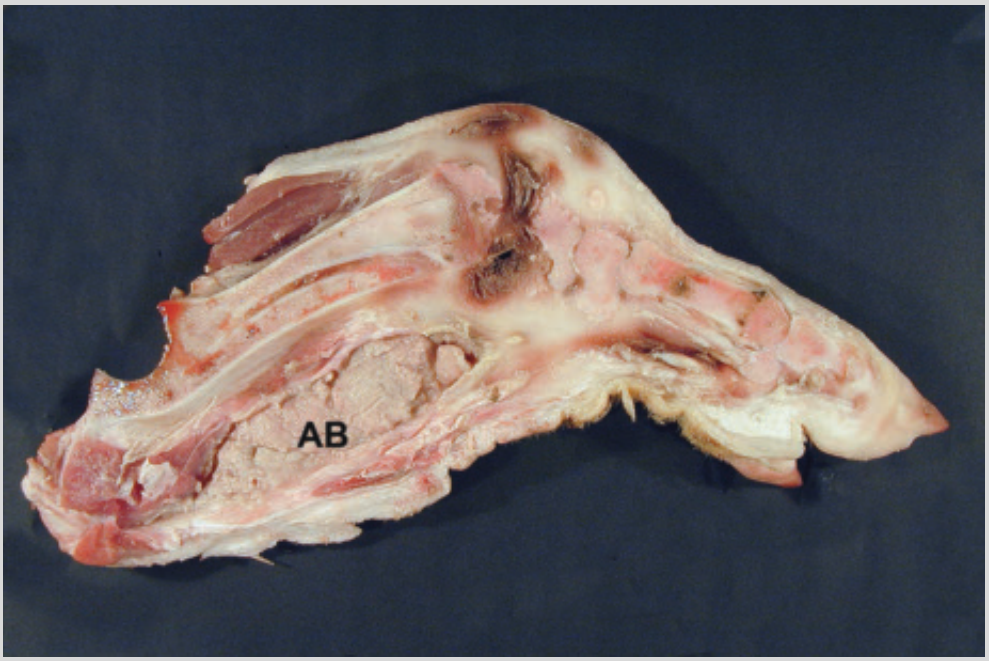
Animal species/Organ	Pig/Humerus (elbow joint)
Lesion	Chronic, erosive, and deforming arthrosis with secondary hyperplasia of the synovial membrane (non-septic arthritic reaction)
Scoring	Partial condemnation
Comments	Occurs often bilaterally thus the contralateral joints should be examined as well

14.71



Animal species/Organ	Pig/Foreleg (distal part)
Lesion	The knee joint is severely thickened with several ulcerations of fistula openings (see 14.72)
Scoring	Cannot be decided prior to cutting the limb
Comments	Splitting longitudinally (sagittal) is highly informative

14.72



Animal species/Organ	Pig/Foreleg (distal part)
Lesion	Chronic, necrotic, purulent arthritis with fistula opening to the skin
Scoring	Partial condemnation
Comments	A large, chronic abscess (AB) can be seen around the ulna; significant periarticular fibrosis

14.73



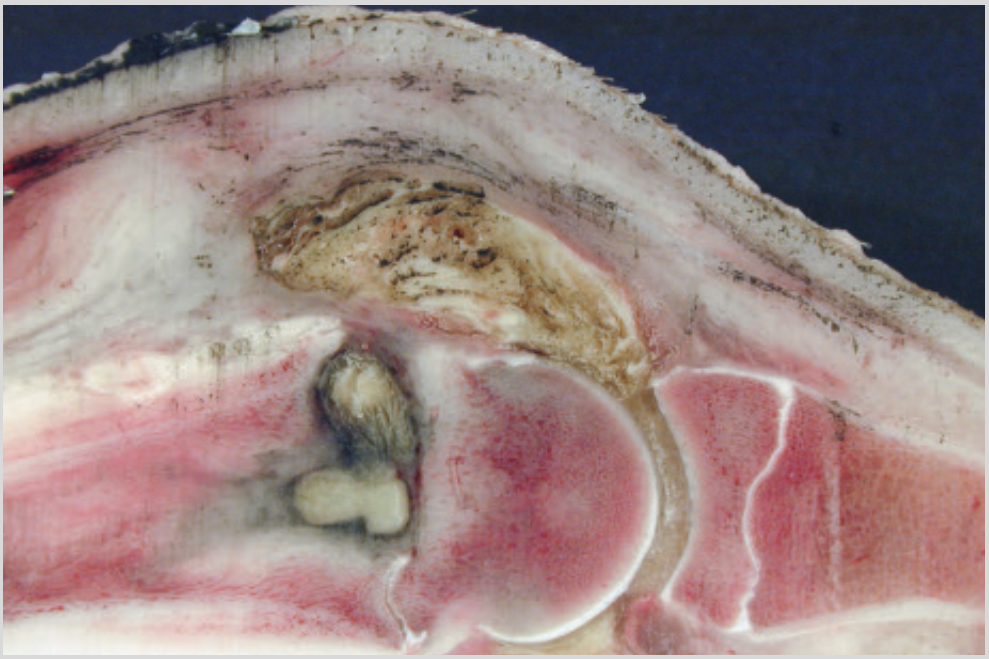
Animal species/Organ	Pig/Hoof joint
Lesion	Chronic, ulcerative arthritis with intraarticular fibrosis
Scoring	Partial condemnation
Comments	Splitting longitudinally (sagittal) is highly informative

14.74



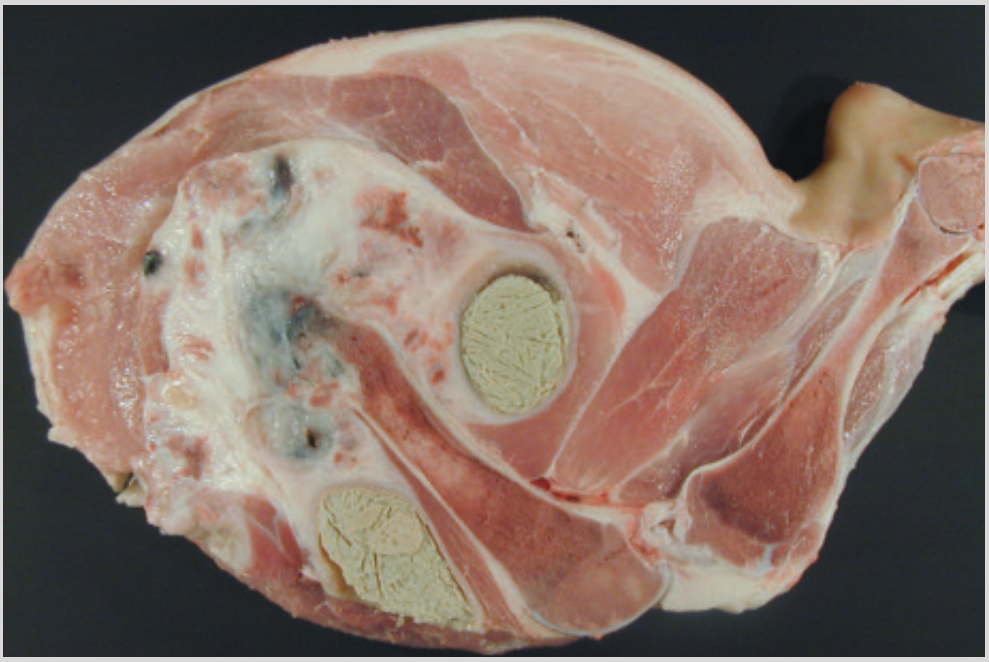
Animal species/Organ	Pig/Foreleg (distal part)
Lesion	Chronic, purulent osteomyelitis, and arthritis
Scoring	Approved for deboning
Comments	There is significant periarticular fibrosis

14.75



Animal species/Organ	Pig/Fetlock joint (close-up of 14.74)
Lesion	Chronic, purulent osteomyelitis and arthritis
Scoring	Approved for deboning
Comments	There is significant periarticular fibrosis

14.76



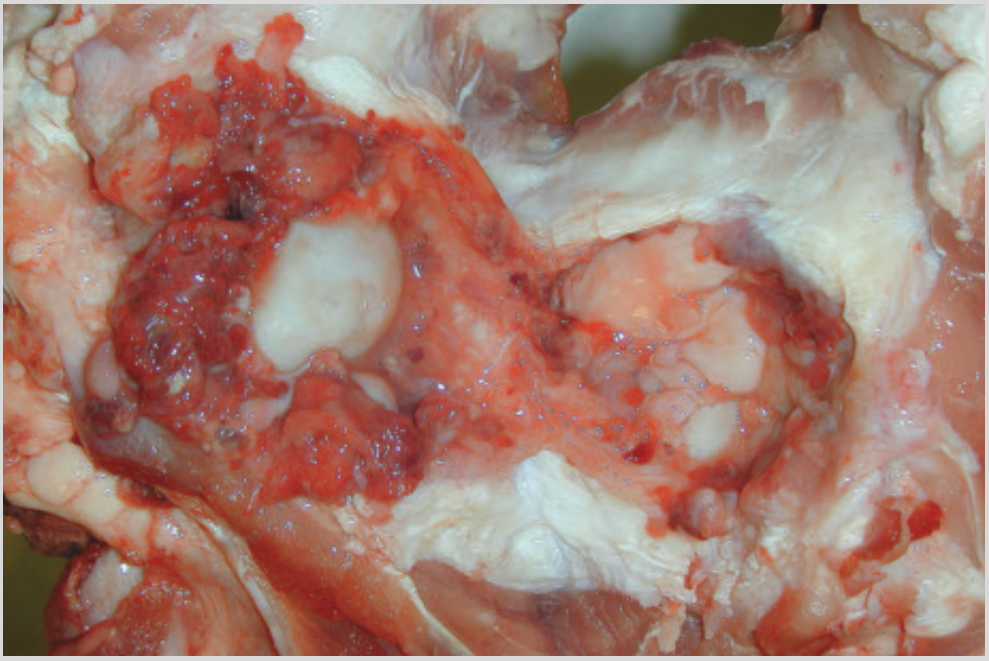
Animal species/Organ	Pig/Hindleg
Lesion	Chronic, purulent osteomyelitis (femur head) and arthritis (hip joint)
Scoring	Approved for deboning
Comments	In addition, periarticular abscesses are present

14.77



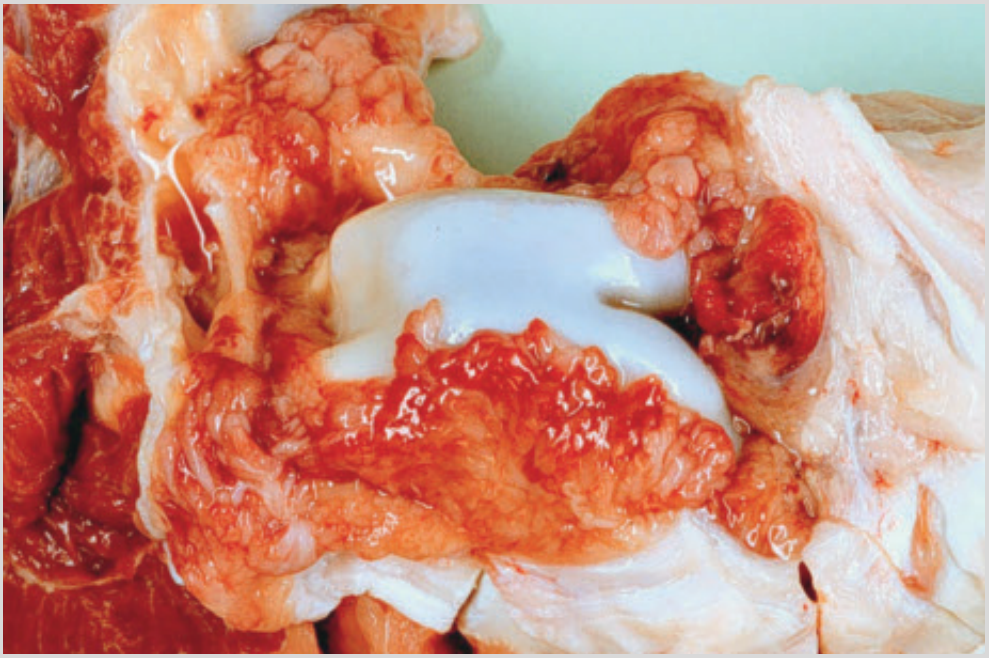
Animal species/Organ	Pig/Forelimb (distal part with elbow joint)
Lesion	Chronic, ankylosing arthritis with periarticular abscess formation
Scoring	Partial condemnation
Comments	The inflammation in the joint has probably been purulent

14.78



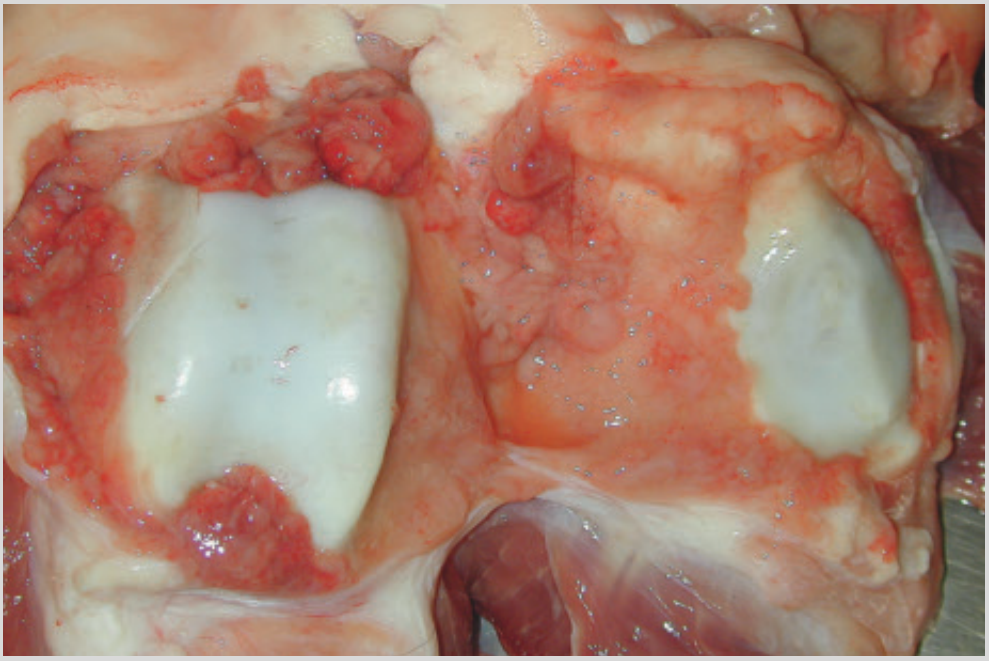
Animal species/Organ	Pig/Hip joint
Lesion	Chronic, proliferative, and deforming arthritis
Scoring	Partial condemnation
Comments	Other larger joints should be examined for similar lesions. Likely aetiology is *Erysipelothrix rhusiopathiae*

14.79



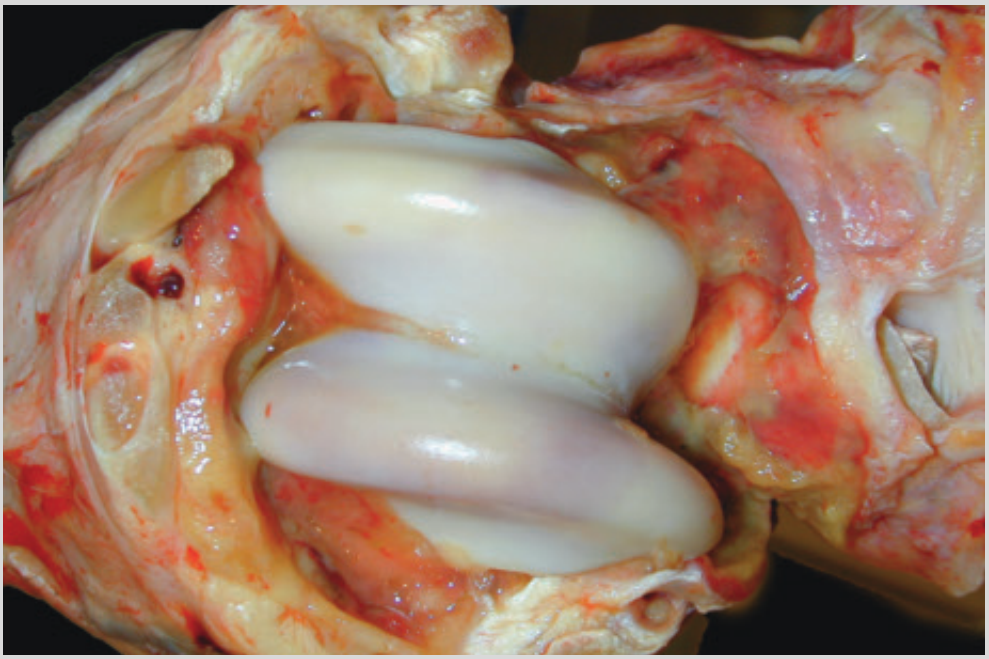
Animal species/Organ	Pig/Knee joint
Lesion	Chronic, proliferative arthritis
Scoring	Partial condemnation
Comments	Other larger joints should be examined for similar lesions. Likely aetiology is *Erysipelothrix rhusiopathiae*

14.80



Animal species/Organ	Pig/Knee joint
Lesion	Chronic, proliferative arthritis
Scoring	Partial condemnation
Comments	Other larger joints should be examined for similar lesions. Likely aetiology is *Erysipelothrix rhusiopathiae*

14.81



Animal species/Organ	Cattle/Tarsal joint
Lesion	Acute, fibrinous arthritis
Scoring	Total condemnation
Comments	Acute arthritis typically causes severe lameness

14.82



Animal species/Organ	Pig/Knee joint
Lesion	Chronic, hyperplastic arthritis
Scoring	Partial condemnation
Comments	Other larger joints should be examined for similar lesions. Likely aetiology is *Mycoplasma hyosynoviae*

14.83



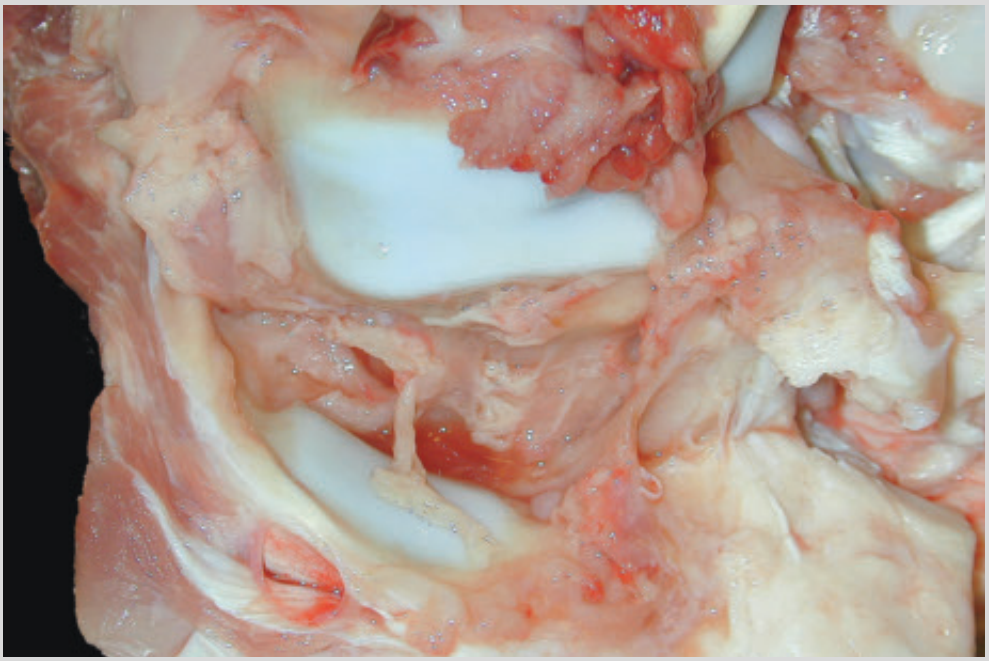
Animal species/Organ	Pig/Elbow joint
Lesion	Chronic, purulent arthritis with dilatation of joint
Scoring	Partial condemnation
Comments	All large joints should be examined for lesions

14.84



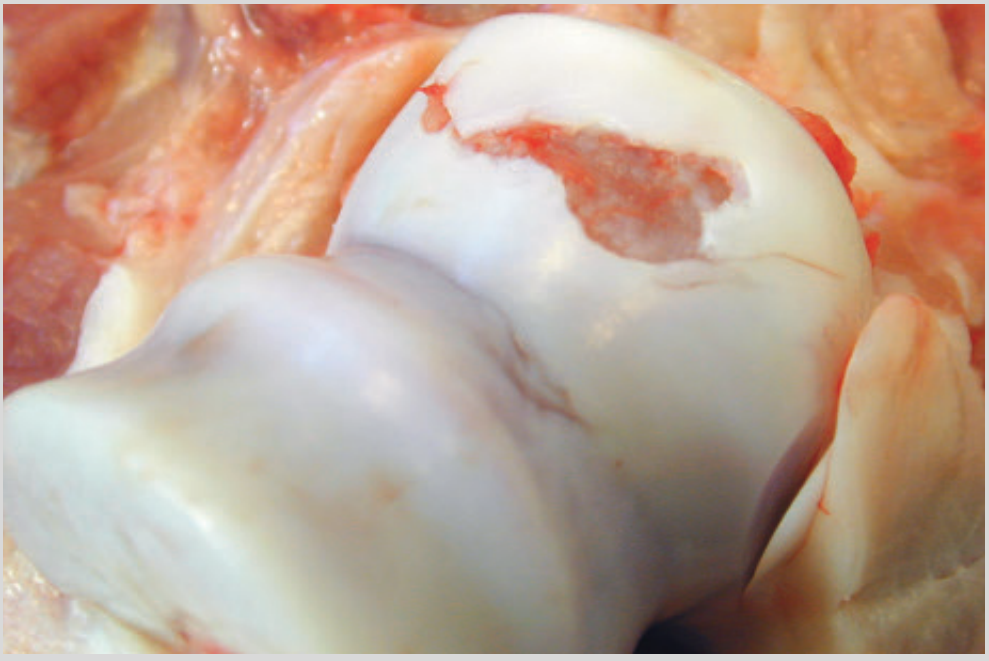
Animal species/Organ	Cattle/Knee joint
Lesion	Chronic, fibrino-purulent arthritis
Scoring	Partial condemnation
Comments	Other large joints should be examined for similar lesions

14.85



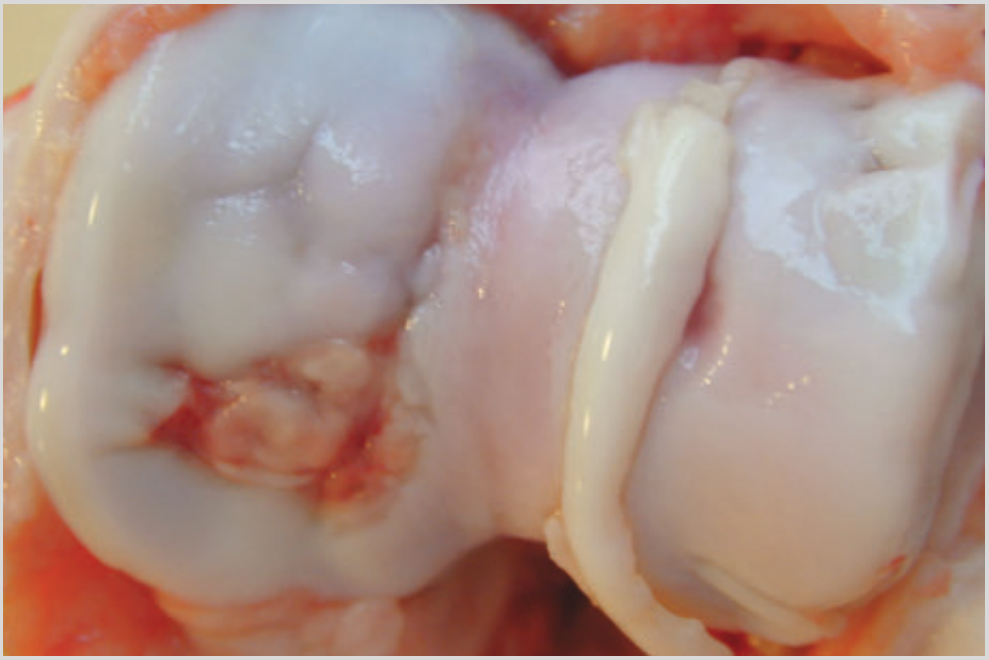
Animal species/Organ	Pig/Knee joint
Lesion	Chronic, proliferative, and fibrinous arthritis
Scoring	Partial condemnation
Comments	Other large joints should be examined for similar lesions. Likely aetiology is *Erysipelothrix rhusiopathiae*

14.86



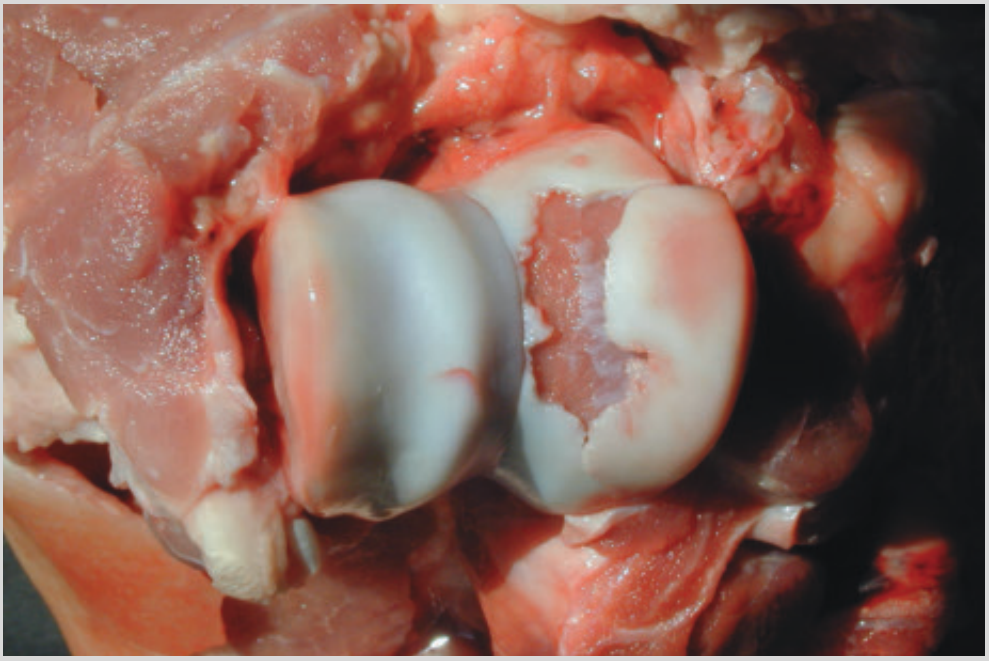
Animal species/Organ	Pig/Elbow joint (distal part of humerus)
Lesion	Chronic, ulcerative arthrosis
Scoring	Partial condemnation
Comments	Probably part of a dyschondroplastic condition

14.87



Animal species/Organ	Pig/Elbow joint
Lesion	Chronic, ulcerative, and hyperplastic arthrosis
Scoring	Partial condemnation
Comments	Probably part of a dyschondroplastic condition

14.88



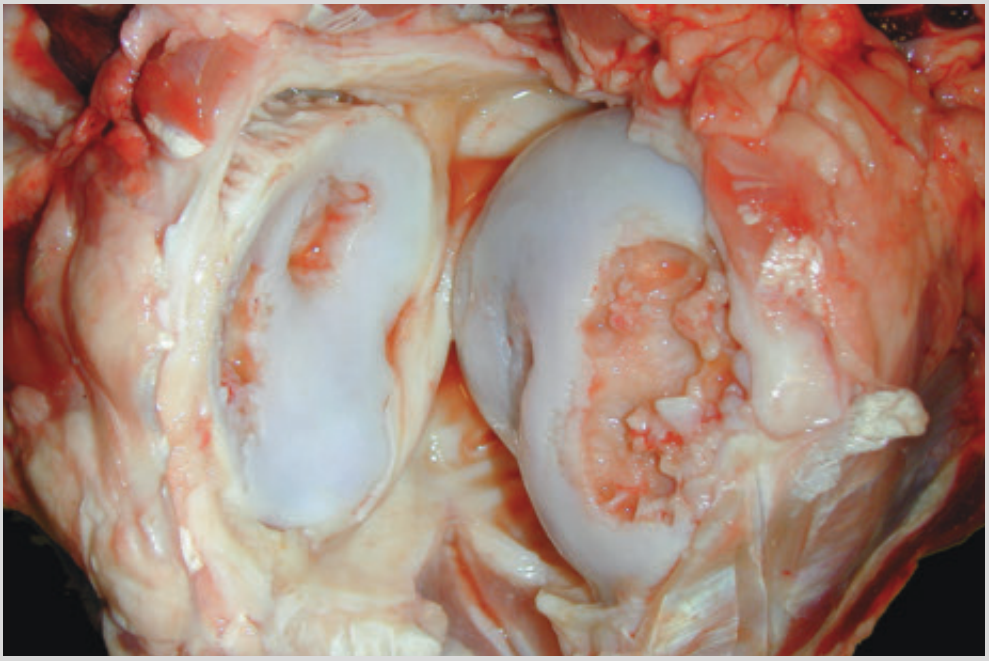
Animal species/Organ	Pig/Elbow joint (distal part of humerus)
Lesion	Chronic, ulcerative arthrosis with secondary synovial hyperplasia
Scoring	Partial condemnation
Comments	Probably part of a dyschondroplastic condition

14.89



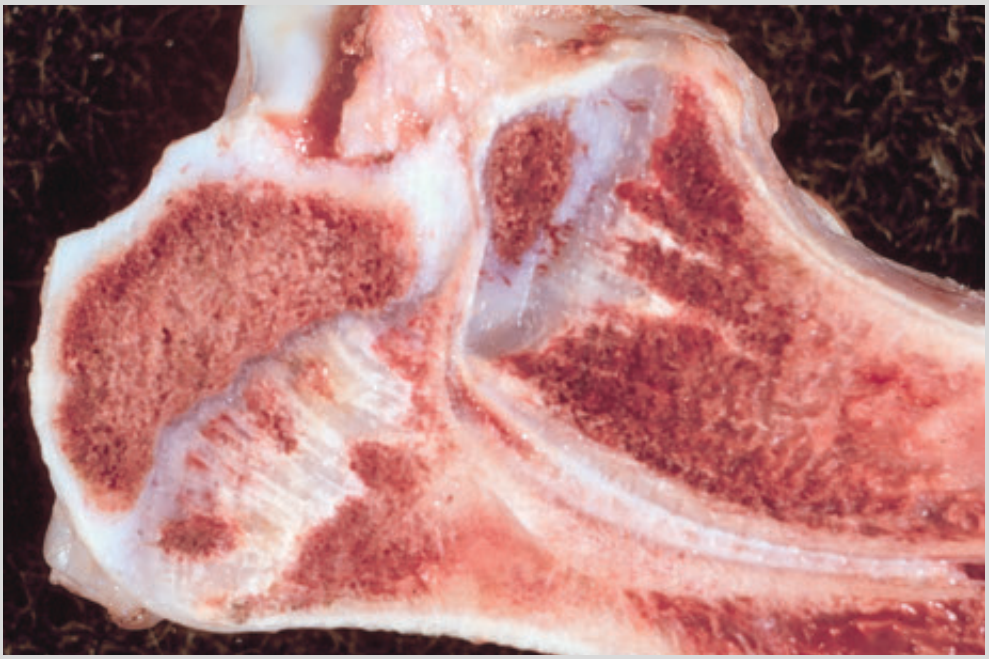
Animal species/Organ	Pig/Elbow joint
Lesion	Chronic, ulcerative, and dissecting arthrosis with secondary synovial hyperplasia
Scoring	Partial condemnation
Comments	Typical findings in osteochrondritis dissecans

14.90



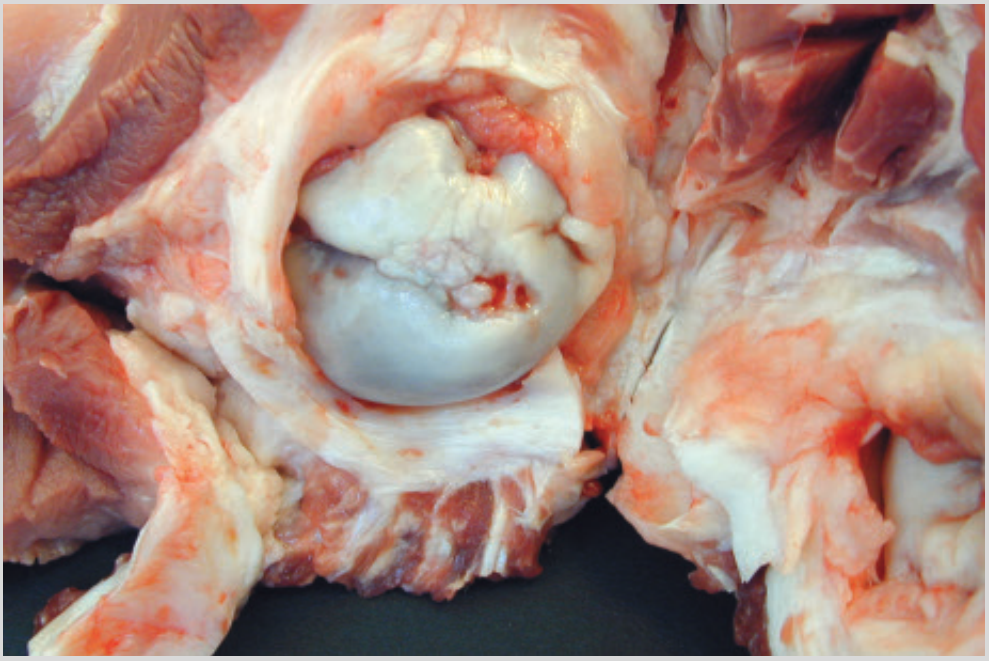
Animal species/Organ	Pig/Shoulder joint
Lesion	Chronic, ulcerative arthrosis with secondary synovial hyperplasia
Scoring	Partial condemnation
Comments	Probably part of a dyschondroplastic condition

14.91



Animal species/Organ	Pig/Distal part of radius and ulna
Lesion	Chondrodysplastic lesions in the epiphyseal plates and the metaphyse
Scoring	Partial condemnation
Comments	Approved for deboning if extensive lesions are present

14.92



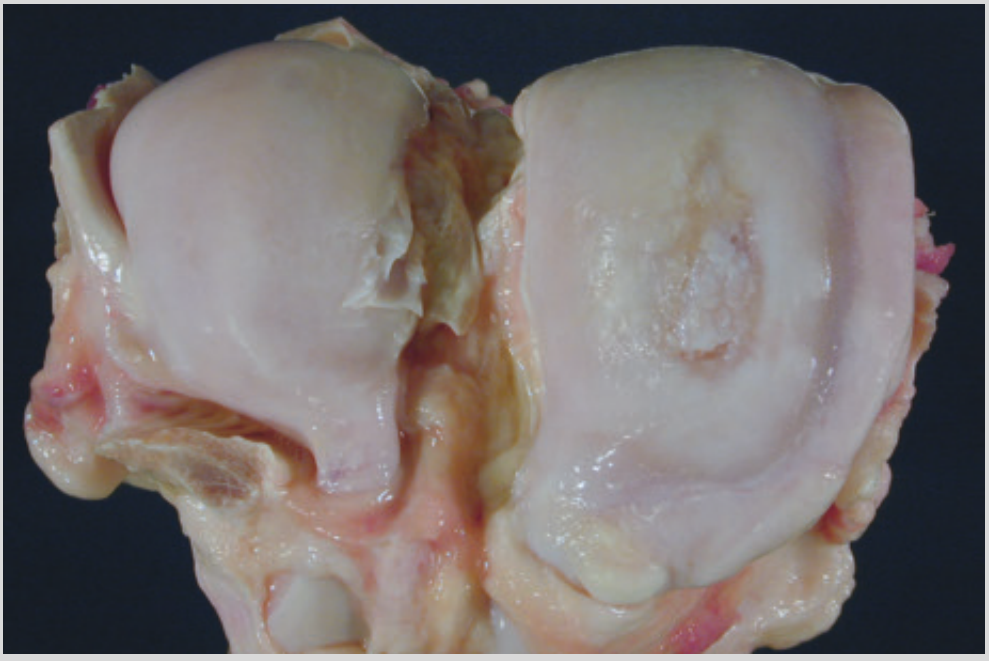
Animal species/Organ	Pig/Hip joint
Lesion	Chronic, deforming arthrosis with rupture of the proximal femoral ligament
Scoring	Partial condemnation
Comments	In addition there is secondary hyperplasia of the synovial membrane

14.93



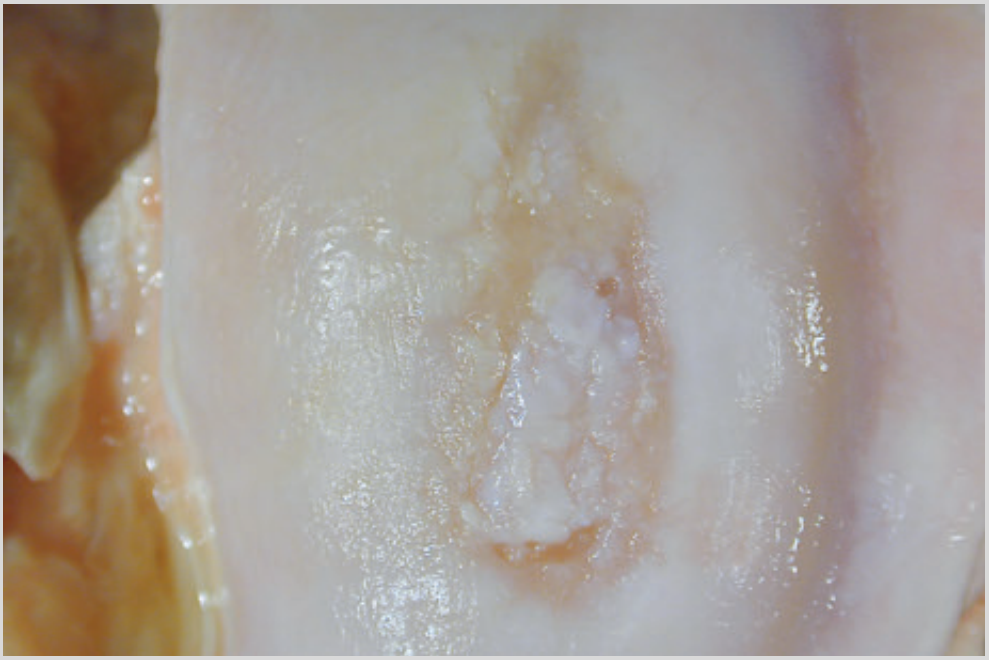
Animal species/Organ	Pig/Proximal humerus
Lesion	Chronic, erosive and proliferative (osteophyte formation) arthrosis
Scoring	Partial condemnation
Comments	Osteophytes are often formed as a result of joint instability

14.94



Animal species/Organ	Horse/Femur
Lesion	Chronic, erosive, and ulcerative arthrosis
Scoring	Partial condemnation
Comments	The condition can be due to unbalanced load on the joint

14.95



Animal species/Organ	Horse/Femur
Lesion	Chronic, erosive, and ulcerative arthrosis (detail of 14.94)
Scoring	Partial condemnation
Comments	The condition can be due to unbalanced load on the joint

14.96



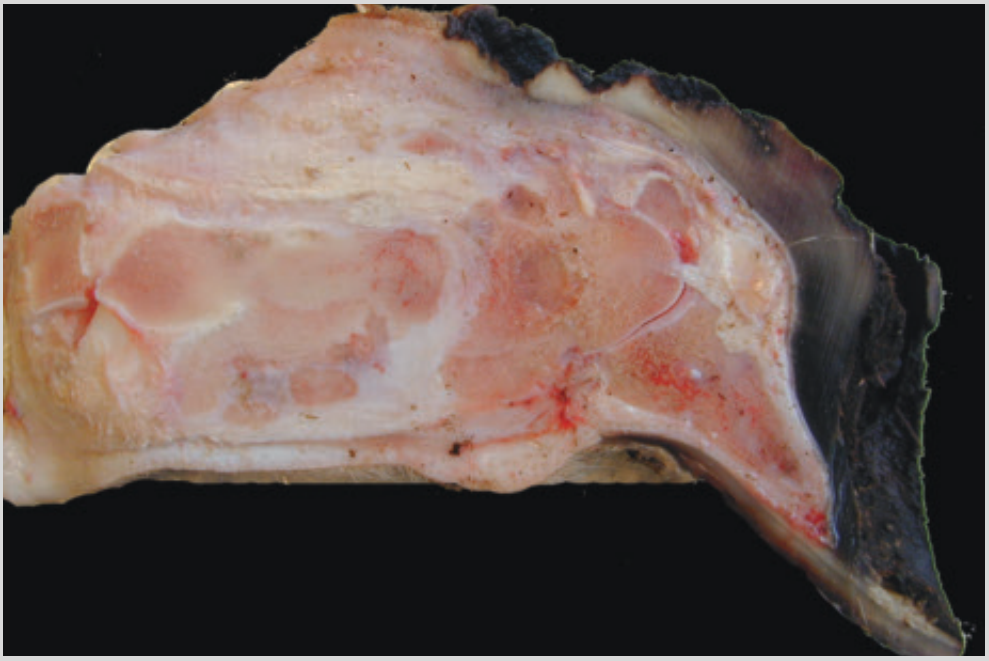
Animal species/Organ	Cattle/Metatarsal region
Lesion	Chronic, purulent tendovaginitis
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare laws must be notified

14.97



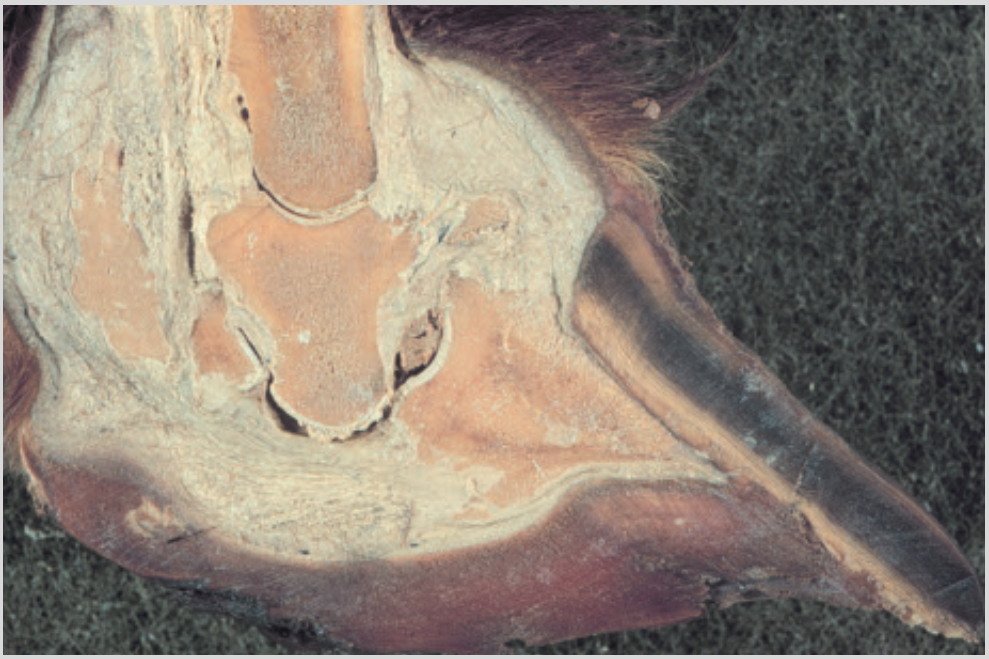
Animal species/Organ	Cattle/Metatarsal region
Lesion	Chronic, purulent tendovaginitis
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare laws must be notified

14.98



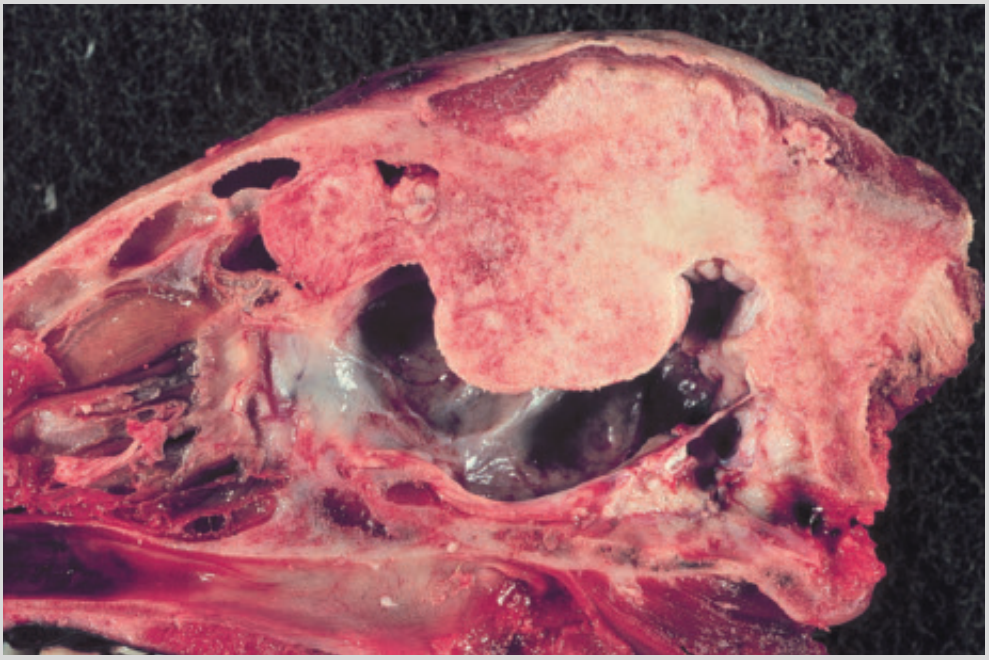
Animal species/Organ	Cattle/Foreleg (distal part)
Lesion	Chronic subluxation of the hoof joint
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare laws must be notified

14.99



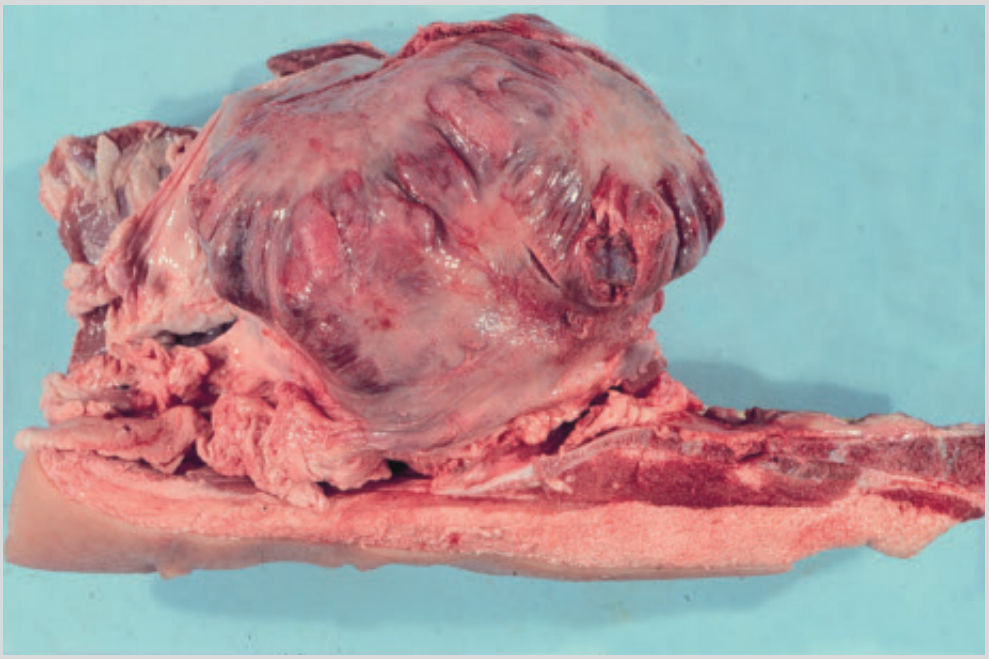
Animal species/Organ	Horse/Foreleg (distal part)
Lesion	Luxation of the hoof joint
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare laws must be notified

14.100



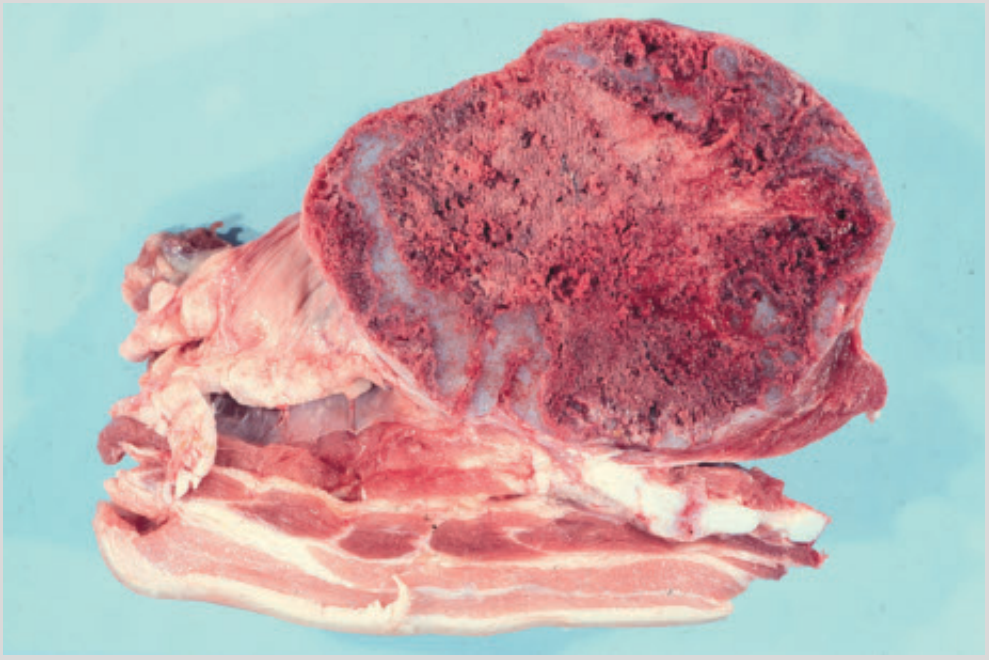
Animal species/Organ	Pig/Head
Lesion	Osteoma
Scoring	Partial condemnation
Comments	Occurs rarely

14.101



Animal species/Organ	Pig/Rib-sternum transition
Lesion	Chondroma
Scoring	Partial condemnation
Comments	Occurs rarely

14.102



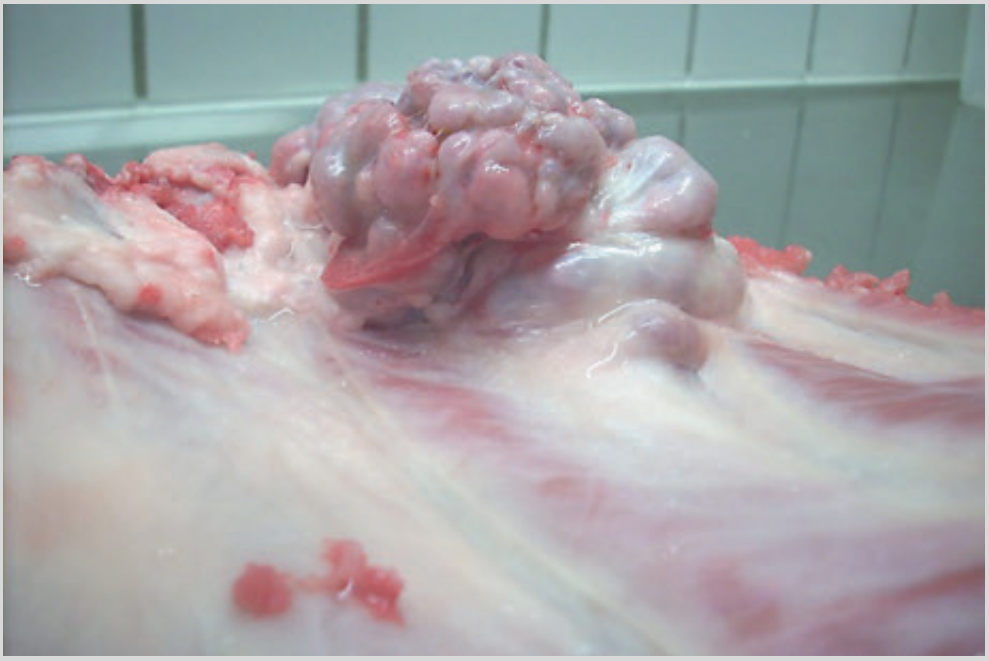
Animal species/Organ	Pig/Rib-sternum transition
Lesion	Chondroma with mineralisation
Scoring	Partial condemnation
Comments	Occurs rarely

14.103



Animal species/Organ	Pig/Rib
Lesion	Chondroma
Scoring	Partial condemnation
Comments	Chondromas originate typically in flat bones

14.104



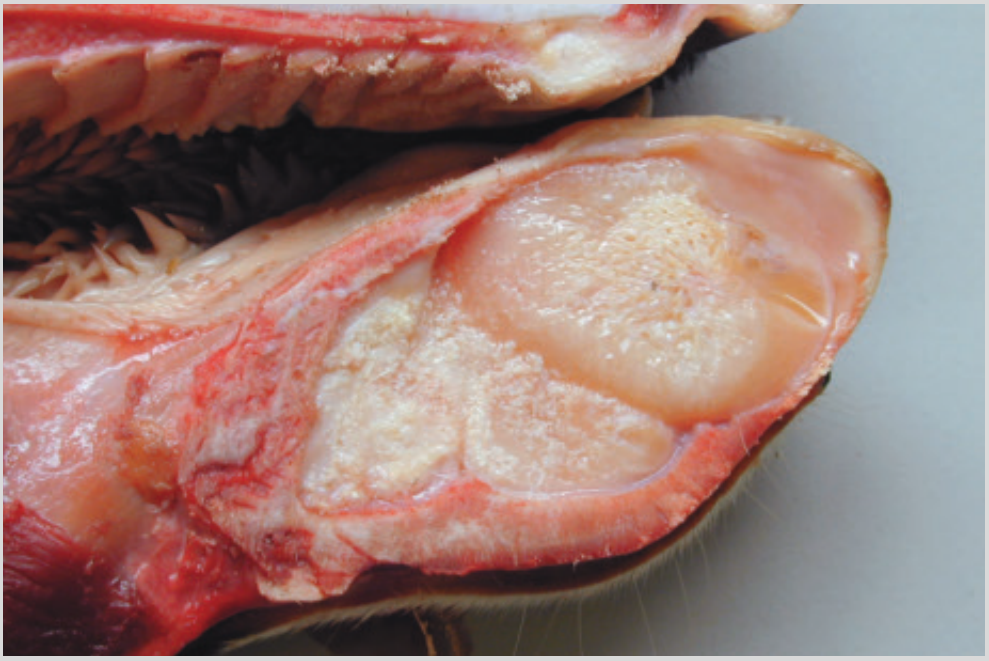
Animal species/Organ	Pig/Rib
Lesion	Chondroma
Scoring	Partial condemnation
Comments	Chondromas are typically nodular on the surface

14.105



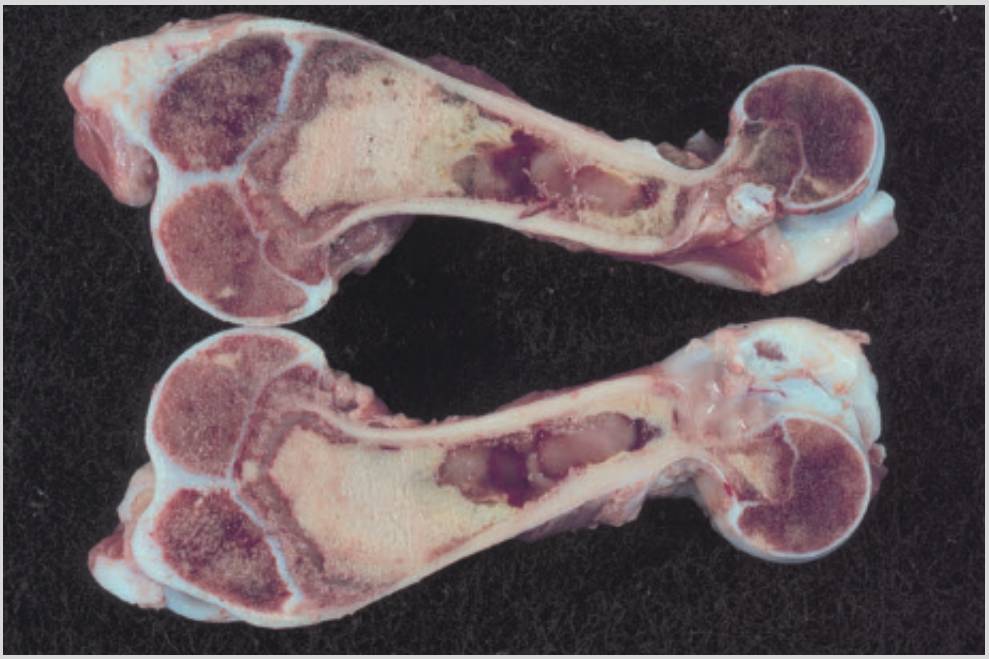
Animal species/Organ	Cattle/Lower jaw
Lesion	Ameloblastoma
Scoring	Partial condemnation
Comments	A benign neoplasm originating from the enamel cells

14.106



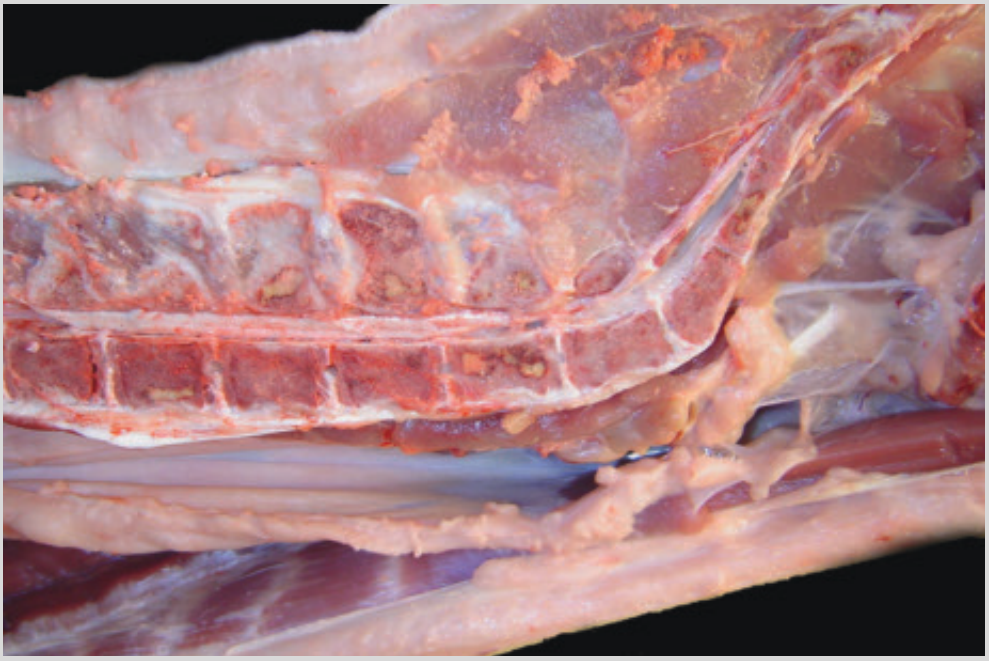
Animal species/Organ	Cattle/Lower jaw
Lesion	Ameloblastoma
Scoring	Partial condemnation
Comments	If the growth is invasive, the neoplasm is malignant, and necessitates total condemnation

14.107



Animal species/Organ	Cattle/Humerus
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	All malignant neoplasms necessitate total condemnation

14.108



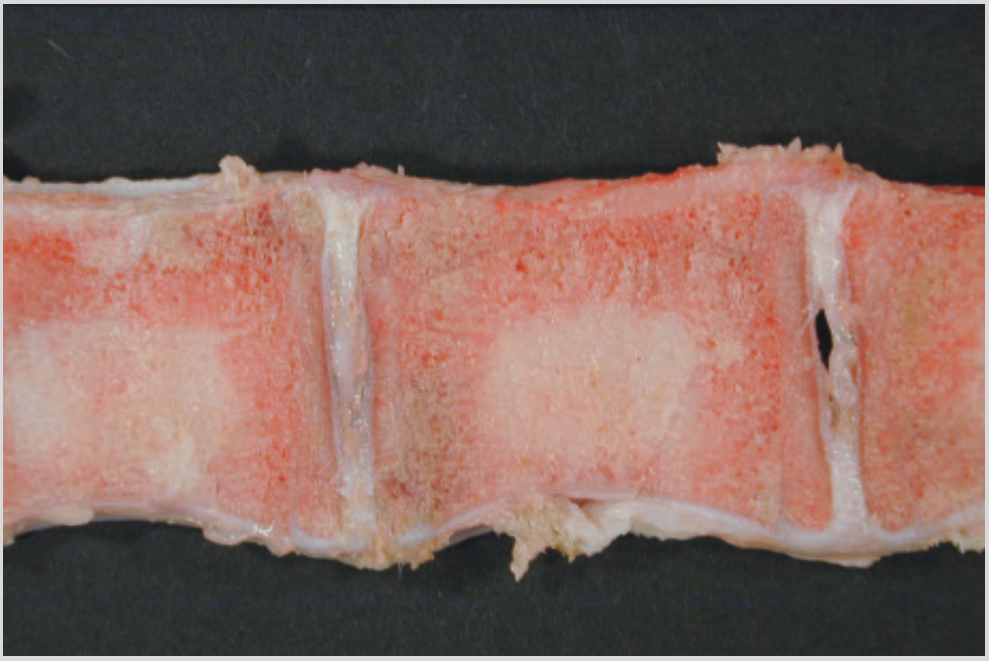
Animal species/Organ	Pig/Vertebrae
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	The condition is often accompanied by infiltration of tumour cells in other organs

14.109



Animal species/Organ	Pig/Vertebrae
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	Note the pale yellow colour

14.110



Animal species/Organ	Pig/Lumbar vertebrae
Lesion	Lipomatosis
Scoring	Partial condemnation
Comments	Is easily misdiagnosed as lymphosarcoma

15 Muscle

Introduction p. 555
Rigor mortis p. 555
Developmental anomalies p. 556
Haemorrhage p. 556
Atrophy p. 557
Necrosis and degeneration p. 557
Trauma p. 559
Myositis p. 559
Colour changes p. 561
Mineralisation and ossification p. 562
Neoplasms p. 562

Introduction

The muscles have a special position at meat inspection because they are generally synonymous with meat. Thus, even partial condemnation of muscles has significant economic consequences compared with rejection of other tissues or organs.

All muscle lesions necessitate as a minimum rejection of the affected areas, but if the lesions cannot be contained condemnation of the entire carcase is necessary. A number of muscle conditions can be a sign of generalised disease or comprise a health risk, thus necessitating total condemnation regardless of the extent.

Muscles normally exhibit a large variation in colour. This is particularly evident in pigs where the muscles are often very pale. This colour variation is due to the different proportions of type I and type II muscle fibres in the individual muscles. Type I fibres are dark and are mainly found in the masticatory muscles, the respiratory muscles, and other muscles that can work for long periods without rest. These muscles are therefore dark. In contrast, type II fibres are found particularly in muscles that work for short periods at a time, but which can be explosive in their action ("sprinter muscles"). Musculus longissimus dorsi and m. semitendinosus are two examples of muscles with a large proportion of type II fibre. It is important to be aware that this normal colour variation is not accompanied by variation in texture, which is otherwise present in certain pathological conditions.

Rigor mortis

Rigor mortis occurs as a result of a number of post-mortem biochemical changes in the muscles and starts about 2 to 6 hours after time of death. The condition manifests first in the jaw muscles, then in the body muscles, and finally in the limb muscles.

Rigor mortis is at a maximum 1 to 2 days post mortem and abates hereafter in the same order as it occurred. It finally ceases about 4 days after time of death.

Rigor mortis occurs very quickly in animals that are exhausted at the time of slaughter because they have a reduced glycogen content in the muscle fibres. In contrast, rigor mortis can be entirely absent in cachectic animals.

Developmental anomalies [15.01 – 15.03]

Muscle anomalies are not very frequent, and only two examples are given in the following.

Congenital muscular hyperplasia ("double-muscling") occurs in certain cattle breeds and is apparent as highly increased muscle mass, particularly in the rear parts and the shoulder region. The condition is genetic, and the high incidence in certain cattle breeds is due to decades of breeding to select the condition because of the increased meat yield. Animals with congenital muscular hyperplasia are given unconditional approval at meat inspection.

Lipomatosis is a congenital condition seen particularly in cattle, and less commonly in pigs, that is characterised by abnormal deposits of fatty tissue in the skeletal muscles. The changes are symmetrical and can be demonstrated particularly in the back and lumbar muscles. In extreme cases, the muscles comprise almost exclusively fatty tissue, but low-grade cases can be easily overlooked. At meat inspection the changed areas necessitate partial condemnation.

Haemorrhage [15.04 – 15.05]

Petechial haemorrhage in muscles often occurs in connection with the slaughter procedure, particularly if electrical stunning is used. The haemorrhage is most probably due to clonic seizures in the non-exsanguinated animal, but may also been seen at percussive stunning when the medulla oblongata is damaged.

Muscles with blood splash must be stripped out. Total condemnation is necessary if complete stripping is not possible.

Haemorrhage in muscles can be seen in a number of conditions of an infectious, immune-mediated, or toxic character. Examples include hog cholera, purpura haemorrhagica in horses, and poisoning with vitamin K antagonists. In addition, particularly in pigs, sporadic cases with coagulation defects occur, in which the cause is unknown, and where there is presumably deficient production of coagulation factors or platelets.

Regardless of the cause, these cases will generally be accompanied by varying degrees of haemorrhage in other organs and tissues.

Scoring depends on the cause of the lesions and their distribution. As they are nearly always generalised, the general rule is total condemnation regardless of the cause.

Atrophy [15.06]

Muscle atrophy can be due to deficient innervation of a muscle (denervation atrophy), lack of use of a muscle, e.g. due to pain (disuse atrophy), or increased muscle degradation as in cachexia or senility (inanition atrophy). In the latter, systemic lesions are found combined with varying degrees of cachexia, which necessitates total condemnation. In denervation atrophy or inactivity atrophy the lesions are generally localised (extremity or muscle group), necessitating rejection of the affected areas, unless the cause or complications dictate otherwise.

Necrosis and degeneration [15.07 – 15.14]

Muscle necrosis can have many causes. At meat inspection, scoring depends partly on the cause and partly on the distribution. There is a certain correlation between cause and distribution of muscle necrosis. Ischaemic necroses are as a rule focal and are typically due to external factors such as pressure. The classic examples are decubital necroses in the thigh muscles in cattle, particularly in newly-calved cows due to increased intramuscular pressure. Similar lesions ("shoulder ulcers") are often seen in the shoulder area in sows, but here the skin and bone tissue are primarily involved. Ischaemic necrosis of the gastrocnemius muscle or the cranial muscles on the limbs is seen particularly in Jersey cows in the period around calving, and is due to elevated intramuscular pressure. The condition represents the so-called compartment syndrome and is seen exclusively in muscles that are surrounded by bone and tight fascia or aponeurotic sheath. The necrotic muscles are often the site of severe haemorrhage and rupture. Ischaemic muscle necroses without complications other than haemorrhage and rupture necessitate partial condemnation.

Muscle necroses can also be due to deficiency conditions, intoxications, infections, and extreme stress, e.g. in connection with transport. These cases are generally systemic, i.e. large parts of the muscles are affected. Actual necrosis of the muscle tissue can be very difficult to detect macroscopically, and these conditions are often called "muscle degeneration". Not all muscles are necessarily affected, but often specific muscle groups (such as respiratory muscles) or muscle types (e.g. primarily type I or type II muscles) are affected.

Infectious muscle necroses will be discussed in the section on myositis, but we will mention one example here, purpura haemorrhagica in horses. Purpura haemorrhagica is due to an immunologic reaction against the strangles bacterium, *Streptococcus equi* subsp. *equi.* Thus it is not a directly infectious condition. The lesions are characterised by disseminated haemorrhagic muscle necroses as well as oedema and haemorrhage in a large number of organs. The condition can be confused with myositis caused by *Clostridium* spp., but purpura haemorrhagica usually manifests with multifocal lesions and is not accompanied by gas production. The systemic lesions in purpura haemorrhagica, combined with the extensive complications, necessitate total condemnation.

Toxic muscle necroses are relatively rare. They occurred far more frequently previously, and were due to accidental or deliberate addition of ionophores to the feed,

particularly monensin. The changes can be difficult to detect in the early stages, but are characterised by flaccid muscles with irregular white stripes. Similar changes can be found in the heart. Toxic muscle necroses necessitate total condemnation.

Nutritional muscle degeneration (NMD) or white muscle disease is due to deficiency of vitamin E and/or selenium and can be seen in all animal species. The condition is particularly important in young animals, where it often results in acute death; however, chronic cases may be seen in slaughter animals. The lesions comprise white-to-yellow more or less confluent streaks with varying degrees of mineralisation and perhaps haemorrhaging in the muscles. Their appearance and distribution depend on the age and animal species. Mineralisation is often obvious in young individuals, particularly lambs and calves. The heart may be involved in all animal species, but particularly in the pig, where heart and liver lesions ("mulberry heart disease" and massive liver necrosis, respectively) often overshadow the muscle lesions. The lesions of NMD can be found in almost all muscles but certain muscle groups, particularly the respiratory muscles and the large thigh and shoulder muscles, have a greater predisposition than others to develop lesions.

NMD necessitates rejection of the affected muscles. Extensive lesions necessitate total condemnation.

Extensive muscle necroses can occur secondary to extreme stress and physical activity. This occurs particularly in pigs and horses. However, the pathogenesis is very different between the two species, and in the horse are most probably caused by several conditions.

The incidence of porcine stress syndrome (PSS) or malignant hyperthermia has dropped considerably thanks to effective breeding. The condition is due to a genetic defect and manifests as abnormally high stress sensitivity seen at transport or under other stressful conditions, that cause extreme physiological disturbances including hyperthermia, seizures, and extreme drop in intramuscular pH.

The lesions at PSS are pale, soft, and exudative muscles (hence they are often called PSE). Rigor mortis occurs very rapidly, and there are often signs of heart failure (pulmonary oedema and pulmonary congestion, hydrothorax and hydropericardium, as well as acute liver congestion). The muscle lesions are due to extensive necroses and extreme intramuscular oedema. The most frequently affected muscles have a high proportion of type II fibre. The lumbar and back muscles, and the hams and shoulders, are particularly affected.

Pigs with high-grade lesions in all muscles are condemned. Pigs with limited distribution of high-grade or low-grade lesions can be approved entirely or partially for processing after deboning. Final scoring can be made after about 24 hours. Parts with high-grade lesions are stripped out. Parts with low-grade lesions are approved for processing. Parts with no lesions can be approved.

Horses are affected by conditions variously referrred to as acute exertional rhabdomyolysis ("tying-up") or paralytic myoglobinuria ("Monday morning disease", "azoturia"). The cause of these conditions has not been clarified and it is uncertain whether these are two separate forms of the same condition or whether they are different diseases. Paralytic myoglobinuria is seen particularly in draught horses and is therefore

quite rare. Acute exertional rhabdomyolysis, which particularly affects riding, racing, and trotting horses, occurs far more frequently. Acute exertional rhabdomyolysis and paralytic myoglobinuria are seen in horses that are used after a shorter or longer rest period, and manifest as extensive muscle necrosis often with release of large amounts of myoglobin into the blood and subsequently into the urine such that it becomes dark (myoglobinuria). In extreme cases, kidney damage may be seen with tubular necrosis. Muscle lesions in acute exertional rhabdomyolysis are generally mild and can be overlooked at examination. Paralytic myoglobinuria on the other hand is associated with severe lesions such as oedematous, swollen and dark-coloured muscles with pale stripes and widespread haemorrhage. The thigh and lumbar region are most often affected.

Horses with extensive lesions are condemned. Limited lesions necessitate partial condemnation

Trauma [15.15]

Traumatic injury to the muscles is seen frequently in slaughter animals, particularly in cattle. These could be butting lesions, lesions that have occurred in connection with transport to slaughter, skidding, or rupture of the m. gastrocnemius in newly-calved cows. The presence of traumatic muscle lesions necessitates partial condemnation. Butting lesions in particular can occasionally be so extensive that they necessitate total condemnation.

Myositis [15.16 – 15.22]

Inflammations in the muscles are seen particularly in cattle. The cause is most often parasitic, but bacterial myositis also occurs.

Bacterial and vaccine-related myositis

Bacterial myositis can be divided into three main groups based on the inflammatory reaction: serofibrinous, granulomatous, and purulent myositis.

Serofibrinous myositis is due in particular to *Clostridium* spp. Pathogenically two different mechanisms may be involved: Penetration through a wound or haematogenous spread after oral uptake of spores.

Wound infections with *Clostridium* spp. are seen in all animal species. The condition is called gas gangrene or malignant oedema and is due to the bacteria's ability to proliferate in the anaerobic and alkaline conditions that are often present in deep wounds. The bacterial species involved are generally *Cl. septicum, Cl. perfringens, Cl. novyi* or *Cl. chauvoei.* The infections manifest as extreme serofibrinous exudation with gas production, necrosis, and pronounced intoxication.

Haematogenous spread of *Clostridium* spp. after ingestion of spores is seen in cattle and sheep. The condition is called blackleg and is primarily due to *Cl. chauvoei*. It is believed that clostridial spores are taken up into the blood stream via the mucous membranes of the alimentary canal. From here they are transported to the muscles where they can remain dormant for a very long time re-emerging when a local event such as muscle necrosis or low oxygen tension triggers growth. Then the inflammatory

process starts with serofibrinous exudation, necrosis, and gas production. The condition has an acute course with extreme intoxication of the animal.

Gas gangrene and blackleg necessitate total condemnation.

Granulomatous myositis is primarily due to *Actinobacillus lignieresii* or *Staphylococcus aureus*. So-called "wooden tongue" in cattle is due to *A. lignieresii* and is discussed in Chapters 8 and 20. *S. aureus* causes pyogranulomatous inflammation, also known as botryomycosis, in all animal species (see Chapter 20). The condition is seen particularly secondary to wound infections in which they cause proliferative lesions characterised by fibrosis with widespread purulent foci. Ruminants which have been vaccinated against Johne's disease occasionally demonstrate extreme reaction to the vaccination in the form of granulomatous inflammation localised to the muscles with varying degrees of purulent content or caseation. The lesions are immune-mediated and do not contain viable bacteria. Uncomplicated cases of granulomatous myositis necessitate partial condemnation.

Purulent myositis is due either to local invasion of pyogenic bacteria or haematogenous spread at pyaemia. *Trueperella* (*Arcanobacterium*) *pyogenes* and streptococci are most frequently involved. Local invasion is seen in wound infections resulting from tail or hoof lesions, for example. The bacteria are often spread locally, sometimes with involvement of the regional lymph nodes, and occasionally cause pyaemia. The so-called psoas abscesses are well-known in pigs, but they are the result of descending infection to the psoas muscle from a lesion in the caudal spine. Purulent myositis secondary to pyaemia is seen particularly in cattle, where pyogenic bacteria, in particular *T. pyogenes*, spread to devitalised areas of the muscle where they cause abscess formation. Such devitalised areas are seen most frequently in the thigh muscle in cattle where, as previously discussed, they are the result of ischaemia due to pressure against an underlying surface (decubital necrosis).

Chronic, purulent lesions without complications, that are due to local spread, necessitate partial condemnation. Pyaemic lesions are scored in accordance with the rules for pyaemia, i.e. the presence of only limited chronic lesions necessitates partial condemnation with approval of the carcase for deboning. Alternatively, total condemnation.

Parasitic myositis

Parasitic myositis is seen primarily in cattle and sheep. It is generally accompanied by varying degrees of tissue eosinophilia, which macroscopically manifests as greenish muscles. The majority of cases of eosinophilic myositis in cattle are due either to sarcosporidia (*Sarcocystis* spp.) or bovine cysticerci (*Cysticercus bovis*). Sarcosporidiosis manifests as multiple grey-to-green lesions in the muscles. These lesions represent areas in which the sarcosporidia have died and caused an inflammatory reaction with necrosis of muscle tissue, a large number of eosinophilic granulocytes, and fibrosis. The size of the lesions varies from almost invisible to several cm in diameter. The sarcosporidia predilection sites are the larynx muscles, the intercostal muscles, the diaphragm, the abdominal muscles, and the heart. The pathogenesis underlying the lesions is only poorly understood. Sarcosporidia occur quite commonly and in most cases no visible lesions develop, but certain animals appear to react very strongly to the degenerated organisms.

At meat inspection, the affected muscles are rejected. Total condemnation is necessary if complete stripping is not possible.

Bovine cysticerci occur sporadically in Danish cattle. The appearance of the lesions depends on the viability of the cysticerci. The viable cysticercus is apparent as a clear, fluid-filled oval cysts 7-10 mm long and 5 mm wide, surrounded by a whitish host capsule. After a certain time, the cysticercus dies and is converted to a yellow-greenish mass surrounded by an eosinophilic reaction which macroscopically appears green. The lesions normally also undergo mineralisation. The cysticercus predilection sites are the masseter muscles, the heart, diaphragm, tongue, intercostal muscles, and the oesophagus. If bovine cysticerci are demonstrated at meat inspection, the masseter muscles, diaphragm, and heart are cut into thin sections and carefully examined. If 10 viable or dead cysticerci are detected at this examination, the tongue and underlying muscles must be examined in the same way. Findings of more than 10 viable or dead cysticerci necessitate total condemnation. Findings of less than 10 viable and dead cysticerci necessitate approval of carcase and organs conditional on freezing. Notwithstanding, the head, heart, diaphragm, oesophagus and cysticerci-infected organs as well as the tongue, if it has been cut for examination, must always be rejected. Findings of up to 10 dead cysticerci in cattle older than 2 years necessitates unconditional approval of the carcase which must be health marked to show that it is not to be exported.

Idiopathic eosinophilic myositis

Not all cases of eosinophilic myositis are due to parasites. In cattle in particular, cases of eosinophilic myositis occasionally occur in which it is not possible to demonstrate a parasitic agent. These cases are called idiopathic eosinophilic myositis and occur as two types: granulomatous and diffuse. The granulomatous type is very reminiscent of myositis caused by sarcosporidia with disseminated lesions that can be found throughout the skeletal muscles and the heart. The diffuse type can have the same localisation as the granulomatous type, but is characterised by larger, confluent, green discoloured areas.

At meat inspection, scoring of idiopathic eosinophilic myositis is the same as that for sarcosporidiosis, i.e. localised lesions are stripped out, and if complete stripping is not possible the entire carcase must be condemned.

Colour changes

Lipofuscinosis is seen particularly in older emaciated livestock, and manifests as a brownish discolouration of the musculature, particularly the diaphragm and masticatory muscles. The condition is due to deposits of the pigment lipofuscin in the muscle cells. The heart muscles and internal organs may also possibly be involved. Lesions that are limited in distribution necessitate partial condemnation. Most cases however are systemic necessitating total condemnation.

In cattle and pigs particularly, the carcase may occasionally have a much darker colour than normal, while the muscle texture is firm and dry. The condition is called DFD (dark, firm and dry) and is due to exhaustion of the glycogen reserves in the muscles prior to slaughter. This means that the normal post-mortem glycolysis and pH

drop do not occur. Limited distribution of the lesions necessitates partial condemnation; alternatively the entire carcase must be condemned.

Mineralisation and ossification [15.23]

Calcification of muscles can be due to prior injury to the muscle tissue (dystrophic calcification), but it can also occur in non-damaged tissue (metastatic calcification). Dystrophic calcification can occur secondary to any type of muscle necrosis but is seen in particular in connection with parasitic muscle lesions. Metastatic calcification in muscles is due to high concentrations of vitamin D or substances with vitamin D-like activity in the feed, including plants. Calcification in muscles necessitates rejection of the affected areas. Extensive lesions or intoxications necessitate total condemnation.

Bone tissue formation in the abdominal wall is seen occasionally in pigs, particularly secondary to hernia. The lesions manifest as ossification in the hernial sac itself or in the hernial ring. The condition is incorrectly called myositis ossificans and represents so-called metaplastic ossification. It does not occur in the muscle itself, but in the newly-formed connective tissue (scar tissue) in the damaged abdominal wall. At meat inspection, the affected parts must be rejected.

Neoplasms [15.24]

Primary muscle tumours are extremely rare. Muscle tumours are more commonly the result of invasion from a tumour in the skeletal system or skin. For example, this is seen in malignant melanomas in horses. Lymphosarcomas can occasionally be found in muscles. Malignant muscle tumours necessitate total condemnation.

15.01



Animal species/Organ	Pig/Psoas muscle
Lesion	Dermoid cyst
Scoring	Partial condemnation
Comments	Congenital malformation with ectopic localisation of skin with hair growth

15.02



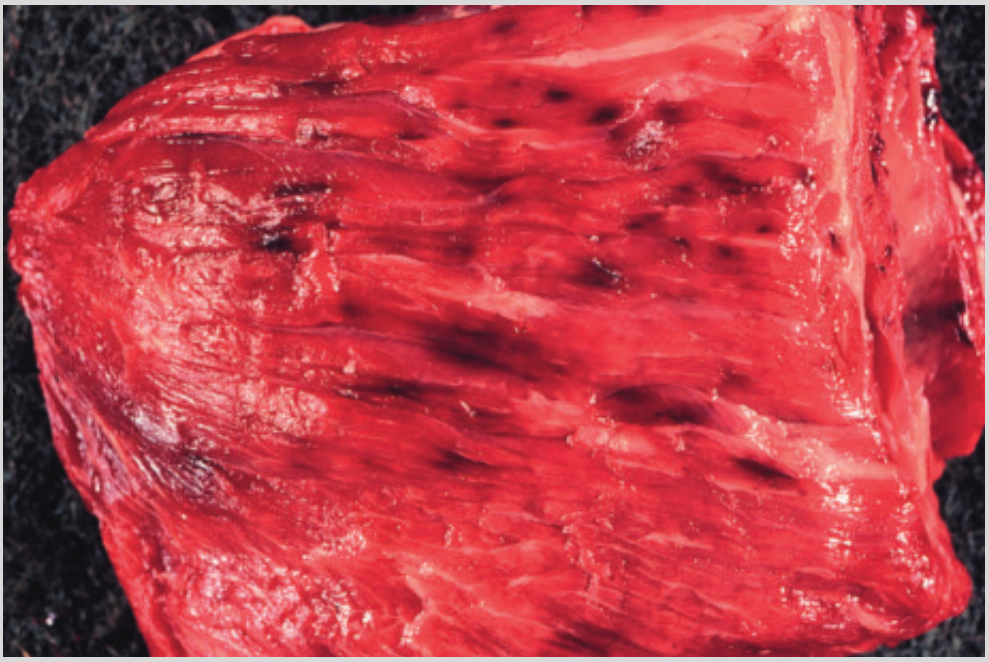
Animal species/Organ	Cattle/Muscle
Lesion	Lipomatosis
Scoring	Partial condemnation
Comments	Excessive amounts of fatty tissue in the muscles

15.03



Animal species/Organ	Pig/Muscle
Lesion	Lipomatosis
Scoring	Partial condemnation
Comments	Extensive lesions necessitate total condemnation

15.04



Animal species/Organ	Cattle/Muscle
Lesion	Blood splash
Scoring	Partial condemnation
Comments	Blood splash cannot be differentiated from other haemorrhage based on appearance alone

15.05



Animal species/Organ	Pig/Muscle
Lesion	Petechial, septicaemic haemorrhages
Scoring	Total condemnation
Comments	Often accompanied by haemorrhage on the serous membranes

15.06



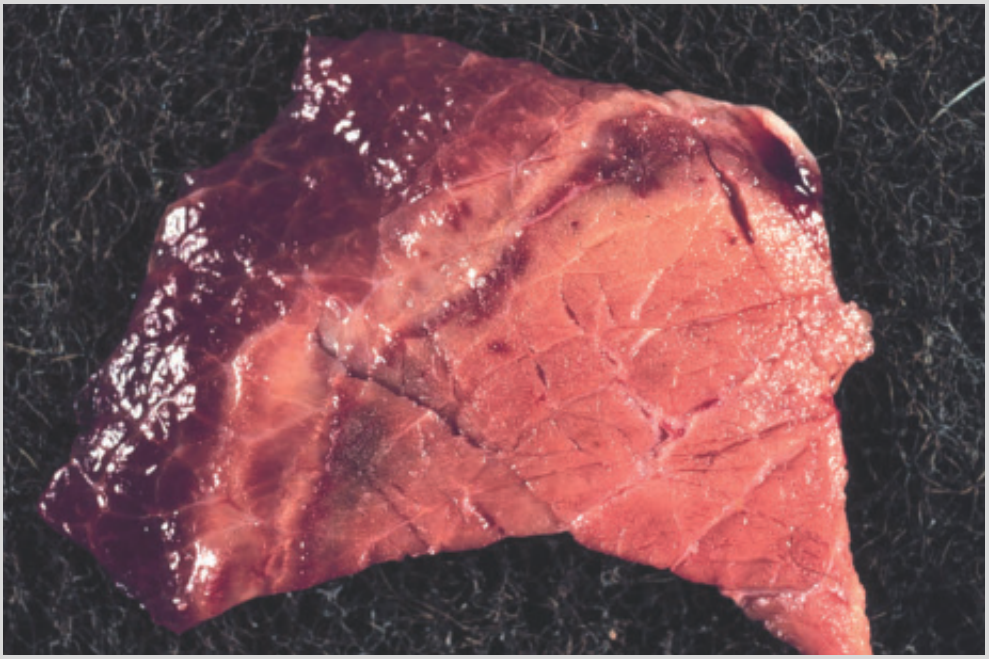
Animal species/Organ	Horse/Larynx
Lesion	Denervation atrophy of m. cricoarytenoideus dorsalis sinister
Scoring	Partial condemnation
Comments	Clinically, the condition is called roarer or whistler

15.07



Animal species/Organ	Cattle/Thigh muscle
Lesion	Acute, decubital, haemorrhagic necrosis
Scoring	Partial condemnation
Comments	Seen particularly in newly-calved cows

15.08



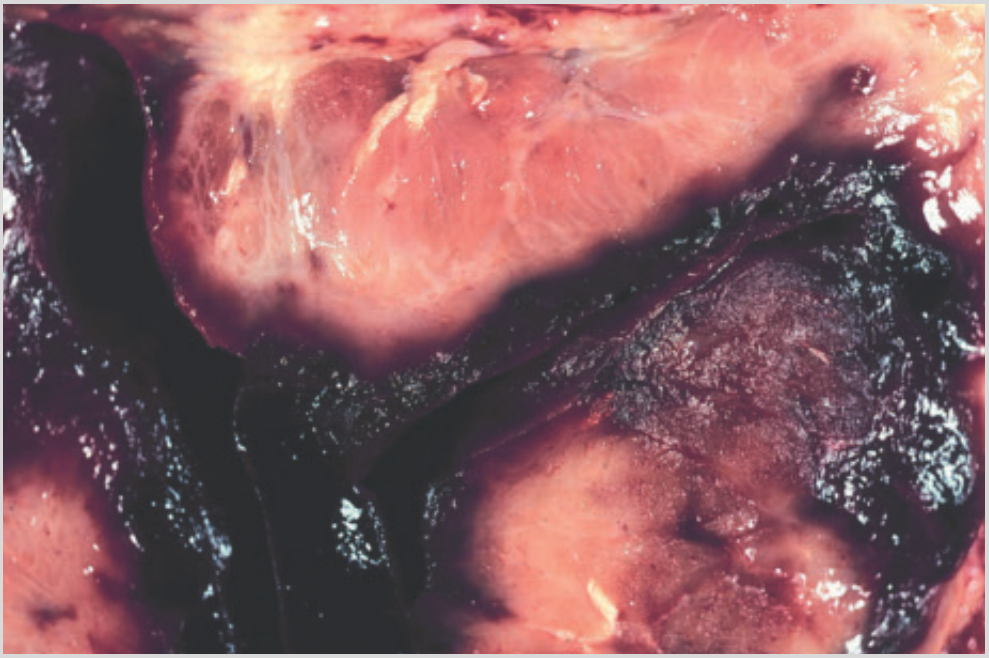
Animal species/Organ	Cattle/Thigh muscle
Lesion	Chronic, decubital, ischaemic necrosis
Scoring	Partial condemnation
Comments	Note the obvious demarcation

15.09



Animal species/Organ	Cattle/Pelvic muscles
Lesion	Chronic, decubital necrosis
Scoring	Partial condemnation
Comments	Highly susceptible to secondary infection

15.10



Animal species/Organ	Cattle/Thigh muscle
Lesion	Chronic, decubital necrosis with secondary rupture
Scoring	Partial condemnation
Comments	Often accompanied by extensive haemorrhage

15.11



Animal species/Organ	Cattle/M. gastrocnemius
Lesion	Rupture
Scoring	Partial condemnation
Comments	Seen particularly in Jersey cows

15.12



Animal species/Organ	Horse/Intercostal muscles
Lesion	Nutritional muscle degeneration
Scoring	Partial condemnation
Comments	Extensive lesions necessitate total condemnation

15.13



Animal species/Organ	Pig/Back muscle
Lesion	Porcine stress syndrome (PSS)
Scoring	Partial condemnation
Comments	Animals with high-grade lesions in all muscles are condemned

15.14



Animal species/Organ	Horse/Psoas muscle
Lesion	Acute, haemorrhagic necrosis (paralytic myoglobinuria)
Scoring	Partial condemnation
Comments	Extensive lesions necessitate total condemnation

15.15



Animal species/Organ	Cattle/Muscles
Lesion	Traumatic lesions (butting)
Scoring	Partial condemnation
Comments	Extensive lesions may necessitate total condemnation

15.16



Animal species/Organ	Horse/Muscle
Lesion	Acute, necrotising myositis caused by *Clostridium* sp.
Scoring	Total condemnation
Comments	The lesions are the site of gas production

15.17



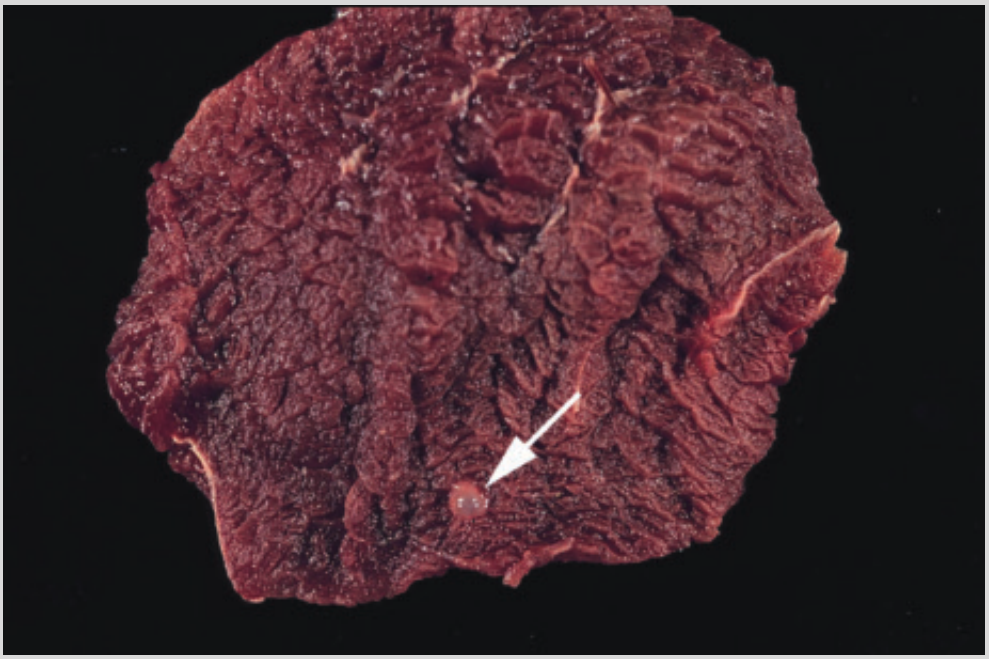
Animal species/Organ	Cattle/Muscle
Lesion	Chronic, necrotising and pyogranulomatous myositis
Scoring	Partial condemnation
Comments	Due to vaccination against Johne's disease

15.18



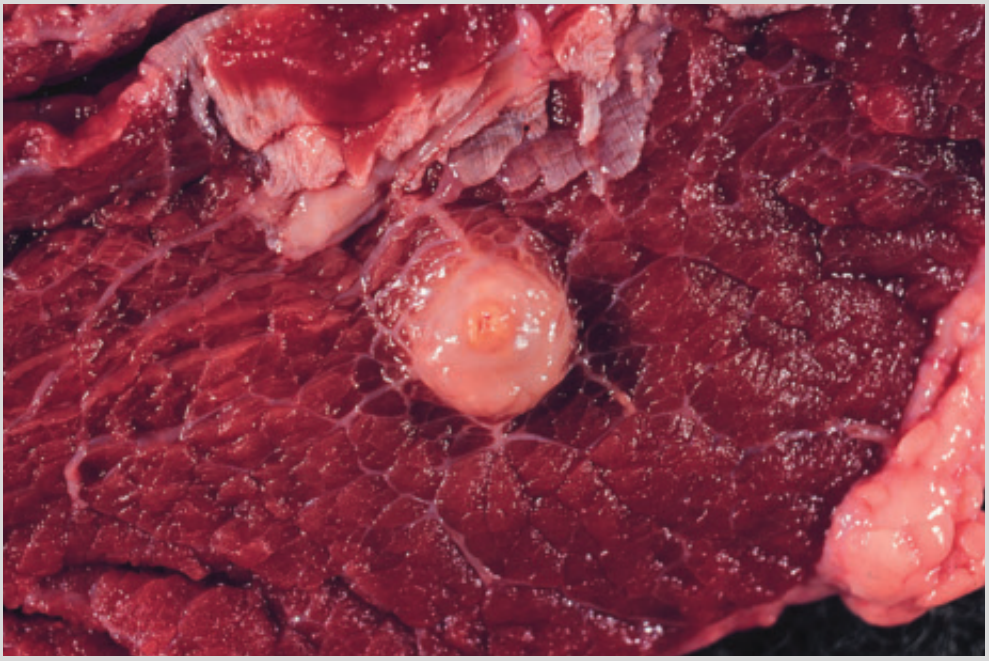
Animal species/Organ	Pig/Muscle
Lesion	Sarcosporidiosis
Scoring	Partial condemnation
Comments	Normally the lesions have a greenish hue

15.19



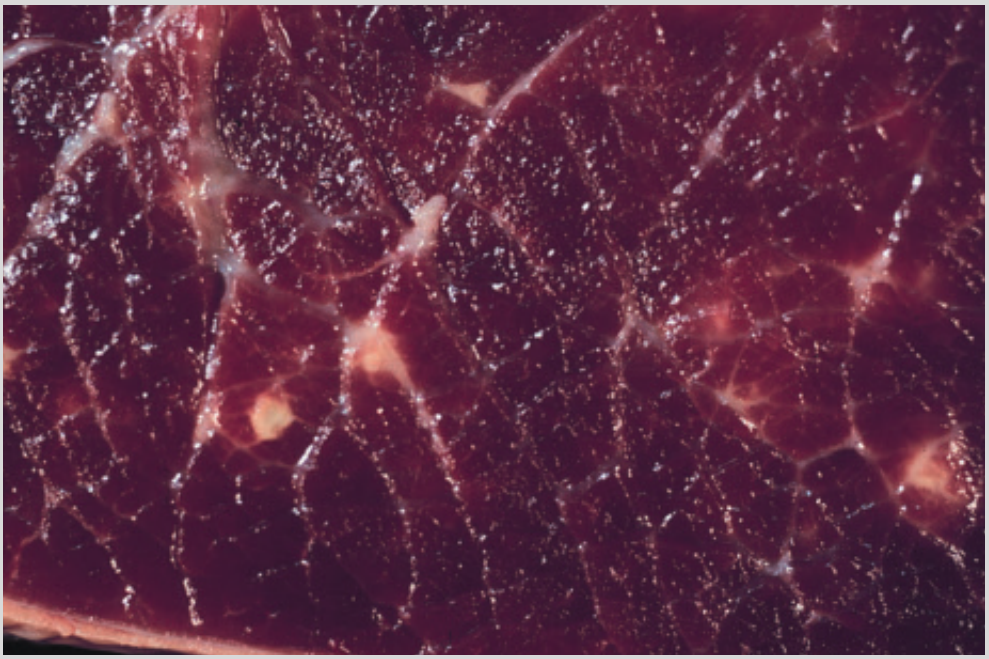
Animal species/Organ	Cattle/M. masseter
Lesion	Cysticercosis (viable *Cysticercus bovis* (bovine cysticercus)(→))
Scoring	Conditional approval of carcase and organs
Comments	Findings of more than 10 cysticerci necessitate total condemnation

15.20



Animal species/Organ	Cattle/M. masseter
Lesion	Cysticercosis (dead *Cysticercus bovis* (bovine cysticercus))
Scoring	Conditional approval of carcase and organs; alternatively UA in cattle > 2 years
Comments	Findings of more than 10 cysticerci necessitate total condemnation

15.21



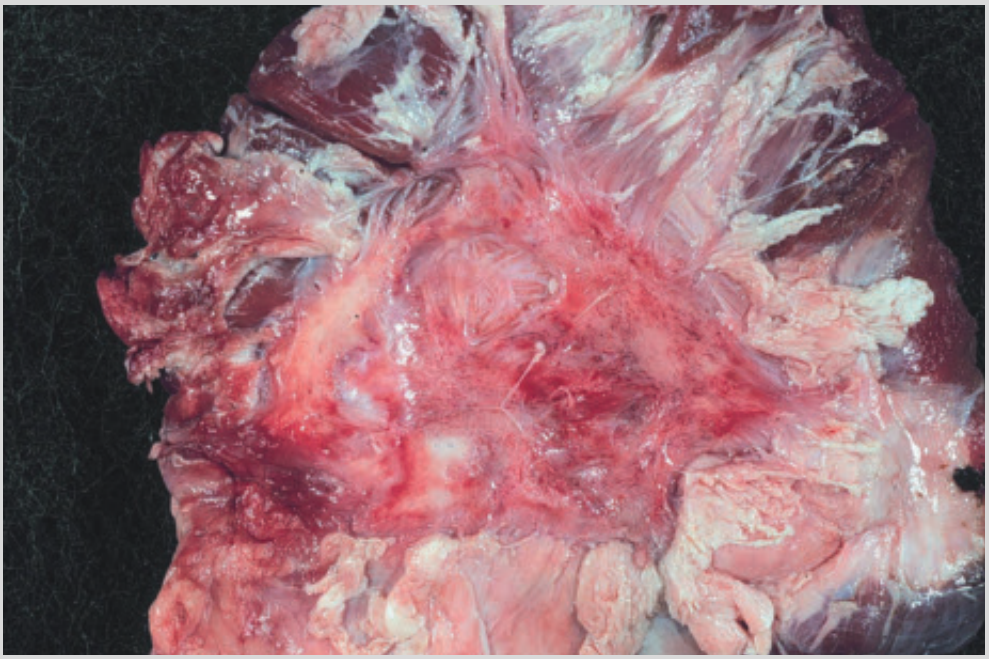
Animal species/Organ	Cattle/Muscle
Lesion	Chronic, eosinophilic, granulomatous myositis
Scoring	Partial condemnation
Comments	The lesions cannot be differentiated macroscopically from sarcosporidiosis

15.22



Animal species/Organ	Cattle/Muscle
Lesion	Chronic, eosinophilic, diffuse myositis
Scoring	Partial condemnation
Comments	Note the greenish hue of the lesions

15.23



Animal species/Organ	Pig/Abdominal wall
Lesion	Myositis ossificans
Scoring	Partial condemnation
Comments	Metaplastic bone formation in the abdominal wall scar tissue

15.24



Animal species/Organ	Pig/Muscles
Lesion	Lymphosarcoma
Scoring	Total condemnation
Comments	An unusual localisation

16 Skin

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Introduction

An increased awareness on animal welfare has resulted in increased focus on lesions that could indicate neglect or maltreatment (see Chapter 22). Because the skin comprises the body's barrier to the surroundings, it is particularly important to identify evidence of trauma and similar causes and lesions here. Nevertheless, the vast majority of lesions observed in the skin have no association to neglect or maltreatment. Some causes act on the whole body such as nutrition, and skin lesions may develop due to nutrient deficiency or malabsorption. Thus, long-term starvation results in loss of subcutaneous fatty tissue; and nutritional panniculitis is related to destruction of vitamin E in the feed. In general, the welfare of animals appears to be positively correlated with the quality of the skin and adnexa (hair, claws, hooves, etc.), and skin can therefore be a subjective indicator of generalized diseases. Many skin lesions occur only locally. Occasionally the cause or causes of the lesions can be determined, but frequently the lesions can only be scored as wounds, dermatitis or eczema. Because pigs are not flayed, as the skin is being used for human consumption, it is particularly in this species that skin lesions have consequences at meat inspection. Scalding, scraping and singeing means that skin lesions will be less obvious at meat inspection. If animals are to be flayed, special attention must be paid to the presence of skin lesions at ante-mortem inspection.

Developmental anomalies [16.01 – 16.03]

In pigs a special form of hypotrichosis (too little hair) occurs localised to the back, the lumbar, sacral, and gluteal regions, and/or the tail. The characteristic macroscopic findings are multiple dark cysts, 1 – 10 mm in diameter, in the cutis or subcutis. The cysts contain a dark, paste-like secretion (sebum and desquamated epidermal cells) and a hair which is curled in a spiral. Sometimes, there is no cyst formation, but just spiral or curled-

up hairs located under the epidermis. This is due to a developmental anomaly of the hair follicle, which means that the hair apparently cannot break through to the surface. This results in retention of sebum-like material and the hair turns around and down into the hair sac. The condition is also called cystic hypotrichosis. The aetiology is unknown.

Wattles are seen occasionally in pigs. Similarly, bilateral symmetrical furrows can be present in the skin behind the thoracic limbs. Dermatosis vegetans is a genetic (autosomal recessive) disease in Landrace pigs. The disease occurred relatively frequently in the 1940s, when it spread from Scandinavia to England, Canada, and Australia via exported animals. Today, the disease has been eradicated through breeding. Three types of changes are present in dermatosis vegetans: 1) Focal skin lesions comprised of scaly/exudate-covered areas with a tendency to papillomatous proliferation and peripheral hyperaemia (can vaguely resemble pityriasis rosea); the skin lesions can coalesce. 2) Oedamatous thickening in the region of the coronary band (claws and dew claws), where exudate can be seen ("club foot") and thickening of the hoof wall, which has concomitant furrows parallel to the coronary band; the lesions in the distal limbs are congenital. 3) Finally, there is interstitial pneumonia, so-called giant cell interstitial pneumonia.

All the types of developmental anomalies mentioned necessitate partial condemnation with rejection of the affected parts and subsequent unconditional approval.

Nutritional diseases [16.04 – 16.06]

Numerous nutritional diseases that manifest in the skin have been described. Years ago, zinc-responsive dermatosis (parakeratosis) occurred relatively frequently in pigs. Today, nutritional panniculitis, which is also called steatitis or yellow fat disease, occurs occasionally. The disease occurs most frequently in pigs, but can also be found in foals. Lesions are present in the subcutaneous fatty tissue, but in both pigs and foals all fatty tissues can be affected. Feed containing low concentrations of vitamin E and high concentrations of unsaturated fatty acids (e.g. fish-based feeds) can result in oxidation of fatty acids and thus formation of free radicals, leading to necrosis and a secondary inflammatory response. In pigs, the fatty tissue assumes a grey to yellow colour (due to ceroid pigments) and becomes soft; in addition it emits a fishy odour. In pigs, nutritional panniculitis may be seen together with muscle degeneration, toxic liver dystrophy, and mulberry heart disease. In foals, the condition may occur together with muscle degeneration. At meat inspection, nutritional panniculitis necessitates total condemnation.

Circulatory disorders [16.07 – 16.15]

Elephantiasis or pachydermia is a general term for thickening of the skin due to presence of large amounts of fibrous tissue. The lesion presumably occurs as a result of chronic oedema in the cutis and subcutis caused by stasis of blood or lymph with subsequent development of fibrosis. The lesions are typically seen distally in the limbs, tail, and ears, and can be seen in all species. In pigs, the lesions often occur as a result of chronic pyogranulomatous lymphangitis, caused by bite lesions, as described in Chapter 18. At meat inspection, scoring is partial condemnation with rejection of the

affected parts and subsequent unconditional approval. The presence of complications necessitates total condemnation.

Haemorrhage in the skin can have many causes, including trauma and infections. Frostbite occurs rarely, but then typically on the tips of the tail and ears, and on the teats in females and scrotum in males. The lesions are in the acute stages characterised by hyperaemia, haemorrhage, and epidermal necrosis. Severe cases can result in development of dry gangrene.

Sunburn and photosensitisation (see Chapter 9) occur on those parts of the skin that have little/no pigmentation or hair cover and are exposed to strong sunlight. Irritants can cause dermatitis (irritant contact dermatitis); the lesions occur where the skin is in contact with the irritant. Faeces and urine are both potential candidates. Urine scald occurs in pigs in which lesions develop laterally on the thighs and on the ventral part of the body. Hyperaemia, haemorrhage, inflammation, and possibly vesicles or bullae (large vesicles) and necrosis are seen on the skin during acute stages.

At meat inspection, scoring is partial condemnation with rejection of the affected parts and subsequent unconditional approval. The presence of complications necessitates total condemnation. The chronic stages are characterised by wounds and ulcers and later by healing, and are scored accordingly. Infections in the skin are described later (p. 580).

Mineralisation of the skin and subcutis occurs rarely. The causes of mineralisation can be prior skin injury and the mineralisation is therefore dystrophic. In connection with umbilical hernia in pigs and castration wounds in geldings, bony tissue metaplasia of the connective tissue (ectopic bony tissue) can occur in the hernial ring or castration wound. This alteration of tissue differentiation to bony tissue may be a response aimed at making the tissue more resistant against injury such as pressure from the abdominal organs on the hernial ring. Scoring is partial condemnation with rejection of the affected parts and subsequent approval.

Jaundice can be caused by a number of different disease processes (see Chapter 9). The pigments localise to the skin and subcutis, and can thus cause a diffuse yellowing of the skin which is very obvious in pigs. For scoring, refer to Chapter 9.

Growth of various fungi (including *Claviceps* spp.) in feed can result in formation of toxic alkaloids (ergotamine, ergometrine and ergotoxin). If ingested these stimulate the adrenergic nerves in the arteriole smooth muscles. This results in peripheral vasoconstriction and thrombosis of the capillaries and development of ischaemic necrosis of peripheral areas of the limbs (generally from the pastern and distally), the ears, and the tail. Initially there is swelling and redness; later dry gangrene (necrosis) with proximal demarcation. The condition is called ergotism, and meat inspection scoring is based on the observed lesions.

Laminitis can occur in all hoofed animals. The condition can occur after ingestion of large volumes of certain types of feed and in toxaemia and sepsis (here, all four limbs will be typically affected), or it can occur after local trauma (involvement only of the traumatised limb(s)). Central to the pathogenesis is necrosis of the basal cells of the epidermis of the hoof capsule, and mild inflammation in this area. The macroscopic lesions in the acute stage are often sparse, but there may be swelling of the coronary band and possibly mild serum exudation to the overlying skin. After sagittal section it

may be possible to see mild oedema immediately below the hoof capsule. In contrast, at ante-mortem inspection the animal has obvious mobility problems. In the chronic stages, rotation of the distal phalanx (coffin bone) can be seen and the area between the hoof wall and bone is filled with newly-formed horn, granulation tissue, and/or fibrous tissue. Separation below the hoof wall and rotation of the underlying bone also occurs as an acute lesion. The distal phalanx can even penetrate the sole giving a high risk of infection. Finally, in the chronic stage, the hoof wall becomes concave. In uncomplicated cases, meat inspection scoring is partial condemnation with rejection of the affected parts and subsequent unconditional approval.

Burns and smoke injury

Burns are divided into four acute macroscopic grades depending on the depth of the lesion. Grade 1 lesions are hyperaemic and oedematous; grade 2 lesions in addition to hyperaemia and oedema in the dermis, include formation of vesicles and bullae; grade 3 lesions exhibit necrosis of both the epidermis and dermis, possibly with carbonisation of the epidermis, as well as peripheral hyperaemia and oedema; grade 4 burns are similar to grade 3 lesions, but with involvement of the subcutis and tissue below the subcutaneous fascia. Burns in slaughter animals occur most frequently as a result of fire and not, for example, from scalds. There is concomitant singeing of the hair layer, and a pronounced smell of smoke from the carcase. Fire smoke can affect the respiratory organs causing tracheobronchitis, bronchopneumonia (often fibrinous) and pulmonary oedema. At meat inspection, acute, grade 1-4 burns necessitate partial condemnation with rejection of the affected parts and subsequent unconditional approval. However, grade 2-4 lesions which involve more than about 5% of the skin necessitate total condemnation. Similarly, the presence of complications necessitates total condemnation. The chronic stages are characterised by formation of wounds and later by healing, and are scored accordingly.

Contusions and lacerations [16.16 – 16.17]

Contusions are trauma injuries to tissues and organs without the concomitant formation of wounds. If the lesion affects the skin, the skin's normal continuity is intact, and the lesion is often seen as so-called bruises. A laceration is a torn wound i.e. it has highly irregular edges. Contusions in the skin can be seen externally in non-pigmented areas with sparse hair. Therefore contusions are particularly visible on the skin of pigs. However, the slaughter process involves scalding and singeing, and the lesions will consequently assume a brown colour due to methaemoglobin formation. In other slaughter animals, flaying is often necessary to reveal contusions. Contusions occurring as a result of a fall will often be localised to regions of bony prominence. The presence of numerous lesions could indicate rough handling at transport, or transport of a sick or weak animal. However, lesions can also occur as a result of maltreatment (see Chapter 22). Scoring is partial condemnation with rejection of affected parts and subsequent unconditional approval. The presence of complications, or if it is not possible to undertake complete stripping, necessitates total condemnation.

Wounds, phlegmons and scars [16.18 – 16.44]

A wound (vulnus) is physical injury (usually trauma) to tissues and organs with interruption of the normal continuity. Tears and bite wounds in the skin of pigs occur frequently as the result of aggressive behaviour. In the acute stages, the lesions are often characterised by bleeding. Bite lesions in the tail, so-called tail bite, often occur as a mixture of different lesions such as dry gangrene, suppuration, wounds, and granulation tissue. Scoring should take into account the fact that the lesion is often associated with complications such as pyaemia (see Chapter 19). The reason for the high risk for pyaemia in pigs is the risk of spread via a special venous plexus (Batson's plexus).

Because the vast majority of hogs are currently castrated, and half of all slaughter pigs are castrates, it is important to inspect the castration site for lesions e.g. boils. Often only minimal changes such as discolouration and scar tissue are seen on the skin surface; however, at incision there can be extensive inflammation and abscess-formation.

Lesions, often abscesses, in the skin, subcutis and underlying muscles in the neck region occur frequently in pigs and particularly in sows. Because this area is used to administer injections, it is reasonable to assume that these are injection injuries. Occasionally, true abscesses are not seen, but areas with accumulation of spherical, up to 0.5 cm, or coalescing pyogranulomas, which macroscopically are characterised by a central yellowish, dry, pasty (sometimes mineralised) material (pus), and enclosed by a thin connective tissue capsule.

Necrosis of the tail tip in cattle occurs as a result of ischaemia caused by compression or other trauma to the tail tip. Decubitus or pressure ulcers are also caused by ischaemia and can occur in all species of slaughter animals. The lesions are localised to the skin above bony prominences. In sows, so-called shoulder ulcers are frequently seen in the region over the tubercle of the spine of scapula. Shoulder ulcers in sows are divided macroscopically into five grades. Grade 0 shoulder ulcers are without lesions, or the lesions are probably the result of fighting. Grade 1 lesions are limited to the epidermis, and can include a moderate scab (crust). Grade 2 lesions involve the dermis, but with limited fibrosis or granulation tissue formation, sometimes with an extensive scab. Grade 3 lesions involve the subcutis, and there is gross evidence of granulation tissue-formation. In grade 4 lesions the shoulder bone is exposed (tubercle of the spine of scapula). The diameter of the ulcer, as measured for example at ante-mortem inspection, correlates positively with the grade.

A hygroma is a false (acquired) bursa, which can develop in the subcutis above bony prominences. Often there is concomitant thickening, scale formation, and hair loss in the overlying skin. The lesions can develop independently of each other, but occur as a result of pressure on the skin. It is uncertain which factors determine whether a decubitus ulcer, hygroma, or just thickening of the skin develop. The hygroma is comprised of a liquid-filled cavity surrounded by a connective tissue capsule (granulation tissue of varying ages). The liquid is often mucinous and yellow to red, depending on the amount of bleeding. It may contain fibrin. The connective tissue capsule inner surface can be smooth or villous, and may contain cartilage (connective tissue metaplasia). Differentation between a hygroma and a bursitis may be difficult, and requires detailed

knowledge of the anatomic location of the bursas. Bursitides occur frequently with the same pathogenesis as hygromas, and hygromas and chronic bursitides reveal the same types of macroscopic lesions. In slaughter animals, chronic bursitides occur occasionally, e.g. precarpal bursitis in cattle. Bacteriologic investigation of chronic bursitides in pigs always reveal sterile lesions, and normal regional lymph nodes.

There are many other causes of wounds in addition to those mentioned here. Occasionally, the cause can be determined e.g. burns and tail bite, and special conditions relating to meat inspection scoring are then applied. More frequently, the cause cannot be determined, and the scoring is of a more general character. Thus, acute lesions without infection, chronic granulating lesions and scars necessitate partial condemnation. If concomitant complications are present (fever, metastases, pyaemia, etc.), acute, infected lesions and phlegmons necessitate total condemnation.

Dermatitis and eczema [16.45 – 16.51]

Dermatitis is inflammation of the skin. Eczema is a special form of dermatitis characterised in the acute stage by itching, redness, oozing of fluid, vesicles, crusts and scales, and in the chronic stage by thickening, excoriation and pigmentation changes. The term eczema is used at meat inspection of pigs about lesions of the skin which after the slaughter process typically appear as irregular, multifocal to confluent, hyperaemic, haemorrhagic, necrotic, erosive to ulcerative, proliferative lesions. There are numerous causes of both dermatitis and eczema. Occasionally the cause can be determined, e.g. mange, photosensitisation, or irritants (urine scald), and special conditions may apply to meat inspection scoring. More frequently, the cause cannot be determined, and the scoring is of a more general character.

Pityriasis rosea, or porcine juvenile pustular psoriasiform dermatitis, occurs occasionally in finisher pigs, but occurs more frequently in younger pigs. The lesions are seen on the abdomen, the groin, and on the medial thighs. After the initial stage with discreet, scab-covered papules (small, focal inflammatory lesions), the characteristic, confluent, locally extensive, inflammatory lesions (plaques) appear with whitish centres and hyperaemic, scaly edges. The lesions are almost identical with ringworm. The cause is unknown, but a genetic aetiology has been proposed. Scoring depends on whether complications are present (total condemnation) or not (partial condemnation).

Infections [16.52 – 16.63]

Porcine circovirus type 2 infection in pigs is associated with a range of diseases or syndromes. In typical weaning pigs, PMWS (postweaning multisystemic wasting syndrome) occurs, see Chapter 10, and in older pigs, including finisher pigs, PDNS (porcine dermatitis and nephropathy syndrome) occurs. In the acute stages of PDNS, discreet, up to 1 cm or larger, sometimes coalescing areas with hyperaemia and haemorrhage occur in the skin localised particularly to the hind quarters (pelvic limbs, perineum, ventral abdomen, and flanks). Later, the lesions become blue to black due to necrosis. Depending on the depth of the lesions, these heal from superficial scabs or true ulcers,

the latter forming scars. The skin lesions are often associated with glomerulonephritis (see Chapter 11). Differential diagnosis of PDNS involves other important diseases such as hog cholera (notifiable), thrombocytopenia (see Chapter 10) and urine scald. The acute stages of PDNS necessitate total condemnation. The later stages of the disease necessitate partial condemnation with rejection of the affected parts and subsequent unconditional approval.

In cattle malignant catarrhal fever and mucosal disease (notifiable) can occur, both caused by a virus. In both infections the lesions are primarily associated with the alimentary tract (see Chapter 8). However, the lesions can involve the muzzle. In mucosal disease the lesions can also occur interdigitally.

Acute infection in pigs with *Erysipelothrix rhusiopathiae* can result in development of highly characteristic diamond-shaped haemorrhagic infarctions in the skin. The disease is also called diamond skin disease or erysipelas. The bacteria are attracted to the endothelium in the arteries causing vasculitis and thrombosis. Infection with *E. rhusiopathiae* can also cause joint (see Chapter 14), endocardial (see Chapter 4) and renal lesions (see Chapter 11). Diamond skin disease necessitates total condemnation. Chronic skin lesions, occurring during healing of the infarctions, necessitate partial condemnation with rejection of the affected parts and subsequent unconditional approval.

In sheep, virulent foot rot is caused by infection with *Dichelobacter nodosus* and *Fusobacterium necrophorum*. The infection starts in the interdigital cleft and in the acute stages is characterised by redness, swelling and erosion, and spread to the claws which are undermined causing shedding of the claw capsules releasing a stinking exudate. Bovine digital dermatitis is associated with infection with *Treponema* spp.; typical solitary lesions develop with a diameter of 1-6 cm. Lesions are most commonly seen at the rear border of the interdigital cleft, between the heel bulbs, and the pelvic limbs are affected far more frequently than the thoracic limbs. The acute stage is characterised by erosion of the affected skin, and pronounced lameness is often seen at ante-mortem inspection. In the chronic stage the lesion develops into a granulation tissue-coated ulcer, in which there are areas of newly-formed white to grey epidermis. Proliferation of epidermis (and dermis) can be so extreme that hair-like proliferation occurs comparable to papillomatosis. During healing the lesion is covered with a crusty scab. Interdigital necrobacillosis in cattle is an infection in the interdigital cleft with *F. necrophorum.* The acute stage is characterised by pronounced lameness at ante-mortem inspection, and depression can occur. Macroscopic lesions are those of necrosis and phlegmon. Abscess formation occurs in the chronic stage. Botryomycosis is a pyogranulomatous type of inflammation (see Chapter 20) caused by *Staphylococcus aureus*. Botryomycosis can occur in the skin and other organs and tissues and is traditionally described in horses as a wound infection after castration, so-called spermatic cord fistula or spermatic cord botryomycosis. Uncomplicated cases of these bacterial infections necessitate partial condemnation. The presence of complications, or if it is not possible to undertake complete stripping, necessitates total condemnation.

Ringworm is an infection in the keratinised parts of the skin caused by fungi belonging to the group of dermatophytes. Ringworm occurs in all species of slaughter animals, but most often in calves. The characteristic skin lesions are circular, locally

extensive (by confluence) and hairless, and have grey crusts, scales and central healing. *Sarcoptes* mange occurs most frequently in pigs. Lesions are present on the outer ear, head, neck, and distally on the limbs. The infection may become systemic. Chronic lesions in *Sarcoptes* mange, *Chorioptes* mange and *Psoroptes* mange are characterised by thickening of the skin (lichenification), crust formation, excoriation, and hair loss. There is considerable risk for secondary bacterial infection, caused partly by the intense itching. In *Chorioptes* mange in cattle, lesions are present on the tail, thigh, perineum, scrotum, udder, and distally on the pelvic limbs. In horses, lesions occur distally on the limbs. Sheep and cattle can get infected with *Psoroptes ovis*. The lesions first appear on the back and spread from here to the surrounding skin.

Cutaneous habronemiasis (summer sores) occurs in horses when flies lay larvae of *Habronema* spp. in previously traumatised or moist skin (lesions are most frequently found on the distal limbs, medial canthus, and preputium). The lesions are characterised by proliferation, ulceration and exudation, and can thus resemble neoplasms. In a cut section, small white-to-yellow foci are seen which represent pyogranulomatous reaction against the larvae and necrotic material.

In cattle, stephanofilariasis can occur on areas of thin skin, particularly on the udder, in the inguinal fold, behind the elbow, on the neck, and in the medial canthus. The causative agent is *Stephanofilaria stilesi* and other filaria species, which live in the dermis and subcutis, where they lay eggs. The microfilariae cause lesions on the skin surface which attract the flies that act as vectors.

Parafilaria bovicola cause verminous haemorrhagic dermatitis in cattle. Adult parasites live in the subcutaneous and intermuscular connective tissue, where they cause yellow-green often focal lesions, 1-2 cm in diameter. In the spring and summer months, the egg-laying females migrate towards the surface of the skin causing large, nodular, and ulcerative, subsequently healed lesions, through which blood and parasite eggs are discharged. Flies act as vectors.

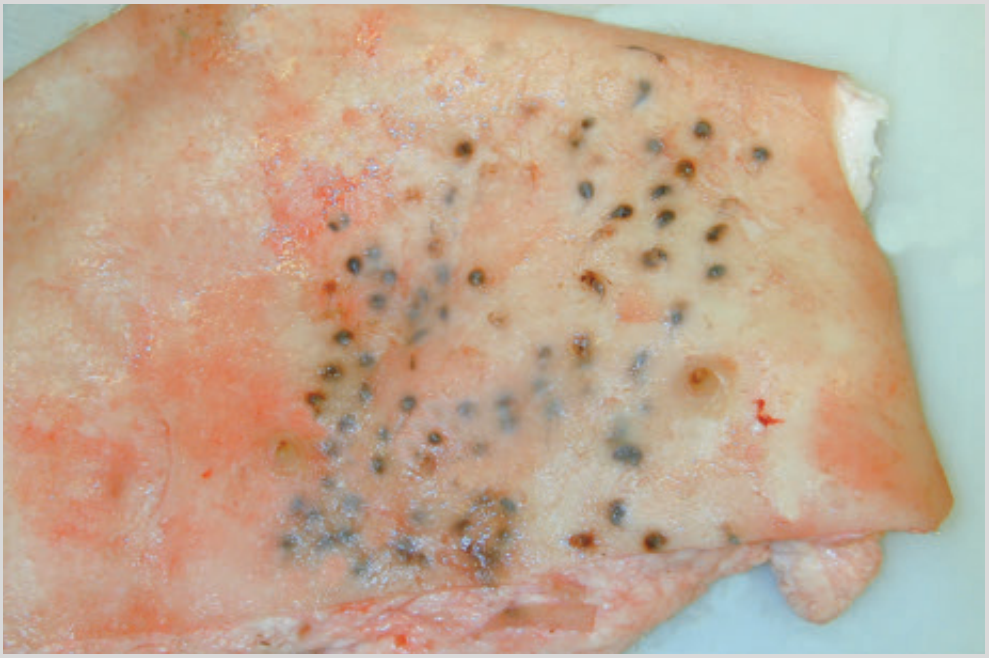
Mycotic and parasitic dermatitis necessitate partial condemnation with rejection of the affected parts and subsequent unconditional approval. The presence of complications, or if it is not possible to undertake complete stripping necessitates total condemnation.

Neoplasms and other growths [16.64 – 16.73]

As with other organ systems, it can be difficult to distinguish between neoplasms and granulomatous and pyogranulomatous inflammation in skin. Benign melanomas and malignant melanomas (melanocarcinomas) are easy to identify due to their black or dark colour. Benign melanomas and malignant melanomas in the skin and other organs and tissues occur particularly frequently in white, grey, and dappled horses. The neoplasms are frequently seen in the skin of the perineal region. Benign melanomas also occur relatively frequently in the skin of certain pig breeds, (see Chapter 21). Papillomatosis is caused by papilloma virus and occurs especially frequently in young cattle and young horses. The lesions are seen primarily around the mouth, around the urogenital orifices, and on the teats and udder (see Chapter 13). Equine sarcoids occur

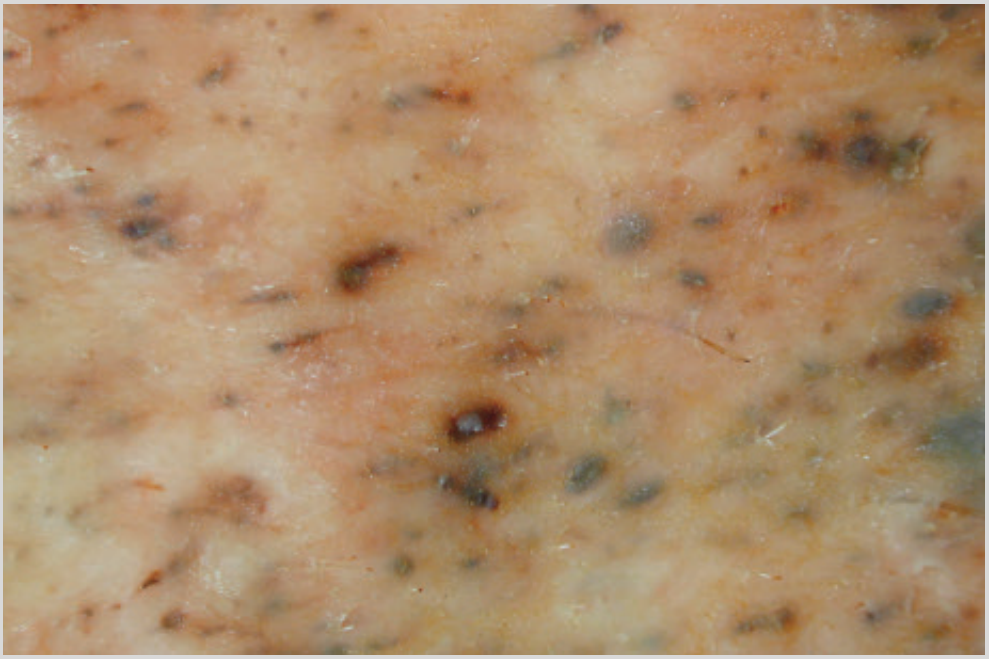
most frequently on the limbs, the head, and ventrally on the abdomen and chest. The lesions are due to infection with bovine papilloma virus. Papillomatosis and sarcoids necessitate partial condemnation with rejection of the affected parts and subsequent unconditional approval.

16.01



Animal species/Organ	Pig/Skin; the same pig as in 16.02
Lesion	Cystic hypotrichosis
Scoring	Partial condemnation
Comments	Particularly the back, the lumbar, sacral, and gluteal regions, and/or tail are affected

16.02



Animal species/Organ	Pig/Skin; the same pig as in 16.01
Lesion	Cystic hypotrichosis
Scoring	Partial condemnation
Comments	Possibly corresponds to naevus comedonicus in humans

16.03



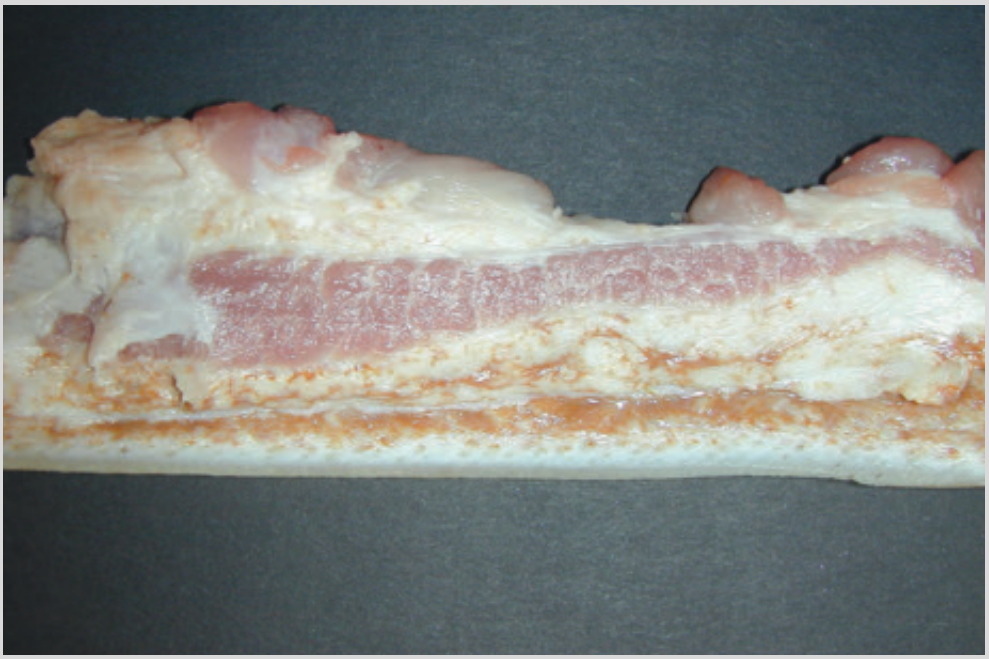
Animal species/Organ	Pig/Skin
Lesion	Bilateral symmetric furrows in the skin caudal to the thoracic limbs
Scoring	Partial condemnation
Comments	The lesion in the skin is not a result of strangulation

16.04



Animal species/Organ	Pig/Skin; the same pig as in 16.05 and 16.06
Lesion	Nutritional panniculitis (yellow fat disease) affecting the subcutaneous fatty tissue
Scoring	Total condemnation
Comments	The lesion can emit a fishy odour

16.05



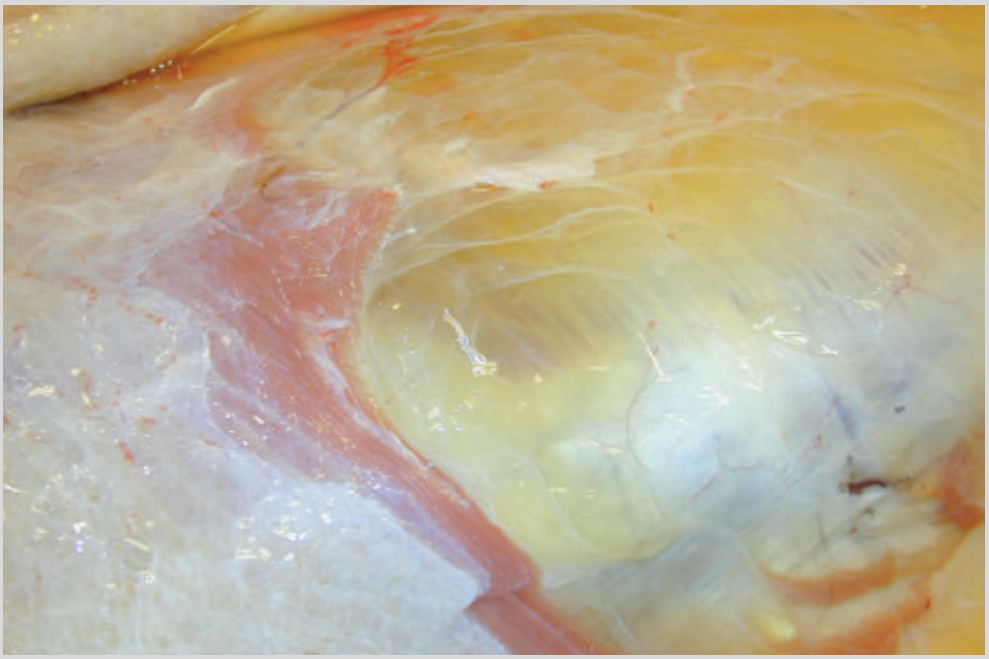
Animal species/Organ	Pig/Skin; the same pig as in 16.04 and 16.06
Lesion	Nutritional panniculitis (yellow fat disease) affecting the subcutaneous fatty tissue
Scoring	Total condemnation
Comments	Can occur if the feed contains a high concentration of unsaturated fatty acids and low concentration of vitamin E

16.06



Animal species/Organ	Pig/Skin; the same pig as in 16.04 and 16.05
Lesion	Nutritional panniculitis (yellow fat disease) affecting the subcutaneous fatty tissue
Scoring	Total condemnation
Comments	Can occur together with muscle degeneration, toxic liver dystrophy, and mulberry heart disease

16.07



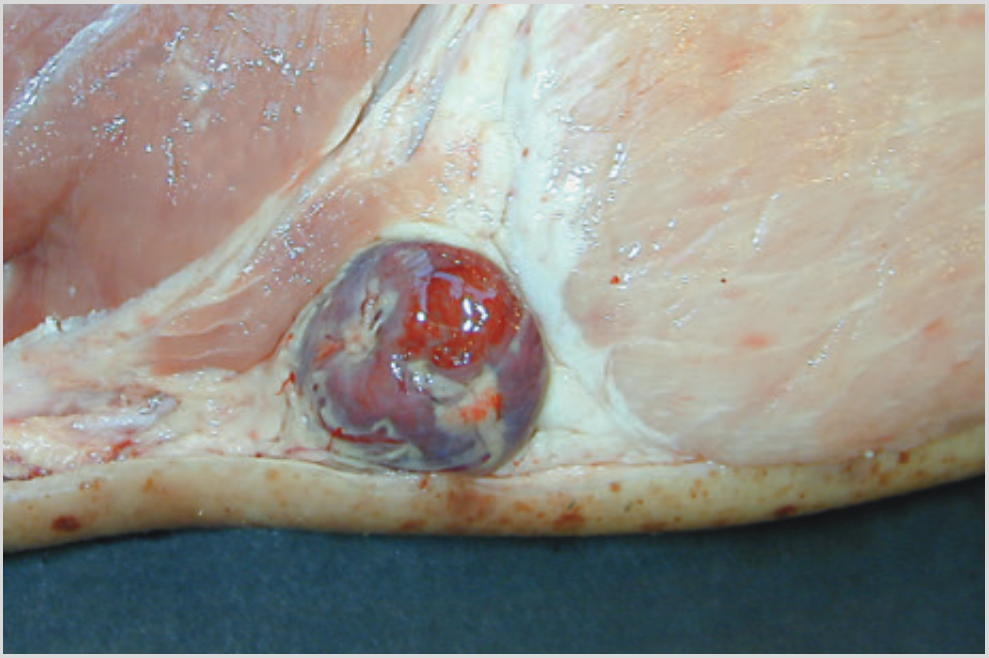
Animal species/Organ	Cattle/Subcutaneous connective tissue
Lesion	Extensive oedema
Scoring	Total condemnation
Comments	Total condemnation if generalised oedema, or if necessitated by the underlying cause

16.08



Animal species/Organ	Pig/Skin; the same pig as in 16.09
Lesion	Acute haemorrhages
Scoring	Partial condemnation
Comments	The cause is possibly thrombocytopenia

16.09



Animal species/Organ	Pig/Skin with regional lymph node; the same pig as in 16.08
Lesion	Blood resorption from the skin to the regional lymph node
Scoring	Partial condemnation
Comments	The cause is possibly thrombocytopenia

16.10



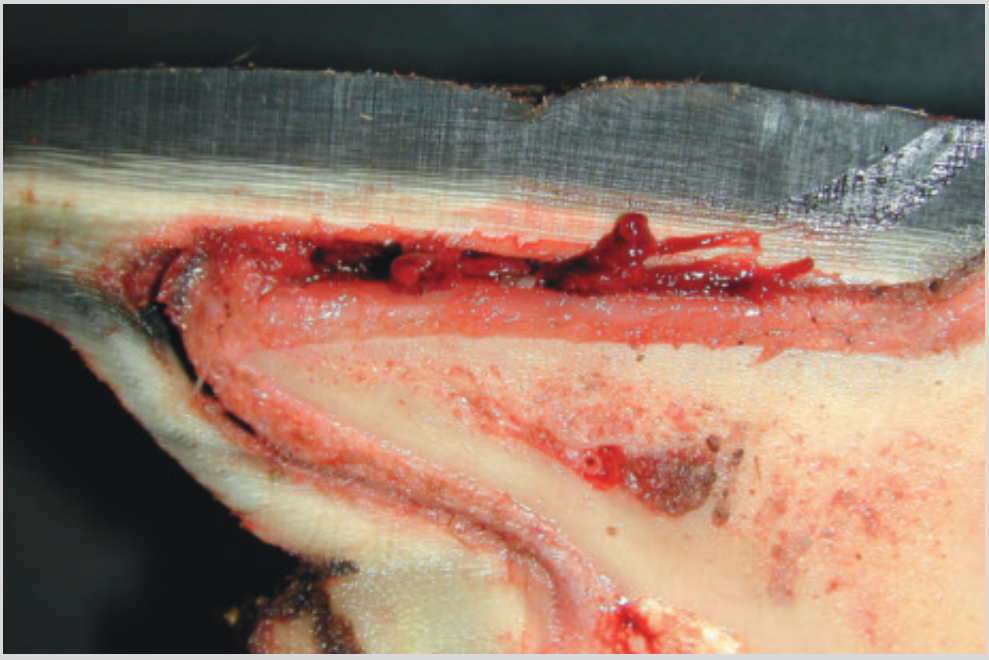
Animal species/Organ	Cattle/Live bull
Lesion	Photosensitisation (ulcers, wounds, hyperaemia, hair loss)
Scoring	Partial condemnation; concomitant findings, for example in the liver, may necessitate a different scoring
Comments	Lesions occur only where the skin is covered by white hair; the most pronounced lesions (ulcers) are seen where the skin is most directly exposed to sunlight

16.11



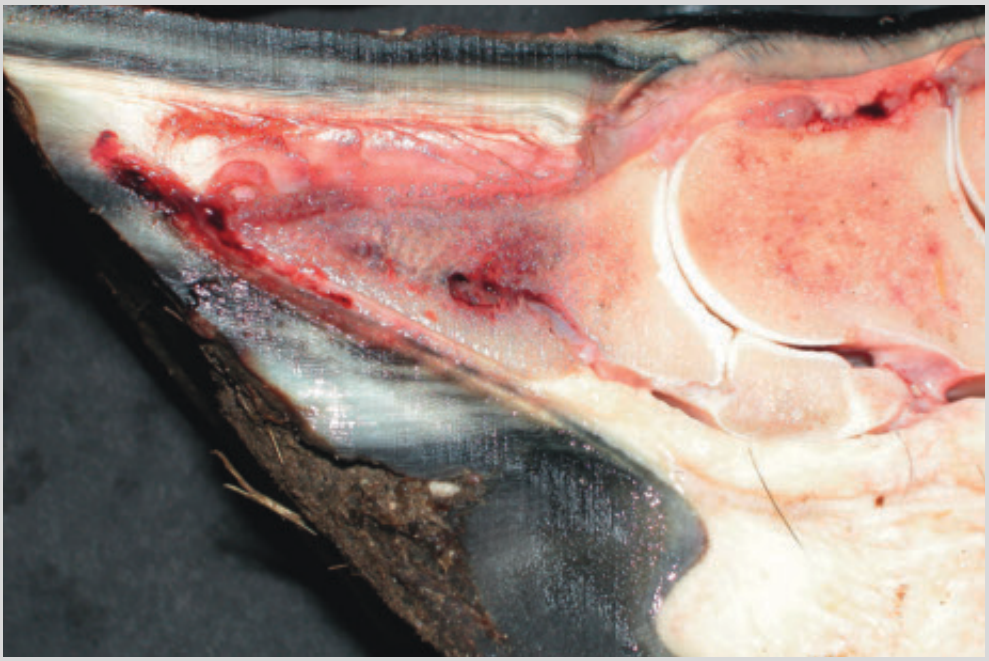
Animal species/Organ	Cattle/Skin
Lesion	Photosensitisation (chronic, locally extensive dermatitis)
Scoring	Partial condemnation; if the condition is caused by porphyria, the animal is also approved for deboning
Comments	The lesions were only found where the skin was covered with white hair

16.12



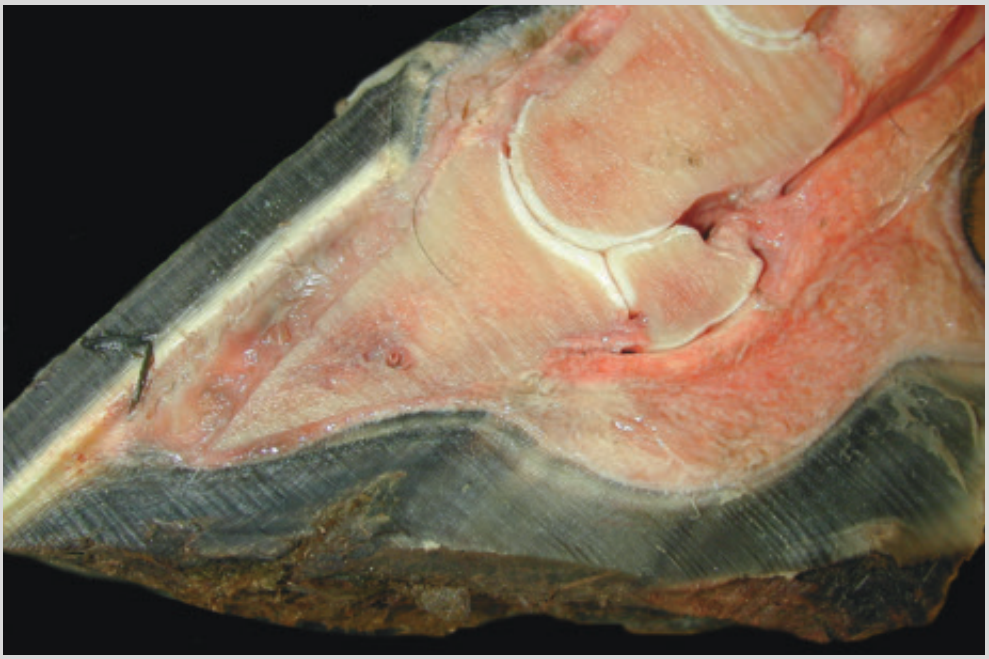
Animal species/Organ	Horse/Hoof, sagittal section
Lesion	Acute laminitis (acute, diffuse, laminar, aseptic pododermatitis) with separation of the hoof capsule and the coffin bone, and rotation of the coffin bone
Scoring	Partial condemnation
Comments	Toxaemia and sepsis (total condemnation) can trigger laminitis

16.13



Animal species/Organ	Horse/Hoof; sagittal section
Lesion	Chronic laminitis (chronic, diffuse, laminar, aseptic pododermatitis) with rotation of the coffin bone
Scoring	Partial condemnation
Comments	There is reparatory horn formation in the area between the hoof wall and coffin bone

16.14



Animal species/Organ	Horse/Hoof; sagittal section
Lesion	Chronic laminitis with rotation of the coffin bone
Scoring	Partial condemnation
Comments	There is formation of reparatory tissue in the area between the hoof wall and coffin bone

16.15



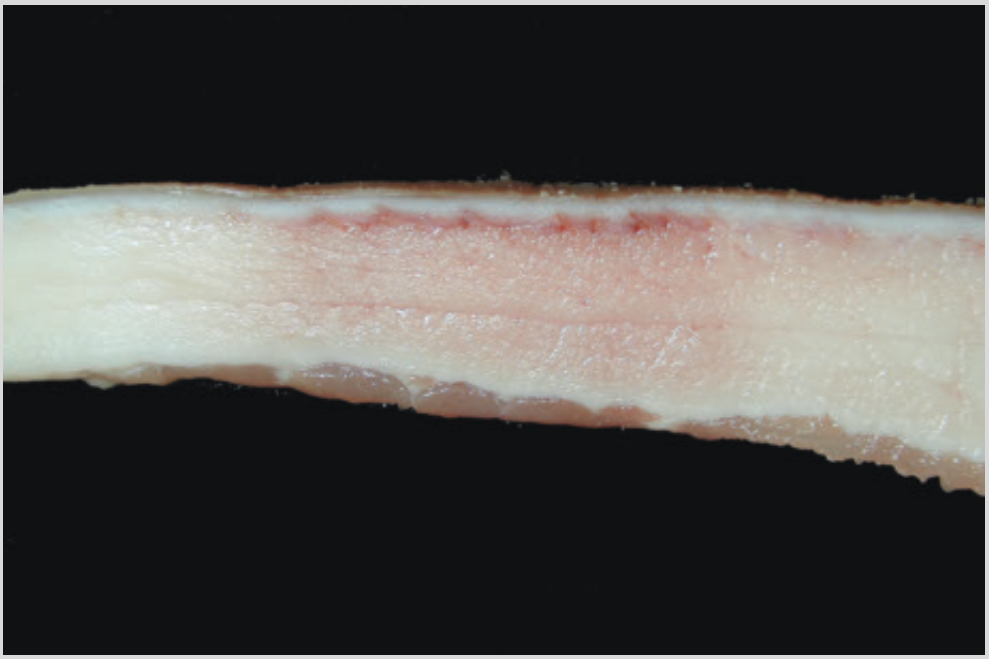
Animal species/Organ	Horse/Hoof; sagittal section
Lesion	Chronic laminitis with separation of hoof wall and coffin bone; in addition, rotation of the coffin bone (fractured and necrotic) which has penetrated the sole
Scoring	Partial condemnation
Comments	Purulent arthritis in the coffin joint with fistula formation; from a bandaged foal

16.16



Animal species/Organ	Pig/Skin; the same pig as in 16.17
Lesion	Contusions
Scoring	Partial condemnation
Comments	The lesions have occurred after knocks

16.17



Animal species/Organ	Pig/Skin; detail of 16.16
Lesion	Contusion
Scoring	Partial condemnation
Comments	The lesion has occurred after a knock

16.18



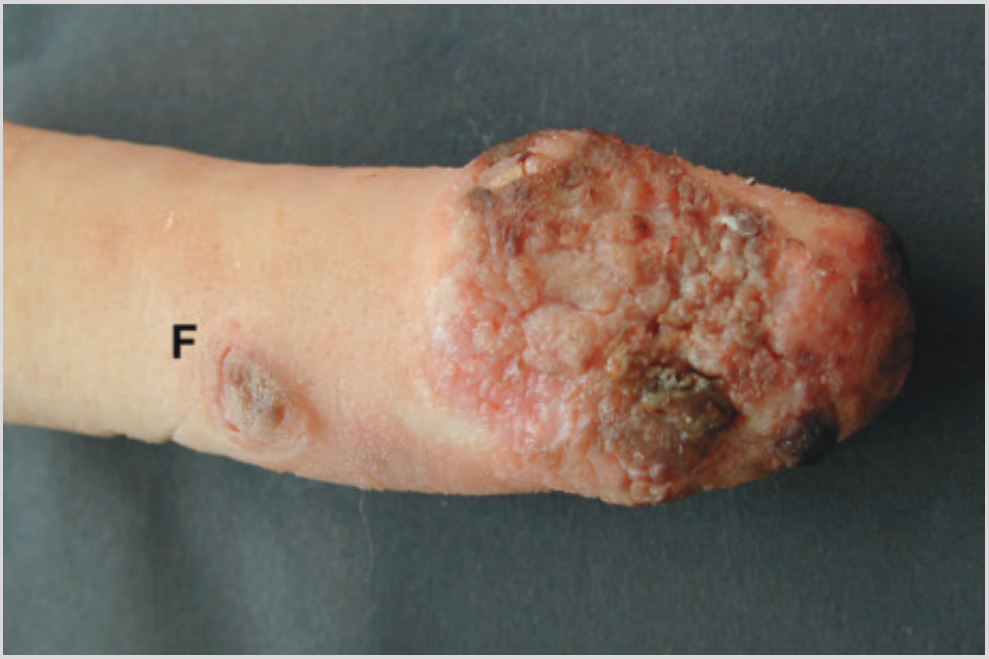
Animal species/Organ	Pig/Tail; the same pig as in 16.19
Lesion	Dry gangrene (tail bite)
Scoring	Partial condemnation
Comments	Development of pyaemia occurs frequently in connection with tail lesions

16.19



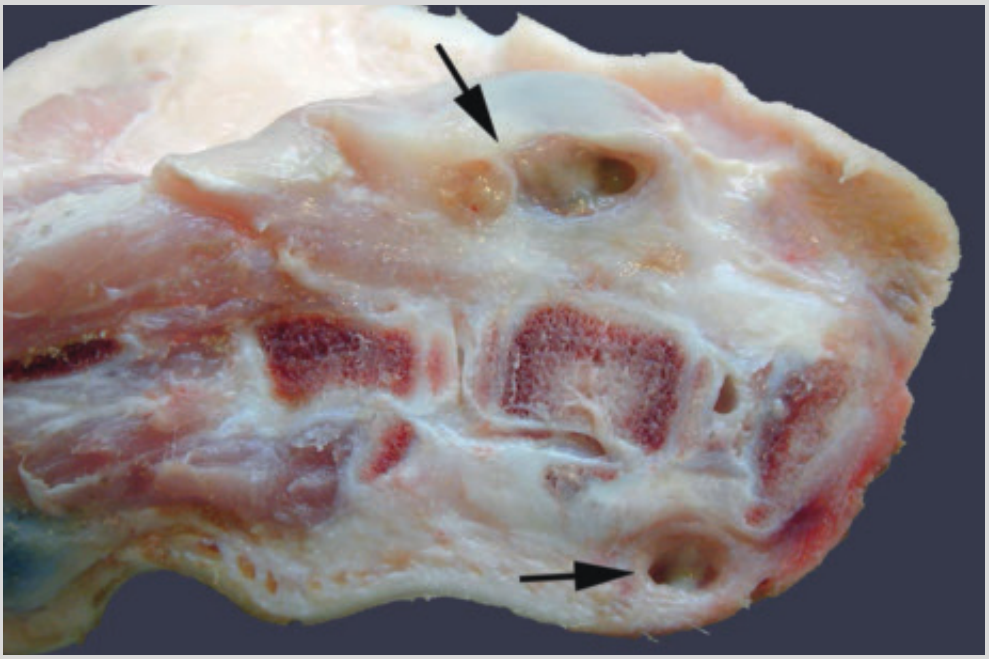
Animal species/Organ	Pig/Tail; the same pig as in 16.18
Lesion	Dry gangrene (tail bite)
Scoring	Partial condemnation
Comments	Necrotic, loosened skin (sequestration)

16.20



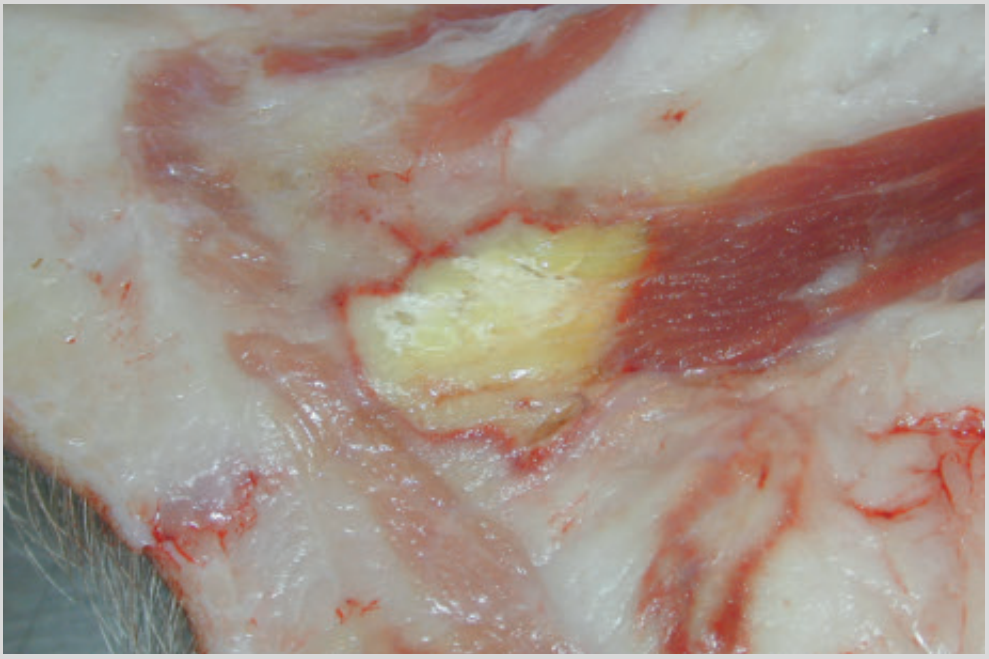
Animal species/Organ	Pig/Tail
Lesion	Chronic wounds characterised by granulation tissue (tail bite)
Scoring	Partial condemnation
Comments	The lesion on the left (F) is probably the result of fistulation

16.21



Animal species/Organ	Pig/Tail
Lesion	Chronic, subcutaneous abscesses (tail bite) (→)
Scoring	Partial condemnation
Comments	Development of pyaemia occurs frequently in connection with tail lesions

16.22



Animal species/Organ	Pig/Subcutis and muscles in the neck region
Lesion	Acute, focal necrosis of fatty tissue
Scoring	Partial condemnation; the lesion (acute) should trigger suspicion of the presence of drug residues in the carcase
Comments	The lesion is surrounded by a haemorrhagic border zone

16.23



Animal species/Organ	Pig/Subcutis in the dorsal neck region; the same pig as in 16.24
Lesion	Multiple, chronic pyogranulomas
Scoring	Partial condemnation
Comments	These are most probably injection injuries

16.24



Animal species/Organ	Pig/Subcutis in the dorsal neck region; detail of 16.23
Lesion	Multiple, chronic pyogranulomas
Scoring	Partial condemnation
Comments	These are most probably injection injuries

16.25



Animal species/Organ	Pig/Skin
Lesion	Shoulder ulcer grade 0
Scoring	Partial condemnation
Comments	There are no pressure lesions in a shoulder ulcer grade 0, but lesions resulting from fighting can be seen

16.26



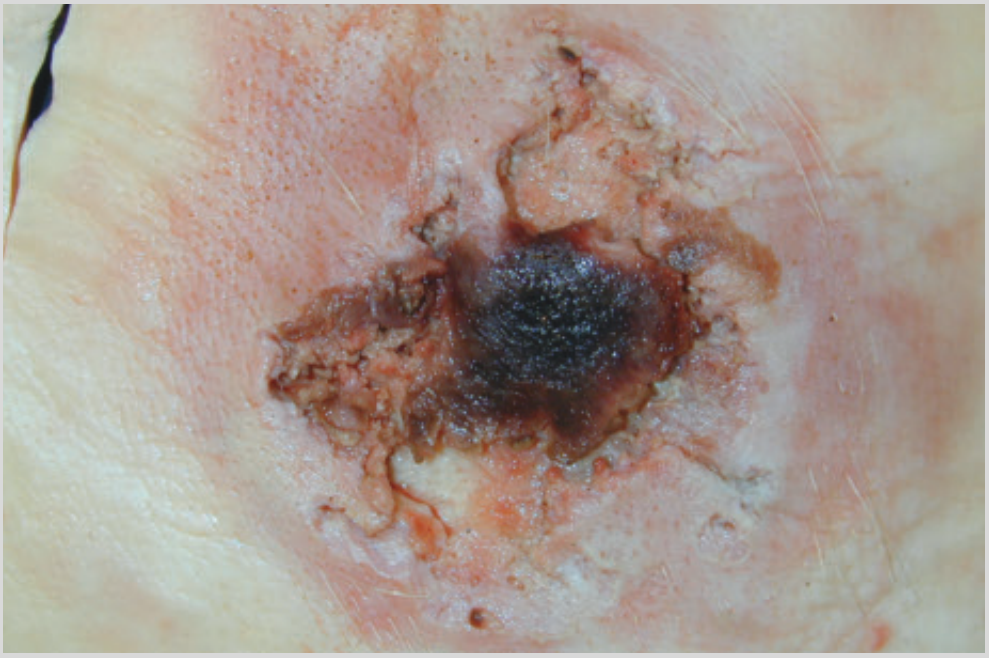
Animal species/Organ	Pig/Skin
Lesion	Shoulder ulcer with typical localisation
Scoring	Partial condemnation
Comments	Grading is performed on a horizontal section that includes the tubercle of the spine of scapula

16.27



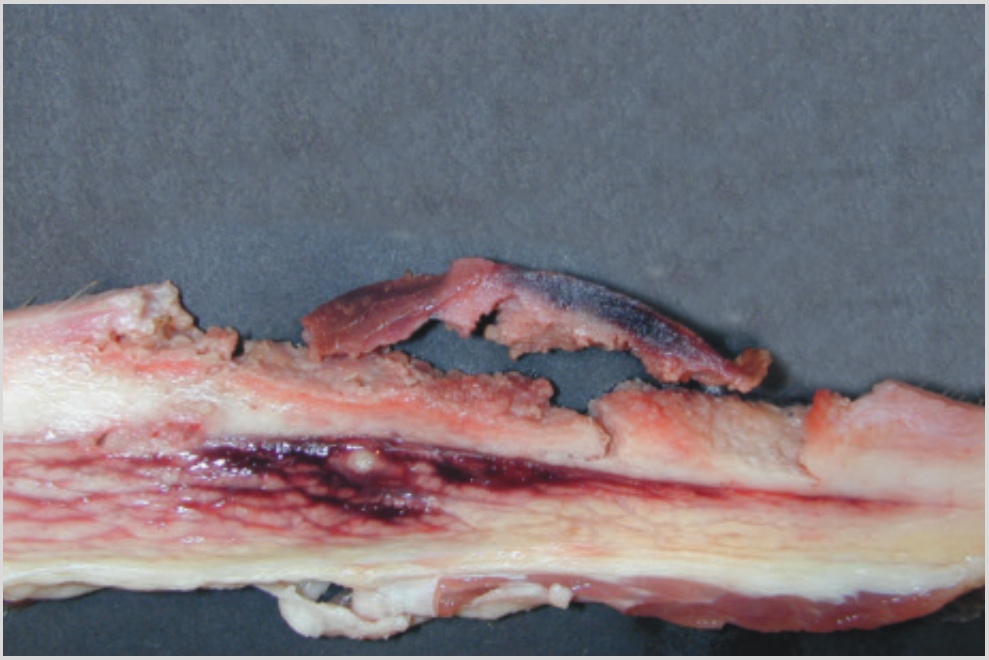
Animal species/Organ	Pig/Skin
Lesion	Chronic, granulated ulcer
Scoring	Partial condemnation
Comments	Decubitus ulcer over the greater trochanter of the femur

16.28



Animal species/Organ	Pig/Skin; the same lesion as in 16.29
Lesion	Shoulder ulcer characterised by dermal necrosis and sequestration
Scoring	Partial condemnation
Comments	Grading is performed on a horizontal section that includes the tubercle of the spine of scapula

16.29



Animal species/Organ	Pig/Skin; the same lesion as in 16.28
Lesion	Shoulder ulcer grade 2-3 characterised by dermal necrosis and sequestration
Scoring	Partial condemnation
Comments	Grading is performed on a horizontal section that should include the tubercle of the spine of scapula

16.30



Animal species/Organ	Pig/Skin
Lesion	Shoulder ulcer grade 4 (the grade was determined after horizontal sectioning)
Scoring	Partial condemnation
Comments	The lesion is prominent due to extensive bone tissue formation

16.31



Animal species/Organ	Pig/Skin
Lesion	Shoulder ulcer grade 1 with intact dermis and slight local haemorrhage and oedema
Scoring	Partial condemnation
Comments	Correct grading necessitates concomitant assessment of the tubercle of the spine of scapula

16.32



Animal species/Organ	Pig/Skin
Lesion	Shoulder ulcer grade 2 with formation of some granulation tissue
Scoring	Partial condemnation
Comments	Tubercle of the spine of scapula has no lesions

16.33



Animal species/Organ	Pig/Skin
Lesion	Shoulder ulcer grade 3
Scoring	Partial condemnation
Comments	Pronounced granulation tissue formation and pseudomelanosis; normal tubercle of the spine of scapula

16.34



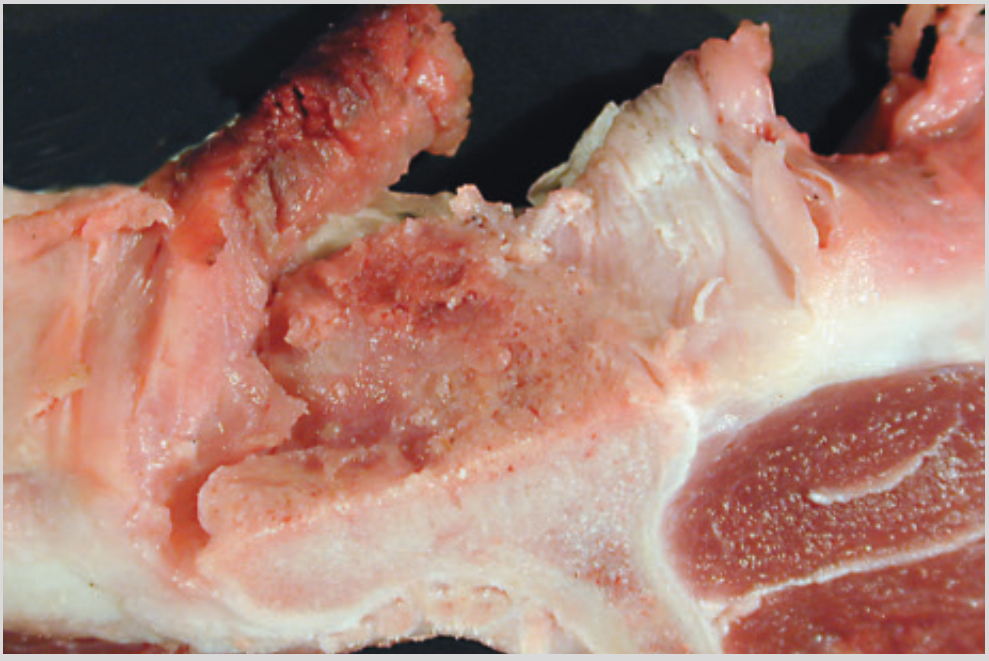
Animal species/Organ	Pig/Skin
Lesion	Shoulder ulcer grade 3-4
Scoring	Partial condemnation
Comments	Pronounced granulation tissue and bony tissue formation as well as formation of chronic abscesses

16.35



Animal species/Organ	Pig/Skin
Lesion	Shoulder ulcer grade 4
Scoring	Partial condemnation
Comments	Pronounced bony tissue formation on the tubercle of the spine of scapula

16.36



Animal species/Organ	Pig/Skin
Lesion	Shoulder ulcer grade 4
Scoring	Partial condemnation
Comments	The plane surface of the bone (tubercle of the spine of scapula with new bone formation) reveals evidence of intravital exposure and abrasion

16.37



Animal species/Organ	Pig/Skin; the same lesion as in 16.38
Lesion	Hygroma
Scoring	Partial condemnation
Comments	A hygroma is a false (acquired) bursa; the differential diagnosis is chronic, proliferative bursitis

16.38



Animal species/Organ	Pig/Skin; detail of 16.37
Lesion	Hygroma
Scoring	Partial condemnation
Comments	The differential diagnosis is chronic, proliferative bursitis

16.39



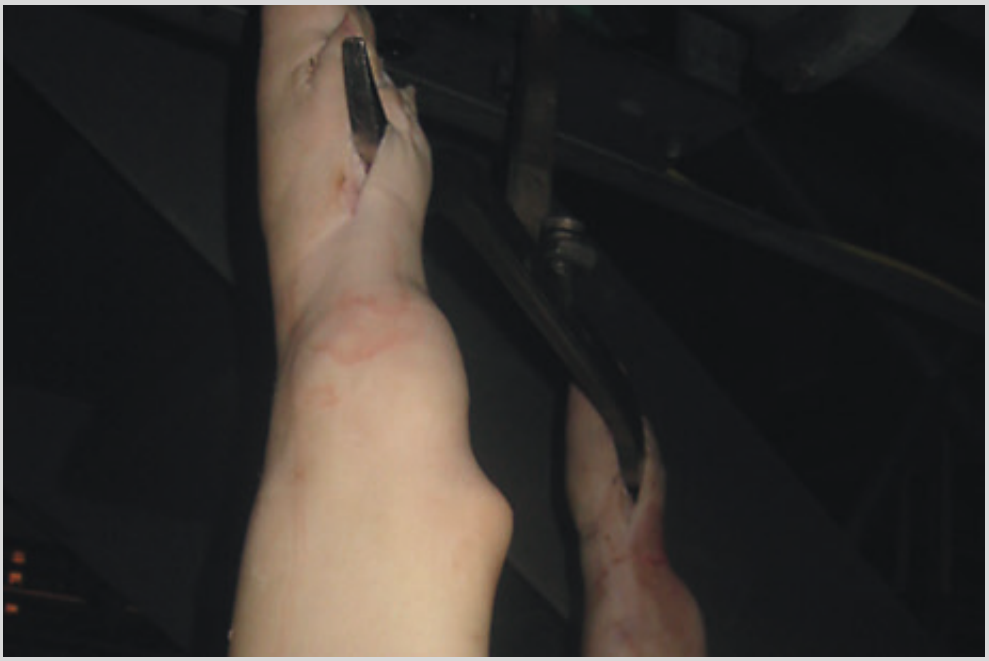
Animal species/Organ	Cattle/Right pelvic limb
Lesion	Swelling laterally to the tarsal joint; incision after slaughter will probably confirm that this is chronic bursitis
Scoring	Partial condemnation
Comments	Thoracic limb precarpal bursitis occurs frequently in cattle

16.40



Animal species/Organ	Pig/Thoracic limb
Lesion	Swelling dorsally to the joint between metacarpus and proximal phalanx
Scoring	Partial condemnation
Comments	Hyperplasia of the regional lymph node does not usually occur in pigs with bursitis

16.41



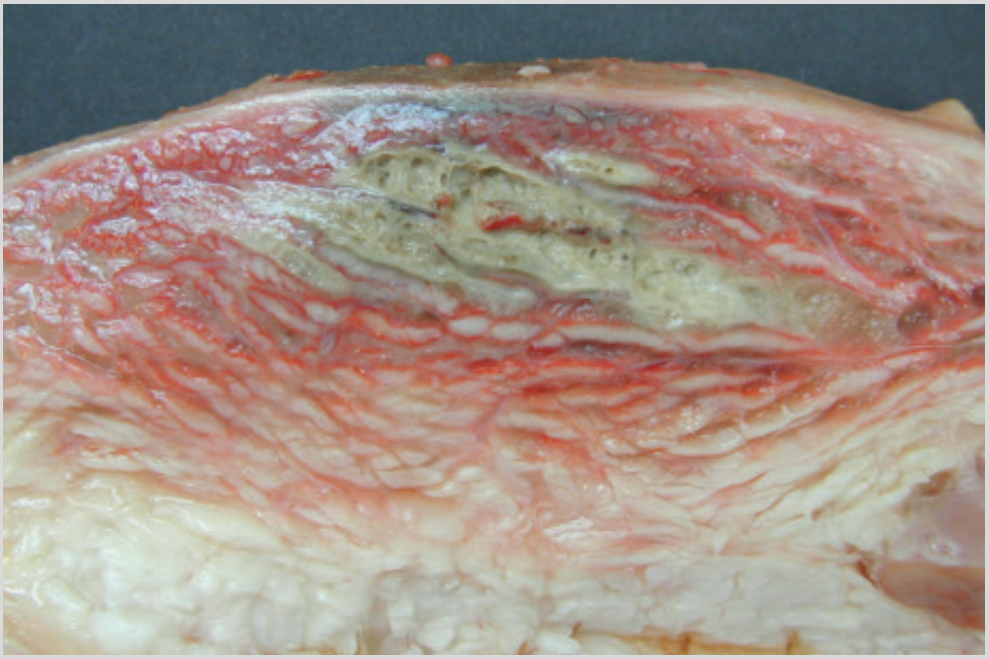
Animal species/Organ	Pig/Pelvic limb
Lesion	Bilateral, chronic bursitis lateral and plantar to metatarsus
Scoring	Partial condemnation
Comments	In pigs chronic bursitides occur also dorsally to the carpus and lateral to the elbows and the hocks

16.42



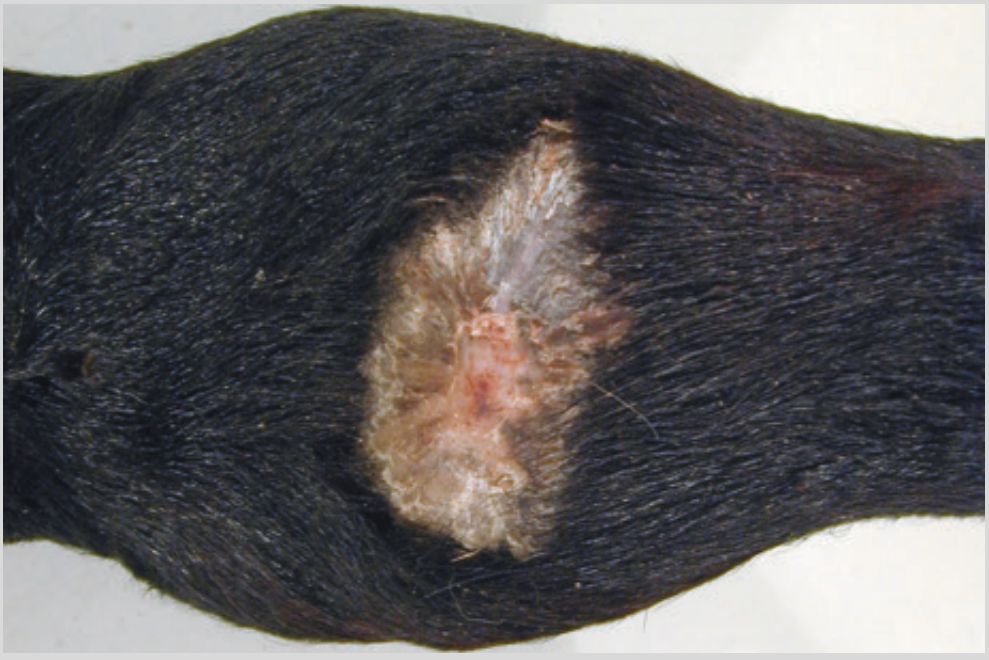
Animal species/Organ	Pig/Pelvic limb
Lesion	Chronic, proliferative bursitis
Scoring	Partial condemnation
Comments	This lesion was sterile at bacteriologic investigation; this is a common finding

16.43



Animal species/Organ	Pig/Skin
Lesion	Phlegmon with onset of abscessation
Scoring	Partial condemnation
Comments	The presence of complications necessitates total condemnation

16.44



Animal species/Organ	Horse/Skin
Lesion	Scar
Scoring	Partial condemnation
Comments	The star shape of the scar is just visible

16.45



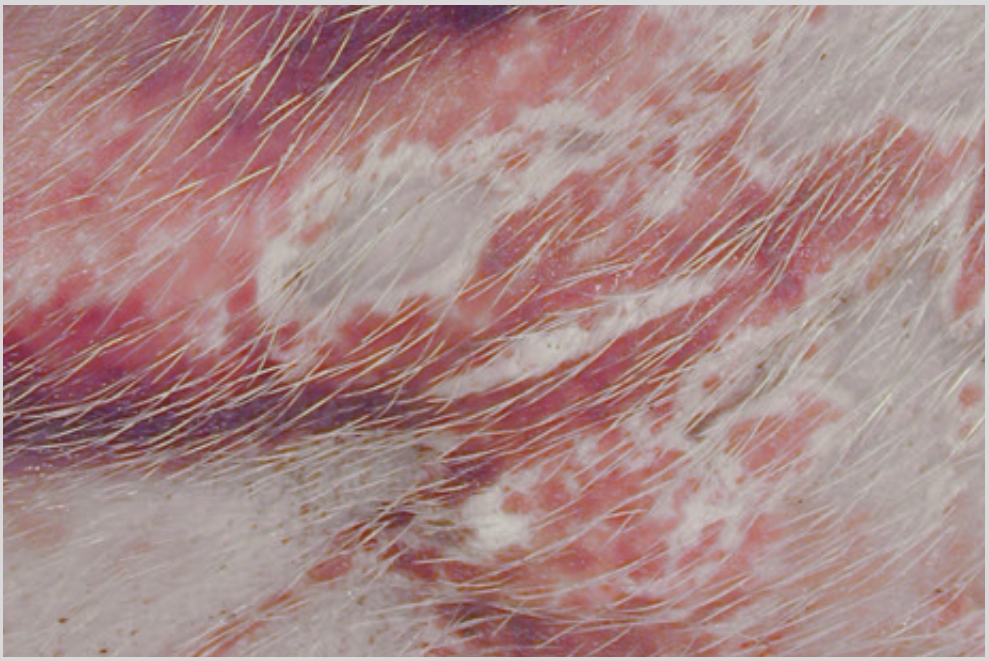
Animal species/Organ	Cattle/Skin; the same lesion as in 16.46
Lesion	Chronic dermatitis characterised by scabs (crusts); areas with hyperaemia and haemorrhage
Scoring	Partial condemnation
Comments	The presence of complications necessitates total condemnation

16.46



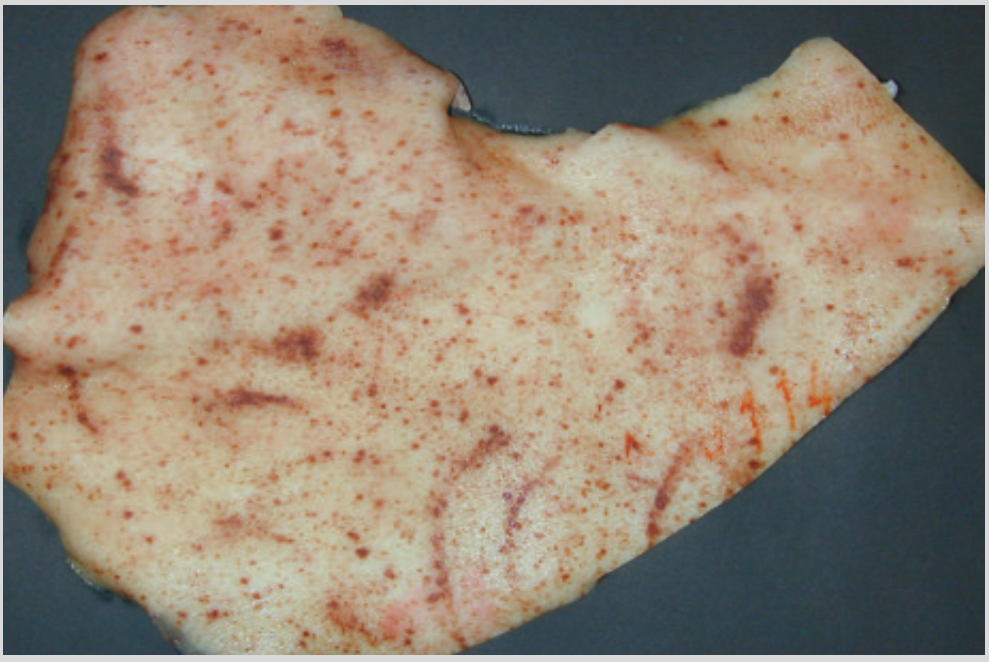
Animal species/Organ	Cattle/Skin; detail of 16.45
Lesion	Chronic dermatitis characterised by scabs
Scoring	Partial condemnation
Comments	Hair growth has lifted the scabs away from the skin

16.47



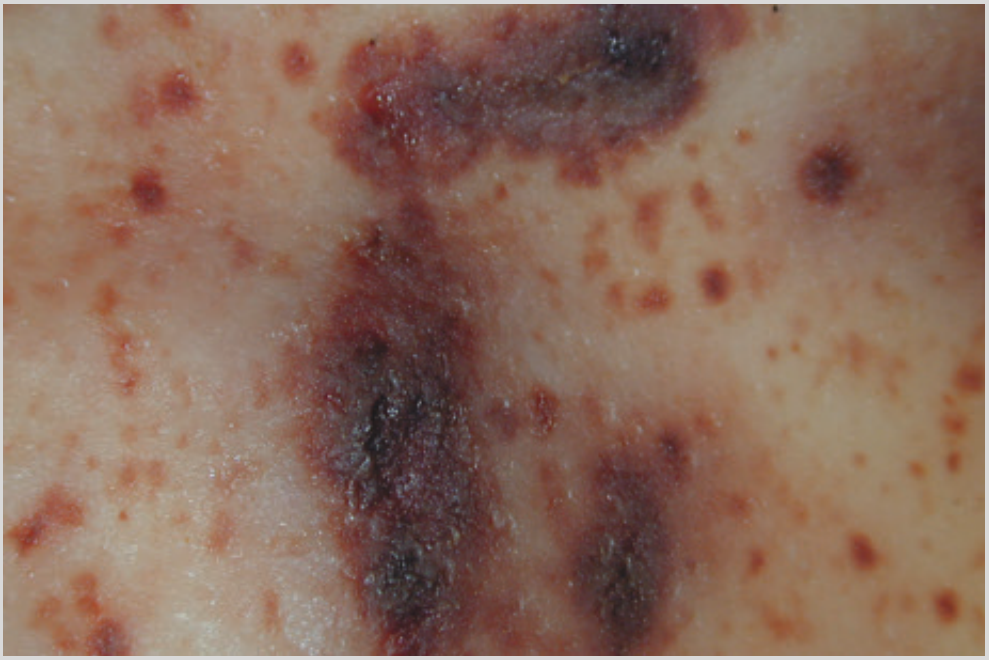
Animal species/Organ	Pig/Skin; photo taken at ante-mortem inspection
Lesion	Skin erosions
Scoring	Partial condemnation
Comments	The pale borders at the transition between the erosions and the normal skin represent onset of re-epithelialisation

16.48



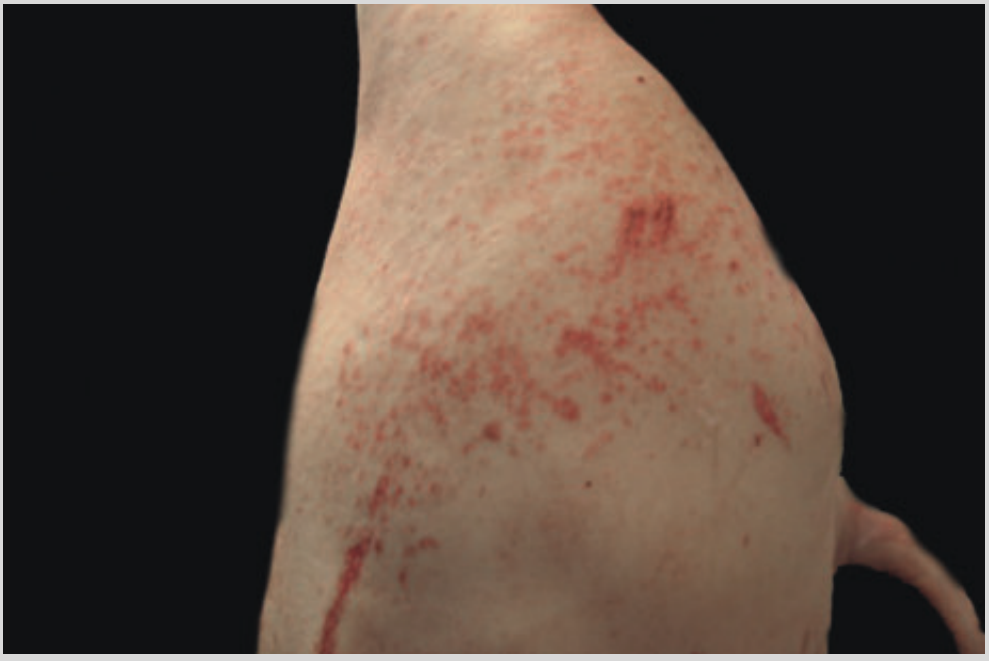
Animal species/Organ	Pig/Skin
Lesion	Eczema characterised by hyperaemia and haemorrhages
Scoring	Partial condemnation
Comments	Infections with certain virus and bacteria (sepsis) can be associated with haemorrhages in the skin

16.49



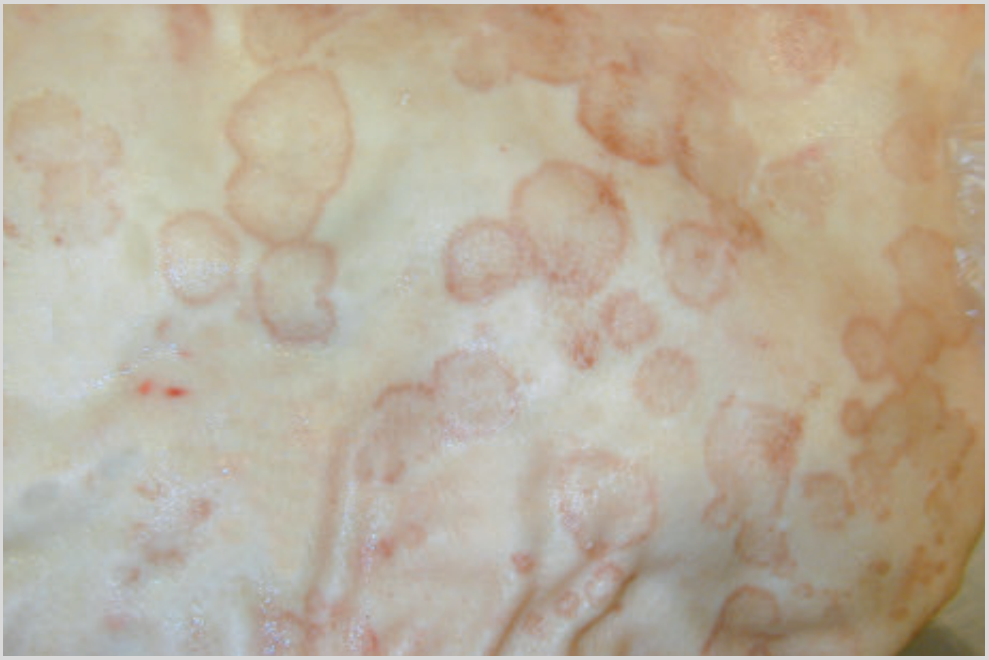
Animal species/Organ	Pig/Skin
Lesion	Eczema characterised by hyperaemia and haemorrhage; acute necrotic/erosive lesions are also present
Scoring	Partial condemnation
Comments	Blood resorption will be present in the regional lymph node

16.50



Animal species/Organ	Pig/Skin
Lesion	Eczema characterised by hyperaemia, haemorrhage, and proliferative response
Scoring	Partial condemnation
Comments	The cause, as in most cases of eczema, is unknown

16.51



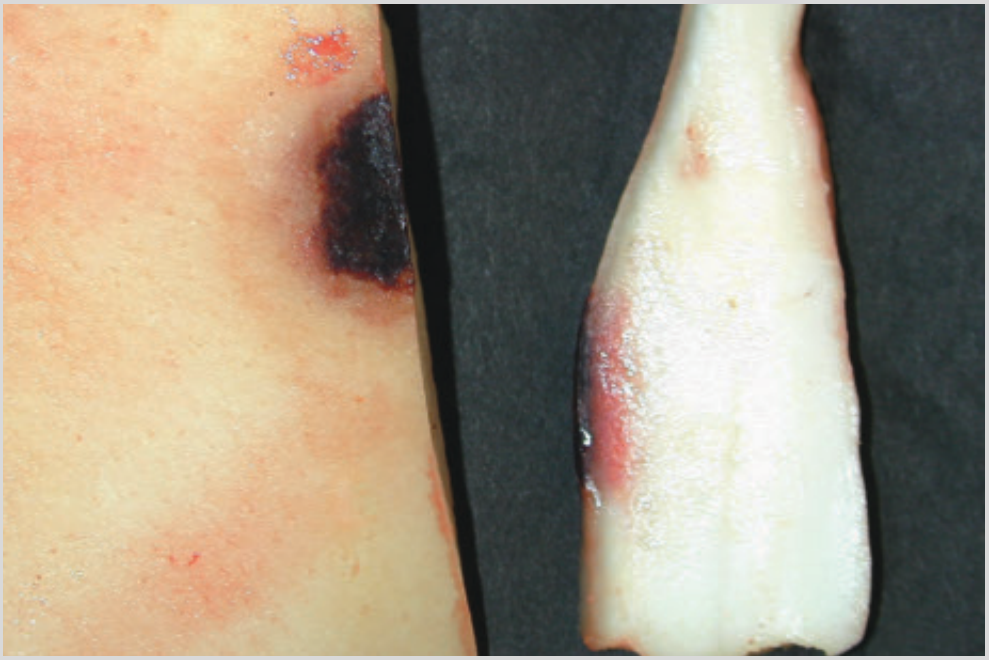
Animal species/Organ	Pig/Skin
Lesion	Pityriasis rosea (false ringworm)
Scoring	Partial condemnation
Comments	The presence of complications necessitates total condemnation

16.52



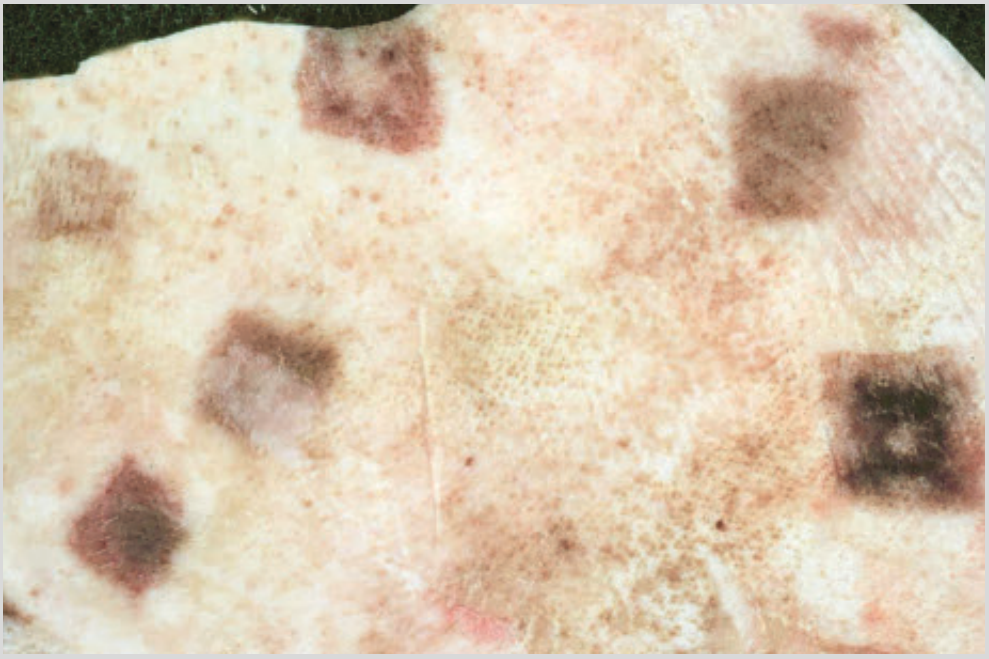
Animal species/Organ	Pig/Skin
Lesion	Acute, haemorrhagic and necrotising dermatitis (PDNS)
Scoring	Total condemnation
Comments	Partial condemnation can be applied to the later stages in the absence of complications

16.53



Animal species/Organ	Pig/Skin
Lesion	Acute, focal skin necrosis
Scoring	Partial condemnation
Comments	If the condition is associated with diamond skin disease, the scoring is total condemnation

16.54



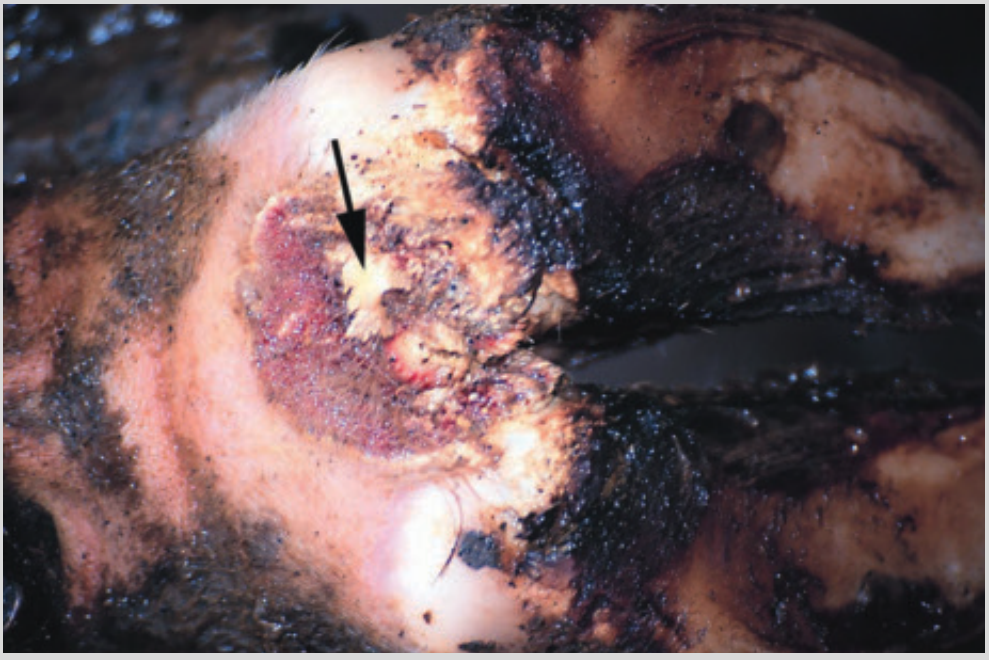
Animal species/Organ	Pig/Skin
Lesion	Acute, haemorrhagic infarctions (diamond skin disease)
Scoring	Total condemnation
Comments	Lesions with manifest skin necrosis are occasionally seen

16.55



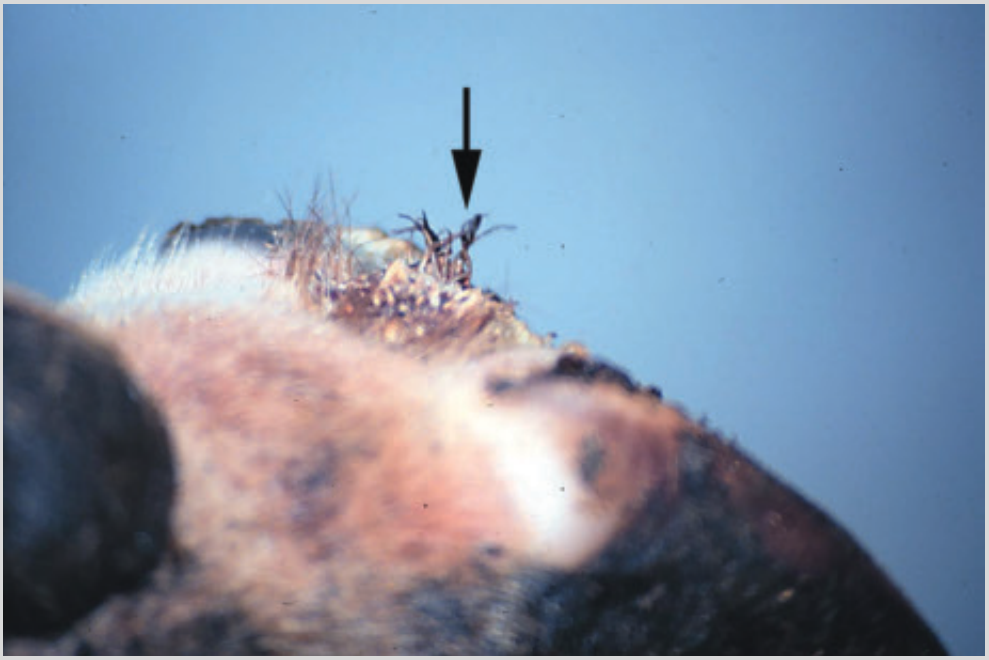
Animal species/Organ	Pig/Skin
Lesion	Chronic, granulated ulcers
Scoring	Partial condemnation
Comments	The diamond-shaped appearance indicates erysipelas

16.56



Animal species/Organ	Cattle/Skin
Lesion	Chronic, ulcerative pododermatitis (bovine digital dermatitis); "islands" of intact skin can be seen (→)
Scoring	Partial condemnation
Comments	The lesions are most frequently found between the heel bulbs

16.57



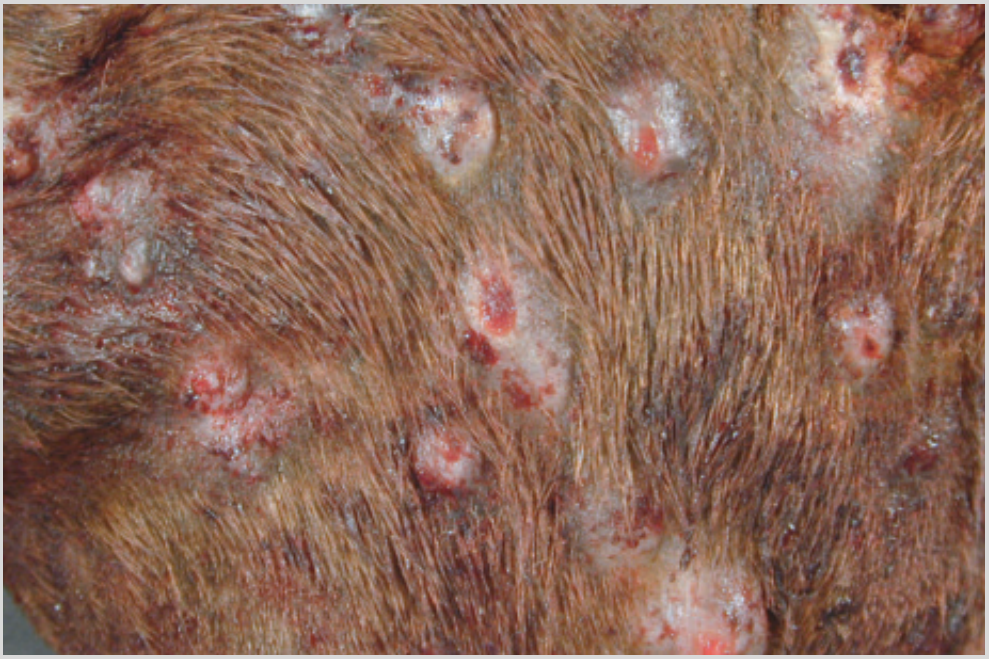
Animal species/Organ	Cattle/Skin
Lesion	Chronic, ulcerative pododermatitis (bovine digital dermatitis); papillomatous proliferation can be seen in "islands" of intact skin (→)
Scoring	Partial condemnation
Comments	Papillomatous proliferation may be misdiagnosed as excessive hair growth

16.58



Animal species/Organ	Horse/Skin; the same lesion as in 16.59 and 16.60
Lesion	Chronic, pyogranulomatous (botryomycotic) dermatitis characterised by scar tissue formation and fistulae
Scoring	Partial condemnation
Comments	The presence of complications necessitates total condemnation

16.59



Animal species/Organ	Horse/Skin; the same lesion as in 16.58 and 16.60
Lesion	Chronic, pyogranulomatous (botryomycotic) dermatitis characterised by fistulae
Scoring	Partial condemnation
Comments	The fistulae are obvious

16.60



Animal species/Organ	Horse/Skin; the same lesion as in 16.58 and 16.59
Lesion	Chronic, pyogranulomatous (botryomycotic) dermatitis
Scoring	Partial condemnation
Comments	May be misdiagnosed as neoplasia

16.61



Animal species/Organ	Cattle/Skin (head)
Lesion	Chronic, locally extensive dermatitis characterised by alopecia and greyish scales and crusts (ringworm)
Scoring	Partial condemnation
Comments	Solitary, circular lesions are most frequently seen in ringworm cases

16.62



Animal species/Organ	Pig/Skin
Lesion	Chronic dermatitis characterised by thickening and folding of the skin (*Sarcoptes* mange)
Scoring	Partial condemnation
Comments	Thickening and folding of the skin is also called lichenification

16.63



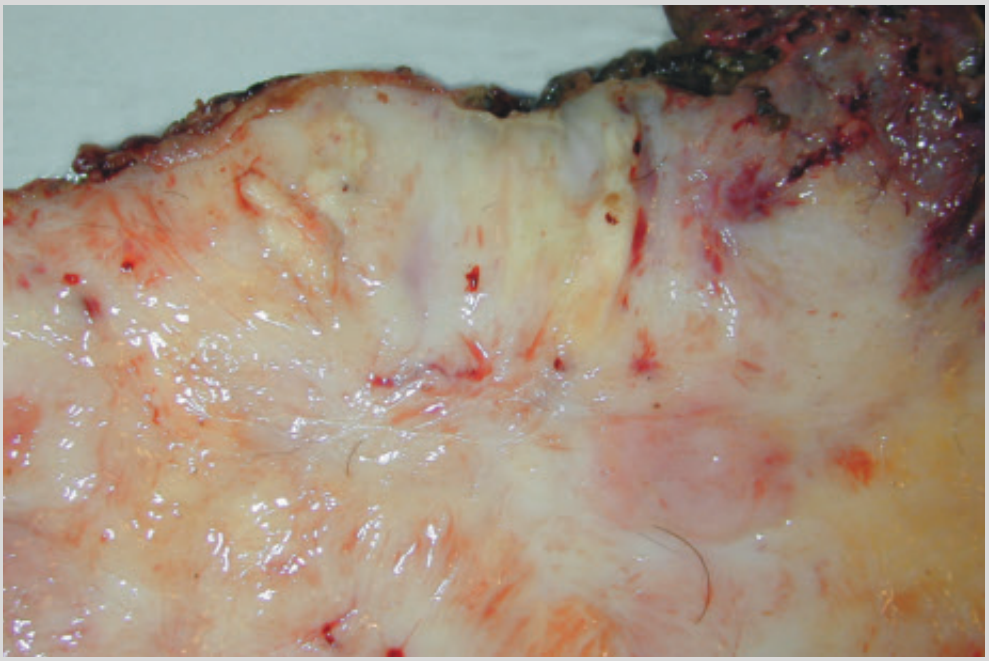
Animal species/Organ	Cattle/Skin (head)
Lesion	Lice
Scoring	Partial condemnation
Comments	The infection often occurs together with other diseases

16.64



Animal species/Organ	Cattle/Skin; the same lesion as in 16.65
Lesion	Malignant neoplasm in the skin
Scoring	Total condemnation
Comments	The neoplasm was growing invasively

16.65



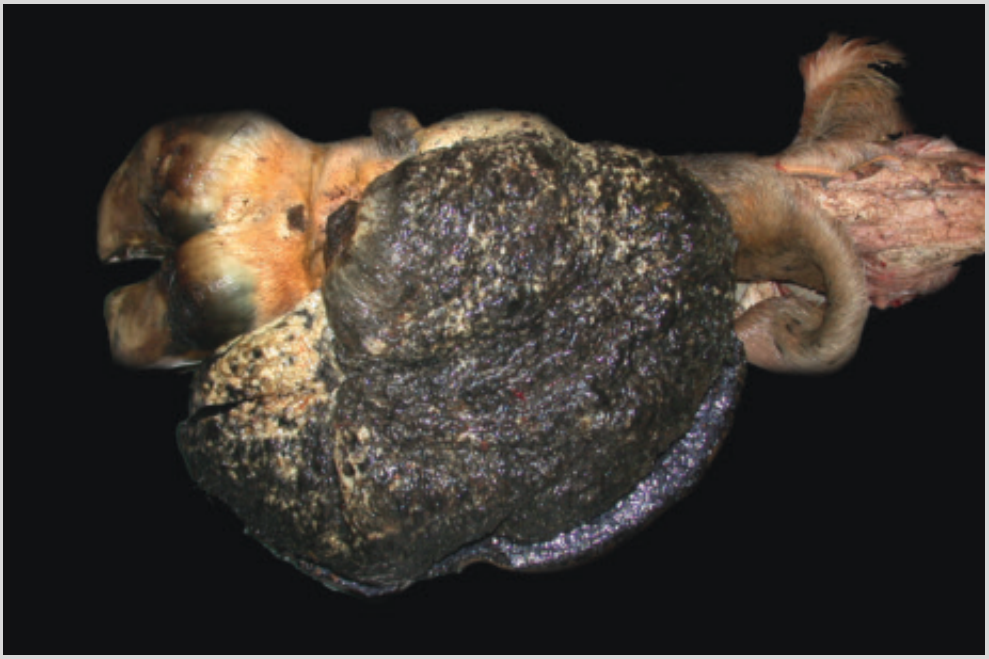
Animal species/Organ	Cattle/Skin; cut section of the neoplasm shown in 16.64
Lesion	Malignant neoplasm in skin
Scoring	Total condemnation
Comments	The neoplasm can be misdiagnosed as pyogranulomatous and granulomatous inflammation

16.66



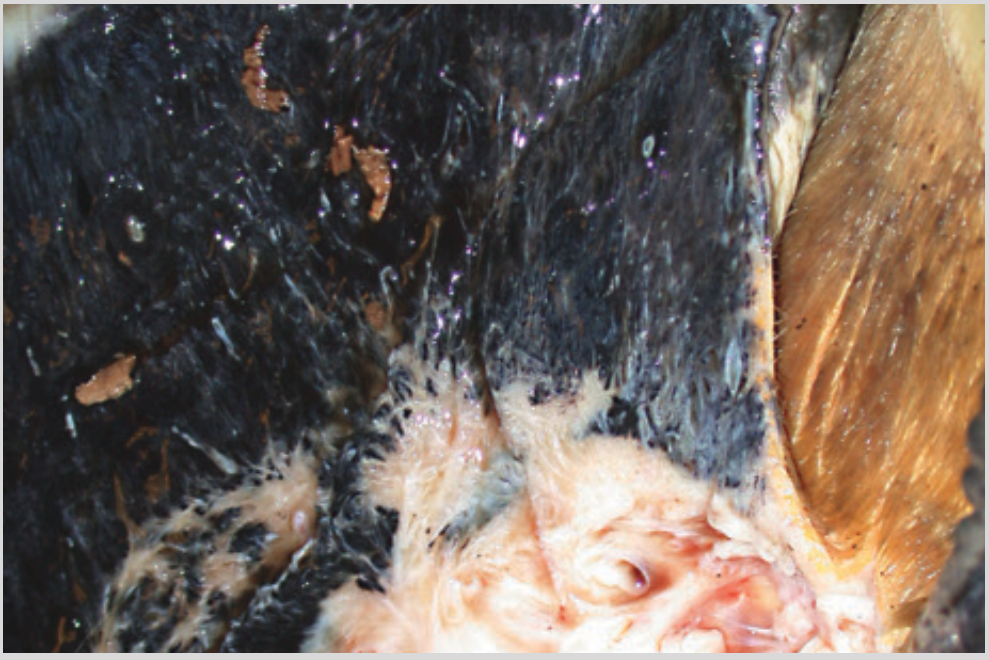
Animal species/Organ	Horse/Skin; the ventral surface of the tail
Lesion	Dermal, malignant melanomas
Scoring	Total condemnation
Comments	In addition, neoplasms (malignant melanomas) were present in the parietal pleura in this horse

16.67



Animal species/Organ	Cattle/Skin; the same lesion as in 16.68
Lesion	Dermal benign melanoma
Scoring	Partial condemnation
Comments	Occasionally large, pedunculated, dermal benign melanomas are found in cattle

16.68



Animal species/Organ	Cattle/Skin; detail (cut section) of 16.67
Lesion	Dermal benign melanoma
Scoring	Partial condemnation
Comments	The cellular origins of the neoplastic growth is obvious (melanocytes)

16.69



Animal species/Organ	Pig/Skin
Lesion	Dermal benign melanoma
Scoring	Partial condemnation
Comments	The surface of the neoplasm is characterised by ulceration

16.70



Animal species/Organ	Horse/Skin
Lesion	Papillomatosis
Scoring	Partial condemnation
Comments	Papillomatosis occurs particularly in young animals

16.71



Animal species/Organ	Horse/Skin of the perineum and udder
Lesion	Equine sarcoids
Scoring	Partial condemnation
Comments	The lesions are caused by bovine papilloma virus

16.72



Animal species/Organ	Cattle/Skin of the perineum and udder
Lesion	Cutaneous lymphosarcoma
Scoring	Total condemnation
Comments	The condition is also known as bovine leukosis

16.73



Animal species/Organ	Cattle/Skin; subcutis
Lesion	Epidermal cyst
Scoring	Partial condemnation
Comments	The cyst contents are comprised of keratin and hair fragments

17 Endocrine System

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Pituitary gland p. 621
Adrenals p. 622
Thyroid gland p. 623
Parathyroid glands p. 624
Islets of Langerhans (endocrine pancreas) p. 624
Chemoreceptors (paraganglia) p. 624

Introduction

The endocrine system is comprised of small modest organs which all produce hormones that are essential for the body's homeostasis. Lesions in these organs become significant either because there is a change in organ function (hyperfunction or hypofunction) or because their size, often due to nodular hyperplasia or neoplasm, increases causing problems for the animal. Although many lesions are difficult to detect macroscopically, clinical signs, including the animal's appearance and behaviour, can be good indicators of which endocrine organ should be examined further. The majority of the pathoanatomic diagnoses can only be made with any certainty using histologic examination.

Lesions in the endocrine system that impact on meat inspection occur very rarely. Scoring of lesions in the endocrine system is based on the general meat inspection rules (see Chapters 1 and 2).

Pituitary gland [17.01 – 17.04]

The pituitary gland is a central organ producing somatotropin, prolactin, thyrotropin, corticotropin, melanocyte stimulating hormone, follicle stimulating hormone, and luteinising hormone, as well as secreting vasopressin and oxytocin. The various hormones are, among others, involved in the regulation of the adrenal cortical cells, the follicular cells of the thyroid, and cells in the reproductive system. Anatomically, the pituitary is divided into the adenohypophysis including the pars distalis, pars tuberalis, and pars intermedia, and the neurohypophysis.

The most commonly occurring lesion is seen in older horses which may develop hyperplasia or neoplasia in the pars intermedia. Pars intermedia adenomas in horses are large, yellow to white, often multinodular lesions, which can be haemorrhagic. The lesion often completely enclose the neurohypophysis, and can cause compression of the hypothalamus, the pars distalis of the adenohypophysis, and sometimes the neurohy-

pophysis. Hyperproduction of corticotropin alone is rarely seen in these pars intermedia adenomas in horses, but on the other hand there is generally hyperproduction of peptides derived from proopiomelanocortin (POMC), such as β-endorphin, α-, β- and γ-melanocyte stimulating hormone, corticotropin-like pars intermedia peptide (CLIP) and β-lipotropin. Thus, the horses do not develop classic Cushing's syndrome, but a complex hormonal disorder, in which secretion of corticotropin is but a small part. The disorder is called Pituitary Pars Intermedia Dysfunction (PPID). The clinical signs are related not only to the effect of the POMC-derived peptides, but also to compression effects on the hypothalamus due to the size of the adenoma. The most obvious sequelae from a pars intermedia adenoma is hypertrichosis (hirsutism), which manifests as a long and irregular hair coat, often due to lack of cyclic shedding of hairs. Old ewes occasionally have an enlarged pituitary gland due to hyperplasia or neoplasia of the acidophils of pars distalis. Inflammations in the pituitary gland are discussed in Chapter 3.

Adrenals [17.05 – 17.12]

The adrenal glands are a paired organ, and it is important to always inspect both adrenals. The adrenal cortex is divided into three zones which produce mineralocorticosteroids (e.g. aldosterone), glucocorticosteroids (e.g. cortisol) and sex hormones (e.g. androstenedione), which are involved in fluid balance, fat-, protein-, and carbohydrate metabolism, and reproduction, respectively. The adrenal medulla produces norepineprine and epinephrine. Mature or older animals' adrenals may have a slightly uneven surface and, at incision, nodular areas of accessory cortical tissue can be found in the capsule, cortex, or medulla. Nodular cortical hyperplasias may also be seen. These lesions are often without clinical significance. Sclerosis of the capsule can occur in older cattle. This also has no clinical significance and has no impact on meat inspection. Particularly in horses, the adrenals may have haemorrhages and haemorrhagic necroses resulting from stress, overexertion, sepsis, or shock. Cortical adenomas are occasionally found in cattle, horses, sheep and goats. Usually they are solitary, unilateral, well-demarcated, completely or partially pale or yellow lesions in the cortex. They can be bilateral. Larger adenomas are well-demarcated, yellowish, lobulated, soft or friable, often with areas of haemorrhage and sometimes calcifications, necroses and cystic spaces. Cortical carcinomas are larger and more poorly demarcated, but if no obvious signs of invasive growth or metastases are present, they can be very difficult to distinguish from adenomas. Both can cause alteration in the size and shape of the adrenal gland. Adjacent adrenal tissue is compressed and extension into the medulla can be seen. If they have been functionally active, compensatory atrophy of the cortex can be seen in the remainder of the affected gland and in the paired adrenal. The most common neoplastic lesion in the adrenal medulla is phaeochromocytoma. Phaeochromocytomas can vary in size from small to large and can alter the size and shape of the adrenal gland. They are most commonly encountered in cattle and are rarely functionally active. When phaeochromocytomas attain a larger size they can be difficult to distinguish from adrenocortical tumors. The colour is usually more reddish-brown and consistency is firmer than adrenocortical tumors. Previously it was belived that phaeochromocytomas were the most common

adrenal tumors in cattle. But a recent Danish retrospective study of adrenal tumors in cattle have shown that adrenocortical tumors are the most common adrenal tumor in cattle. Phaeochromocytomas can be seen concomitantly with hyperplasia or adenoma in other endocrine organs. Especially in bulls, additional lesions can occur in the thyroid gland (C-cell hyperplasia, C-cell adenomas, or carcinomas).

Thyroid gland [17.13 – 17.15]

The thyroid gland is one gland comprised of a right and left lobe joined either by a fibrous isthmus (horse, sheep and goat) or a glandular isthmus (cattle). In pigs, there is no clear division between the right and left half. The thyroid gland contains two cell types; follicular cells which produce triiodothyronine (T3) and tetraiodothyronine (T4, thyroxin) which are involved in all basic metabolism, and C-cells which produce calcitonin that is involved in calcium metabolism.

Goitre is a non-neoplastic and non-inflammatory disorder of the thyroid gland. There are two types in production animals and horses: diffuse, hyperplastic, follicular goitre, and colloid goitre. In both cases, the gland is uniformly enlarged and the colour is either dark (diffuse, hyperplastic, follicular goitre) or pale (colloid goitre). Goitre is rarely seen today. Diffuse, hyperplastic, follicular goitre can be due to lack of iodine in feed, excessive iodine in feed, intake of goitre-inducing substances (e.g. sulfonamides and certain types of cabbages (Brassica spp) or a genetic defect (very young animals). The endocrine function is impaired (reduced production of T3 and T4 – hypothyroidism), and secondarily the pituitary gland can be slightly enlarged due to hyperplasia and hypertrophy of the basophil cells in the pars distalis which produces thyrotropin. Colloid goitre is an involution phase that can be seen after diffuse, hyperplastic, follicular goitre. Nodular hyperplasias are seen particularly in older horses. They are apparent as bilateral, often multifocal, well-defined, non-encapsulated, white to yellowish-brown, firm lesions of various sizes. Often the thyroid gland acquires an irregular appearance. The lesions are mostly functionally inactive.

The most common neoplastic lesions are follicular adenomas; these are most common in horses. They are generally unilateral, solitary, well-defined, completely or partially encapsulated, white to yellowish-brown, often small, firm lesions. Occasionally the adenomas can become cystic and thus larger. They can show hormonal activity and cause hyperthyroidism (rare). C-cell hyperplasias or neoplasms can change the shape of the thyroid gland in both horses and cattle. C-cell adenomas are more grey than follicular adenomas. C-cell carcinomas are also seen; they are often large, multinodular and firm with fibrous bands on the cut surface. They metastasize frequently to the cervical lymph nodes. In cattle, particularly bulls, a more primitive form of C-cell neoplasms can be seen, ultimobranchial neoplasms, which cannot be distinguished macroscopically from other C-cell neoplasms. In older bulls, but not cows, a high-calcium intake can predispose to C-cell hyperplasias and neoplasias. Such lesions in the thyroid gland in bulls, can be accompanied by lesions in the adrenal medulla (phaeochromocytomas).

Parathyroid glands

The parathyroid glands are a paired organ, the position and number of which (2-4) depends on the species. The glands are very small and difficult to locate in production animals and horses unless they are enlarged. The chief cells produce parathyroid hormone, which is essential for calcium metabolism.

Hyperparathyroidism, in which there is long-term elevated excretion of parathyroid hormone and development of fibrous osteodystophy (osteodystrophia fibrosa), may be due to a primary functional neoplasm (adenoma or carcinoma) in one of the glands. Adenomas are the most frequent type of neoplasm and occur as solitary, unilateral, well-defined, encapsulated, pale, nodular lesions. They are often functionally active and the gland containing the neoplastic lesion becomes considerably enlarged with compensatory atrophy of the other glands. Hyperparathyroidism with fibrous osteodystrophy is more frequently seen secondary to chronic renal disease (see Chapter 11) or secondary to nutritional calcium/phosphorus imbalance (see Chapter 14). In these cases, uniform hypertrophy and hyperplasia of all glands is present.

Islets of Langerhans (endocrine pancreas) [17.16]

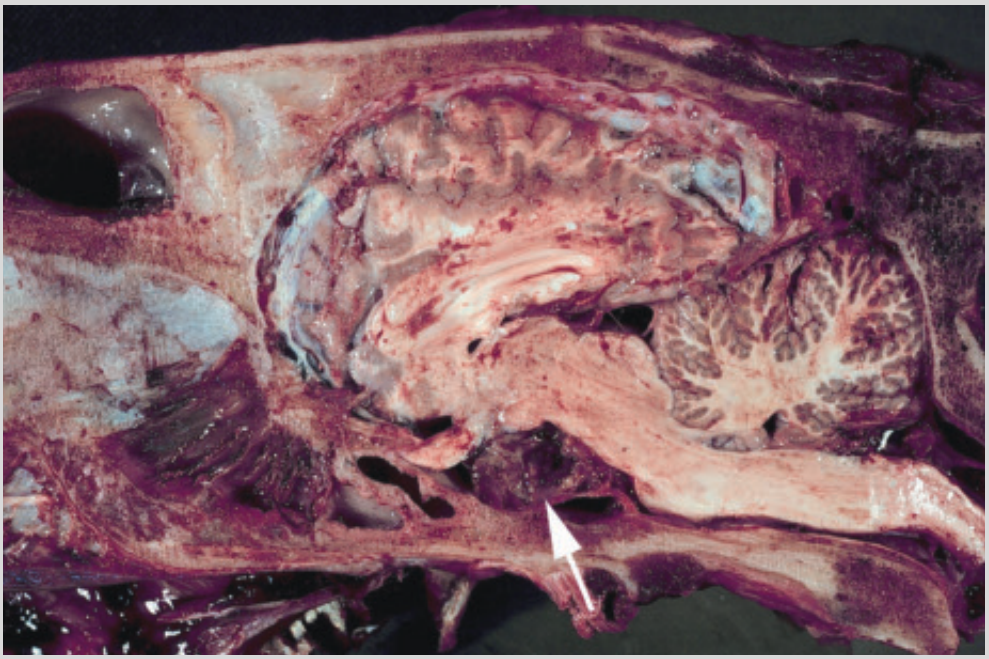
The endocrine part of the pancreas is comprised of islets of Langerhans. The fact that they are scattered throughout an exocrine gland makes them special. The islets contain four types of cells which produce insulin and islet amyloid polypeptide (B cells), glucagon (A cells), somatostatin (D cells), and pancreatic polypeptide (F cells). These hormones are highly important in carbohydrate, protein, and fat metabolism. The most common endocrine disorder associated with changes in the function of the islets of Langerhans, is diabetes mellitus. Diabetes mellitus is characterised by deficient or reduced amounts of insulin available for the cells of the body. This may be due to hypofunction of the B cells. Diabetes mellitus is diagnosed rarely in production animals and horses, and even in cases with clinical signs of diabetes mellitus, macroscopic changes can rarely be seen. The most common macroscopic lesion in diabetes mellitus is the secondary development of fatty liver (diffuse hepatic steatosis). The most common neoplastic lesions in the islets of Langerhans originate from the B cells. Functional B cell adenomas (insulinomas) can be seen in cattle (older animals). They occur as solitary or multiple, yellow to dark-red, nodular lesions that are surrounded by a thin capsule. They are often small, between 1-3 cm in diameter, and have the same consistency as the surrounding pancreatic tissue.

Chemoreceptors (paraganglia)

Chemoreceptors are paraganglia that are found at numerous sites in the body. At meat inspection, the most important are the aortic glomus and the carotid glomus, as neoplastic lesions (chemodectomas) most frequently develop here. Chemodectomas originating in the aortic glomus are most frequently seen in cattle. The neoplastic lesions are located at the base of the heart and can vary considerably in size (0.5-12.5 cm in

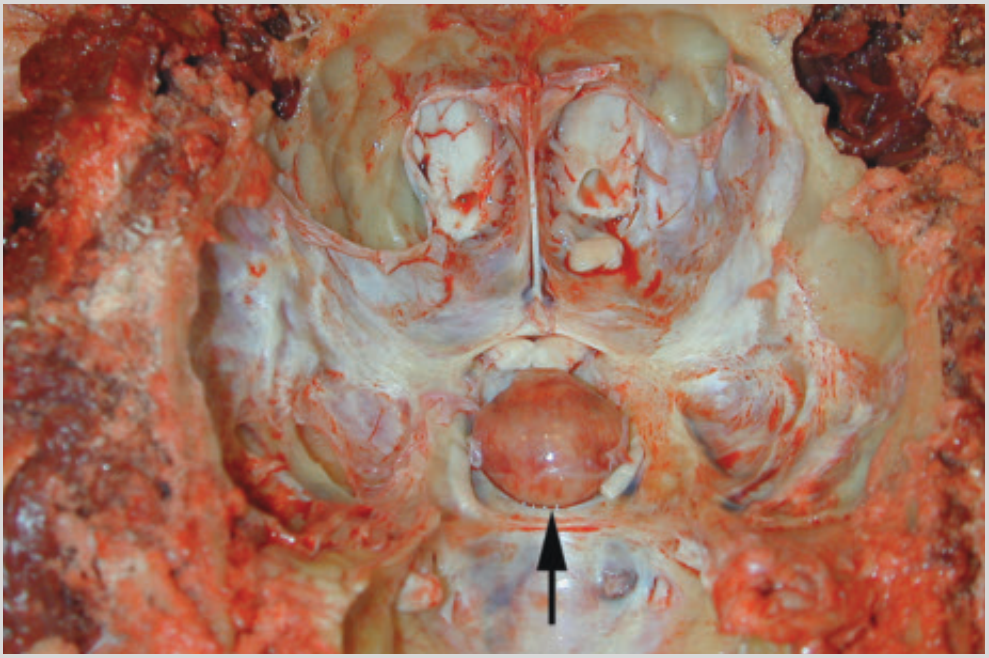
diameter). Small chemodectomas are nodular with a smooth surface and a white and red marbled cut surface. Larger chemodectomas can be multilobular, enclose the major blood vessels, compress the atrial walls and displace the trachea. The malignant forms are almost always large and grow invasively. Chemodectomas at the base of the heart rarely metastasize regardless of the degree of malignancy, and are never functional but, because of their size and location, they may cause circulatory disturbances.

17.01



Animal species/Organ	Horse/Head (midline section)
Lesion	Benign pituitary neoplasia with haemorrhage (→)
Scoring	Partial condemnation
Comments	Complications or signs of malignancy necessitate total condemnation

17.02



Animal species/Organ	Horse/Pituitary gland in situ after removal of the calvarium and brain
Lesion	Benign pituitary gland neoplasia (→)
Scoring	Partial condemnation
Comments	Complications or signs of malignancy necessitate total condemnation

17.03



Animal species/Organ	Horse/Pituitary gland (cross section)
Lesion	Adenoma in the pituitary gland pars intermedia
Scoring	Partial condemnation
Comments	Note compression of the remainder of the gland and the haemorrhagic area in the tumour

17.04



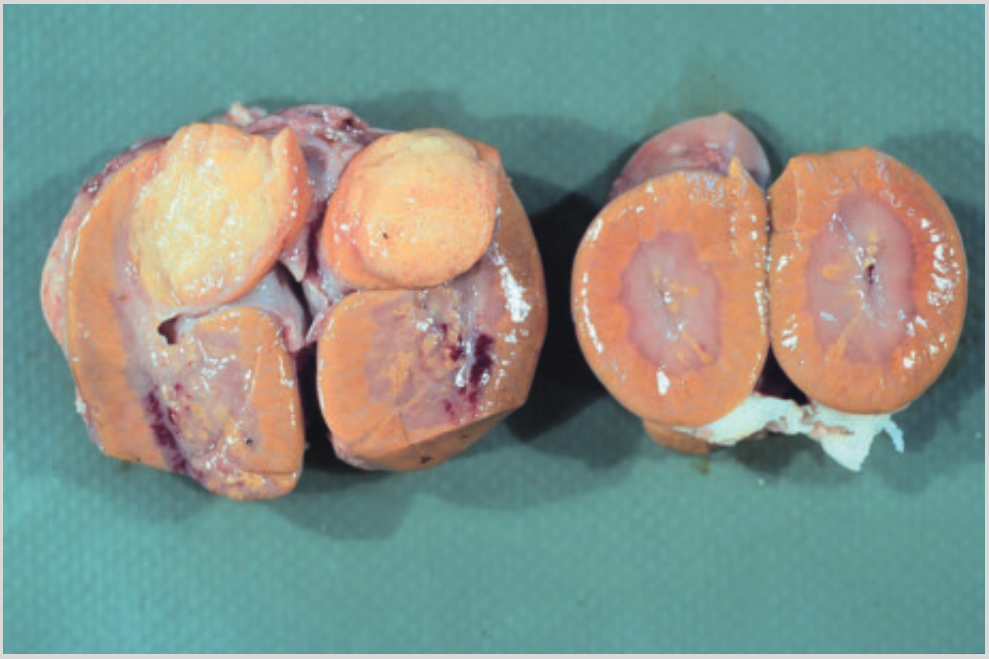
Animal species/Organ	Horse/Skin and hair coat
Lesion	Hypertrichosis
Scoring	Partial condemnation
Comments	The condition is also known as hirsutism, and is often seen in horses with pituitary neoplasia

17.05



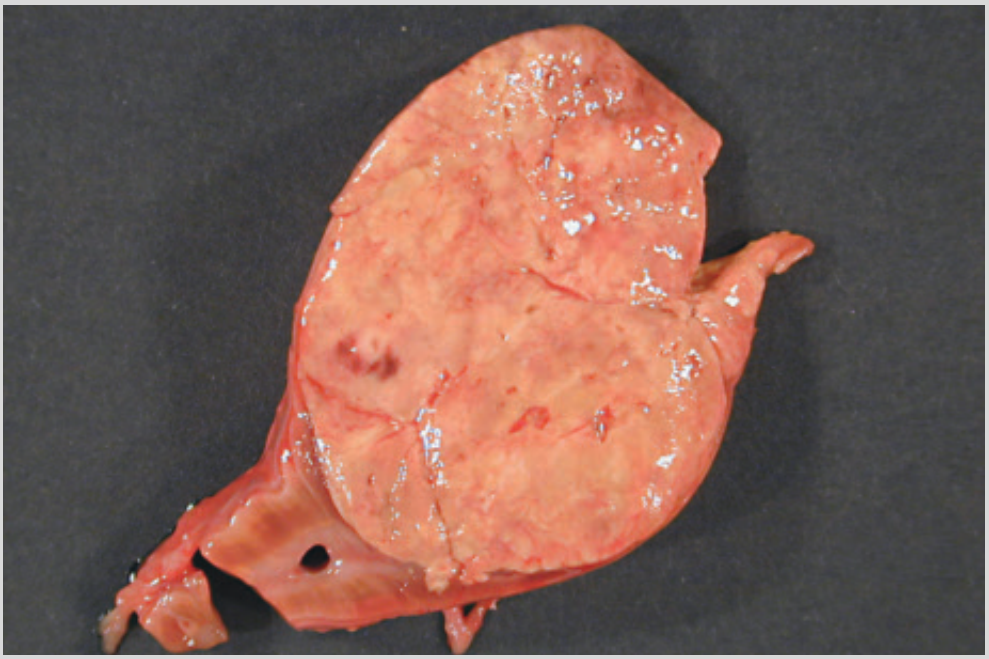
Animal species/Organ	Horse/Adrenal glands (cross sections)
Lesion	Cortical haemorrhage
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

17.06



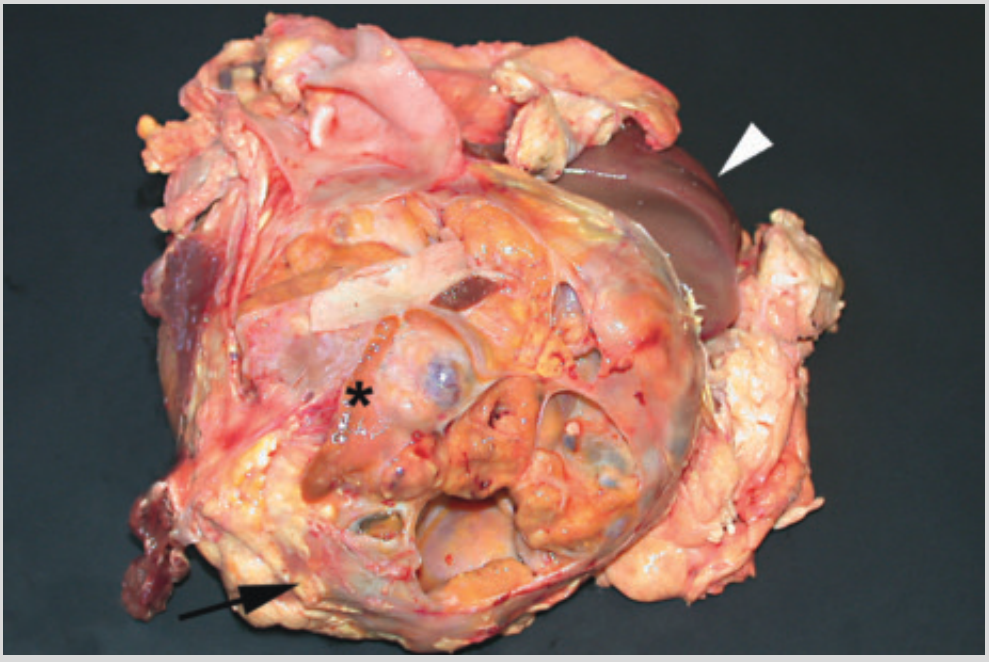
Animal species/Organ	Cattle/Adrenal glands (cross sections)
Lesion	Adrenocortical adenoma, solitary in one adrenal
Scoring	Partial condemnation
Comments	Presumably non-functional, as there is no atrophy of the contralateral adrenal cortex

17.07



Animal species/Organ	Horse/Adrenal gland (cross section)
Lesion	Adrenocortical adenoma
Scoring	Partial condemnation
Comments	Complications or signs of malignancy necessitate total condemnation

17.08



Animal species/Organ	Cattle/Adrenal gland (➞) and kidney (▻)
Lesion	Adrenocortical adenoma
Scoring	Partial condemnation
Comments	Note the small remnant of normal cortical tissue centrally in the photo (*)

17.09



Animal species/Organ	Cattle/Adrenal gland (cross section) and kidney renculus (►)
Lesion	Adrenal cortical adenoma
Scoring	Partial condemnation
Comments	Note the small remnant of cortical tissue (➞)

17.10



Animal species/Organ	Cattle/Adrenal gland (cross section)
Lesion	Adrenocortical adenoma
Scoring	Partial condemnation
Comments	Complications or signs of malignancy necessitate total condemnation

17.11



Animal species/Organ	Cattle/Adrenal gland (cross section) and kidney
Lesion	Adrenocortical adenoma
Scoring	Partial condemnation
Comments	Large neoplasm in the adrenal with haemorrhagic areas and mineralisation

17.12



Animal species/Organ	Horse/Adrenal gland (cross section)
Lesion	Phaeochromocytoma
Scoring	Partial condemnation
Comments	Complications or signs of malignancy necessitate total condemnation

17.13



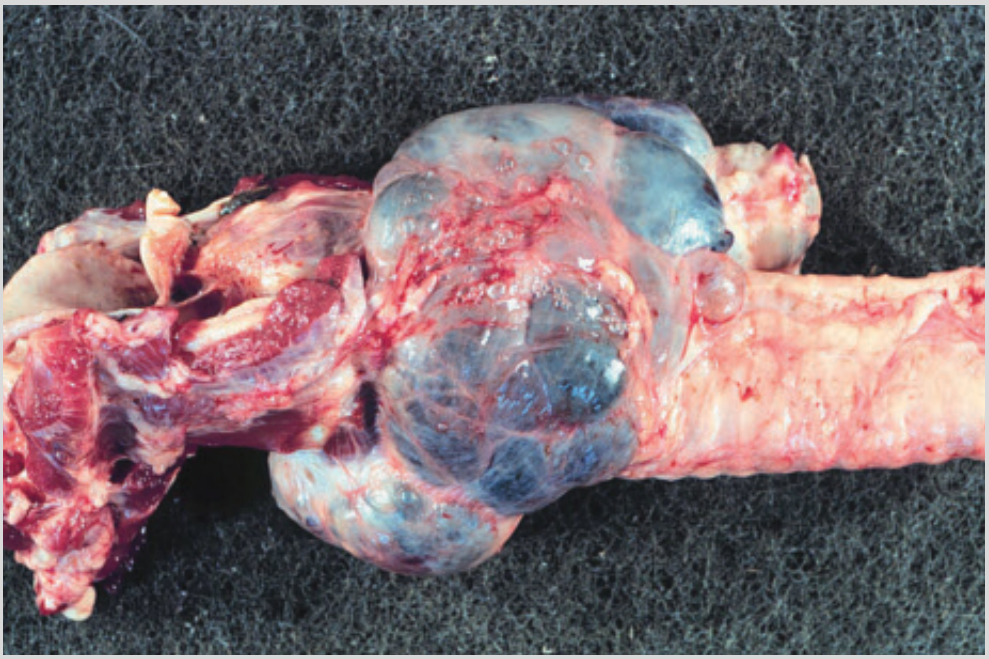
Animal species/Organ	Goat kids (newborn)/Thyroid gland
Lesion	Congenital goitre
Scoring	Partial condemnation
Comments	Complications necessitate total condemnation

17.14



Animal species/Organ	Horse/Thyroid gland lobes (cross sections)
Lesion	Bilateral, nodular hyperplasias
Scoring	Partial condemnation
Comments	Complications necessitate total condemnation

17.15



Animal species/Organ	Cattle/Thyroid gland
Lesion	Cystic adenomatous hyperplasia
Scoring	Partial condemnation
Comments	Complications necessitate total condemnation

17.16



Animal species/Organ	Cattle/Pancreas
Lesion	Insulinomas
Scoring	Partial condemnation
Comments	Complications or signs of malignancy necessitate total condemnation

18 Eyes and Ears

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Introduction

The eyes and ears are important sense organs. The eyes facilitate the visual senses, and the ears facilitate balance and hearing. Both organ systems lie well-protected in the cranium. At meat inspection, the inner parts of the eyes or ears are rarely exposed. The outer parts can also be difficult to inspect macroscopically, in particular the outer parts of the eyes. The eyelids and outer ears are also part of the skin, and skin lesions can therefore also be found in these. Lesions in both organ systems can be a sign of generalised disease, and it is important to weigh the observed lesions in eyes and ears against lesions found elsewhere in the body.

With regard to the eyes only lesions in the eyelid, conjunctiva, cornea, and anterior chamber will be reviewed as these structures can be immediately examined when inspecting the head. Similarly, only lesions in the outer ear and middle ear will be reviewed as it is very difficult to examine the inner ear when inspecting the head. General meat inspection rules apply at scoring of lesions in the eyes, outer ear, and middle ear. This always necessitates, as a minimum, rejection of the pathologic tissue. In infectious conditions, the regional lymph nodes must always be inspected for signs of local spread, and other organs must be carefully examined for signs of systemic spread. The same applies for neoplastic lesions.

Developmental anomalies of the eye [18.01 – 18.02]

Incomplete closure of parts of the embryonic optic fissure (coloboma) is the most common developmental anomaly in the eye, but this seldom has clinical significance. Lack of closure of the embryonic fissure in the anterior part of the eye is apparent as

a coloboma of the iris or ciliary body, and can cause macroscopically visible changes in the shape of the pupil. Unilateral or bilateral corneal dermoid (heterotopic skin) is a focal differentiation of skin, which can be seen in the cornea, conjunctiva, or both places. The lesion is seen most frequently in cattle and causes local irritation with inflammation of the conjunctiva (conjunctivitis) and/or cornea (keratitis).

Although congenital malformations of the eyes are rare, one of the most important malformations is micropthalmus. This condition can be due to intrauterine viral infections (e.g. bovine viral diarrhoea virus in cattle). Another cause of excessively small eyes can be collapse of the eyeball (phthisis bulbi) as a result of chronic inflammation (end-stage eye). Excessively outward turning eyelids and/or lashes (ectropion) or inward turning eyelids and/or lashes (entropion) can result in keratitis.

Conjunctivitis [18.03 – 18.04]

Conjunctivitis is inflammation of the conjunctiva, which is seen acutely as oedema, swelling, and redness of the conjunctiva with increased lacrimal flow. Later, the flow from the eyes can remain serous or become mucoid or mucopurulent, and the conjunctiva will appear thickened and perhaps granular on the surface. The causes of conjunctivitis are many ranging from local irritation, allergy (type 1), infection with bacteria (e.g. *Moraxella ovis* in sheep; *Listeria monocytogenes* in cattle, mycoplasms in cattle, sheep and goats, *Chlamydophilia psittaci* in sheep, goats and pigs, parasites (e.g. *Habronema* spp in horses) or vira (e.g. bovine herpes virus type 1 and equine arteritis virus). Conjunctivitis often occurs together with keratitis as in e.g. infectious bovine keratoconjunctivitis ("bovine pink eye"), where *Moraxella bovis* is the most frequently isolated agent and is considered to be the primary cause. The lesions can be unilateral or bilateral. Mucopurulent to purulent conjunctivitis with ulcerative keratitis is present, and a pus-filled ulcer is formed centrally in the cornea ("corneal abscess").

Oedema and corneal ulceration [18.05 – 18.11]

The cornea is normally kept dehydrated and transparent, partly passively through the hydrophobic properties of the corneal epithelium and partly actively by a pump mechanism in the corneal endothelial cells. Oedema is due to fluid uptake from the lacrimal fluid, blood vessels, or aqueous humor. If the corneal epithelium is injured (superficial ulcerations in the cornea and keratitis) local oedema may be present in the cornea. Diffuse oedema in the cornea, in which the entire cornea becomes opaque and almost bluish is usually due to injury to the cornea's endothelial cells as a result of e.g. inflammation in the inner part of the eye; glaucoma; lens luxation; perforating ulceration of the cornea; or severe keratitis. Note that in cattle diffuse bilateral oedema in the cornea is often associated with malignant catarrhal fever. Corneal ulceration is a result of injury to the corneal epithelium and stroma through physical or chemical trauma or infections. The ulcerations can be superficial, deep, or perforating. Injury to the epithelium gives an immediate risk of secondary infection. Collagenolysis is seen particularly in horses, in which the cornea becomes almost liquid due to secondary bacterial infection with *Pseudomonas*

aeruginosa, for example. Some bacteria are primary pathogens and do not require prior injury to the corneal epithelium; this applies for example to *M. bovis*. Corneal ulcerations may heal completely, but scar tissue can often occur which can be seen in the cornea as a slightly opaque area (nebula), a whitish defined spot (macula) or a white, pronounced, slightly raised scar (leukoma). Deep ulcerations are associated with a risk for prolapse of the anterior part of the eye (Descemet's membrane and iris) as well as hypotonia of the eyeball. Perforating ulcerations are associated with an additional risk of secondary infection of the inner eye and for collapse of the eyeball resulting in pthisis bulbi. Collapse of the eyeball, due to perforation of the cornea, can also occur from within due to inflammation in the inner part of the eye with injury to the corneal endothelium.

Lesions in the anterior chamber [18.12 – 18.17]

Lesions that can be seen in the anterior chamber include accumulation of blood (hyphema) resulting from trauma or rupture of the friable, newly-formed vessels in inflammatory conditions in the eye; fibrin (aqueous flare) and/or pus (hypopyon) either as a result of inflammation in the anterior uvea or in the rest of the eye. The pathogenesis of inflammations in the eye is either haematogenous spread (by injury to the blood-retinal barrier or blood-aqueous barrier) or sequelae after corneal ulceration (perforating trauma). At inflammation of the entire eyeball (panophthalmitis), the eye may be be converted to an abscess, and it can be difficult to determine whether the inflammation arose haematogenously, or as a result of a perforating ulcer in the cornea. Panophthalmitis can be seen in cases of malignant catarrhal fever. Impairment or obstruction of aqueous humour drainage due to inflammation of the inner part of the eye, e.g. the anterior uvea, may result in development of glaucoma (increased intra-ocular pressure). Buphthalmos (enlargement of the eyeball), in which the sclera has yielded to the increased intra-ocular pressure, can be seen in conjunction with secondary glaucoma, but is more frequent in young animals e.g. if the glaucoma is due to a congenital developmental anomaly in the iridocorneal angle.

Ocular neoplasms [18.18 – 18.22]

Ocular melanomas are frequently seen in horses, particularly in dappled horses. The neoplastic lesions are typically located at the edge of the eyelid or in the anterior uvea and may affect the horse's vision. The degree of malignancy has not been clarified. If aqueous humour drainage is impaired or completely obstructed due to neoplastic lesions in the inner part of the eye, e.g. the anterior uvea, glaucoma can develop.

Squamous cell carcinomas are seen most frequently in cattle ("cancer eye"), but may also occur in horses. In cattle the neoplastic lesions often originate in the conjunctiva on the third eyelid or the lower eyelid, from where they spread to the eye region and grow invasively. Ulceration is frequently seen. Metastases typically develop late in the disease. Typically, cattle with unpigmented skin and hair in the area of the eyes are affected. Exposure to sunlight and sunburn are presumably important factors in development of these neoplastic lesions. In horses, squamous cell carcinomas are apparent as smaller, irregular, pale-pink or white lesions in the conjunctiva.

Lymphosarcomas can occur retrobulbarily in cattle and cause exopthalmus. In horses lymphosarcomas often occur locally in the conjunctiva. Whether these are metastases or part of a multicentric localisation is not clear.

Peripheral auricular necrosis and ulceration [18.23 – 18.30]

Auricular necrosis manifests itself as necroses along the margins of the pinna, especially in pigs. The necroses can progress into suppurating ulcers particularly at the base of the pinna. The cause of these necroses and ulcers are not known with certainty. They can be a result of frostbite, "cold agglutination disease" (an autoimmune disease that is rarely diagnosed in production animals), poisoning with ergot (ergotism), thrombosis in relation to trauma (typically in connection with fighting or excessive sucking on the ears by other pigs) or caused by self mutilation for example due to irritation from inflammation of the outer ear (otitis externa) e.g. with sarcoptic mange. The significance of infections with the haemothropic *Mycoplasma suis* (earlier *Eperythrozoon suis*) or *Treponema* spp or other microorganisms that may be found in the lesions is still debated. Feed, management and stall conditions may also play a role.

Mange (scabies)

Mange is a skin condition that is due to infection with mites. Sarcoptic mange (scabies) can be seen in the area around the ears of pigs infected with the ectoparasite *Sarcoptes scabei* var. *suis.* The parasite can infest many areas of the body, but has a particular predilection for the ears. The lesions can be seen as brown, oily crusts or dry dark scabs often on the inner side of the pinna (scaphae), but also into the outer ear canal. The infection causes itching and there is a risk that the pig can injure the ear due to scratching. Another mite, the ectoparasite *Psoroptes ovis* and *P. cuniculi,* can cause similar lesions in the ears of sheep, and occasionally cattle, goats and horses and can cause an itching otitis externa with a risk for self-imposed trauma. In sheep, *P. ovis* is the cause of psoroptic mange, the so called "sheep scab" with extensive lesions all over the body.

Equine auricular plaques [18.31]

Equine auricular/aural plaques are solitary or multiple, raised, smooth, scaly or crust-like, white-grey lesions on the inner surface of the pinna in horses. The lesions comprise hyperplastic and hypertrophic epithelium, presumably as a result of infection with a papillomavirus. The precise type of papillomavirus is however still unknown.

Othaematoma [18.32 – 18.35]

Othaematoma (auricular haematoma) is seen particularly in pigs, but may also be seen in other livestock species. It can occur both unilaterally and bilaterally. It presumably arises due to injury to the auricular cartilage and its vessels, such that the ear cartilage is split lengthwise and the cavity fills with serohaemorrhagic fluid. Injury to the ear cartilage

is often due to trauma, e.g. bite, impact, or violent rubbing against the surroundings. It is important to determine if the pruritus and irritation is caused by an inflammation in the outer ear (e.g. sarcoptic mange). In the acute phase, the ear is club-shaped due to distention by fluid (fluctuating). As the healing process advances, the fluid is resorbed and granulation tissue forms in between the split cartilage which remains split. During the healing process, retraction of the scar tissue may be so severe that it causes the pinna to curl up and deform ("cauliflower ears"). If the auricular haematoma is due to trauma from a bite, there is a high risk that the ear may become infected and thus a theoretical risk for haematogenous spread to the rest of the animal. Occasionally in the chronic auricular haematoma, a well-encapsulated abscess may be found between the split cartilage.

Auricular elephantiasis [18.36 – 18.39]

Auricular elephantiasis (auricular botryomycosis) is a chronic pyogranulomatous dermatitis, which is seen in pigs (see Chapter 20). The ear, in particular the dorsum, becomes extremely thickened due to fibrosis after severe lymphatic oedema. In contrast to auricular haematomas the cartilage is always intact, and the ear does not curl up. The pathogenesis is not completely understood, but is mostly due to infection with *Staphylococcus aureus.* The associated lymph nodes (superficial and deep parotid lymph nodes) are very often enlarged due to chronic pyogranulomatous lymphadenitis and must always be condemned together with the affected ear.

Otitis media [18.40]

In pigs, middle ear infection is a very frequent disorder that can cause accumulation of pus in the tympanic cavity, sometimes with osteolysis of the ossicles and/or cellulae tympanicae cells in the bulla. Otitis media is almost always associated with infection. Bacteria such as *Pasteurella multocida*, *Streptococcus suis*, *Mycoplasma hyorhinis*, non-haemolytical *Escherichia coli* and *Trueperella pyogenes* have been isolated from middle ear infections in pigs. The most frequent route is ascending infection via the Eustachian tube (tuba auditiva), often associated with upper airway infections. Infection can however occur via other routes such as otogenic spread (through the tympanic membrane in connection with otitis externa) or haematogenous spread (very rare). If clinical signs are present at ante-mortem inspection, such as tilting the head, the head should be split in the mid-line and the bullae opened. Lesions in the guttural pouches which are diverticula of the Eustachian tubes, are reviewed in Chapter 5.

Auricular neoplasms [18.41 – 18.42]

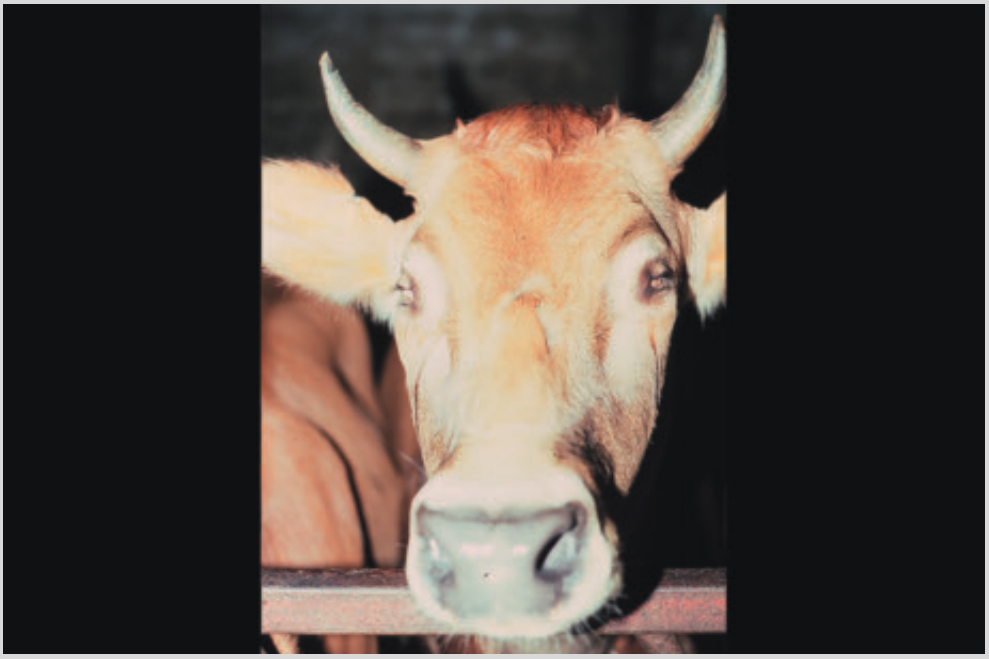
Generally, neoplasms of the ear are rarely found in slaughter animals. They are primarily related to the skin of the outer ear, or the ceruminous glands. For example, papillomas are occasionally seen with papillomatosis in cattle due to infection with bovine papillomavirus. In horses, equine sarcoids can also occur on the ears (see also Chapters 16 and 21).

18.01



Animal species/Organ	Pig and Cattle/Eye
Lesion	Corneal dermoid
Scoring	Partial condemnation
Comments	Heterotopic hair-covered skin covers the entire cornea

18.02



Animal species/Organ	Cattle/Eyes
Lesion	Micropthalmus, bilateral
Scoring	Partial condemnation
Comments	A rarely occurring condition. May be due to foetal infection with bovine viral diarrhoea virus

18.03



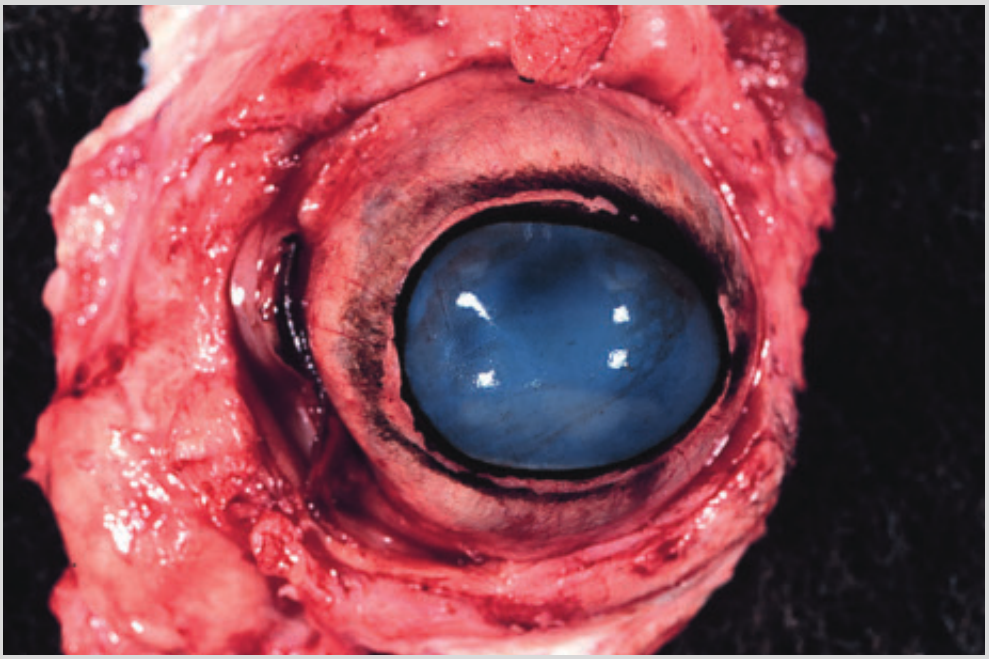
Animal species/Organ	Goat/Eye
Lesion	Keratoconjunctivitis
Scoring	Partial condemnation
Comments	Note the moisture around the eye as a sign of increased lacrimal flow, exudate and/or serous fluid

18.04



Animal species/Organ	Sheep/Eye
Lesion	Purulent conjunctivitis
Scoring	Partial condemnation
Comments	There may be underlying lesions in the cornea

18.05



Animal species/Organ	Cattle/Eye
Lesion	Diffuse oedema of the cornea
Scoring	Partial condemnation
Comments	If sequela after malignant catarrhal fever, total condemnation is neccesitated

18.06



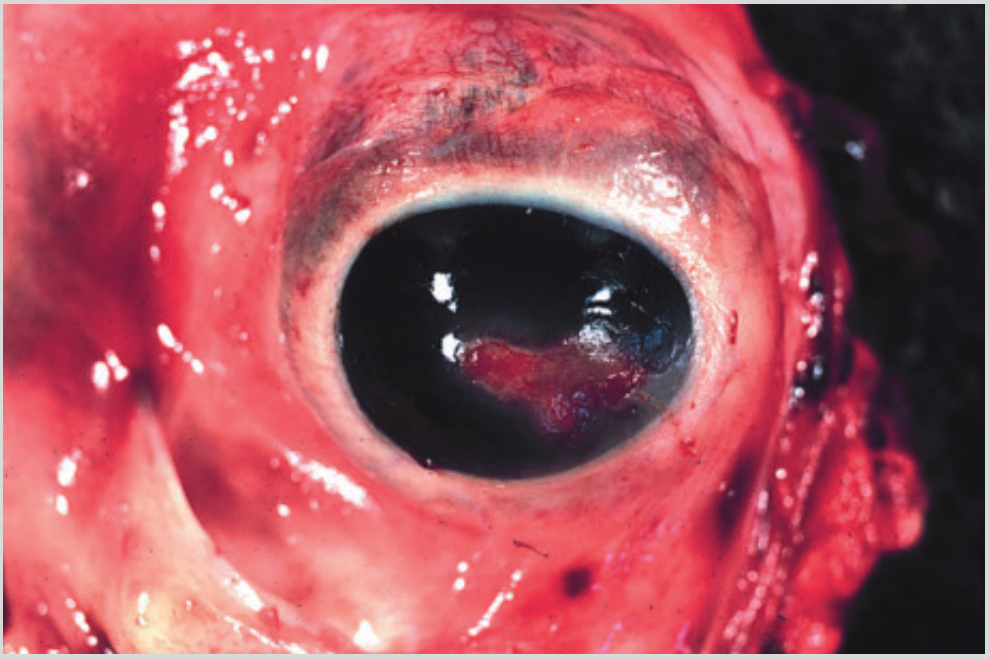
Animal species/Organ	Sheep/Eye
Lesion	Chronic, diffuse, non-ulcerative keratitis
Scoring	Partial condemnation
Comments	Note that inflammation of the inner parts of the eye may be present

18.07



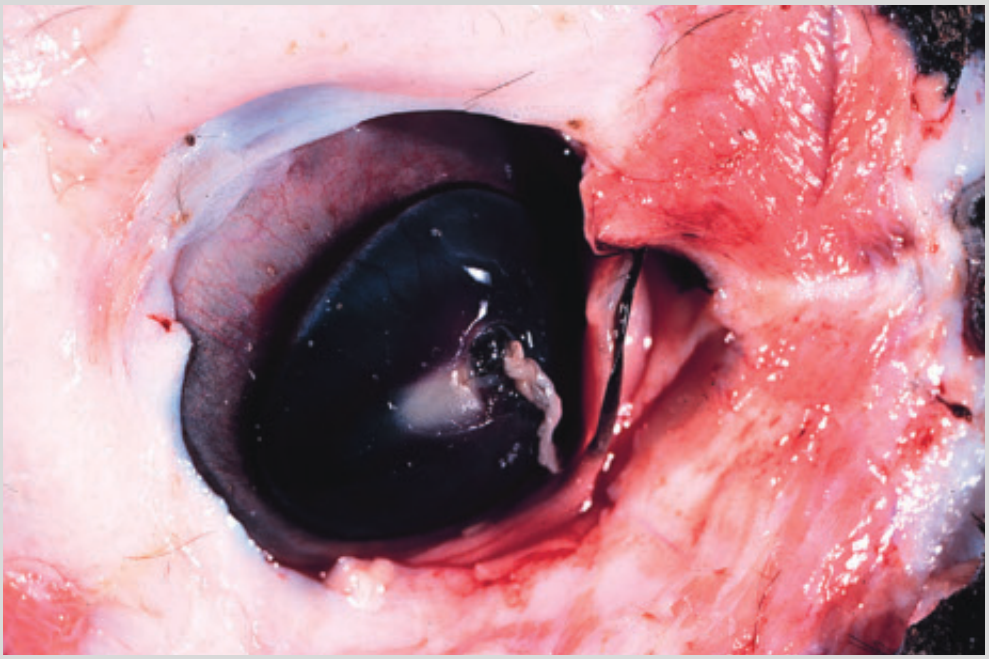
Animal species/Organ	Sheep/Eye (18.06 (divided))
Lesion	Chronic, diffuse, non-ulcerative, severe, stromal keratitis
Scoring	Partial condemnation
Comments	Note that the anterior uvea (➞) is apparently not involved

18.08



Animal species/Organ	Cattle/Eye
Lesion	Chronic, ulcerative keratitis
Scoring	Partial condemnation
Comments	The inner eye may be involved

18.09



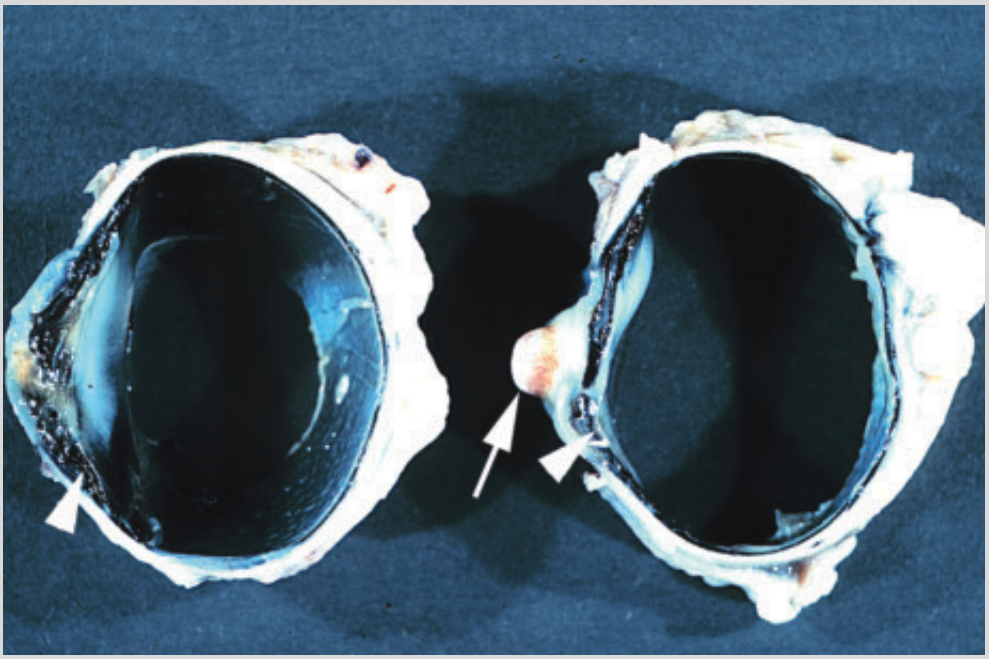
Animal species/Organ	Cattle/Eye
Lesion	Deep ulceration of the cornea (severe, ulcerative keratitis)
Scoring	Partial condemnation
Comments	Fibrin plaques have loosened and are hanging out of the ulceration, and a descemetocele (prolapse of Descemet's membrane) can be seen

18.10



Animal species/Organ	Sheep/Eye
Lesion	Chronic, purulent, ulcerative keratitis
Scoring	Partial condemnation
Comments	Note exudation around the eye. The inner eye may be involved

18.11



Animal species/Organ	Cattle/Eye cross sections
Lesion	Staphyloma (protuding ectatic scar tissue containing prolapsed uveal tissue) in the cornea after perforating lesion with prolapse of part of the eye (→)
Scoring	Partial condemnation
Comments	Note that the iris is now diffusely attached to the cornea (anterior synecchia) (←)

18.12



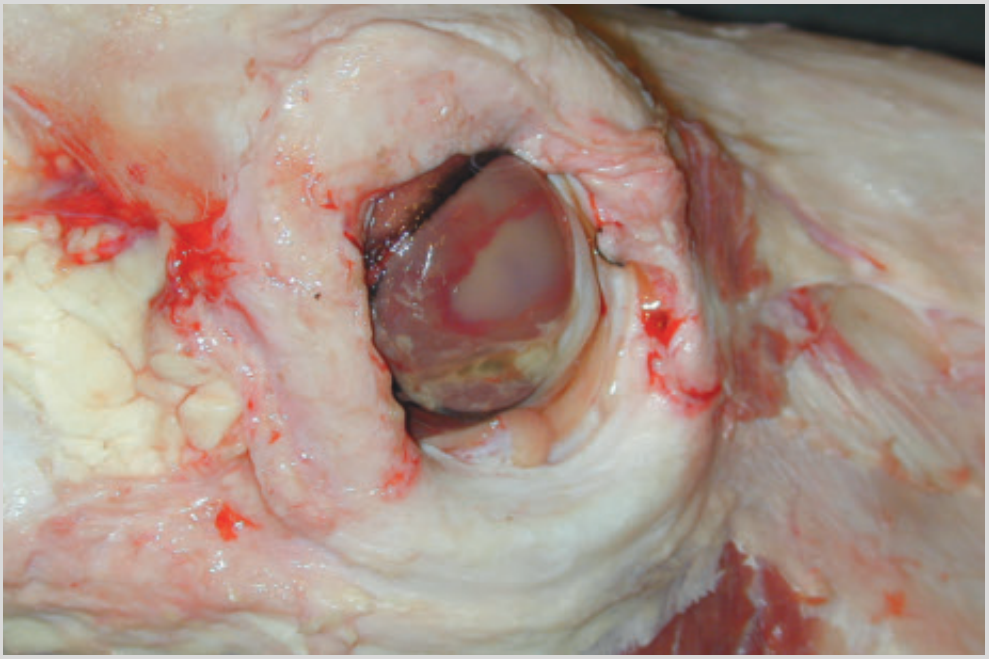
Animal species/Organ	Horse/Eye
Lesion	Hypopyon
Scoring	Partial condemnation if non-generalised infection
Comments	Bilateral hypopyon may be due to an underlying uveitis and/or endophthalmitis as a result of generalised infection with *Rhodococcus equi*, for example

18.13



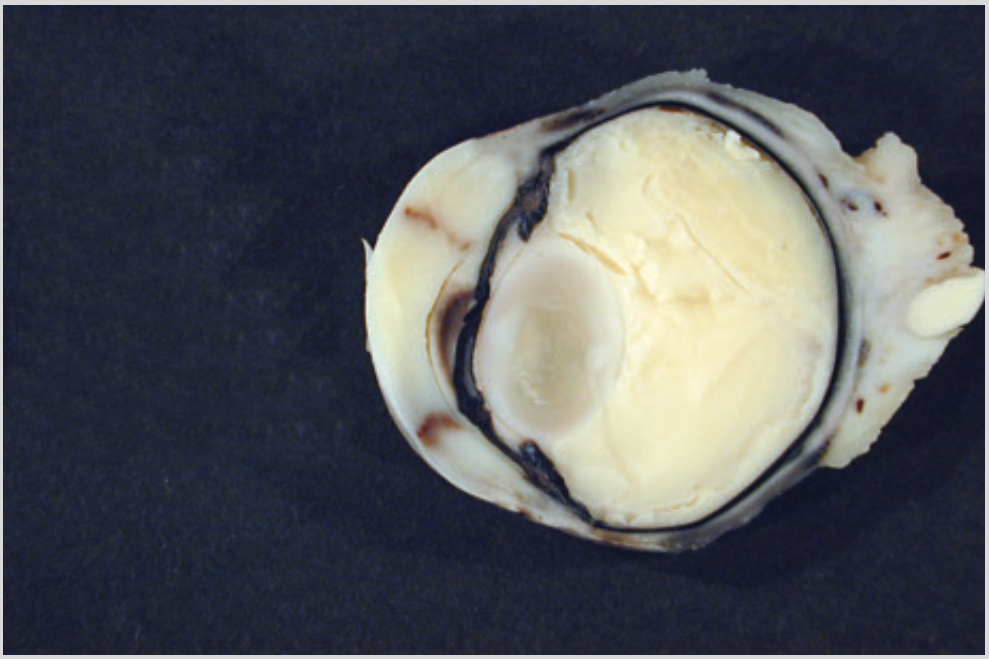
Animal species/Organ	Cattle/Eye
Lesion	Hypopyon
Scoring	Partial condemnation if non-generalised infection
Comments	In this case due to infection with *Escherichia coli*

18.14



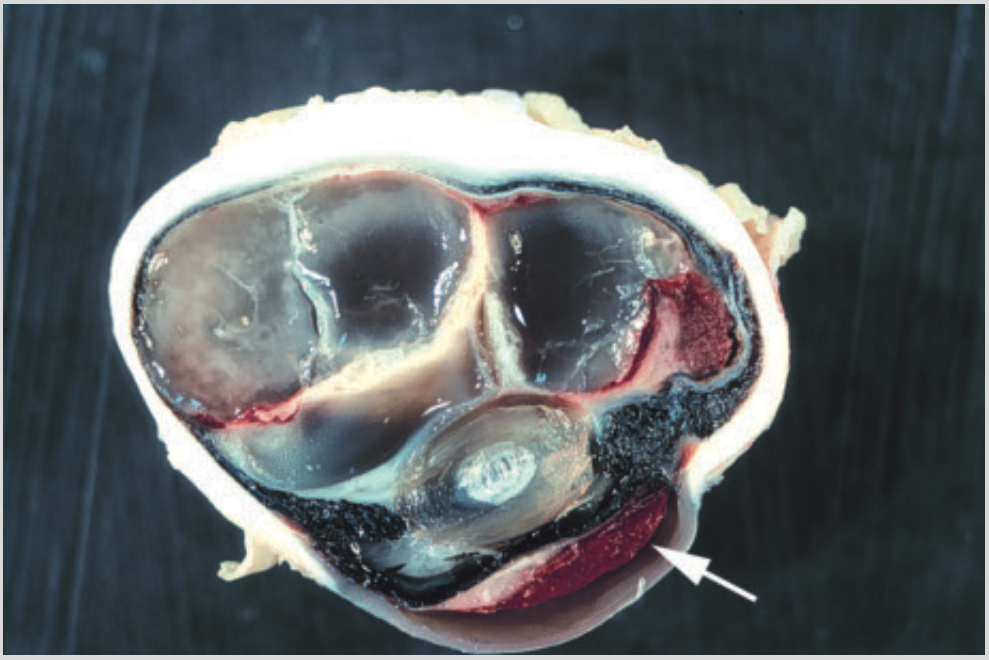
Animal species/Organ	Cattle/Eye, right
Lesion	Chronic, diffuse, severe keratitis
Scoring	Partial condemnation if non-generalised infection
Comments	There was concomitant severe, purulent endophthalmitis

18.15



Animal species/Organ	Cattle/Eye (18.14 (cross section))
Lesion	Chronic, purulent endophthalmitis
Scoring	Partial condemnation
Comments	Can be approved for deboning if associated with pyaemia

18.16



Animal species/Organ	Horse/Eye
Lesion	Hyphema (blood in the anterior chamber) (→)
Scoring	Partial condemnation
Comments	The condition is a result of an inflammatory condition (endophthalmitis) in the eye

18.17



Animal species/Organ	Sheep/Eye
Lesion	Unilateral (left) buphthalmos due to glaucoma
Scoring	Partial condemnation
Comments	Buphthalmos is seen rarely and mainly in young animals

18.18



Animal species/Organ	Horse/Eye
Lesion	Uveal melanoma
Scoring	Partial condemnation
Comments	Complications or signs of malignancy necessitate total condemnation

18.19



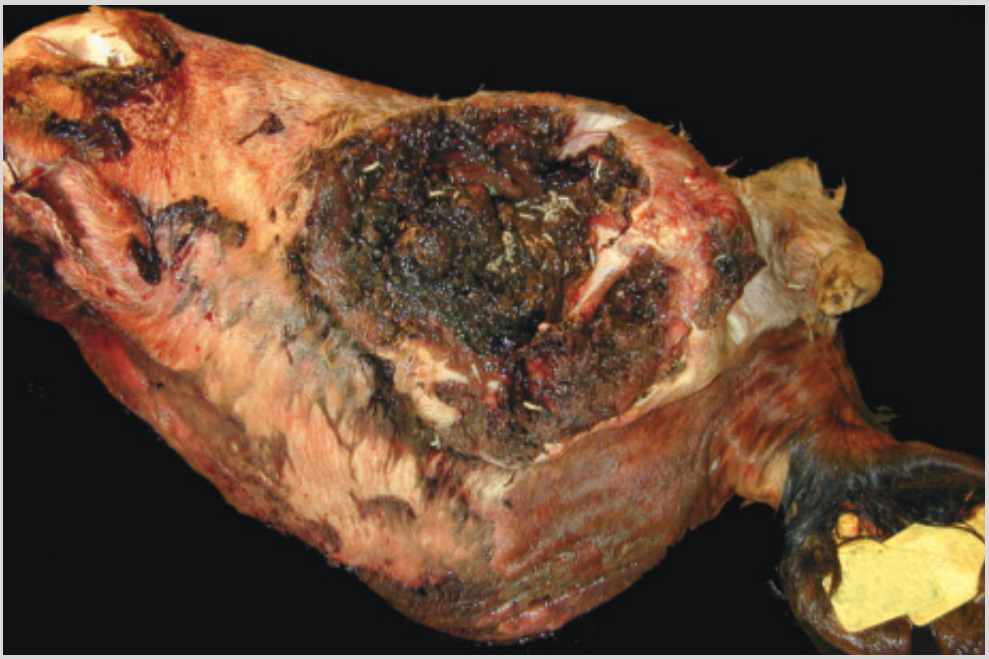
Animal species/Organ	Sheep/Eye
Lesion	Squamous cell carcinoma
Scoring	Total condemnation
Comments	Not a common lesion in sheep

18.20



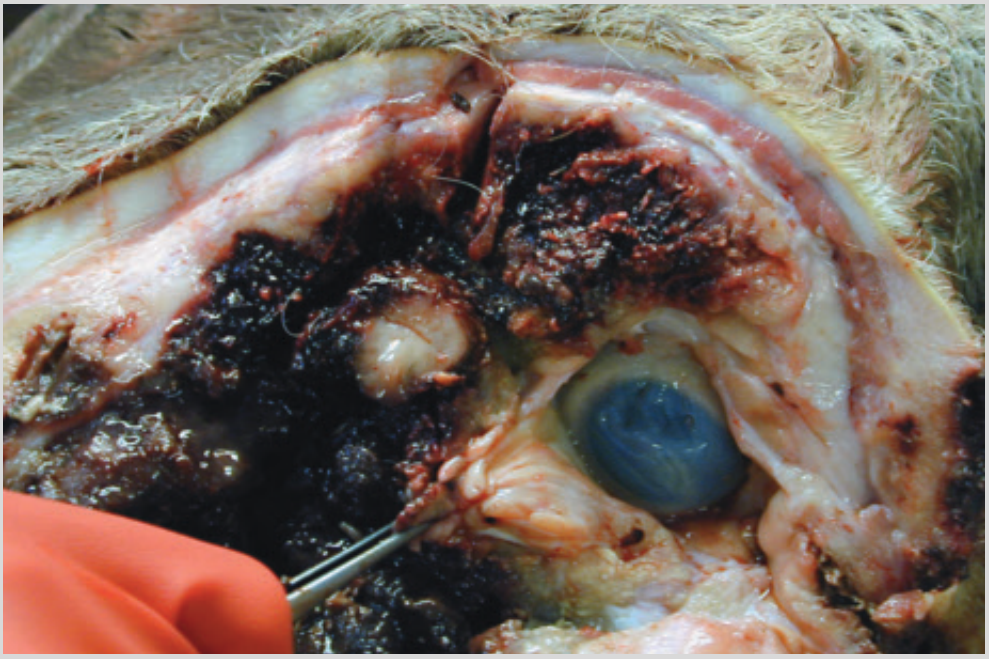
Animal species/Organ	Cattle/Eye
Lesion	Squamous cell carcinoma
Scoring	Total condemnation
Comments	The entire eye region is involved; there may be invasion of the underlying bone

18.21



Animal species/Organ	Cattle/Eye, left
Lesion	Squamous cell carcinoma
Scoring	Total condemnation
Comments	Infestation with fly larvae (maggots) is secondary

18.22



Animal species/Organ	Cattle/Eye (close-up of the lesion in 18.21)
Lesion	Squamous cell carcinoma
Scoring	Total condemnation
Comments	The eyeball is not involved, but there is invasive growth into the upper jaw and sinus system

18.23



Animal species/Organ	Pig/Ear
Lesion:	Chronic, bilateral, auricular, exudative ulcers
Scoring	Partial condemnation
Comments	The causes of these ear lesions are not known, but trauma by other pigs biting or sucking could exacerbate the lesion

18.24



Animal species/Organ	Pig/Ear
Lesion:	Chronic, auricular, exudative ulcer
Scoring	Partial condemnation
Comments	The lesion is often localised to the lower edge and dorsum at the base of the ear

18.25



Animal species/Organ	Pig/Ear
Lesion	Ulceration of the edge of the pinna and loss of the tip of the pinna
Scoring	Partial condemnation
Comments	May be due to trauma from biting and/or sucking on the ears

18.26



Animal species/Organ	Pig/Ear (18.25 (cross section))
Lesion	Chronic dermatitis on the edge of the pinna
Scoring	Partial condemnation
Comments	May be due to trauma from biting and/or sucking on the ears

18.27



Animal species/Organ	Pig/Ear (same ear as in 18.25)
Lesion	Status after sloughing of the tip of the pinna
Scoring	Partial condemnation
Comments	The lesion is well-healed

18.28



Animal species/Organ	Pig/Ear
Lesion	Chronic dermatitis on the edge of the pinna (due to ear sucking)
Scoring	Partial condemnation
Comments	Such lesions occur frequently

18.29



Animal species/Organ	Pig/Ear
Lesion	Necrosis of the tip of the pinna
Scoring	Partial condemnation
Comments	Note the bluish colour and the dry margin

18.30



Animal species/Organ	Pig/Ear (18.29 (cross section))
Lesion	Necrosis and dermatitis on the tip of the pinna
Scoring	Partial condemnation
Comments	Such lesions occur frequently

18.31



Animal species/Organ	Horse/Ear
Lesion	Auricular plaques
Scoring	Partial condemnation
Comments	Note that the lesions are located on the scapha

18.32



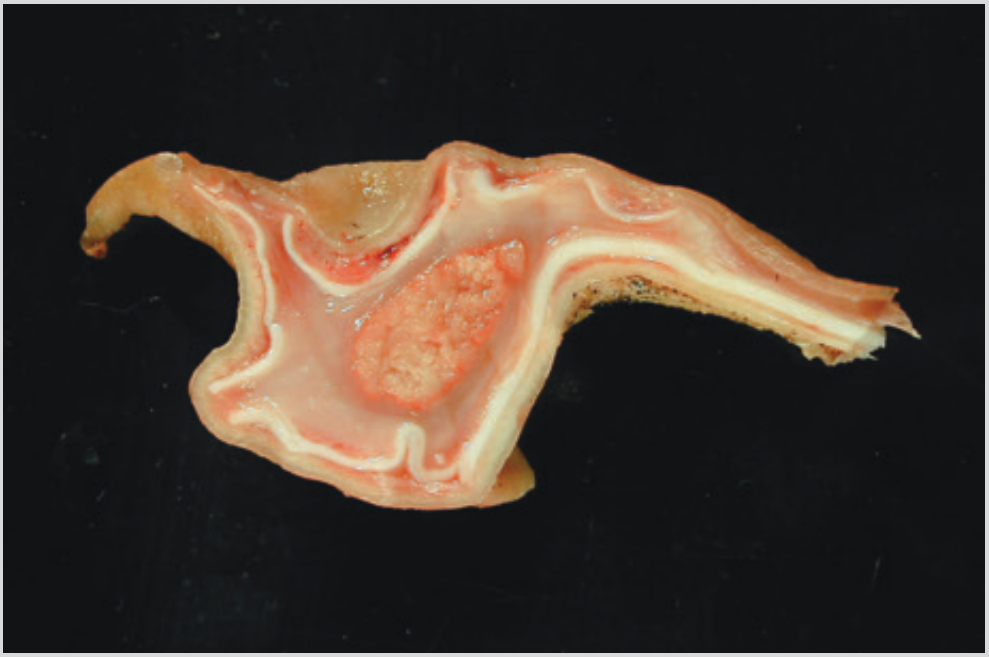
Animal species/Organ	Pig/Ear
Lesion	Othaematoma (auricular haematoma)
Scoring	Partial condemnation
Comments	Note that the ear is club-shaped due to distention with fluid

18.33



Animal species/Organ	Pig/Ear (cross section)
Lesion	Chronic othaematoma (auricular haematoma)
Scoring	Partial condemnation
Comments	Note the split in the cartilage and the serohaemorrhagic fluid in the cavity

18.34



Animal species/Organ	Pig/Ear (cross section)
Lesion	Chronic, deformed othaematoma (auricular haematoma) with central abscess formation
Scoring	Partial condemnation
Comments	Local infections in the ears can be portals of entry for pyaemia

18.35



Animal species/Organ	Pig/Ear (cross section)
Lesion	Chronic, deforming othaematoma (auricular haematoma)
Scoring	Partial condemnation
Comments	Note that the ear cartilage is split (→)

18.36



Animal species/Organ	Pig/Ear
Lesion	Auricular elephantiasis
Scoring	Partial condemnation
Comments	A result of infection with *Staphylococcus aureus* (“botryomycosis”)

18.37



Animal species/Organ	Pig/Ear
Lesion	Auricular elephantiasis
Scoring	Partial condemnation
Comments	The ear is grossly enlarged (otomegaly), but not curled up as in chronic othaematoma

18.38



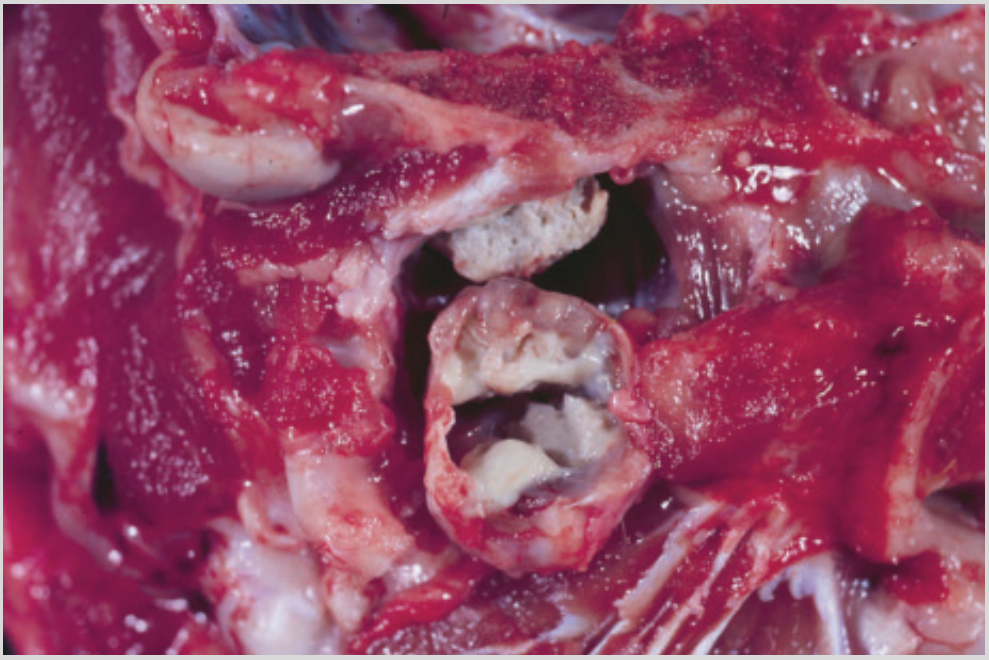
Animal species/Organ	Pig/Ear (cut surface)
Lesion	Auricular elephantiasis
Scoring	Partial condemnation
Comments	Note that the cartilage is not split, and that the fibrosis is thickest on the dorsum

18.39



Animal species/Organ	Pig/Ear (cross section)
Lesion	Auricular elephantiasis
Scoring	Partial condemnation
Comments	Note that the cartilage is not split, and note the shiny, slightly granulated surface

18.40



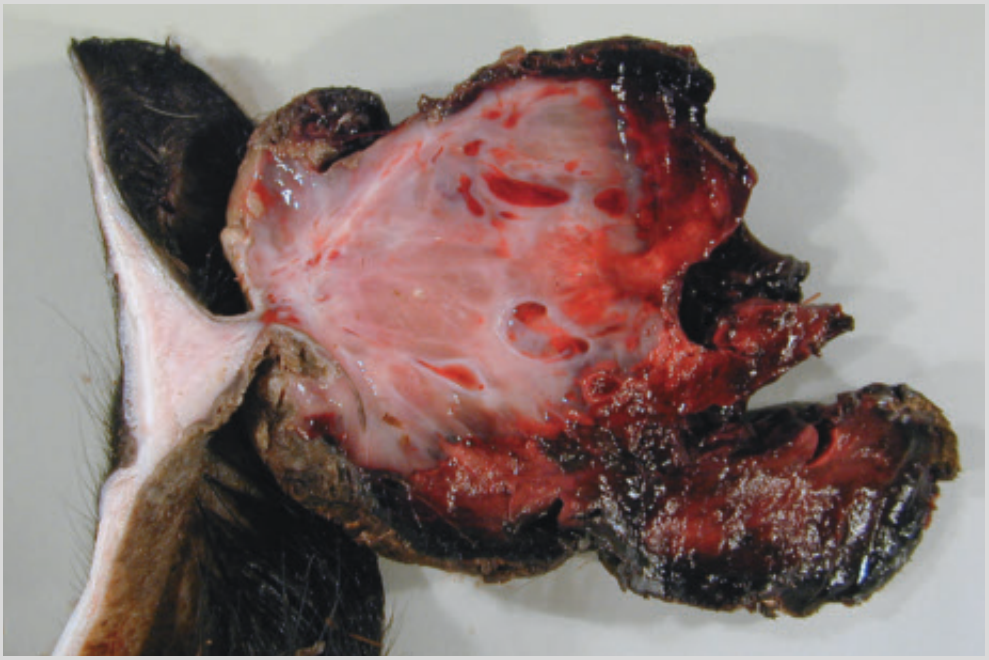
Animal species/Organ	Pig/Middle ear (opened)
Lesion	Chronic, purulent otitis media
Scoring	Partial condemnation
Comments	This is probably due to an ascending infection via the Eustachian tube

18.41



Animal species/Organ	Cattle/Ear
Lesion	Papilloma
Scoring	Partial condemnation
Comments	Occurs most frequently in younger animals

18.42



Animal species/Organ	Cattle/Ear (18.41 (cross section))
Lesion	Papilloma
Scoring	Partial condemnation
Comments	Note the pedunculated connection to the scapha and the fibrous core

19 Pyaemia

Introduction p. 661
Pyaemic conditions p. 661
Pyaemic lesions p. 662
Pyaemic investigation p. 662
Scoring rules p. 663

Introduction

Purulent lesions can occur in various ways. For example, they can start as a localised lesion on a surface exposed to the surroundings (e.g. the skin), and spread from here by direct invasion to another organ or tissue (e.g. from the skin to underlying muscle or bone). Or they can spread locally from lesions in the skin or deeper structures via the lymph system or by blood to other organs, respectively. The latter occurs typically by spread of bacteria via the portal venous system from forestomach lesions in cattle and tail bite lesions in pigs, where local spread foci appear in the liver and bone and soft tissue up to the sacrum (including the sacral joints), respectively. At meat inspection it is critical to distinguish between local spread of purulent lesion from the presence of pyaemia. The purulent lesions in pyaemia are considered to be the result of generalised haematogenous spread of pyogenic bacteria.

Pyaemic conditions [19.01 – 19.09]

The following three conditions must be met for a pyaemic condition to be present: 1) pus must be present (or necrosis in the acute stage), 2) spread must take place via the blood, 3) the lesions must occur due to generalisation, i.e. the result of spread via the minor circulation (pulmonary circulation) or the major circulation (via the aorta).

Pyaemic lesions occur following spread of a few bacteria, or as emboli. Initially there is focal necrosis, which is rapidly infiltrated by neutrophilic granulocytes. When cell infiltration is present together with necrotic tissue, it is detected macroscopically as pus. Because of the initial necrosis, the soft tissues (e.g. lung and lever tissue) will appear dull and in general reddish due to haemorrhage and peripheral hyperaemia. In lung tissue, the lesions will be firm in texture. With time, the necrotic/purulent foci, (depending on aetiology, animal health, and size of the lesions) will typically be enclosed by a connective tissue capsule. Under favourable conditions, the lesions can be replaced by scar tissue. Do note that the formation of an abscess is the organism's

damage-limiting process and that, with time, the abscess will disappear via granulation of tissue replacing the pus-filled cavity. It is also important to remember that nearly all abscesses contain pure cultures of pyogenic bacteria such as *Staphylococcus aureus*. After a certain time, only scar tissue will remain, and the condition can no longer be considered to be pyaemic because pus is no longer present.

Pyaemic lesions [19.10 – 19.54]

The localisation in an organ, as well as the presence of a primary lesion (portal of entry), are important in ascertaining macroscopically whether purulent foci have occurred as a result of generalised haematogenous spread. The latter applies for example when assessing spread in connection with tail lesions in pigs, where the concomitant presence of tail lesions and pus-containing lesions in the bones and surrounding tissue up to and including the ileosacral joint, is in all probability the result of local lympho-haematogenous spread (local spread), and is therefore not an expression of a pyaemic condition. Similarly, it is highly probable that the presence of hepatic abscesses, which is a relatively frequent occurrence in fatling calves, has occurred after local spread of pyogenic bacteria from lesions in the intestinal tract.

If abscesses are present in organs which do not have direct access to the surroundings, the presence of a single abscess should be interpreted to be indicative of pyaemia. This is the case for abscesses in the cardiac muscles in the absence of signs of localised trauma. Abscess localisation centrally in the brain, and in most cases in the bone marrow or spleen, should also be immediately interpreted as spread to the organ via the blood, and thus an indication of pyaemic spread. In these cases it is important to ensure that this is not due to spread through invasion or local spread as in lumpy jaw in cattle, for example. In organs accessible from the surroundings (e.g. lungs, kidney, and liver) the distribution of the lesions is essential for macroscopic clarification of whether the lesions are due to haematogenous spread or other type of spread (lungs: aerogenic; kidneys: ascending via the urinary tract, and liver: ascending via the bile ducts). In general, interpretation is based on whether the lesions are randomly distributed (disseminated) in the organ. Dissemination of lesions is indicative of haematogenous spread. If this is found to be the case then, as with findings of all other types of lesions in slaughter animals, an overall assessment must be made before a final decision is taken. A non-disseminated distribution of lesions can still be due to pyaemia if a obvious portal of entry for a pyaemic condition can be found. These considerations/assessments always depend on the individual case.

Pyaemic investigation

In accordance with regulations, the presence of lesions which can be considered to be part of a generalised haematogenous spread (pyaemia), necessitates careful examination of all organs, including deep palpation of the lungs, in order to determine whether disseminated embolic lesions are present. Bone growth lines are a predilection site for localisation of pyaemic lesions, and must be examined carefully. This applies

in particular to all bones of the spine, the pelvis (including the ileosacral joints), the osteochondral transition in the ribs, and the bones of the limbs when these appear thickened in growth zones, or where there are fistular eruptions from these localisations. In addition, attention must be paid to the presence of secondary dissecting abscesses necessitating excision of the tenderloin/ileopsoas muscles and, if necessary, inspection and palpation of the shoulder blade and inner thigh.

An incision must always be made into the thigh muscle of cows suspected of having pyaemia.

Scoring rules [19.55 – 19.67]

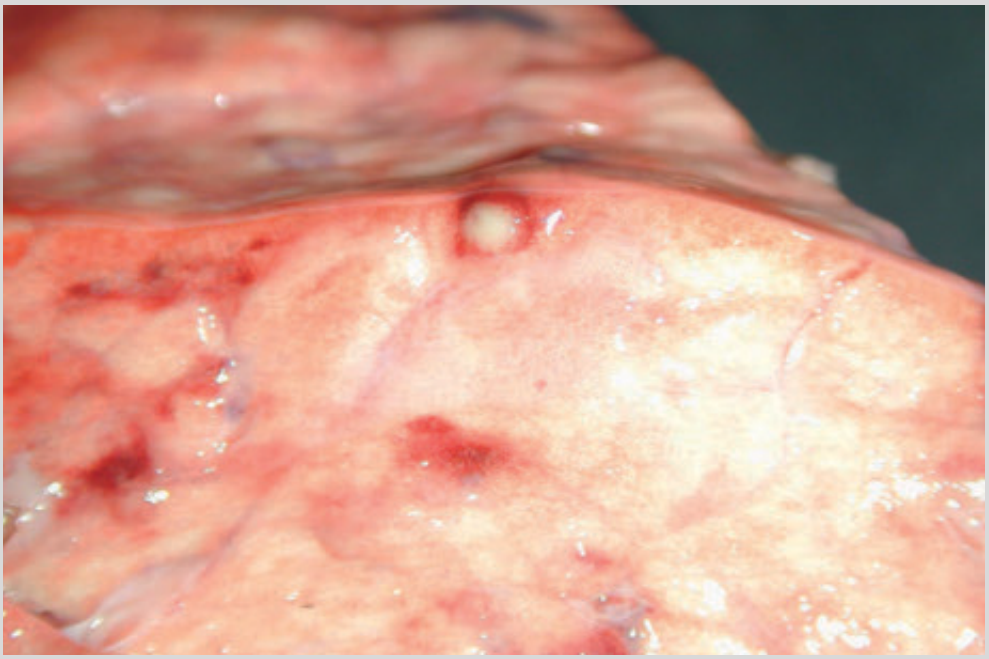
In pyaemia, meat inspection differentiates clearly between acute and chronic lesions, based initially on the presence of an enclosing connective tissue capsule. Furthermore, at meat inspection it is essential to determine whether an established connective tissue capsule totally encloses the lesions.

In the acute stage of pyaemia (non-encapsulated lesions) there is an increased risk for the presence of bacteria in the muscles, lymph nodes, and spleen, due to the generalised haematogenous spread. Therefore, acute forms of pyaemia and non-encapsulated lesions always necessitate total condemnation. In particular, chronic lesions located in or adjacent to cartilage may not be encapsulated. This is a particular problem at localisation of chronic pyaemic lesions in the osteochondral transition in the ribs. These lesions must therefore be sawn lengthwise before a final decision can be made.

Scoring of older pyaemic lesions presenting as encapsulated lesions is not based on the risk for an ongoing haematogenous spread (general infection), which of course had occurred a couple of weeks previously. On the contrary, the risk is related to the presence of chronic abscesses at sites which are not immediately detectable (primarily in the skeletal system). Because of increased pressure in the abscesses, fistulous tracts will often form with eruption to internal or external surfaces. Openings may form here, or new pus-filled cavities can be established in non-preformed cavities (abscesses). If such abscesses are located peripherally in relation to the primary abscess, they are popularly known as "secondary dissecting abscesses". Typical examples of "secondary dissecting abscesses" are abscesses localised in the tenderloin ("psoas abscesses") after fistulation from primary pyaemic osteomyelitis in the vertebral bones. Similar purulent foci, occurring after fistulation from pyaemic osteomyelitis, can also occur but more rarely in other parts of the skeletal muscles such as the muscles of the rear limbs. On the other hand, it is very rare that primary abscesses are found in the skeletal muscles and, in these cases the abscesses are found in previously damaged muscles (e.g. thigh muscle in cows after hypocalcaemic paresis ("downer syndrome"/downer/milk fever)).

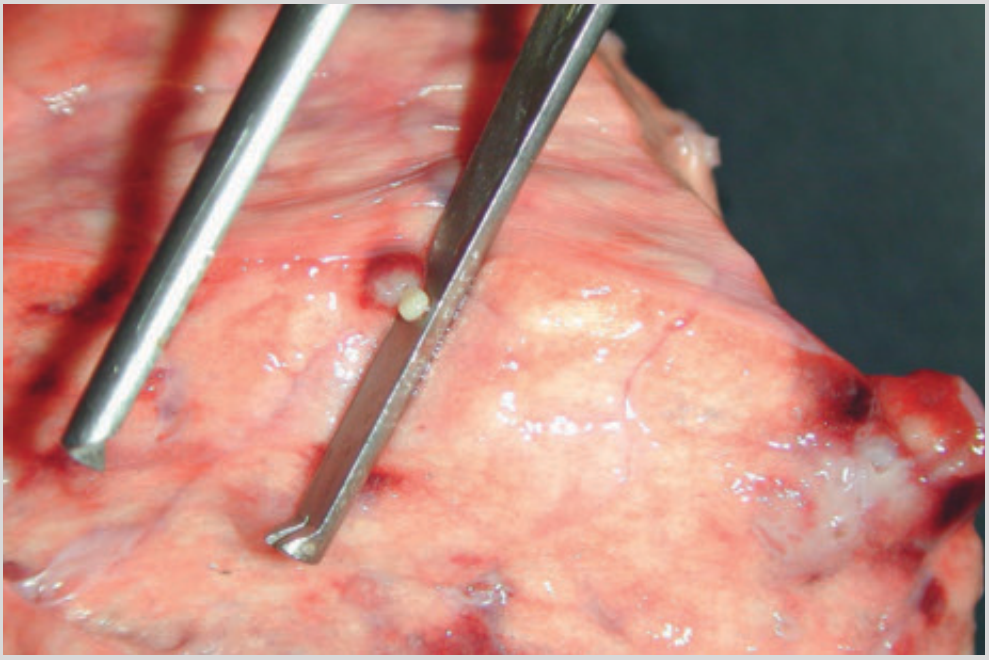
At meat inspection, animals with exclusively chronic, well-defined pyaemic lesions may be approved for deboning, at which all muscle to be approved is removed from the underlying bones. Approval for deboning is as with all scorings dependent on an overall assessment including whether deboning is hygienically realistic.

19.01



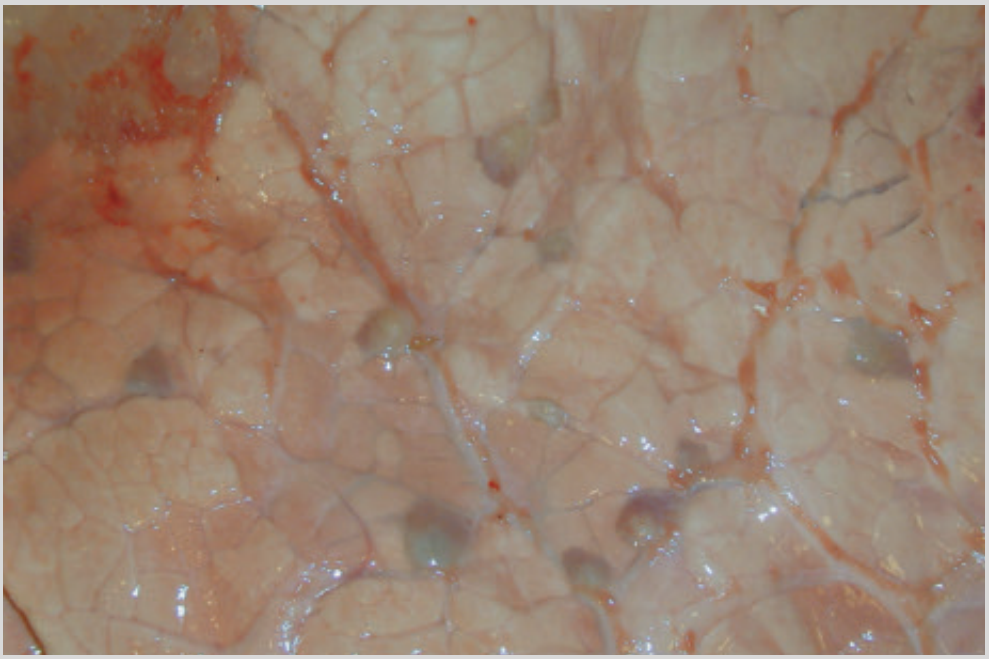
Animal species/Organ	Pig/Lung
Lesion	Chronic, focal, embolic pneumonia with abscess formation
Scoring	Approved for deboning
Comments	Acute lesions necessitate total condemnation

19.02



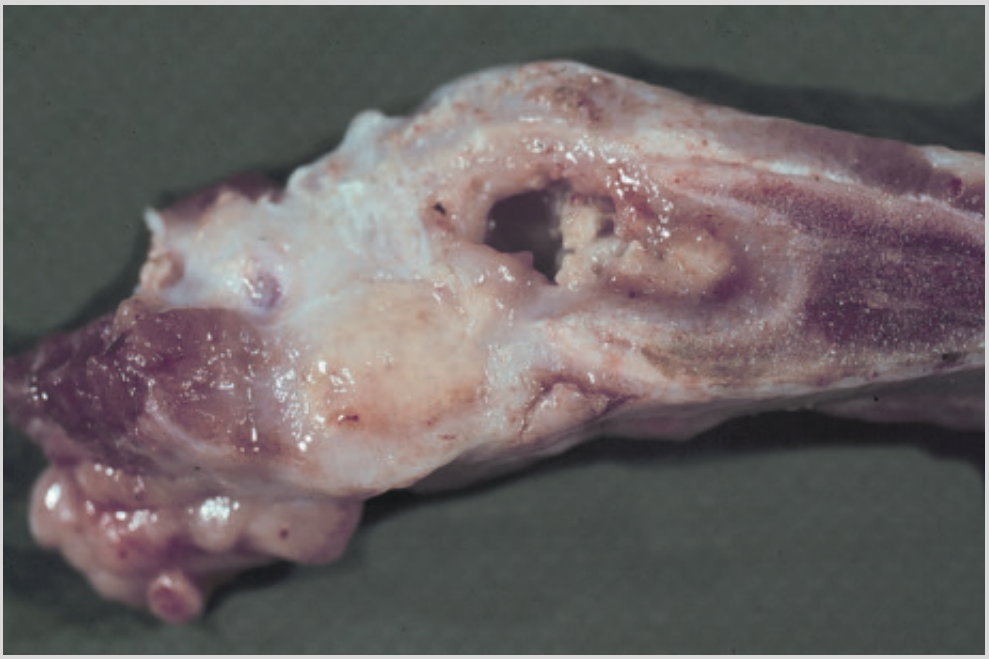
Animal species/Organ	Pig/Lung
Lesion	Chronic, focal, embolic pneumonia with abscess formation
Scoring	Approved for deboning
Comments	Acute lesions necessitate total condemnation

19.03



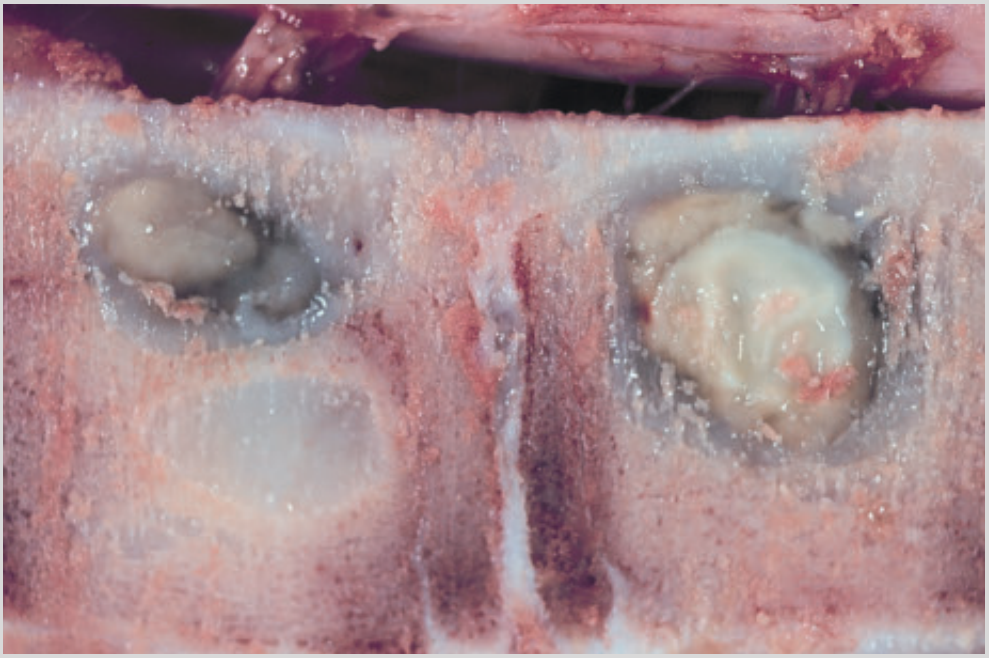
Animal species/Organ	Cattle/Lung
Lesion	Chronic, embolic, disseminated, focal pneumonia with abscess formation
Scoring	Approved for deboning
Comments	Disseminated distribution is compatible with embolic pathogenesis

19.04



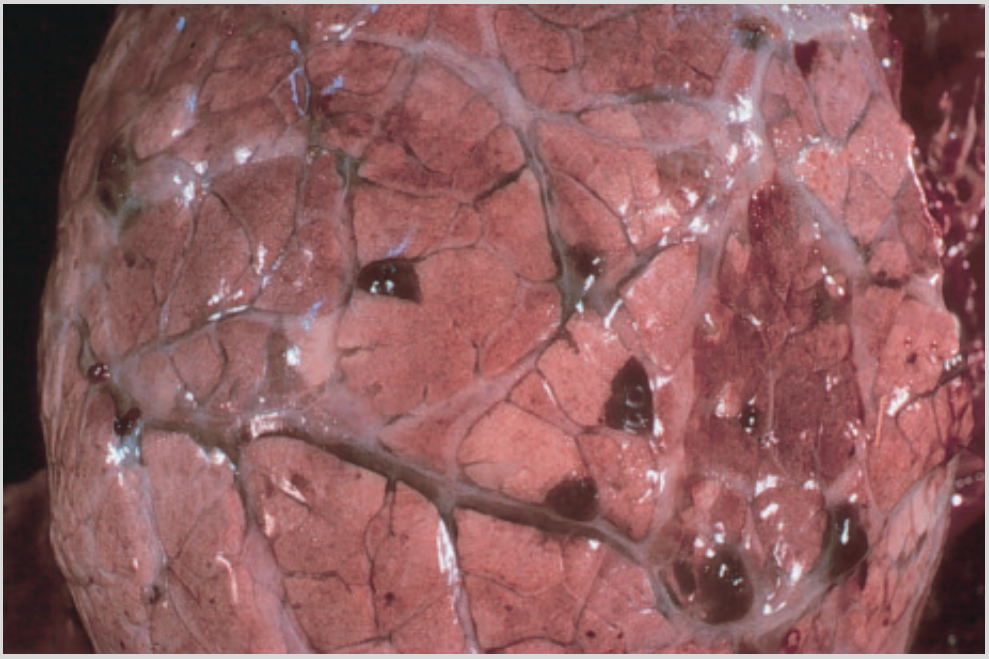
Animal species/Organ	Pig/Rib
Lesion	Chronic osteomyelitis with abscess formation
Scoring	Approved for deboning
Comments	Lesions that are not completely encapsulated with connective tissue necessitate total condemnation

19.05



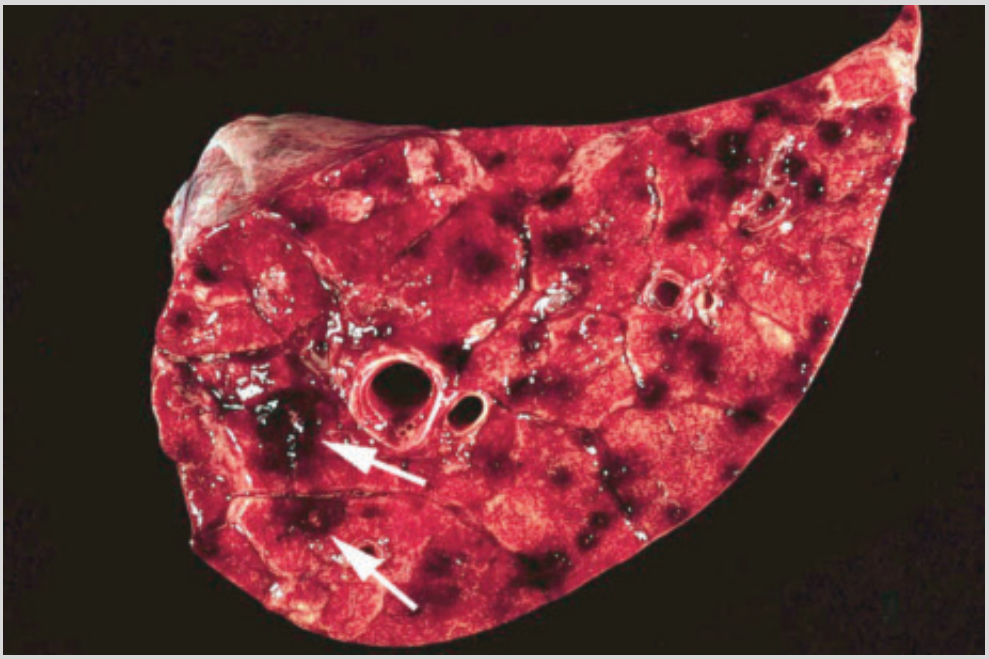
Animal species/Organ	Pig/Lumbar vertebrae
Lesion	Chronic osteomyelitis with abscess formation
Scoring	Approved for deboning
Comments	Lesions that are not completely encapsulated with connective tissue necessitate total condemnation

19.06



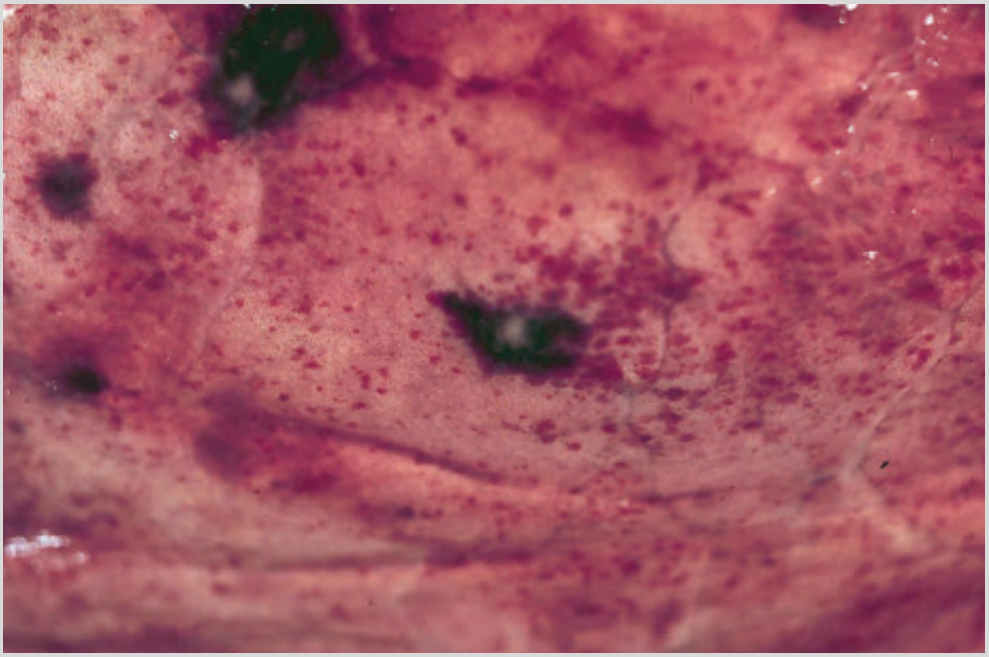
Animal species/Organ	Cattle/Lung
Lesion	Acute, embolic, disseminated, focal pneumonia with infarction
Scoring	Total condemnation
Comments	In the initial stages pus is absent from the lesions

19.07



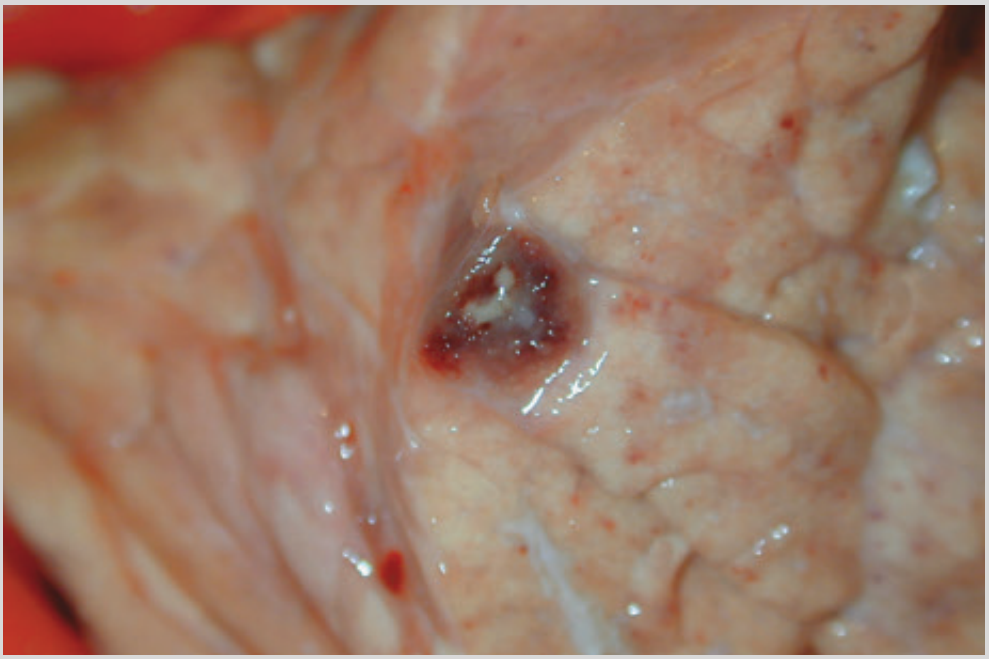
Animal species/Organ	Pig/Lung
Lesion	Chronic, verminous, cicatrix-forming pneumonia (parasitic scars with secondary, peripheral bleeding) (→)
Scoring	Partial condemnation
Comments	Can easily be confused with bacterial, disseminated, embolic pneumonia

19.08



Animal species/Organ	Pig/Lung
Lesion	Chronic, verminous, cicatrix-forming pneumonia (parasitic scars with secondary, peripheral bleeding)
Scoring	Partial condemnation
Comments	Can easily be confused with bacterial, disseminated, embolic pneumonia

19.09



Animal species/Organ	Pig/Lung
Lesion	Chronic, focal, embolic pneumonia with abscess formation
Scoring	Approved for deboning
Comments	Lesions that are not completely encapsulated with connective tissue necessitate total condemnation

19.10



Animal species/Organ	Pig/Oral cavity
Lesion	Periodontitis
Scoring	Partial condemnation
Comments	Periodontal lesions can be portals of entry in pyaemia

19.11



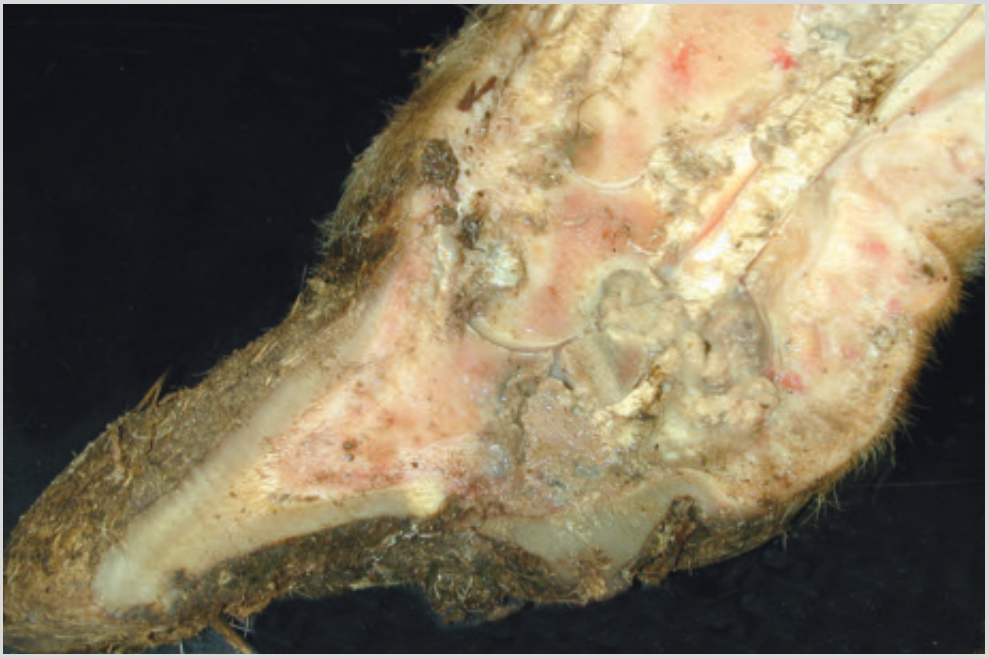
Animal species/Organ	Pig/Oral cavity (close-up of 19.10)
Lesion	Periodontitis
Scoring	Partial condemnation
Comments	Periodontal lesions can be portals of entry in pyaemia

19.12



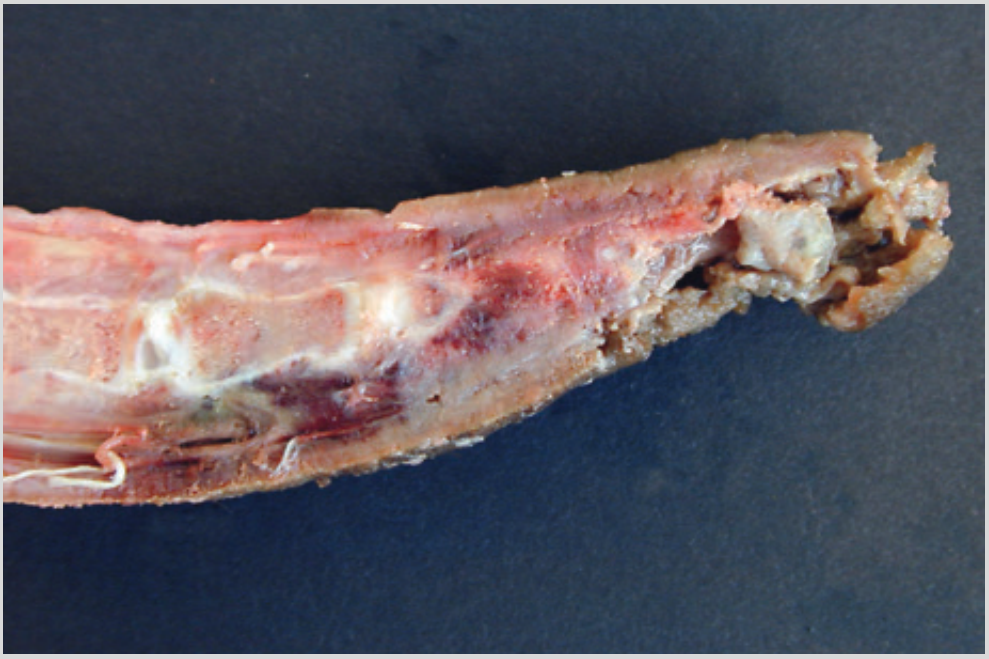
Animal species/Organ	Horse/Toe
Lesion	Complete ulceration of the entire distal part of the toe, and osteosis
Scoring	Partial condemnation
Comment	Toe lesions are often a portal of entry in pyaemia

19.13



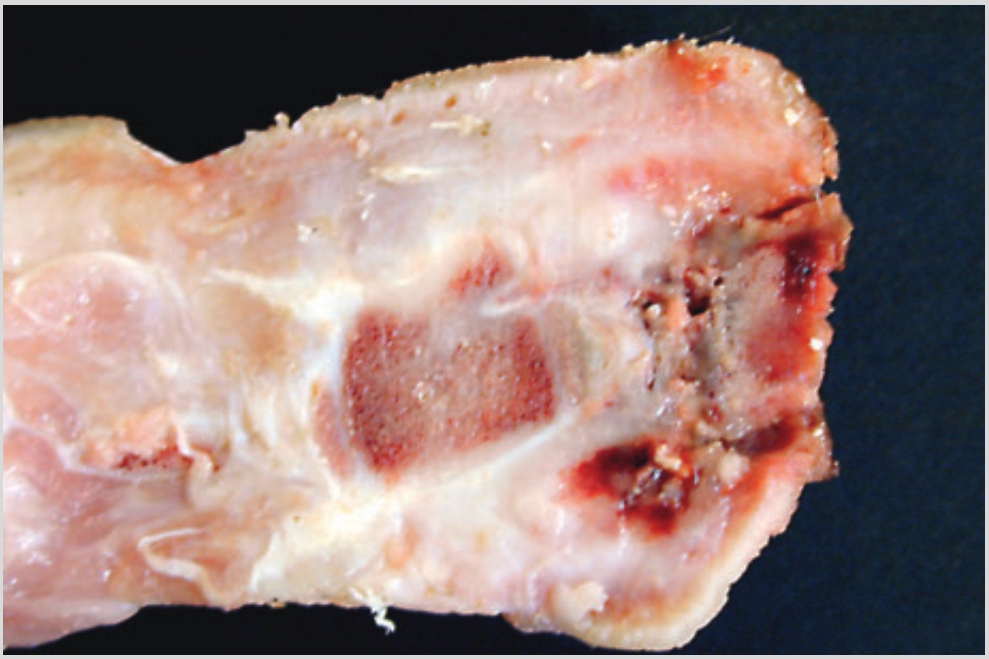
Animal species/Organ	Cattle/Toe
Lesion	Complete ulceration of the sole with chronic, purulent tendovaginitis, osteomyelitis, and arthritis
Scoring	Partial condemnation
Comments	Toe lesions can be a portal of entry in pyaemia

19.14



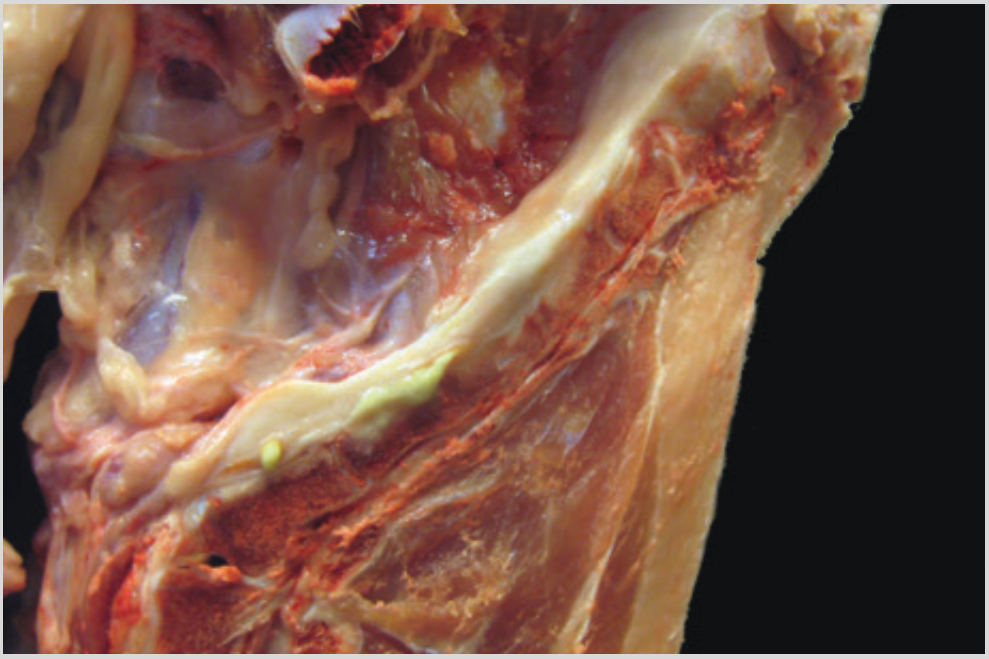
Animal species/Organ	Pig/Tail
Lesion	Gangrene and proximal cellulitis
Scoring	Partial condemnation
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

19.15



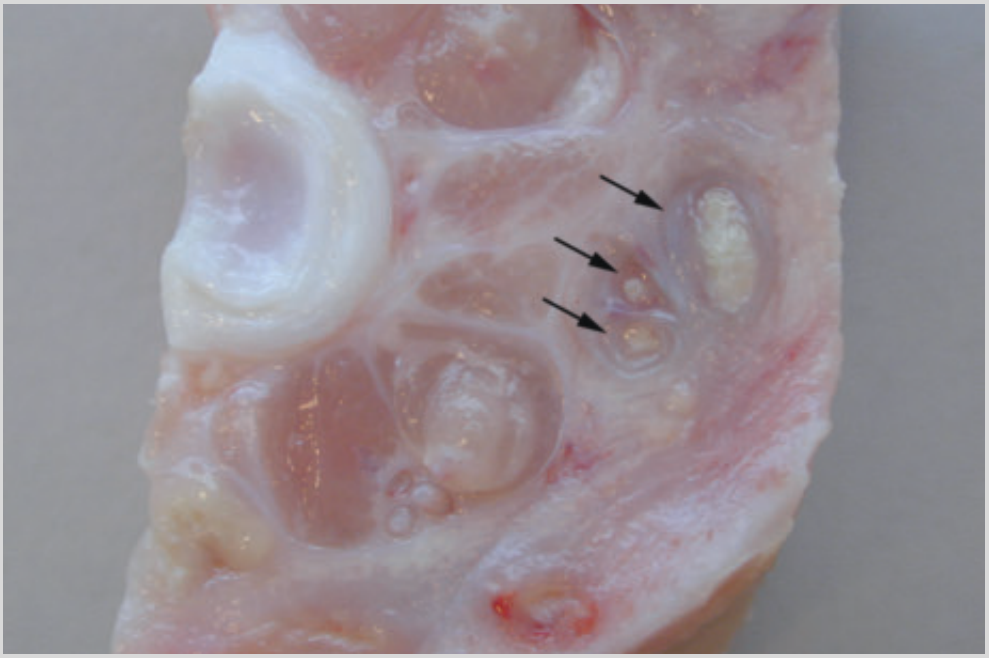
Animal species/Organ	Pig/Tail
Lesion	Chronic, sequestrating epiphysitis and discospondylitis
Scoring	Partial condemnation
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

19.16



Animal species/Organ	Pig/Pelvic region en bloc
Lesion	Chronic, purulent lymphangitis
Scoring	Rejection of the pelvic region en bloc if concomitant finding of tail lesion
Comments	Bacteria from tail lesions are typically spread via the lymphatic system

19.17



Animal species/Organ	Pig/Tail (cross-section)
Lesion	Chronic, purulent rhabdomyositis (longitudinal fistulous tract limited by fascia (→))
Scoring	Partial condemnation
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

19.18



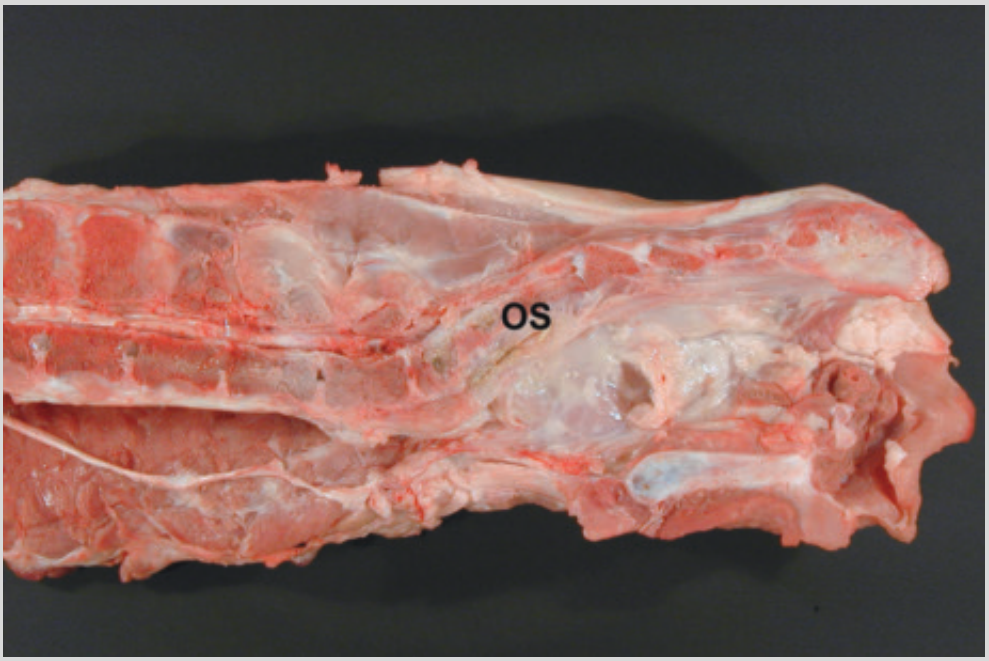
Animal species/Organ	Pig/Tail
Lesion	Fistulating from underlying rupture from underlying chronic, purulent discospondylitis
Scoring	Partial condemnation
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

19.19



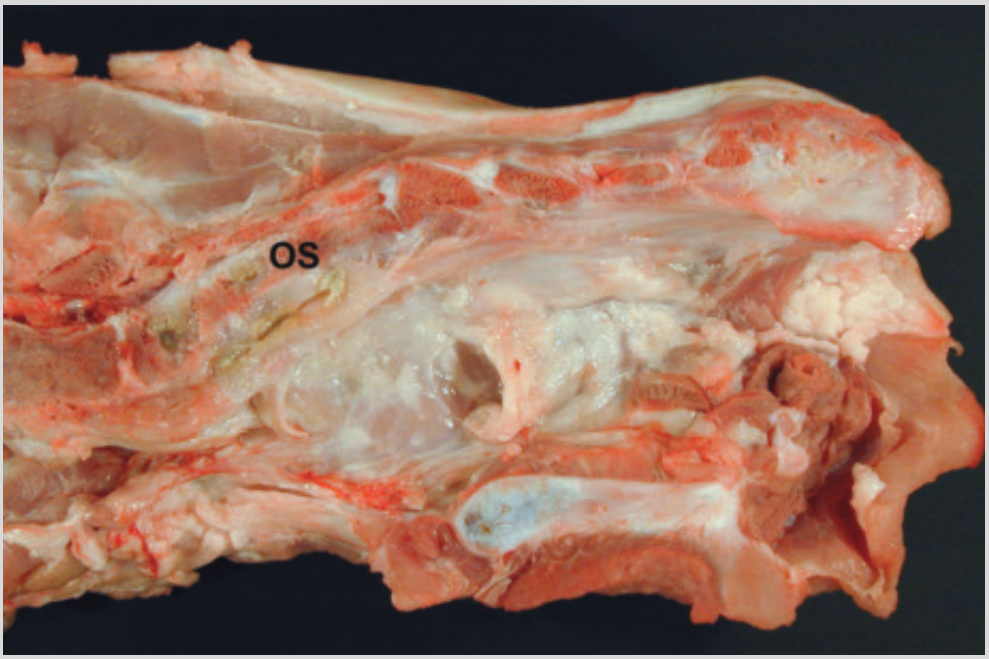
Animal species/Organ	Pig/Tail
Lesion	Chronic, purulent and sequestrating discospondylitis
Scoring	Partial condemnation
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

19.20



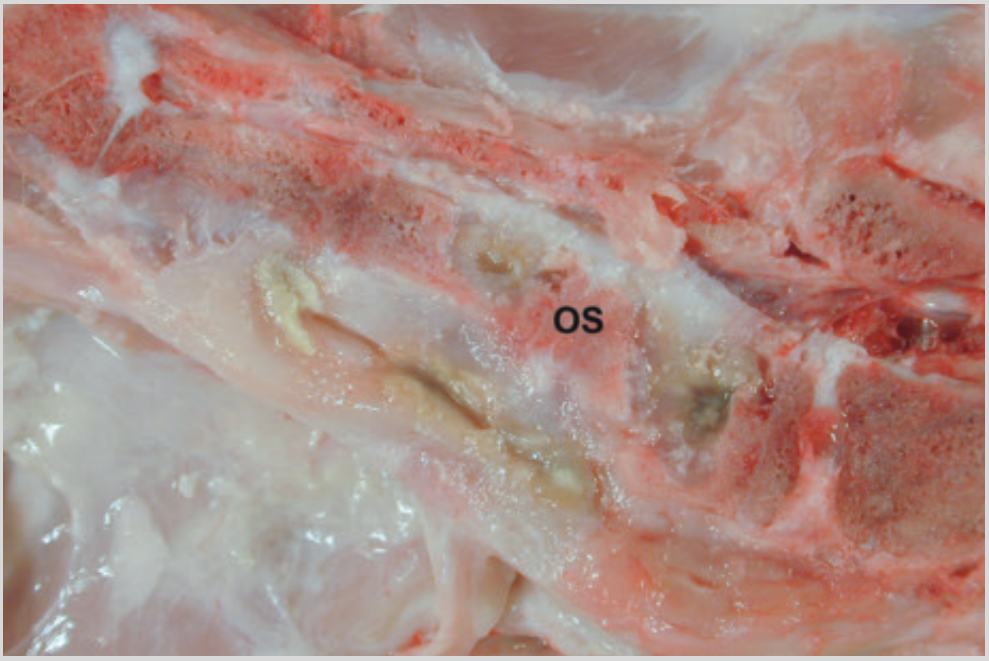
Animal species/Organ	Pig/Pelvic region en bloc
Lesion	Chronic, purulent osteomyelitis localised to the os sacrum (OS) with secondary dissecting abscess
Scoring	Rejection of the the pelvic region en bloc if concomitant finding of tail lesions
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

19.21



Animal species/Organ	Pig/Pelvic region en bloc (close-up of 19.20)
Lesion	Chronic, purulent osteomyelitis localised to the os sacrum (OS) with secondary dissecting abscess
Scoring	Rejection of the pelvic region en bloc if concomitant finding of tail lesions
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

19.22



Animal species/Organ	Pig/Pelvic region en bloc (close-up of 19.21)
Lesion	Chronic, purulent osteomyelitis localised to the os sacrum (OS) with secondary dissecting abscess
Scoring	Rejection of the pelvic region en bloc if concomitant finding of tail lesions
Comments	Tail lesions are always associated with a risk for local and/or systemic spread

19.23



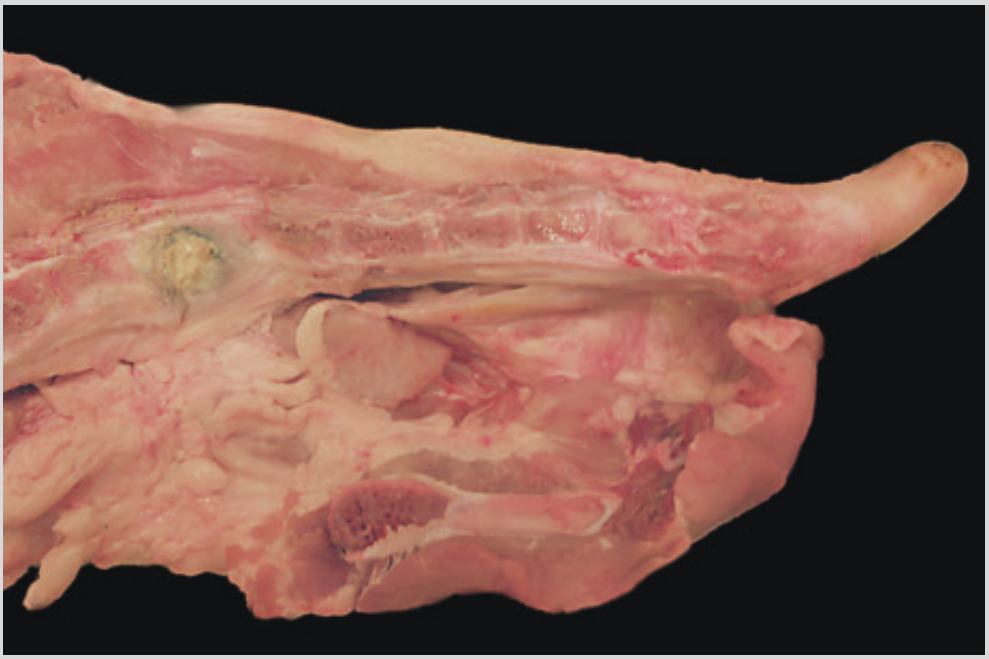
Animal species/Organ	Pig/Pelvic region en bloc
Lesion	Chronic abscess formation (→)
Scoring	Approved for deboning if it is a secondary dissecting abscess from the lumbar vertebrae
Comments	Scoring is rejection of the regional lymph node if the abscess originates from the lymph node

19.24



Animal species/Organ	Pig/Pelvic region en bloc
Lesion	Chronic abscess formation (→)
Scoring	Approved for deboning if it is a secondary dissecting abscess from the lumbar vertebrae
Comments	Scoring is rejection of the regional lymph node if the abscess originates from the lymph node

19.25



Animal species/Organ	Pig/Pelvic region en bloc
Lesion	Chronic, purulent osteomyelitis caudally for the os sacrum
Scoring	Rejection of the pelvic region en bloc
Comments	Approved for deboning in the absence of tail lesions

19.26



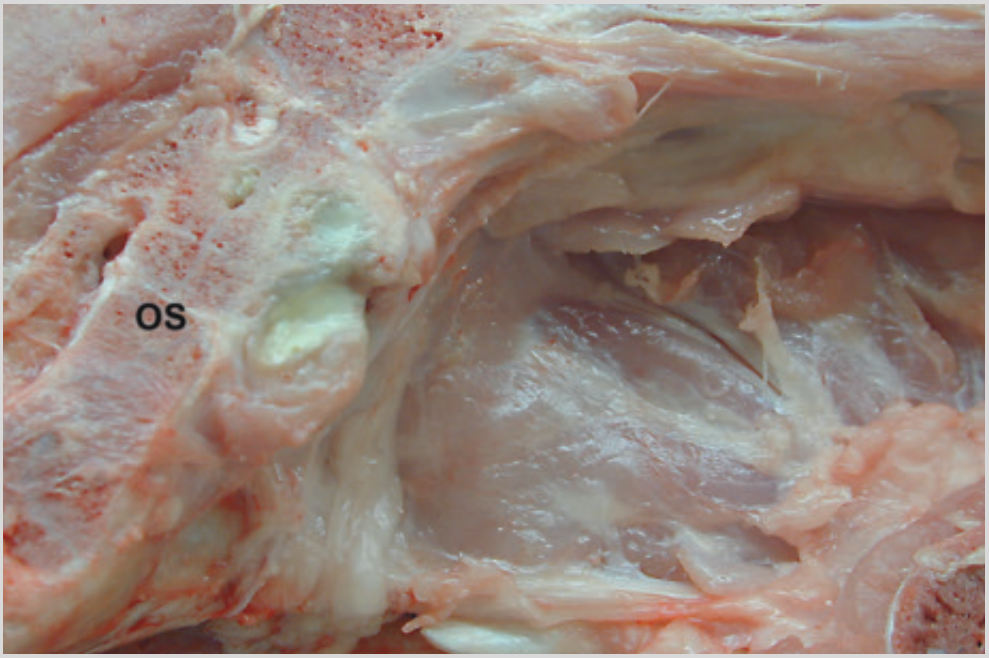
Animal species/Organ	Pig/Pelvic region en bloc
Lesion	Chronic, purulent osteomyelitis caudally for the os sacrum
Scoring	Rejection of the pelvic region en bloc
Comments	Approved for deboning in the absence of tail lesions

19.27



Animal species/Organ	Pig/Pelvic region en bloc with os sacrum (OS)
Lesion	Chronic, purulent discospondylitis and osteomyelitis (→)
Scoring	Approved for deboning
Comments	A non-encapsulated lesion necessitates total condemnation

19.28



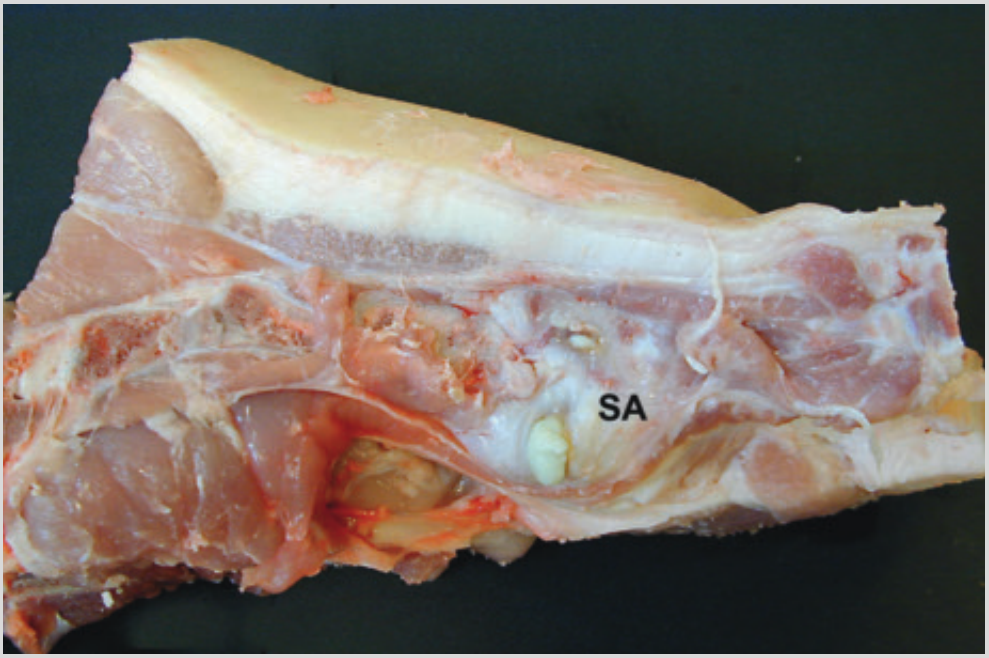
Animal species/Organ	Pig/Pelvic region en bloc with os sacrum (OS)
Lesion	Chronic, purulent osteomyelitis with formation of a secondary dissecting abscess
Scoring	Rejection of the pelvic region en bloc
Comments	Approved for deboning in the absence of tail lesions

19.29



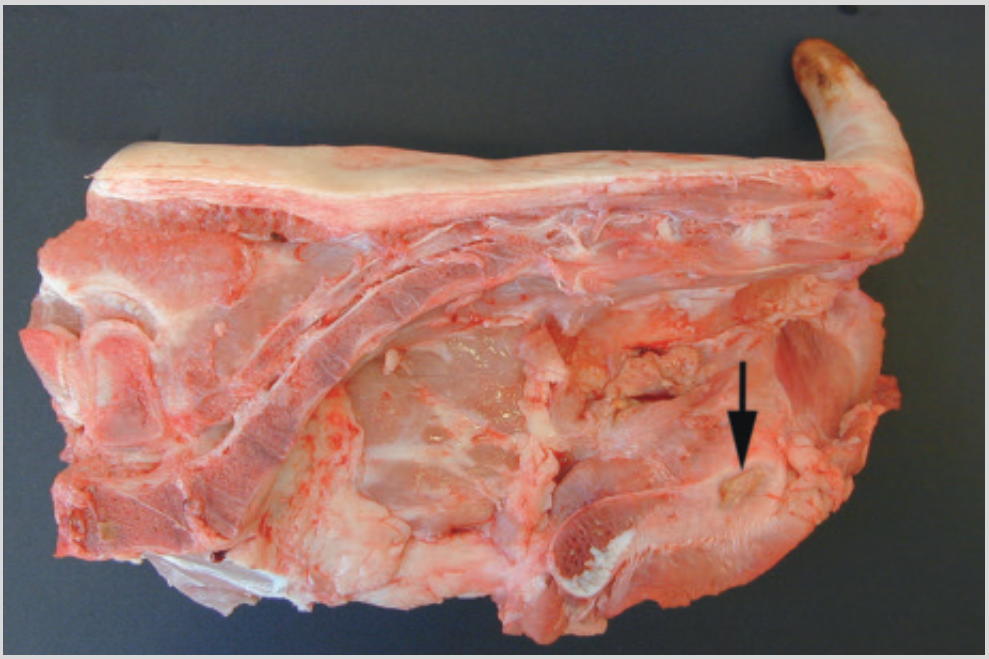
Animal species/Organ	Pig/Pelvic region en bloc (close up of 19.28)
Lesion	Chronic, purulent osteomyelitis with formation of a secondary dissecting abscess
Scoring	Partial condemnation
Comments	Approved for deboning in the absence of tail lesions

19.30



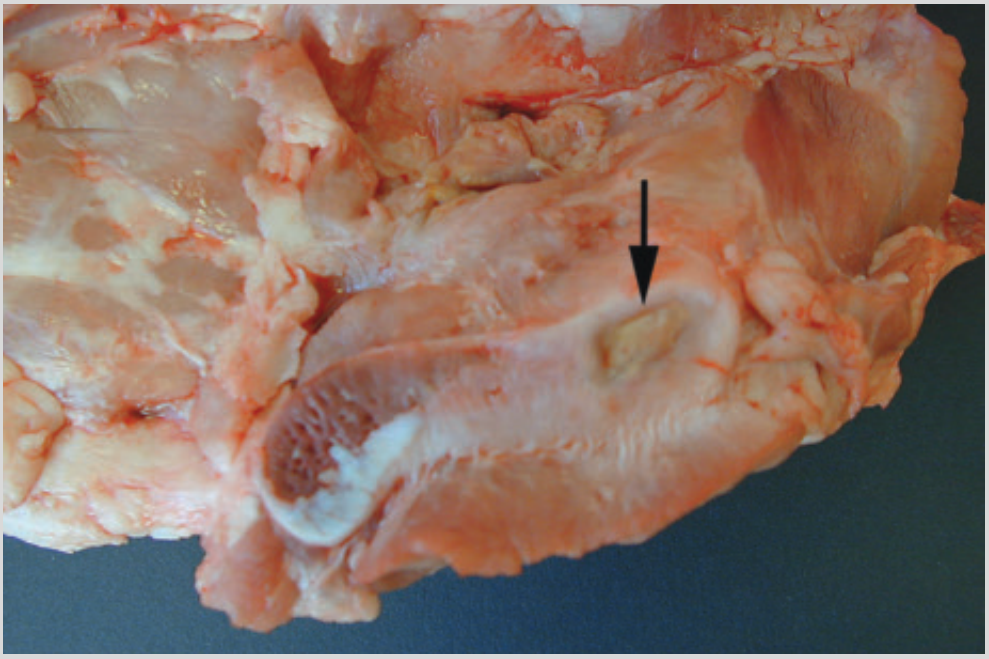
Animal species/Organ	Pig/Lateral part of the pelvic region en bloc
Lesion	Secondary dissecting abscess (SA) localised to the muscle lateral for the pelvis
Scoring	Partial condemnation if originating in the os sacrum or bones caudal to this
Comments	Approved for deboning in the absence of tail lesions or if originating from the lumbar vertebrae

19.31



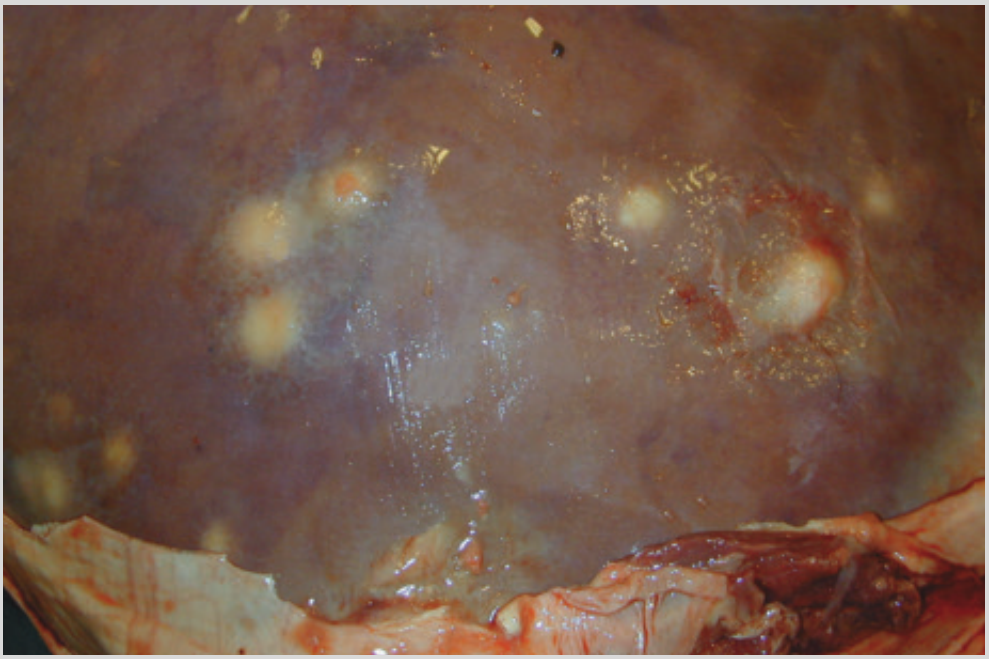
Animal species/Organ	Pig/Pelvic region en bloc
Lesion	Chronic, purulent osteomyelitis localised to the os ischii (→)
Scoring	Partial condemnation if concomitant or suspicion of previous tail lesions
Comments	Approved for deboning in the absence of tail lesions

19.32



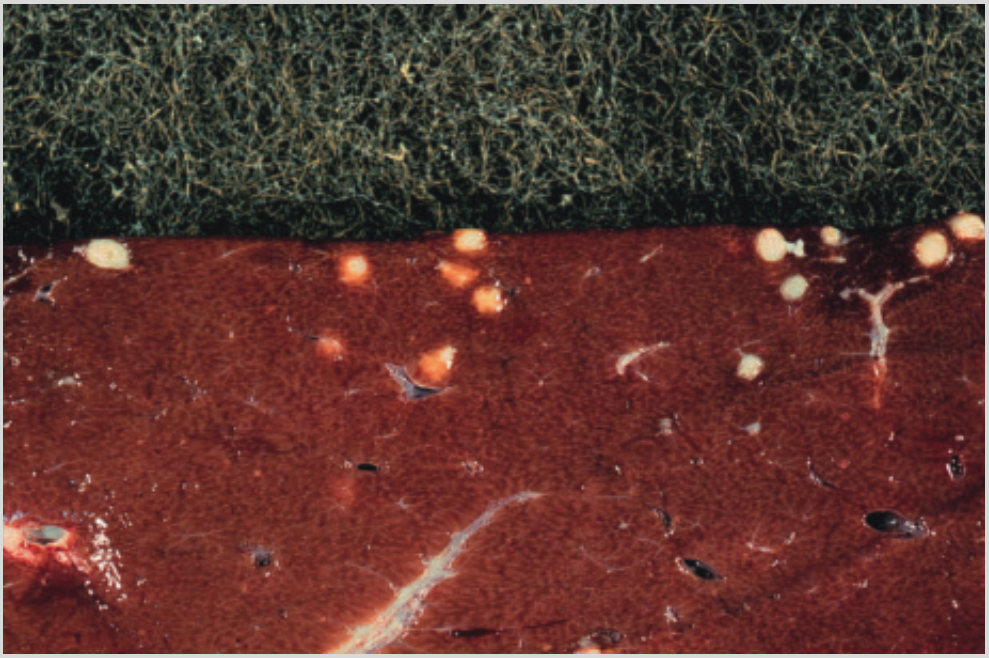
Animal species/Organ	Pig/Pelvic region en bloc (close-up of 19.31)
Lesion	Chronic, purulent osteomyelitis localised to the os ischii (→)
Scoring	Partial condemnation if concomitant tail lesions or suspicion of previous tail lesions
Comments	Approved for deboning in the absence of tail lesions

19.33



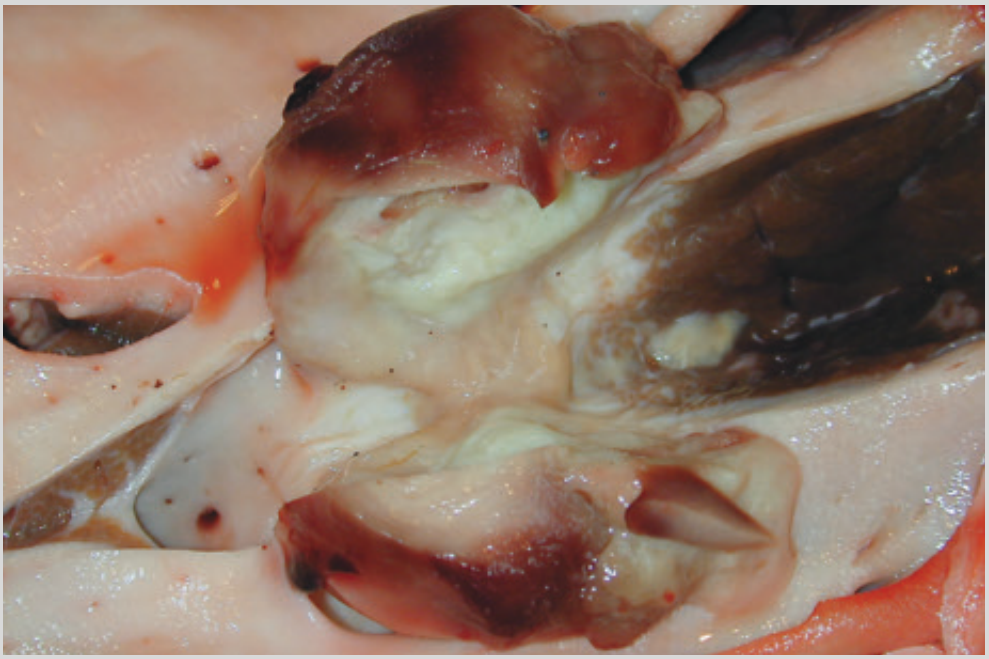
Animal species/Organ	Cattle/Liver
Lesion	Chronic, multifocal hepatitis with abscess formation, and overlying chronic, fibrous perihepatitis
Scoring	Partial condemnation
Comments	Spread to the liver has most probably occurred via the venous portal system

19.34



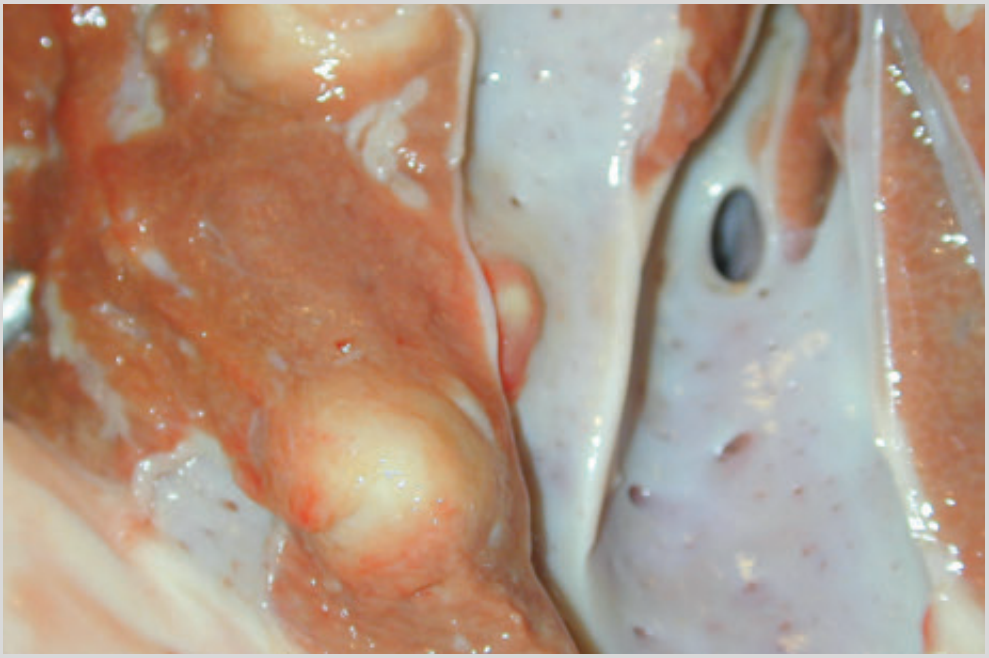
Animal species/Organ	Cattle/Liver
Lesion	Chronic, multifocal hepatitis with abscess formation
Scoring	Partial condemnation
Comments	Spread to the liver has most probably occurred via the venous portal system

19.35



Animal species/Organ	Cattle/Caudal vena cava (opened)
Lesion	Chronic, purulent and thrombotic endophlebitis
Scoring	Total condemnation
Comments	The caudal vena cava must be opened in animals older than 6 weeks

19.36



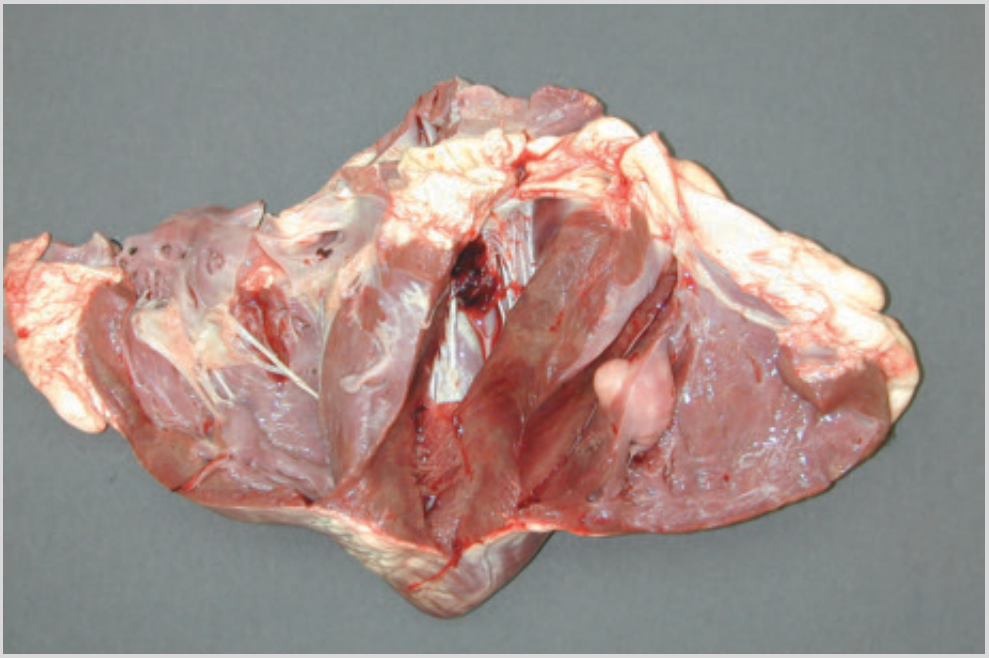
Animal species/Organ	Cattle/Liver
Lesion	Chronic, multifocal hepatitis with abscess formation and thrombotic endophlebitis
Scoring	Total condemnation
Comments	Scoring is partial condemnation in the absence of endophlebitis

19.37



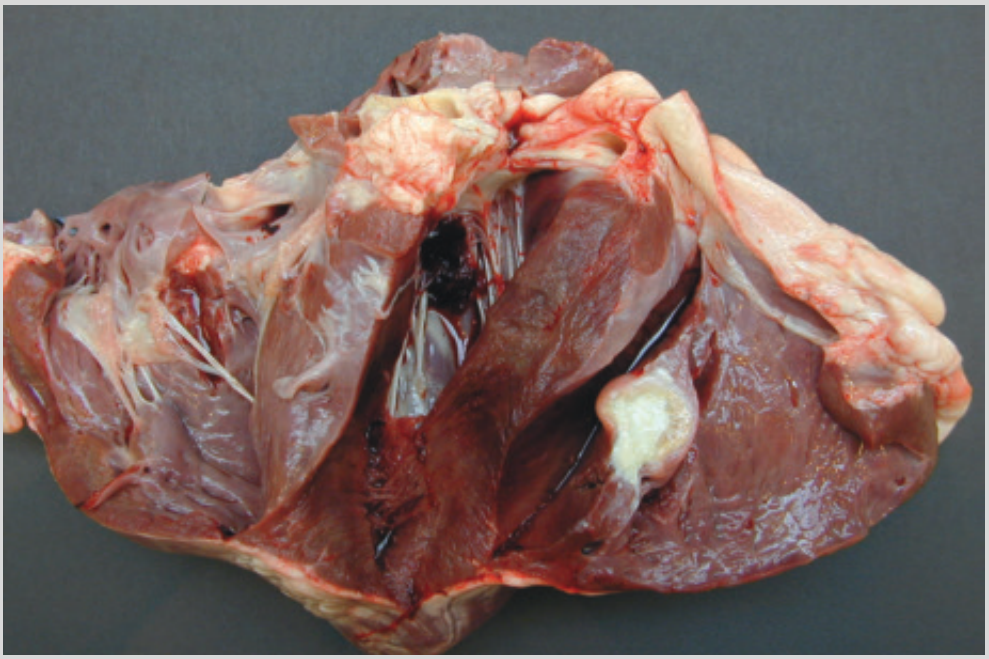
Animal species/Organ	Cattle/Liver
Lesion	Chronic, multifocal hepatitis with abscess formation, and local thrombotic endophlebitis
Scoring	Total condemnation
Comments	Scoring is local condemnation in the absence of rupture to the vein

19.38



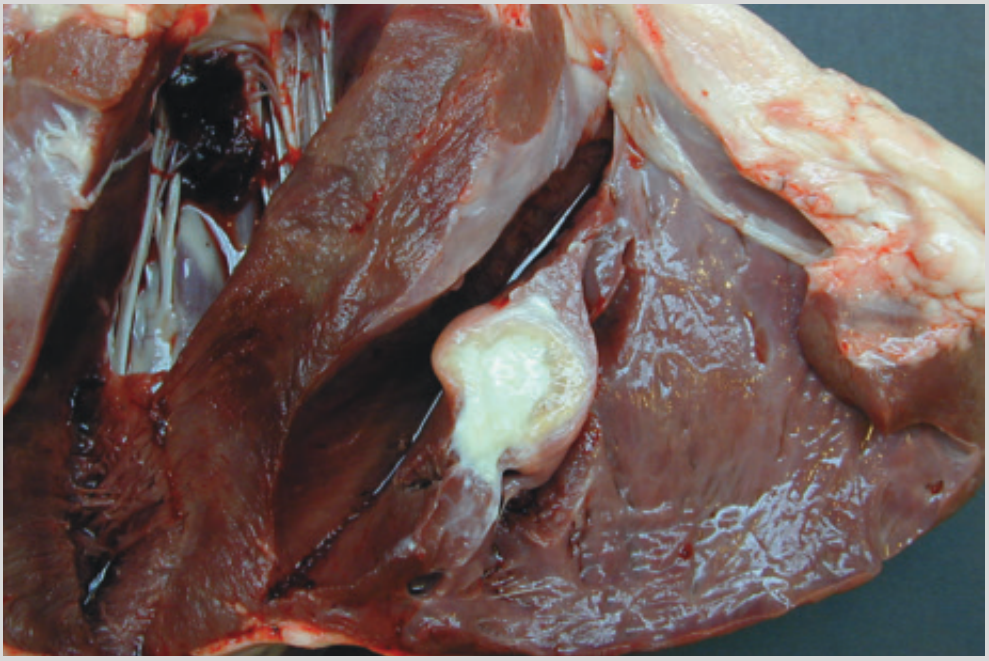
Animal species/Organ	Cattle/Heart
Lesion	Chronic myocarditis with abscess formation
Scoring	Approved for deboning
Comments	Non-encapsulated lesions necessitate total condemnation

19.39



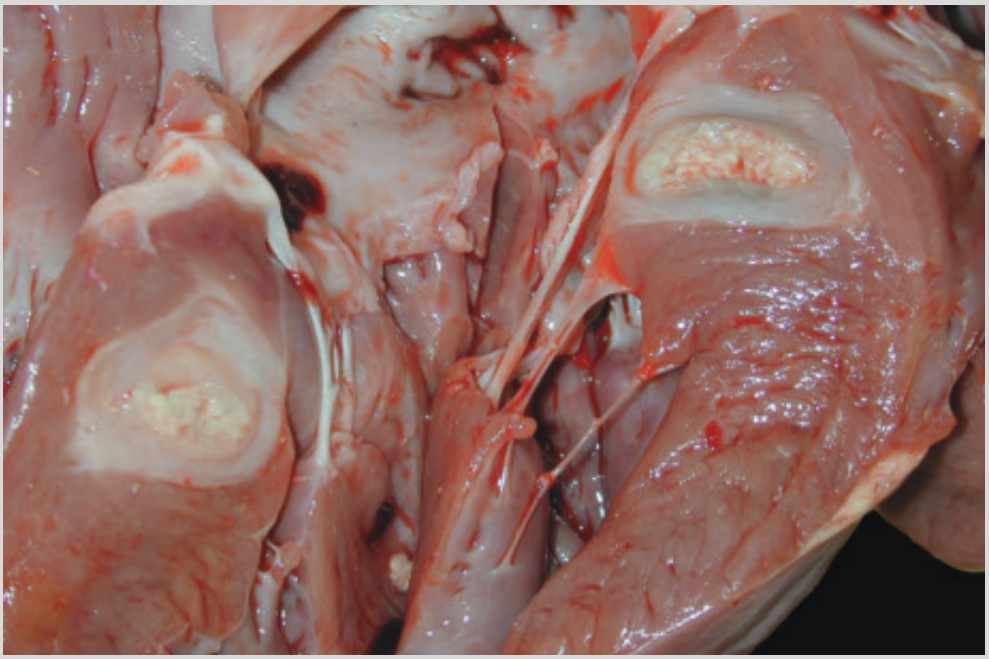
Animal species/Organ	Cattle/Heart
Lesion	Chronic myocarditis with abscess formation
Scoring	Approved for deboning
Comments	Non-encapsulated lesions necessitate total condemnation

19.40



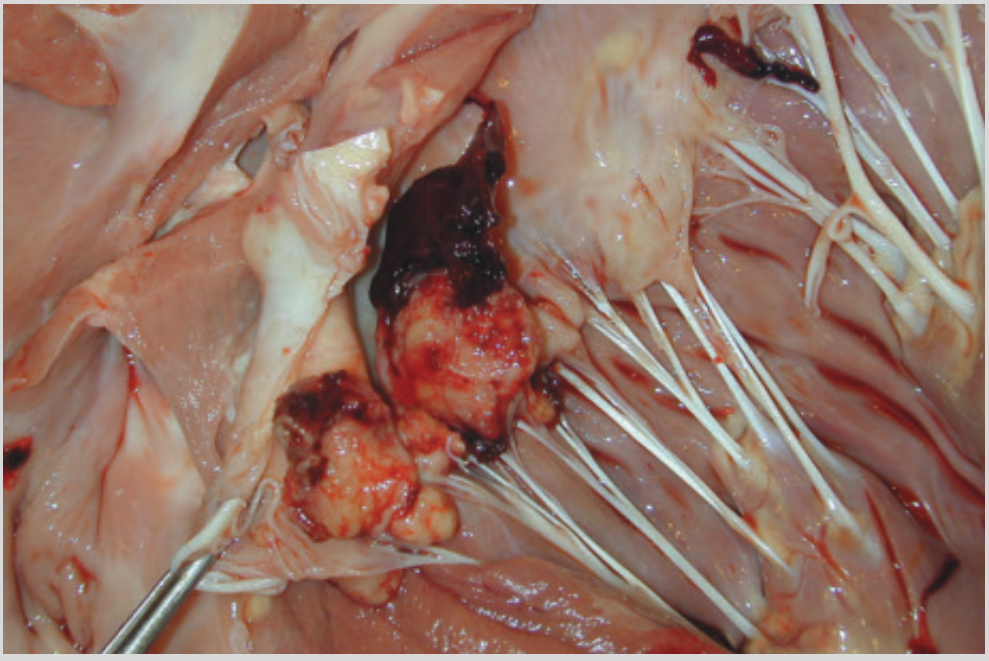
Animal species/Organ	Cattle/Heart (close-up of 19.39)
Lesion	Chronic myocarditis with abscess formation
Scoring	Approved for deboning
Comments	Non-encapsulated lesions necessitate total condemnation

19.41



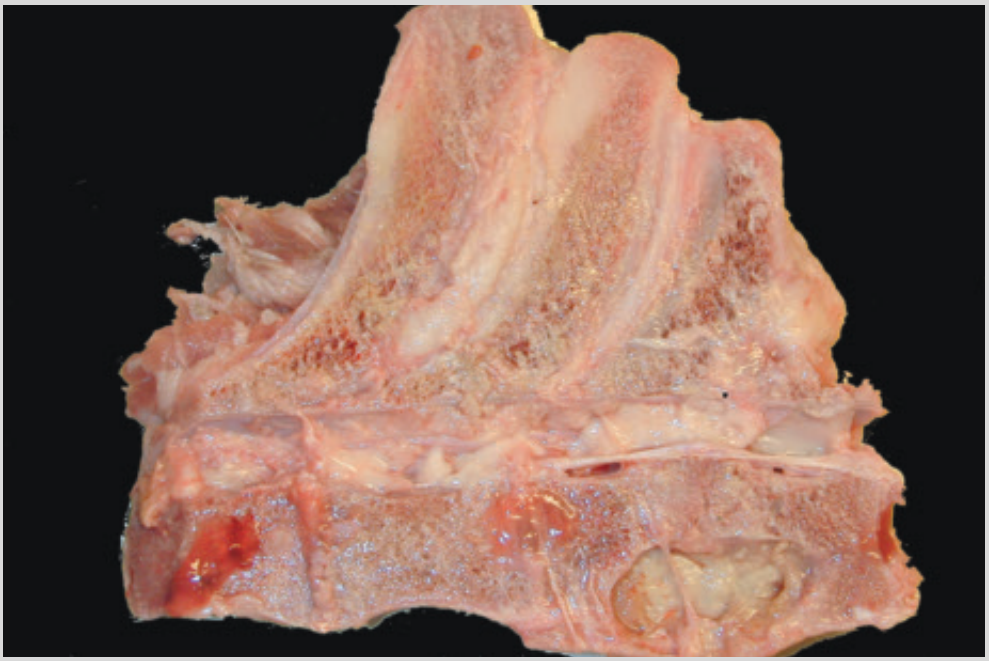
Animal species/Organ	Pig/Heart
Lesion	Chronic myocarditis with abscess formation
Scoring	Approved for deboning
Comments	Non-encapsulated lesions necessitate total condemnation

19.42



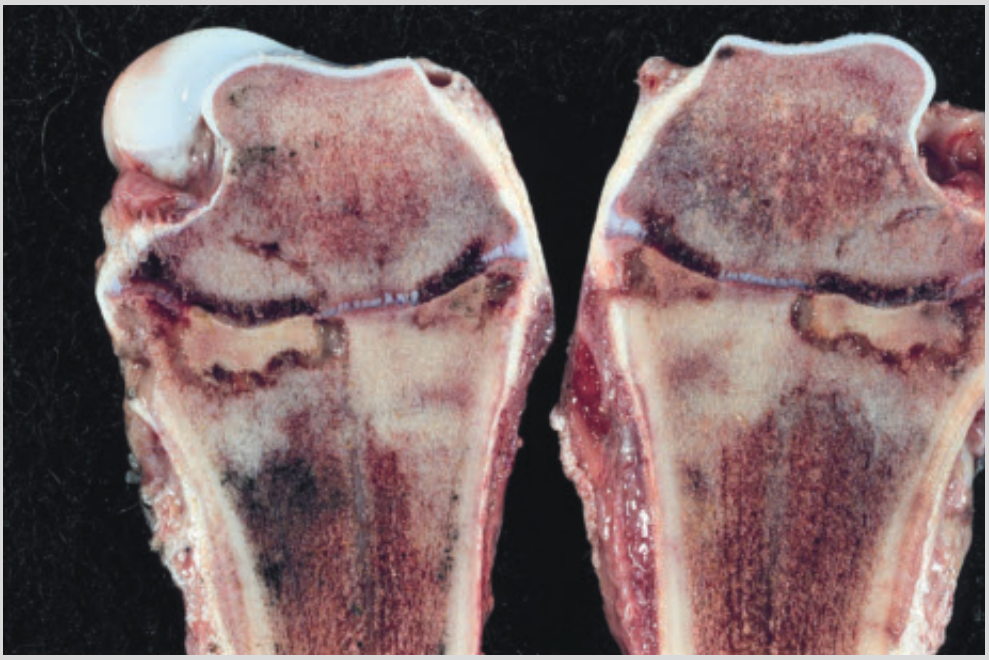
Animal species/Organ	Cattle/Heart
Lesion	Chronic, valvular, thrombotic endocarditis
Scoring	Total condemnation
Comments	Is only very rarely healed

19.43



Animal species/Organ	Pig/Thoracic vertebrae
Lesion	Chronic, purulent osteomyelitis
Scoring	Approved for deboning
Comments	Non-encapsulated lesions necessitate total condemnation

19.44



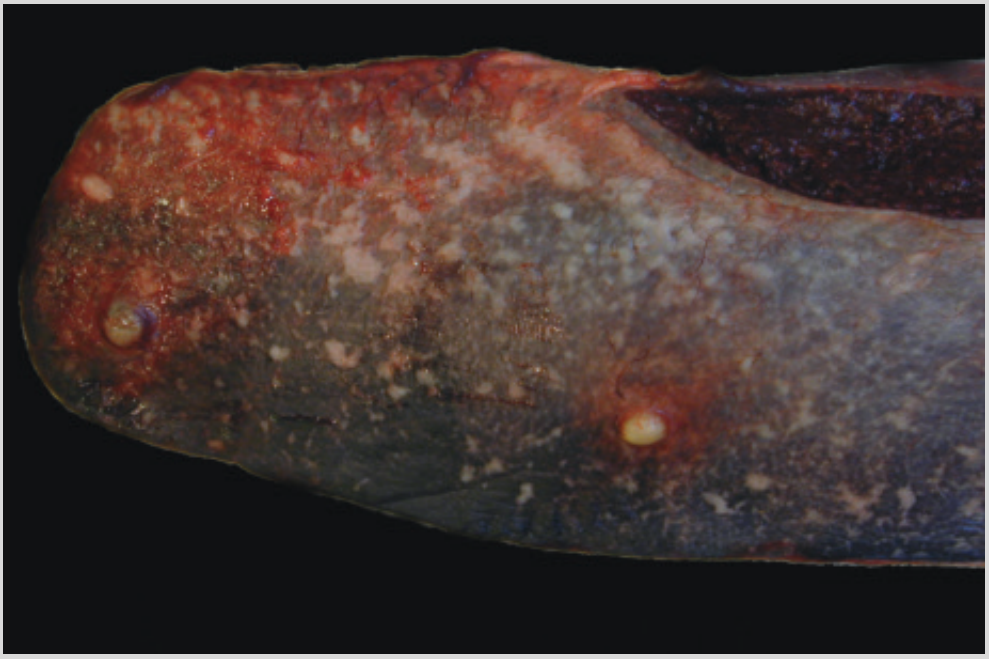
Animal species/Organ	Cattle/Femur
Lesion	Chronic, purulent and sequestrating osteomyelitis
Scoring	Approved for deboning
Comments	Non-encapsulated lesions necessitate total condemnation

19.45



Animal species/Organ	Cattle/Tibia
Lesion	Chronic, purulent osteomyelitis
Scoring	Approved for deboning
Comments	Non-encapsulated lesions necessitate total condemnation

19.46



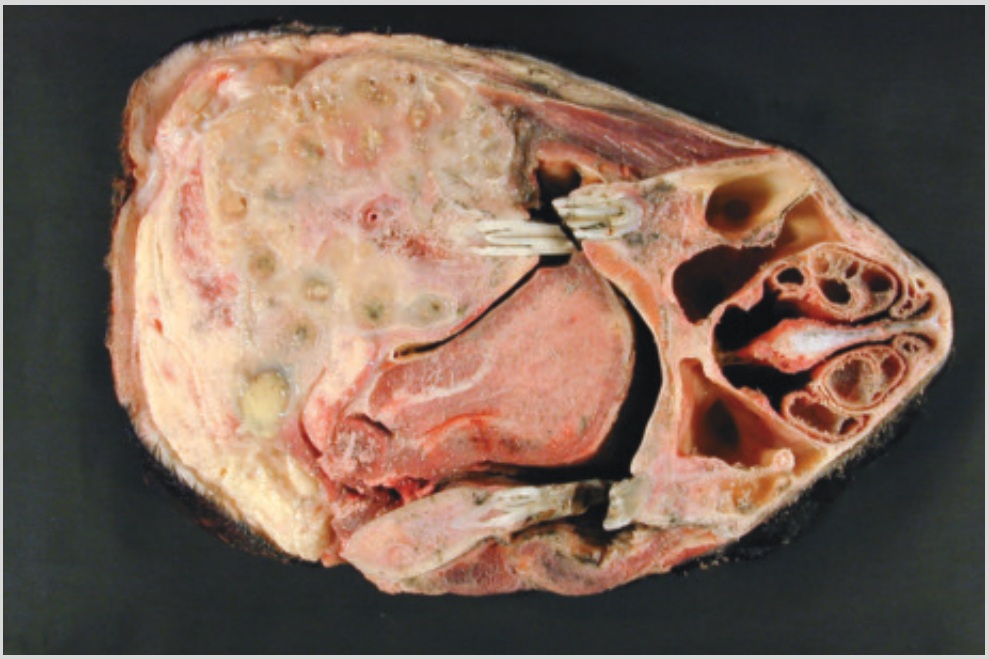
Animal species/Organ	Cattle/Spleen
Lesion	Chronic, lienitis with abscess formation (pyaemic condition)
Scoring	Approved for deboning
Comments	The presence of one or more non-encapsulated lesions necessitates total condemnation

19.47



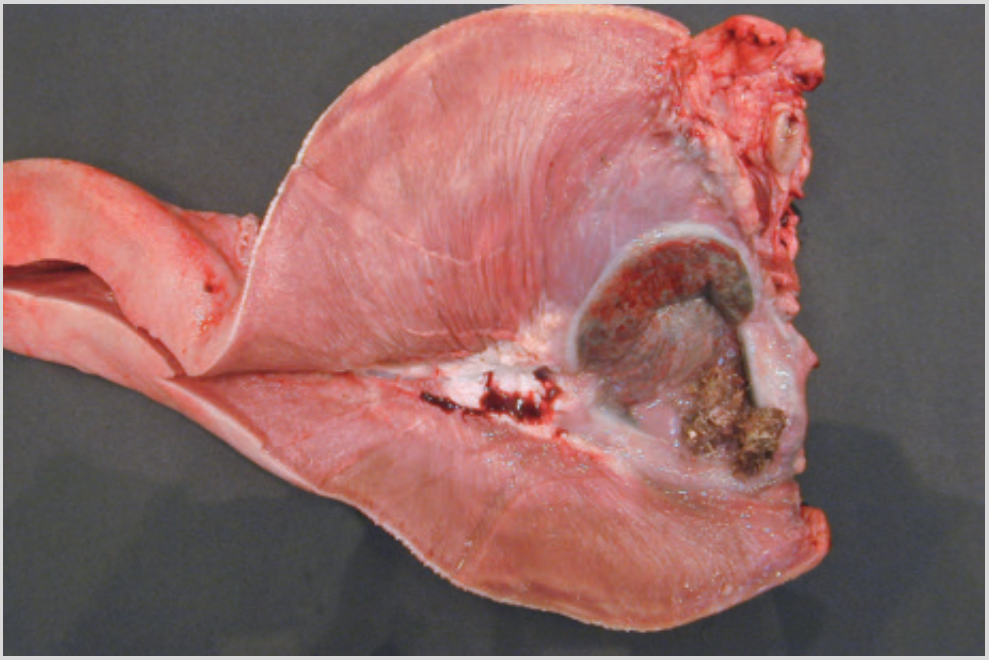
Animal species/Organ	Cattle/Spleen
Lesion	Chronic lienitis with abscess formation and overlying chronic, fibrous perilienitis
Scoring	Approved for deboning because the lesion is probably the result of pyaemic spread
Comments	Non-encapsulated lesions necessitate total condemnation. Partial condemnation if caused by a foreign body

19.48



Animal species/Organ	Cattle/Head (transverse section)
Lesion	Chronic, pyogranulomatous osteomyelitis localised to the left mandible branch
Scoring	Partial condemnation
Comments	Due to local spread from an oral cavity lesions

19.49



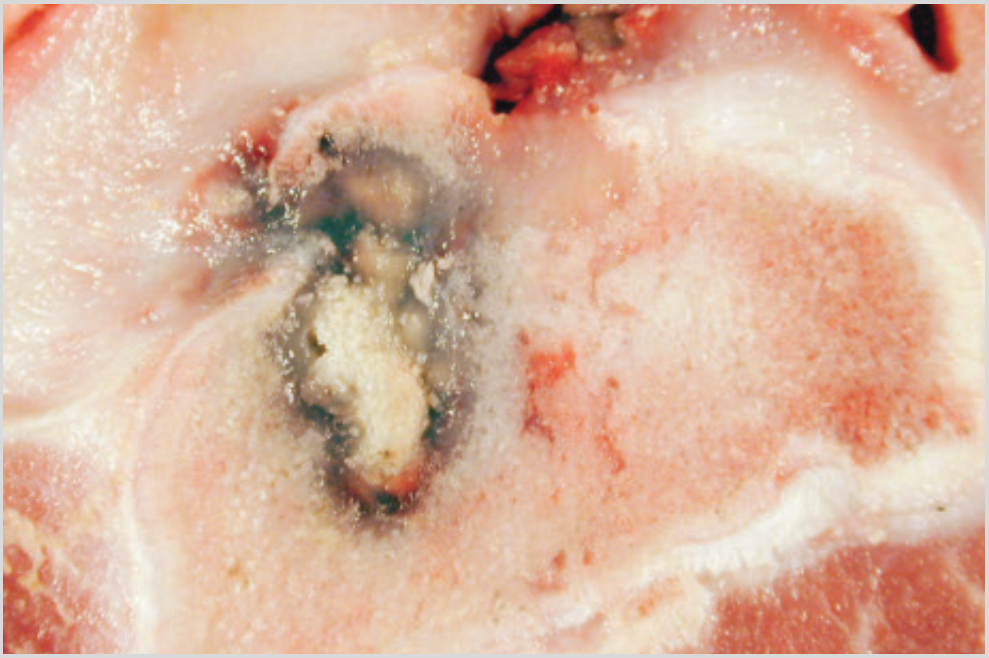
Animal species/Organ	Cattle/Tongue
Lesion	Chronic glossitis with abscess formation
Scoring	Partial condemnation
Comments	The lesion has occurred after spread from lesions laterally on the tongue surface

19.50



Animal species/Organ	Pig/Scapula with overlying ulceration (shoulder ulceration)
Lesion	Chronic, sequestered osteomyelitis
Scoring	Partial condemnation
Comments	The surrounding dark pigmentation is termed “pseudomelanosis”

19.51



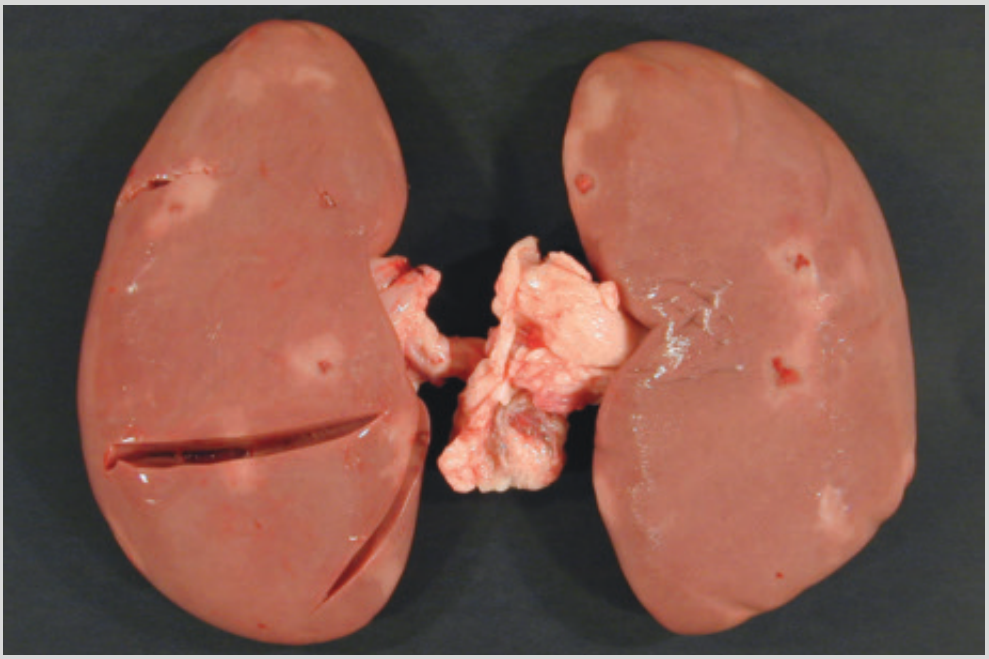
Animal species/Organ	Pig/Scapula with overlying ulceration (shoulder ulceration) (close-up of 19.50)
Lesion	Chronic, sequestered osteomyelitis
Scoring	Partial condemnation
Comments	Is not part of pyaemia

19.52



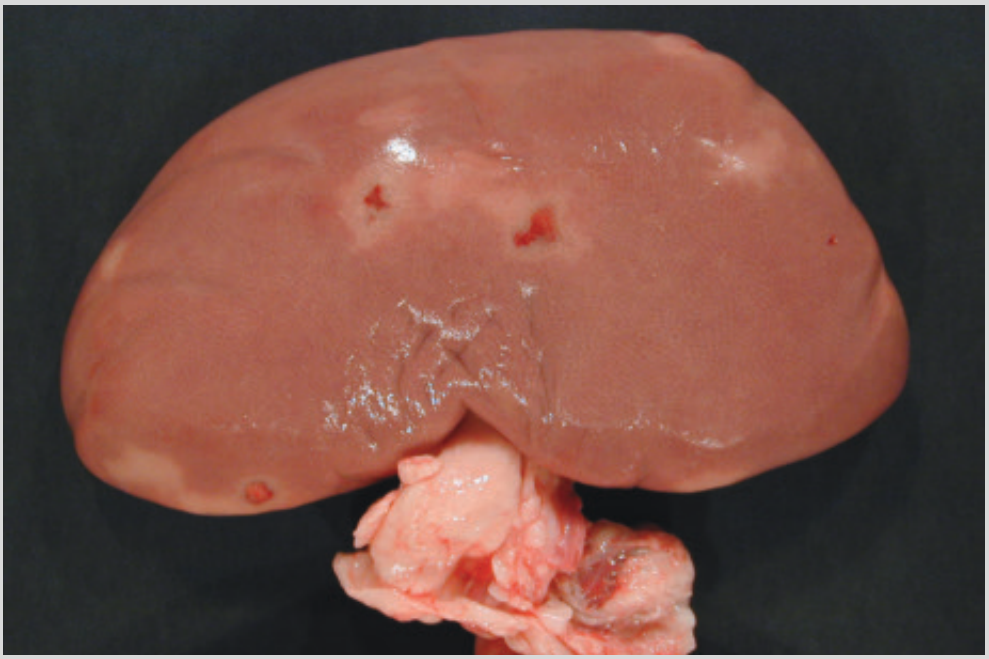
Animal species/Organ	Cattle/Kidney
Lesion	Chronic, disseminated nephritis with abscess formation with poorly-defined lesions
Scoring	Total condemnation
Comments	Approval may be given for deboning if the lesions are encapsulated

19.53



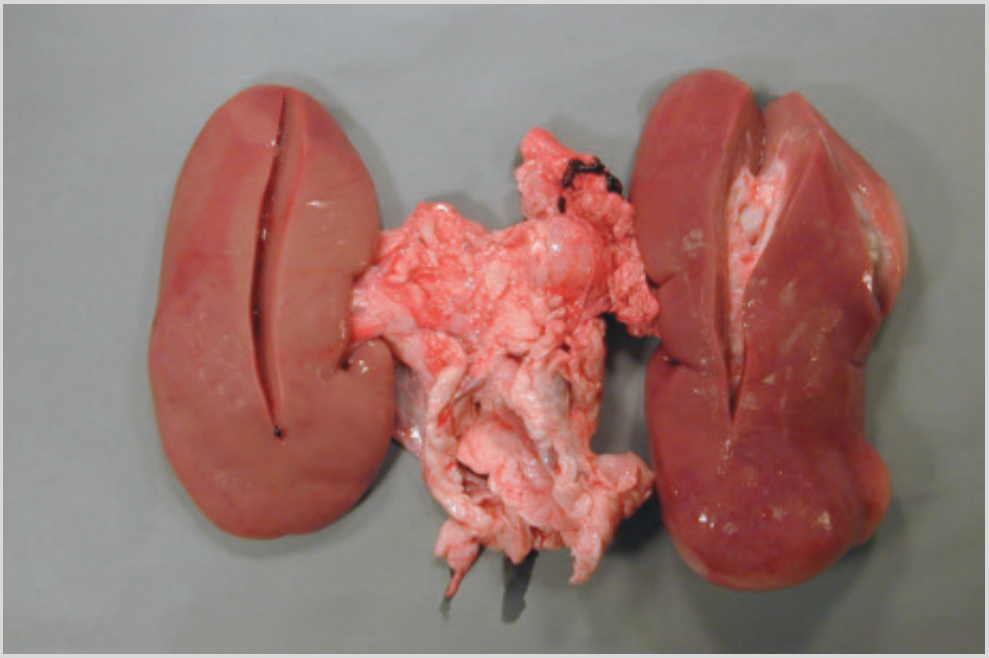
Animal species/Organ	Pig/Kidney
Lesion	Subacute, haemorrhagic infarcts
Scoring	Total condemnation
Comments	Chronic cases with abscess formation may be approved for deboning

19.54



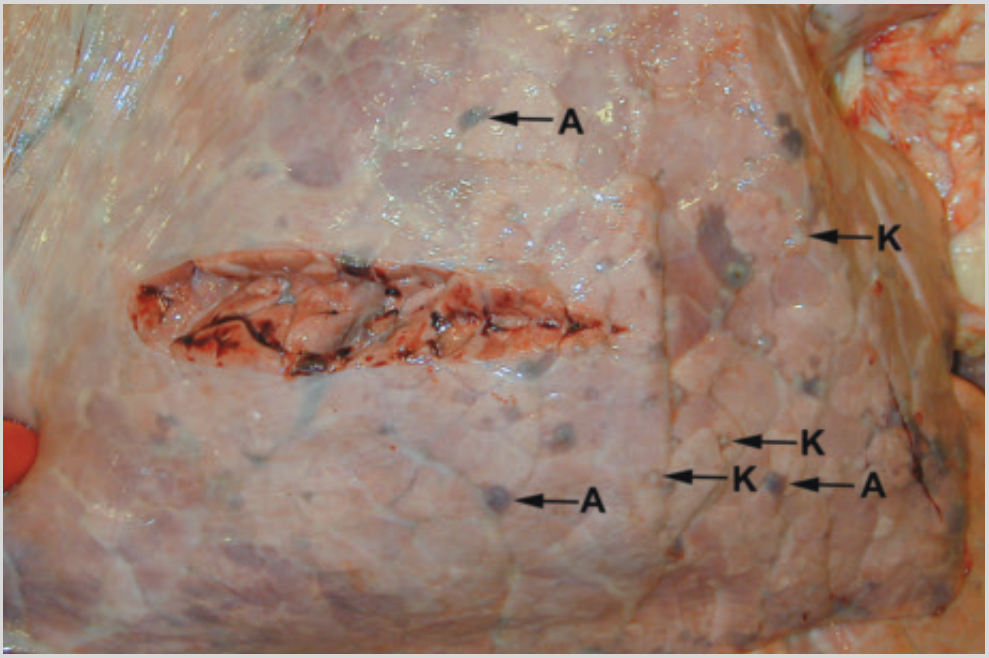
Animal species/Organ	Pig/Kidney (close up of 19.53)
Lesion	Subacute, haemorrhagic infarcts
Scoring	Total condemnation
Comments	Chronic cases may be approved for deboning

19.55



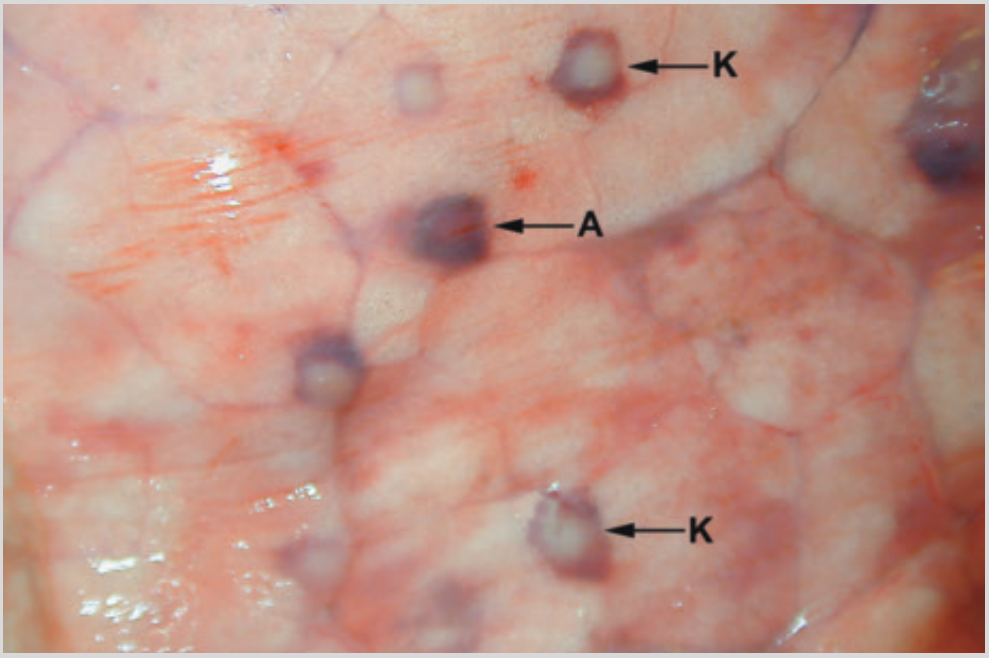
Animal species/Organ	Pig/Kidney
Lesion	Chronic, unilateral, focal, nephritis with abscess formation
Scoring	Partial condemnation
Comment	As there is only one lesion in one kidney, this is most probably not the result of embolic spread

19.56



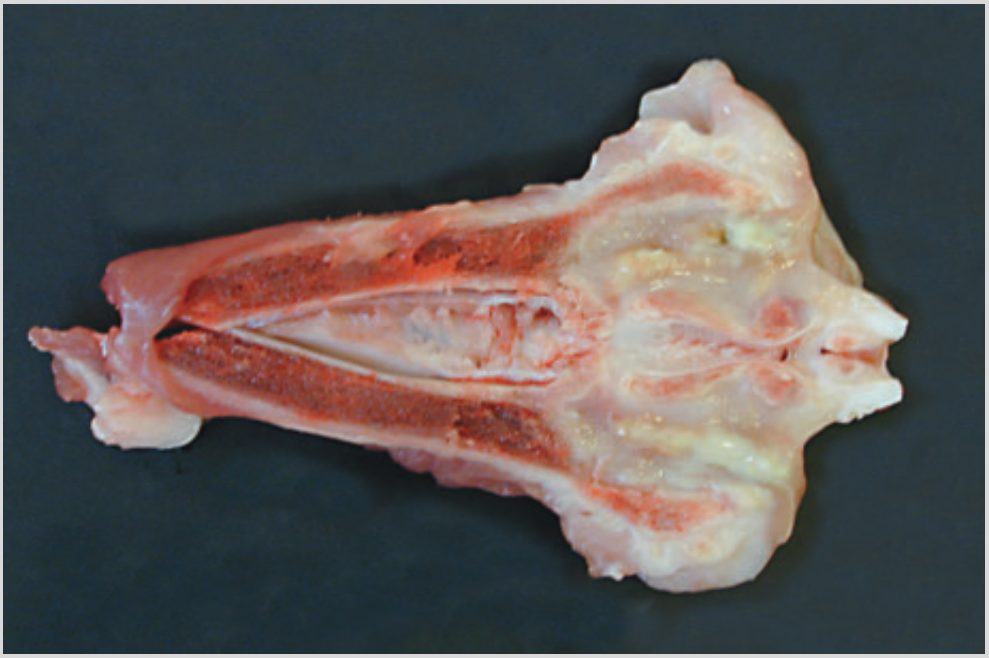
Animal species/Organ	Cattle/Lung
Lesion	Acute (A) and chronic (K), focal, embolic pneumonia with abscess formation
Scoring	Total condemnation
Comments	Scoring is always based on the most recent lesions

19.57



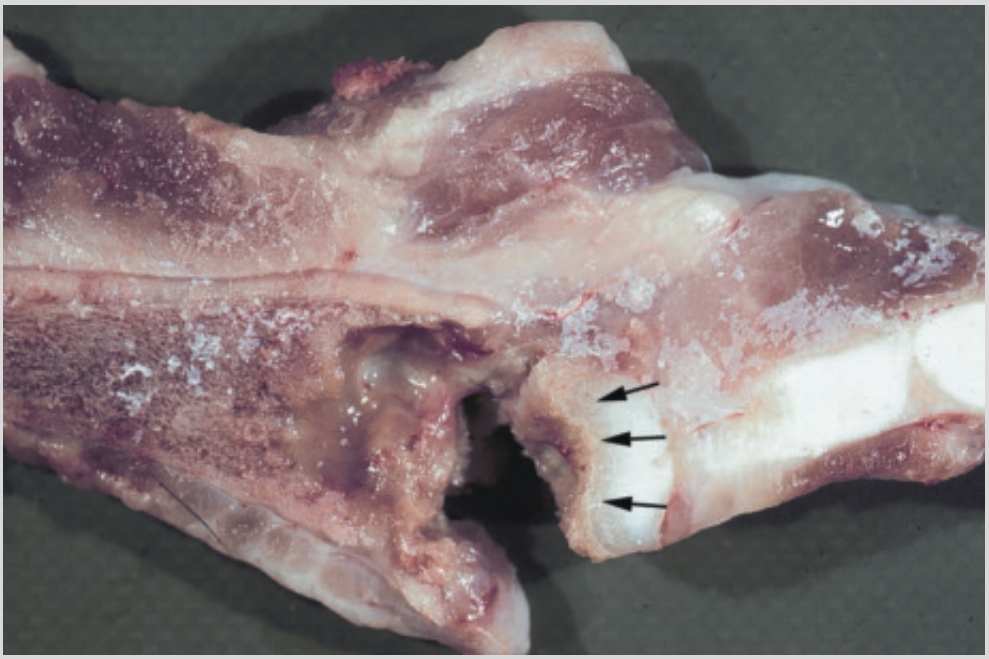
Animal species/Organ	Pig/Lung
Lesion	Acute (A) and chronic (K), focal, embolic pneumonia with abscess formation
Scoring	Total condemnation
Comments	Scoring is always based on the most recent lesions

19.58



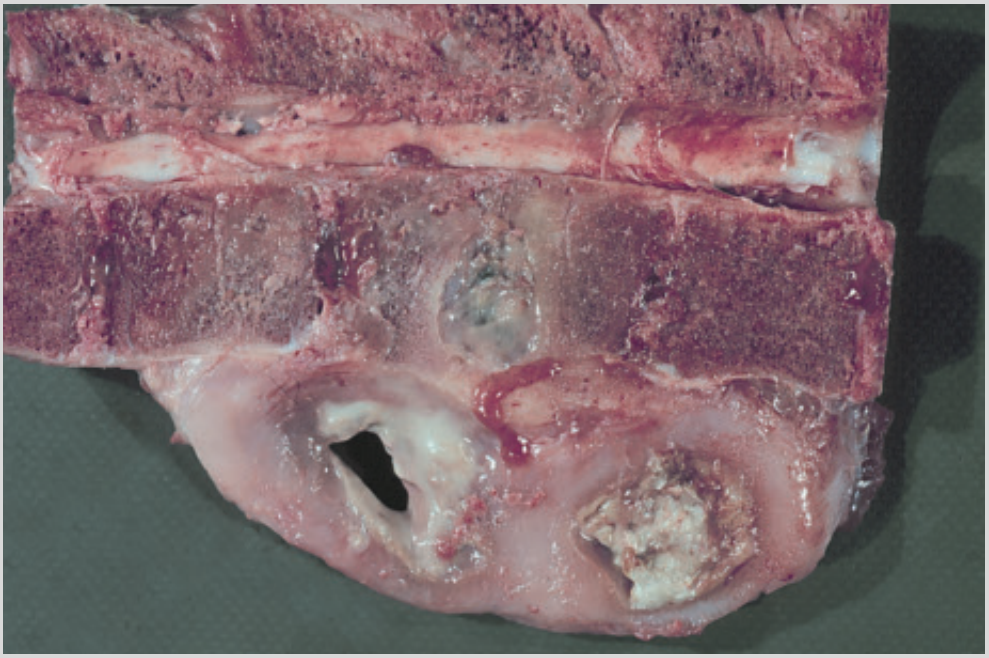
Animal species/Organ	Pig/Rib
Lesion	Chronic, purulent osteomyelitis (the lesion is encapsulated)
Scoring	Approved for deboning
Comments	A non-encapsulated lesion necessitates total condemnation

19.59



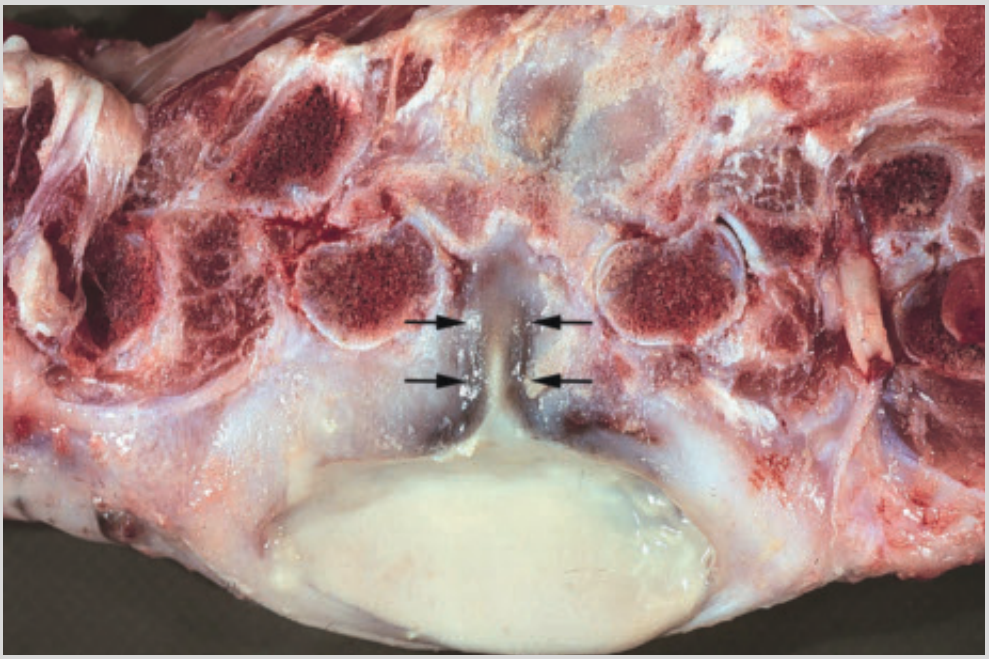
Animal species/Organ	Pig/Rib
Lesion	Chronic, purulent osteomyelitis (the lesion is not encapsulated towards the cartilage (→))
Scoring	Total condemnation
Comments	Approval could have been given for deboning if the lesion had been encapsulated

19.60



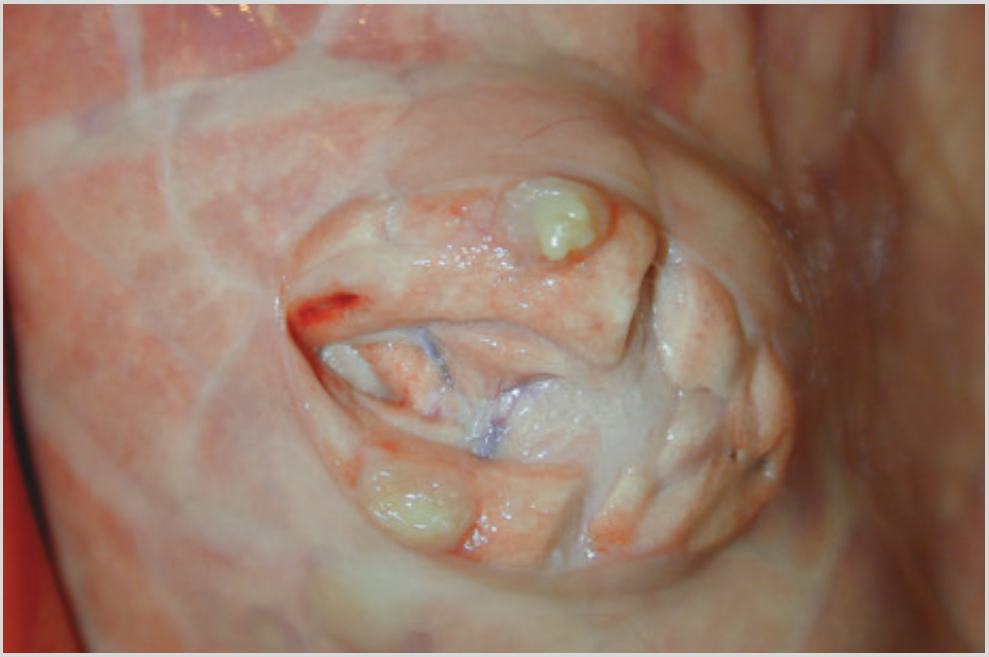
Animal species/Organ	Pig/Lumbar vertebrae
Lesion	Chronic, purulent discospondylitis with formation of secondary dissecting abscess
Scoring	Approved for deboning
Comments	Non-encapsulated lesions necessitate total condemnation

19.61



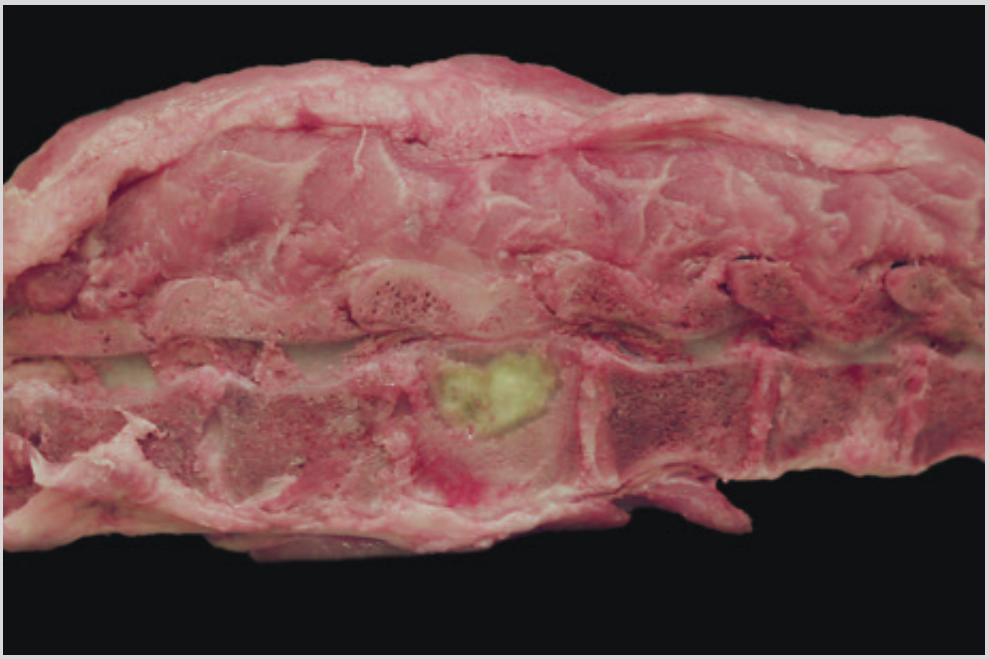
Animal species/Organ	Pig/Thoracic vertebra
Lesion	Secondary dissecting abscess (fistulous tract can be seen (→)) from chronic, purulent osteomyelitis
Scoring	Approved for deboning
Comments	Non-encapsulated lesions necessitate total condemnation

19.62



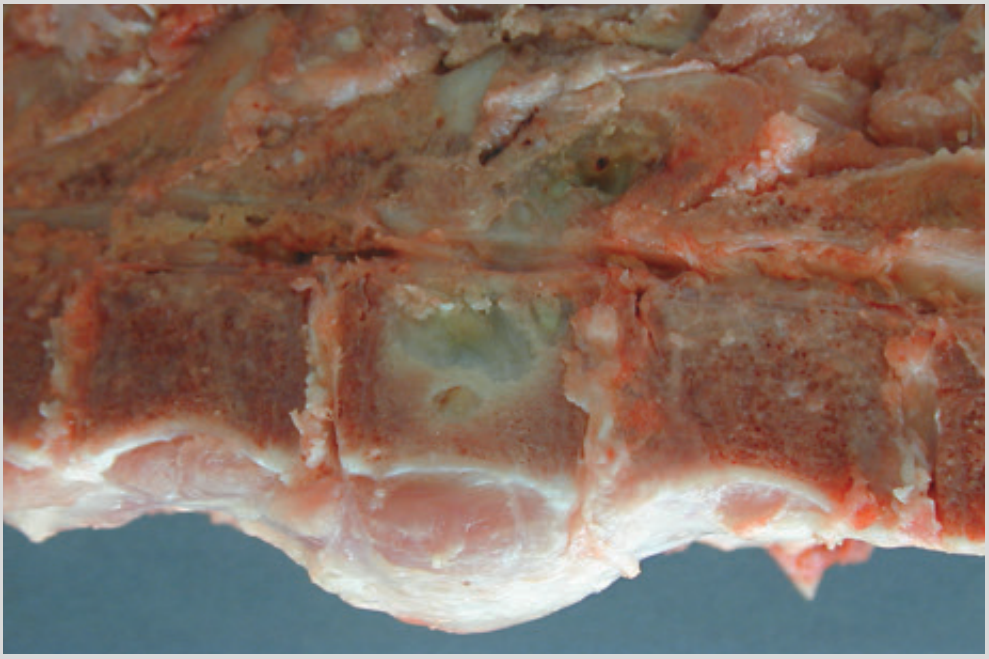
Animal species/Organ	Cattle/Lung
Lesion	Chronic, focal, embolic pneumonia with abscess formation (the lesion is encapsulated)
Scoring	Approved for deboning
Comments	Non-encapsulated lesions necessitate total condemnation

19.63



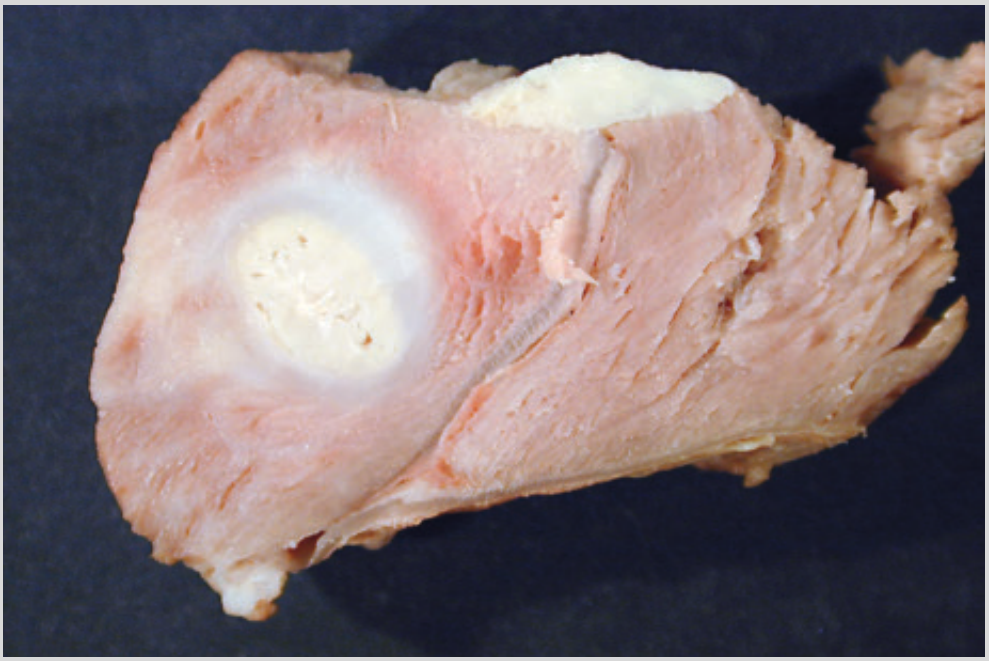
Animal species/Organ	Pig/Vertebrae
Lesion	Chronic, purulent osteomyelitis
Scoring	Approved for deboning
Comments	Non-encapsulated lesions necessitate total condemnation

19.64



Animal species/Organ	Pig/Vertebrae
Lesion	Chronic, purulent osteomyelitis with fistula rupture to the spinous processes and secondary dissecting abscess
Scoring	Approved for deboning
Comments	Acute cases necessitate total condemnation

19.65



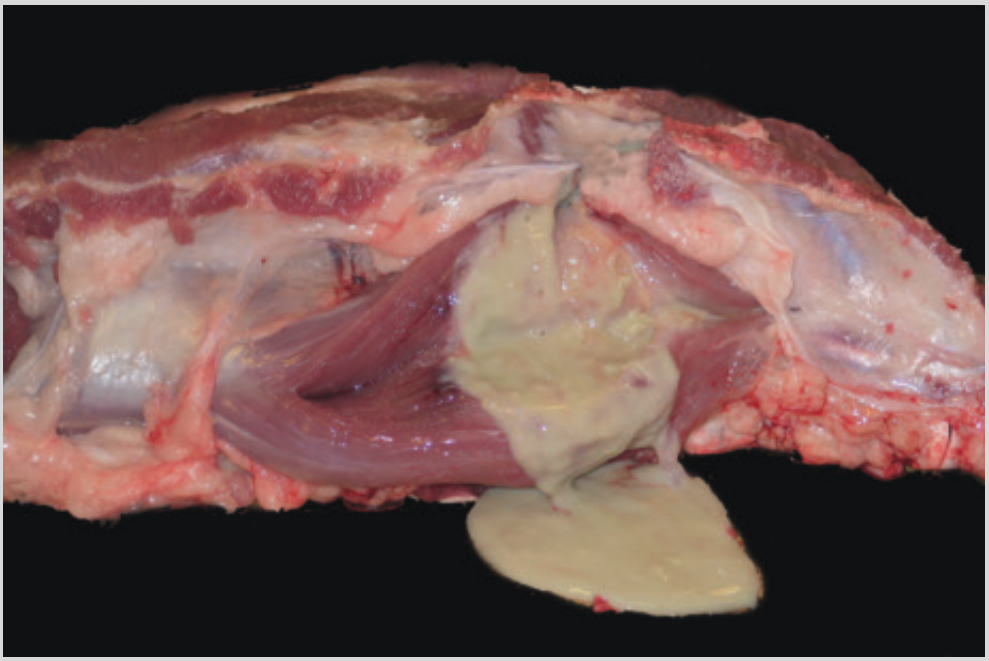
Animal species/Organ	Pig/Thigh muscle
Lesion	Secondary dissecting abscess from chronic, purulent osteomyelitis in the femur
Scoring	Approved for deboning
Comments	Non-encapsulated lesions necessitate total condemnation

19.66



Animal species/Organ	Pig/Carcass
Lesion	Chronic, myositis with abscess formation (psoas muscle).
Scoring	Approved for deboning
Comments	The lesion is a result of fistulation from a chronic vertebral osteomyelitis

19.67



Animal species/Organ	Pig/Psoas muscle
Lesion	Chronic myositis with abscess formation
Scoring	Approved for deboning
Comments	The lesion is a result of fistulation from a chronic vertebral osteomyelitis

20 Granulomatous and Pyogranulomatous Inflammations

Introduction p. 699
Granulomatous inflammations p. 700
Tuberculosis/mycobacteriosis p. 700
Portals of entry, complexes, and scoring of tuberculosis/mycobacteriosis 701
Tuberculosis/mycobacteriosis in the various species p. 702
Differential diagnosis of tuberculosis/mycobacteriosis p. 704
Johne's disease p. 705
Pseudotuberculosis p. 706
Pyogranulomatous inflammations p. 706
Actinomycosis p. 707
Actinobacillosis p. 707
Botryomycosis p. 708
Other pyogranulomatous inflammations p. 708

Introduction

Previously, differentiation was made principally between specific and nonspecific inflammations. The cells of nonspecific inflammations consisted of ordinary cells. The cells in specific inflammations consisted of specialised macrophages such as epitheloid cells and/or giant cells, which are not present in normal tissue. Later, the term non-specific inflammation fell into disuse, and specific inflammations are now called granulomatous inflammations. The name granulomatous covers not only inflammatory conditions involving epitheloid cells and/or giant cells, but also those that are dominated by macrophages. The large majority of granulomatous inflammations contain not only macrophages and cells derived from these (epitheloid and/or giant cells) but also lymphocytes, plasma cells and fibroblasts. Several infectious diseases in livestock are characterised by inflammation that is always, or nearly always, granulomatous. In addition to these well-defined conditions, granulomatous inflammation can also occur occasionally with other infectious agents or as reaction to foreign bodies (foreign body granulomas).

Granulomatous inflammations are characterised primarily as either lepromatous or tuberculoid. In the lepromatous form, the inflammation is diffusely distributed and consists almost exclusively of macrophages and epitheloid cells. A typical example of the lepromatous form is Johne's disease in cattle. In contrast, the tuberculoid form manifests by formation of well-defined small nodular lesions containing various mononuclear cells, as well as epitheloid and giant cells.

When suppuration (pus formation) is a characteristic finding together with granulomatous inflammation, the condition is called pyogranulomatous inflammation. This

form is characteristic for a number of frequently occurring infectious diseases in slaughter animals.

Granulomatous inflammations [20.01 – 20.06]

As mentioned previously, granulomatous inflammations are grouped according to the characteristic histological changes (presence of macrophages and/or thereof derived cells), but in many cases they will also reveal a characteristic macroscopic appearance. As noted, granulomatous inflammations can be present either as nodular lesions (tuberculoid form) or as a diffuse lepromatous form. Infection with mycobacteria will often involve the regional lymph nodes because typically there is both haematogenous and lymphatic spread. The presence of large numbers of mononuclear cells confers a greyish colour on the lesions. If there is fibroplasia, which usually occurs in the periphery, the lesions will be whiter at the periphery. The lesions are often seen to converge on serous membranes, typically with localisation in the lymph vessels, in which nodules are formed. On serous membranes, the lesions can be localised like pearls on a string ("pearl disease") or, after coalescence, appear as large, uneven formations. In cases of infection-related granulomatous inflammations of the tuberculoid form, there will often also be necrosis present as dry, firm caseous areas (a particular form of necrosis) possibly with dystrophic calcification. These lesions are, however, not specific for tuberculosis. If caseous lymphadenitis or tubercles in an organ is found, the animal must be examined in accordance with the regulations. Occasionally, metastatic mineralisation (calcification) can occur in association with granulomatous inflammations. These mineralisations can be seen in connection with tuberculosis and Johne's disease in cattle and with pseudotuberculosis in sheep. This is probably due to the formation of calcitriol or calcitriol-like substances with vitamin D effect in the granulomatous tissue. These mineralisations are most frequently found in the lungs and vascular system, with affection in particular of the aorta and heart.

Tuberculosis/mycobacteriosis

Tuberculosis is a chronic disease caused by infection with *Mycobacterium* spp. The most important mycobacteria are *Mycobacterium tuberculosis*, *Mycobacterium bovis* and *Mycobacterium avium* subsp. *avium*. These three mycobacteria primarily infect their hosts; humans, cattle and birds, respectively, but cross-infection does occur. Moreover, they can infect many other species including pig, sheep, goat and horse. The pattern of disease varies depending on the mycobacterium, the species involved, and the animal's immune status. The term tuberculosis is conventionally limited to infection with *M. tuberculosis* and *M. bovis*. Infection with other mycobacteria are called mycobacteriosis. Previously, tuberculosis was a common, serious, and loss-incurring disease in production animals, especially cattle. Today, however, tuberculoid changes are only seen occasionally at slaughterhouses. The lesions are most frequently caused by *M. avium* subsp. *avium*, and only in a few cases by infection with other mycobacteria strains. At meat inspection, it is nevertheless important to know when material should be sent in

for type determination because tuberculosis in livestock caused by infection with *M. tuberculosis* and *M. bovis* is now a notifiable disease governed by Danish legislation. In the following, the term mycobacteria will be used exclusively for *M. tuberculosis, M. bovis* and *M. avium* subsp. *avium.*

Portals of entry, complexes, and scoring of tuberculosis/mycobacteriosis [20.07 – 20.09]

Portals of entry and complexes

The histological lesions associated with tuberculosis/mycobacteriosis are often considered to be the prototype of a granulomatous inflammation. The changes are seen as tuberculous granulomas (tubercles) of concentric cell layers with centrally located mycobacteria. The granulomas will typically be exudative or productive. The exudative form is the most acute and is characterised histologically by primary caseation and free mycobacteria in the centre. In contrast, the productive form has epitheloid and giant cells in the centre with phagocytosed mycobacteria.

In addition, the tubercles may be characterised by encapsulation, secondary caseation and calcification. Macroscopically, the tubercles appear as either greyish, semi-transparent, sharply-defined, often irregular and angular and, occasionally, confluent, nodular lesions in the organs or as encapsulated, whitish, nodular lesions of varying sizes with a central yellowish, dry, grainy, necrotic mass (caseation). Dystrophic calcification, which is apparent as a hard, white material, may occur in the lesions at a later stage. All age groups can be infected with mycobacteria, but the large majority are infected as young animals. Portals of entry include the alimentary system, the airways, the reproductive system, or the skin. In pregnant animals, especially cows, the mycobacteria can spread to the embryo causing congenital tuberculosis. In dogs, the most common portals of entry are the gastro-intestinal tract and the airways. A primary focus (a primary tubercle) is formed in the portal of entry organ. From here, spread can occur, primarily to the rest of the organ, but also via local lymphatic spread to the organ's associated lymph nodes. This takes place either as free mycobacteria in the lymph or as intracellular mycobacteria in macrophages. This combination of a primary focus at the portal of entry and concomitant findings of tubercles in the regional lymph nodes is termed a complete primary complex. Findings of lesions in a lymph node draining obvious portals of entry, e.g. gastro-intestinal tract and airways, in which there is no concomitant finding of lesions in the organs associated with the lymph nodes is termed an incomplete primary complex. This is seen predominantly in infections via the mucous membranes such as the pharynx or intestines. In susceptible, non-immune animals spread can take place from the lymph nodes to the rest of the body (lymphatic/haematogenous spread). In cases of generalised tuberculosis it can be impossible to identify the primary complex. When mycobacteria gain access to the vascular system, they can spread rapidly, almost explosively, and induce disseminated, densely-packed, yellowish (due to primary caseous necrosis) tubercles, a few mm in size, in many organs. This is called miliary tuberculosis. Originally, the lesions were

compared to millet seed, giving the term miliary (Latin *milium*: millet seed). Spread of mycobacteria in the body can also occur via natural passageways. For example, mycobacteria can spread from tubercles in the kidneys via the ureters to the urinary bladder where new tubercles are formed, or mycobacteria can spread from the lungs to the intestines after swallowing mycobacteria-containing expectorate. Another important dissemination route is to serous membranes such as pleura or the peritoneum. This spread is either haematogenous or by local invasion due to release of mycobacteria from tubercles located on the serous membranes on the lymph nodes and organs, or in subserous lymph vessels. When mycobacteria are released into the body cavities they spread rapidly, forming multiple tubercles.

Scoring

In accordance with current Danish legislation, caseation in a lymph node or tuberculous changes in an organ necessitate heightened examination of all animals, except pigs. At heightened examination, all organs including the skeletal system and meninges must be examined carefully for signs of dissemination. Incisions must also be made in specific lymph nodes (only cattle and pigs). In pigs, however, heightened examination is only done when tuberculous changes are found in organs other than the head, gastro-intestinal tract, and liver. At meat inspection, the scoring of generalised tuberculosis is total condemnation regardless of the species. Findings of miliary tuberculosis is considered to be a sign of acute generalisation and necessitates total condemnation. Serous membrane tuberculosis also necessitates total condemnation because haematogenous spread cannot be excluded. Scoring of localised tuberculous changes depends on the species. In all species, the carcase can be unconditionally approved after condemnation of the changed areas in local, well-demarcated tuberculosis/mycobacteriosis, if this is present as a primary complex in one organ and its lymph nodes. Moreover, in pigs, the carcase can also be unconditionally approved after condemnation of the changed areas at findings of incomplete primary complex lesions in the mandibular or mesenteric lymph nodes (caseous lymphadenitis). Also in cases of tuberculosis/mycobacteriosis spread via the portal venous system in pigs, the carcase can be unconditionally approved after condemnation of the liver and the hepatic lymph nodes.

A sample must always be submitted for species determination if tuberculous changes are found in cattle, sheep, goat, or horse. In contrast, samples from pigs only need to be submitted if tuberculous changes are found in organs other than the head, gastro-intestinal tract or liver and associated lymph nodes, or if the changes can be assumed to be due to bovine mycobacteria.

Tuberculosis/mycobacteriosis in the various species

[20.10 – 20.20]

Cattle

Cattle can be infected with *M. tuberculosis*, *M. bovis*, and *M. avium* subsp. *avium*. Only infection with *M. bovis* results in clinical symptoms. In contrast, infections with *M.*

avium subsp. *avium* are predominantly mild and self-limiting. Smaller lesions are generally found in the mesenteric and retropharyngeal lymph nodes. Similarly, infections with *M. tuberculosis* often give rise to only a few lesions other than the primary complex.

By far the most frequent portals of entry for *M. bovis* are the airways, followed by the gastro-intestinal tract. In addition, congenital, genital and percutaneous infection has been described. The primary complex is therefore generally found in the lungs and bronchial lymph nodes. The intestines and mesenteric lymph nodes are often the sites of secondary infection due to swallowing of mycobacteria-containing expectorate. Tubercles in the lungs are frequently encapsulated, often with macroscopically visible caseous centres and a tendency to calcification. The lesions can coalesce forming large areas, up to entire lung lobes, with caseous bronchopneumonia. Mycobacteria can be spread from one bronchi to another due to coughing, and ulcerating tubercles can be seen in the trachea and possibly the larynx. Frequently, there is spread to the pleura either by direct invasion, or by lymphatic or haematogenous spread. The lesions in the pleura are comprised initially of collections of small, reddish pedunculated granulation tissue flaps containing tubercles. Later these become more nodular fibrous lesions often with caseous or calcified centres. The lesions are often clustered together forming large cauliflower-like lesions. Or the changes can be flat with large plaques of caseous exudate, in which the underlying pleura is uniformly thickened. From the primary portal of entry, the infection can be generalised either via massive dissemination with development of miliary tuberculosis in several organs, or as a slower progression in which fewer mycobacteria are released at a time into the blood stream. Lesions are rarely seen in the mucous membranes of the gastro-intestinal tract. When lesions are found, they are generally in the form of ulcerating tubercles. In contrast in the mesenteric lymph nodes, lesions are frequently seen as caseous or calcified tubercles. Findings of tubercles in the liver of foetuses or new-born calves is considered to be indicative of congenital infection, whereas tubercles in the liver of older animals can be indicative of haematogenous spread or local spread via the portal venous system. In the liver, the central necrotic tissue in the tubercles often degenerates and liquefies. Tuberculous changes occur less commonly in the peritoneum than in the pleura. The pathogenesis can be haematogenous in generalised infections prenatally or postnatally. In congenital infections, there may be additional involvement of the liver's serosa and adjacent peritoneum via local or lymphatic spread from the liver. Tubercules in the kidneys are a result of haematogenous spread in generalised infections. Typically, the lesions will be limited to the renal cortex in which tubercles form in the interstitial tissue. If mycobacteria reach the udders, they will often spread internally via the canalicular system. Tuberculous mastitis is primarily due to haematogenous spread of mycobacteria. This gives rise to miliary tuberculosis; larger, nodular tuberculous changes; or large, irregular areas with caseous necrosis. Mycobacteria can be secreted in the milk, and tuberculous mastitis constitutes a major infection risk for calves and humans. Haematogenous spread of mycobacteria can also cause osteomyelitis, particularly in young animals, or meningitis or arthritis.

Small ruminants

Infections with mycobacteria in sheep and goat are rare, even though sheep and goats are not particularly resistant. The most important mycobacteria are *M. bovis* and *M. avium* subsp. *avium.* Infection and progression are highly reminiscent of that in cattle.

Pig

Pigs are susceptible and can be infected with all three mycobacteria strains. Most infections are however subclinical, and generalised infections are rare. The most common infection route is via feed, with the portal of entry in the pharynx, tonsils or intestines. The primary complex is often incomplete with caseous tubercles in the pharyngeal and mesenteric lymph nodes. Frequently, there is spread via the portal venous system from the intestinal tract to the liver. In the liver, *M. bovis* and *M. avium* subsp. *avium* can give rise to tubercles with different appearances. Tubercules associated with *M. bovis* bacteria are often encapsulated with an obvious caseous or calcified centre, which may liquefy. In contrast, tubercles associated with *M. avium* subsp. *avium* are more productive and cell-rich histologically, i.e. at macroscopic examination they appear more uniformly grey without or with a very small centre of caseous necrosis, and they are more reminiscent of the type of tubercles seen in horses. Moreover, the portal lymph nodes can be more diffusely hyperplastic without focal caseation.

Horse

Infections with mycobacteria in horses are rare, and the horse is normally assumed to be relatively resistant. They can, however, be infected with all three strains which can induce local and generalised infections. *M. bovis* is the mycobacterium most frequently isolated in horses. The most common infection route is via the gastrointestinal tract, which is reflected in the macroscopic findings. Typically, incomplete primary complexes are found that involve the retropharyngeal or mesenteric lymph nodes. The lesions in the gastro-intestinal tract cannot normally be recognised or, in the small intestine may resemble the hyperplastic enteritis form that is seen in Johne's disease in cattle. If lesions are found in the large intestine, they are often present as ulcerating tubercles. Severe cases frequently become generalised with tubercular lesions in many organs. In the liver and spleen, in particular, the tubercles have a tendency to become larger, almost tumorous with a homogenous uniformly-coloured cross-section, and a consistency similar to lard. In contrast to tubercles in cattle, caseous necrosis or calcification is a rare macroscopic finding

Differential diagnosis of tuberculosis/mycobacteriosis

[20.21 – 20.33]

With regard to differential diagnosis several pathological lesions in the different species can, at macroscopic examination, resemble tuberculosis. However, histological and bacterial examination (including examination for acid-resistant rod bacteria) will nearly always enable confirmation or exclusion of tuberculosis/ mycobacteriosis.

In regard to the liver and respiratory organs, a number of parasite infections here

and in other organs can induce lesions characterised by caseation, calcification and/ or fibrosis. Typically, the parasites have been carried to organs where they are not normally to be found, or they have infected the wrong animal species. As described under the liver and respiratory system, the inflammatory reaction associated with normal parasite migration through the organs as that which occurs with *Ascaris suum* in pigs, can also give rise to lesions ("lymphadenopathies") that can be confused with tuberculous lesions. In small ruminants, the subpleurally located greyish lesions which occur at infection with certain types of lungworms, can also resemble tuberculous lesions. Some neoplasms, particularly those located in the lungs and lymph nodes, can also cause confusion. These are generally sarcomas, and include lymphosarcomas, in which necrotic areas in the flaccid neoplasm can be confused with central caseation. Similarly, lung carcinomas, which contain yellowish necrotic centres, can be confused with tuberculous lesions. In lymph nodes and other organs, a number of fungi and parasite infections induce granulomatous reactions with caseous necrosis and mineralisation. Macroscopically, these lesions are often indistinguishable from tuberculosis, and laboratory investigation is necessary to determine the aetiology. However, it should also be noted that in some cases of granulomatous lesions, it is not possible to determine the aetiology.

Finally, it must be noted that various diseases that do not occur in Denmark, such as glanders (malleus) and brucellosis in some stages induce lesions that can be confused with tuberculosis, because they induce granulomatous/pyogranulomatous reactions.

Johne's disease [20.34 – 20.35]

Mycobacterium avium subsp. *paratuberculosis* can infect a number of animal species such as ruminants, horses and pigs. However, infections are most frequently seen in cattle and the small ruminants, in which the lesions are quite different. In cattle, infection gives rise to a chronic lepromatous hyperplastic enteritis. Even though the lesions, which can be segmented or diffusely distributed, can be found from the duodenum to the rectum, they are most frequently localised in the ileum and the oral sections of the colon/ caecum. Macroscopically, a diffuse thickening of the intestinal mucosa is observed with transverse folding. Characteristically, these folds cannot be smoothed out. In addition to thickening of the intestinal mucosa, lymphangitis, which is conspicuous on the intestine's serous membranes, is highly characteristic of Johne's disease. The lymph vessels appear as distended, distorted, grey/red vessels. The mesenteric lymph nodes will typically also macroscopically appear diffusely and/or more nodularily enlarged due to cell infiltration. In the small ruminants, the intestinal changes are less pronounced than in cattle. Particularly in goats, and to a lesser extent in sheep, the changes are of the tuberculoid form (nodules 1-4 mm in diameter), in which there is often caseous necrosis and mineralisation. As in cattle, lymphangitis and regional lymphadenitis are characteristically associated with intestinal infection in the small ruminants. In all species, spread can occur to other organs but this is very rare. In local haematogenous spread, the granulomatous lesions will typically localise in the liver whereas in generalised infections, lesions can be found in the lungs, spleen, and kidneys, for example.

At meat inspection, Johne's disease localised to the intestines with or without local spread to the regional lymph nodes and liver, necessitates partial condemnation. The presence of complications, such as emaciation, necessitates total condemnation. Generalised infection always necessitates total condemnation as in the other forms of mycobacteriosis.

Pseudotuberculosis [20.36 – 20.37]

The term pseudotuberculosis is used if the disease is caused by specific well-defined bacteria in small animals (hares, rabbits and rodents) and sheep. In smaller animals, for which meat inspection is not particularly relevant, the condition is due to infection with *Yersinia pseudotuberculosis*. In sheep it is due to *Corynebacterium pseudotuberculosis*. The infection is chronic in sheep, with development of widespread caseous lesions in superficial lymph nodes. The necrotic material is in reality dry ("inspissated") pus, and therefore is often not in fact a granulomatous/ pyogranulomatous condition. In addition to the lymph node changes, the infection can cause embolic absedating pneumonia. At meat inspection the regulations governing other suppurative inflammations must be complied with. Thus, local lesions with or without local invasion and/or metastases to the local lymph nodes necessitate partial condemnation and removal of the local lymph nodes. In generalised conditions, in which spread has occurred haematogenously (pyaemia), animals with uncircumscribed or non-encapsulated lesions necessitate total condemnation. In contrast, findings of circumscribed and encapsulated lesions may be approved for deboning.

Pyogranulomatous inflammations

In slaughter animals, the group of pyogranulomatous inflammations include a number of well-characterised, frequently occurring, infectious diseases. Even though the terminology for these inflammations is based on microscopic characteristics, a correct diagnosis can often be made based on gross lesions. In addition to the characteristic granulomatous inflammation cells, the lesions also contain pus which can often be extruded from the centre of the lesions when incised.

Meat inspection follows the regulations governing pyogranulomatous lesions and other suppurative inflammations. Thus, local lesions with or without local invasion of other tissue and organs and/or spread to the local lymph nodes necessitate partial condemnation and removal of the local lymph nodes. This is of course conditional on the absence of complications, which are seen particularly at localisation of actinomycosis in the jaw and actinobacillosis in the tongue, at which uptake of feed can be severely affected. In generalised conditions, in which spread has occurred haematogenously (pyaemia), animals with uncircumscribed or nonencapsulated lesions necessitate total condemnation. In contrast, findings of circumscribed and encapsulated lesions may be approved for deboning.

Actinomycosis [20.38 – 20.41]

The term actinomycosis covers a particular histological reaction in a pyogranulomatous inflammation, namely the formation of so-called club-shaped configurations (asteroid bodies or Splendore-Hoeppli phenomena), surrounding centrally-located bacterial colonies. Macroscopically, the lesions manifest as typical suppurative, fibrotic, granulomatous lesions, from which yellowish-brownish pus can be extruded. With regard to aetiology, the actinomycotic reaction can be caused by a number of bacteria and fungi, but is typically caused by infection with *Actinomyces bovis, Staphylococcus aureus, Corynebacterium pseudotuberculosis* or *Truepella pyogenes*. The classic form of actinomycosis is localised to the jaw, particularly the mandibular bones in cattle ("lumpy jaw"). In this condition, which can also occur in horses, pigs and small ruminants, *A. bovis* (in rare cases *T. pyogenes*) spreads typically to the bone marrow of the jaw via lesions around the teeth and/or by lymphatic spread from lesions in the oral mucosa. Localisation in the bone marrow results in development of a massive, fibrosing, pyogranulomatous osteomyelitis, from which fistulae often develop that may discharge to the oral mucosa and even the surface of the skin. In the infected bones, an advanced necrotic condition develops with extensive periostal bone formations. A further characteristic is loss of the teeth from the affected areas of the jaw. Lymphatic dissemination can occur from the site in the bone, to the regional lymph nodes or even the surrounding jaw muscles. In addition to the classic bone localisation of the actinomycotic reaction ("bone actinomycosis"), it also occasionally occurs in soft tissues such as the testicles in bulls and deep bursas in horses, where the infection is most probably the result of haematogenous spread.

Actinobacillosis [20.42 – 20.47]

Actinobacillus lignieresii is the cause of actinobacillosis, for which the morphological, histological and gross lesions are the same as those described for actinomycosis. Actinobacillosis, which was previously called "soft tissue actinomycosis" is best known in connection with local infection of the tongue in cattle ("wooden tongue"), in which the tongue becomes hard due to massive fibrosis. At examination of a cross section of the tongue, the muscle will appear pale due to the fibrosis, with localised, multiple, small purulent foci. The tissue around the lesions is grey due to the granulomatous reaction. The condition which is also found in horses, pigs and small ruminants, is often associated with spread to the regional lymph nodes where the same type of lesions can be found. Local invasion of the jaw muscles may also be seen.

In addition to localisation in the tongue, *A. lignieresii* can also infect other soft tissues such as the pharynx, skin, and forestomach of ruminants. In generalised infections, embolic pneumonia develops in which the lesions are disseminated, irregular, fibrotic, with central suppuration. It is essential in cattle to distinguish disseminated pulmonary actinobacillous lesions from disseminated spread of emboli from carcinomas originating in the uterus. This differentiation is important at meat inspection because metastatic uterine carcinomas always necessitate total condemnation, while the presence of encapsulated and demarcated pyogranulomatous lesions arising in connection with generalised infec-

tion (pyaemia), and in the absence of complications, can be approved for deboning. *A. lignieresii* can also cause aerogenic infection of lungs, and can in this case cause development of a mainly cranially located multifocal, pyogranulomatous bronchopneumonia.

Botryomycosis [20.48 – 20.52]

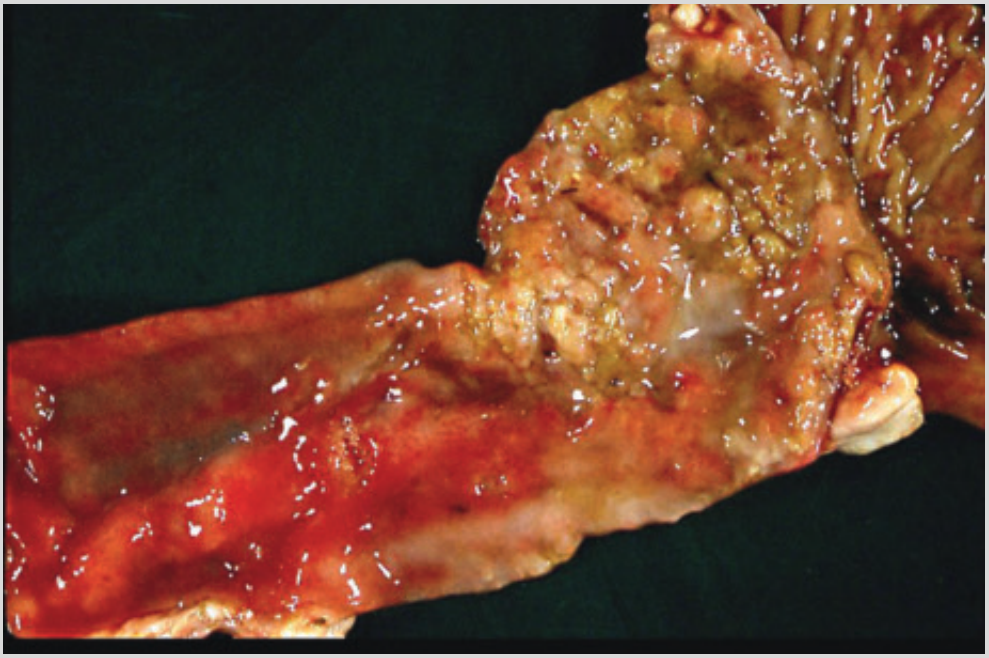
Staphylococcus aureus is the causative agent in botryomycosis, which macroscopically is principally identical with actinomycosis and actinobacillosis. Histologically, the condition can in some cases be distinguished from the two other pyogranulomatous inflammations, because the so-called club-shaped configurations (asteroid bodies or Splendore-Hoeppli phenomena) appear as a homogenous, eosinophilic capsule surrounding the centrally-located bacterial colony. The term botryomycosis refers therefore exclusively to pyogranulomatous lesions caused by S. *aureus.* These lesions occur, as with actinomycotic and actinobacillous lesions, at localisations typical to the different species. In pigs, botryomycosis is found particularly in the skin distally on the extremities, ears, and udder. Botryomycotic lesions on the ears give rise to elephantiasis, a term covering massive progressive fibrosis of the skin due to chronic lymphoedema. The condition occurs due to development of pyogranulomatous lymphangitis with associated obstructed lymph drainage, oedema, and concomitant compression of the lymph vessels. In the majority of cases of elephantiasis, lymphatic spread occurs to the regional lymph nodes where pyogranulomatous lymphadenitis develops. Frequently, the purulent content of elephantiasis is inconspicuous, and it can be difficult to see at gross examnation that the lesion is in fact pyogranulomatous. When localised in the skin of the udder, the botryomycotic lesions typically occur as conglomerates of abscesses often with fistular discharges to the skin surface. Botryomycotic lesions are also seen regularly in castration wounds in pigs. Also in horses, botryomycosis develops mainly in castration wounds, and locally in the skin and underlying fascie and muscles in connection with secondarily infected compression injuries.

Other pyogranulomatous inflammations [20.53 – 20.59]

Infection with *Rhodococcus equi* is a well-known cause of granulomatous bronchopneumonia in foals younger than about 6 months. The lesions in the lungs will often be highly purulent, and occur as conglomerate-like formations. In horses, the infection is occasionally seen in other organs, especially the intestines, where ulcerating enterocolitis can develop. Frequently, granulomatous lymphadenitis will develop in the regional lymph nodes concomitantly with lesions in the draining organ. The cervical, and in particular the mandibular, lymph nodes in various species are regularly infected with *R. equi*. Lesions caused by *R. equi* in the mandibular lymph nodes particularly in pigs can easily be confused with tuberculosis, because the lesions are comprised of small, yellow, necrotic lesions that are similar to the lesions that occur in the lymph nodes at infection with *M. avium* subsp. *avium*. Nevertheless, well-developed lesions can often be distinguished from the mycobacteria-caused lesions because they are surrounded by a distinct connective tissue capsule, which allows the central, necrotic area (caseous tissue), with or

without calcification, to be easily loosened from the surroundings. More acute *R. equi* lesions however lack this surrounding connective tissue capsule, and therefore do not appear clearly demarcated from the surroundings. But older mycobacterial lesions will at times be encapsulated and loose, and thus demarcated similarly to the lesions caused by *R. equi.* Differentiating between the two infections is therefore very uncertain on gross examination, and laboratory investigations (e.g. Ziehl-Neelsen staining of smear preparations) are often necessary to determine the aetiology based on the shape of the bacteria. At meat inspection, lesions caused by *R. equi* and *M. avium* subsp. *avium* in the mandibular lymph nodes necessitate, if they occur locally, removal of the lymph nodes.

20.01



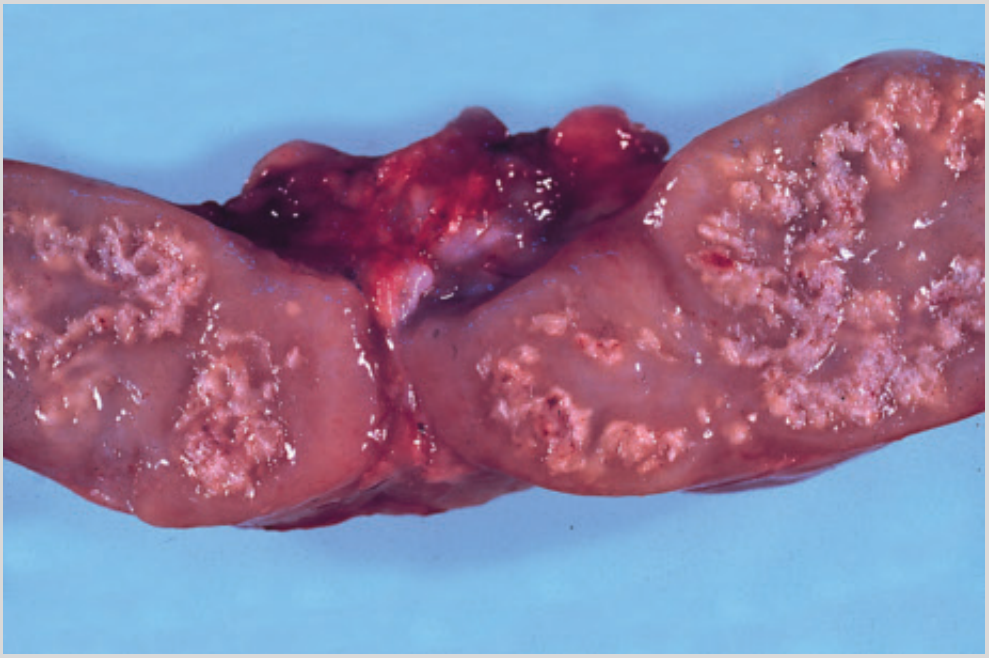
Animal species/Organ	Goat/Duodenum
Lesion	Chronic, necrotising and granulomatous enteritis (tuberculoid form)
Scoring	Partial condemnation
Comments	Due to infection with *Mycobacterium bovis*

20.02



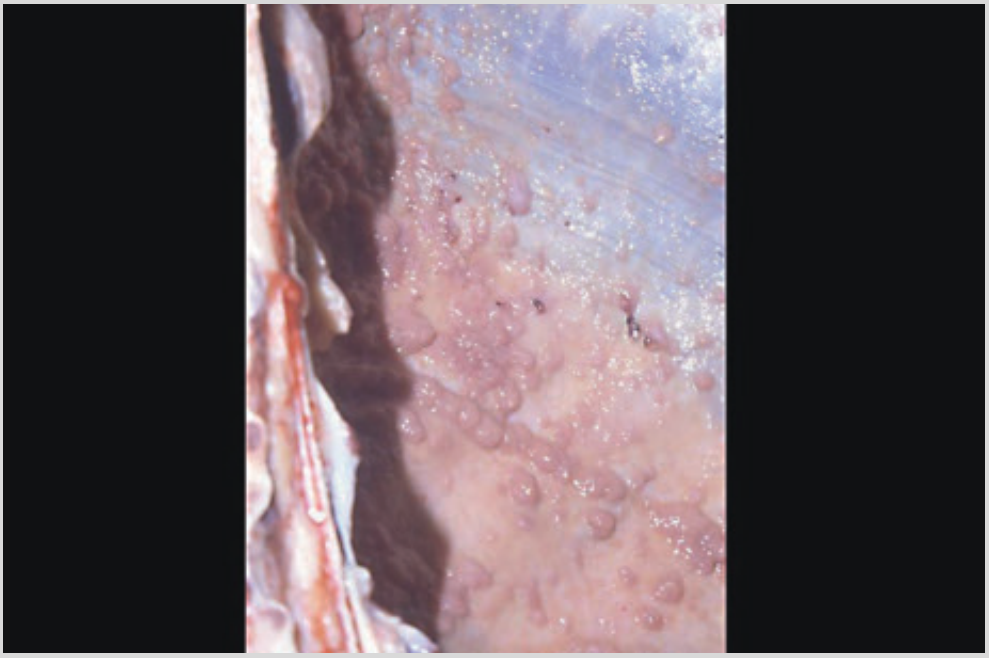
Animal species/Organ	Sheep/Jejunum
Lesion	Chronic, segmental, diffuse, proliferative and granulomatous enteritis (lepromatous form) (Johne's disease)
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

20.03



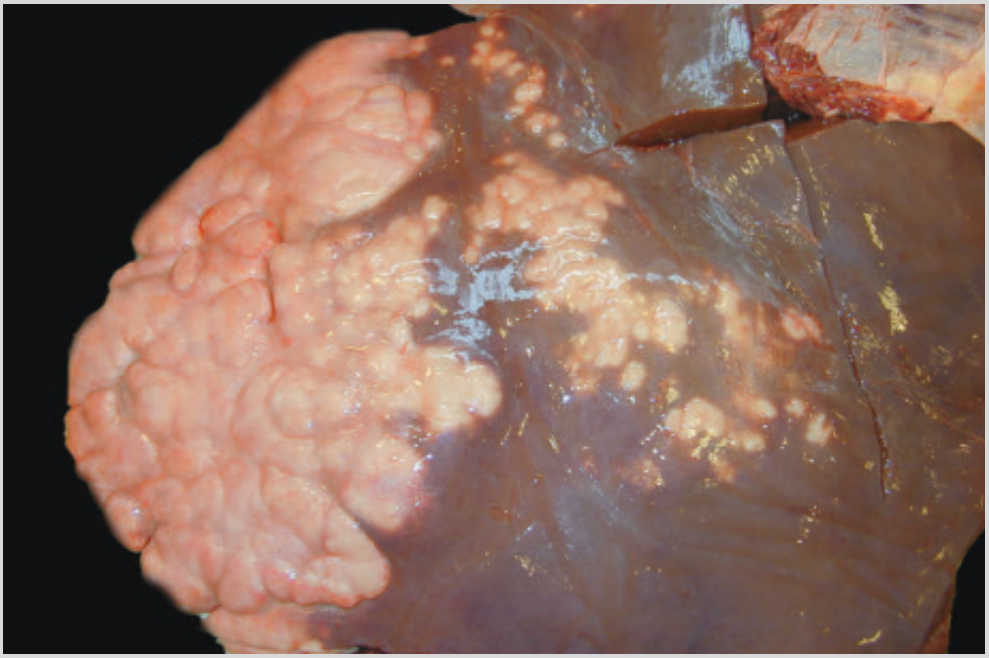
Animal species/Organ	Pig/Mesenteric lymph node (cross section)
Lesion	Chronic, caseous and granulomatous lymphadenitis
Scoring	Partial condemnation
Comments	Due to infection with *Mycobacterium avium* subsp. *avium*

20.04



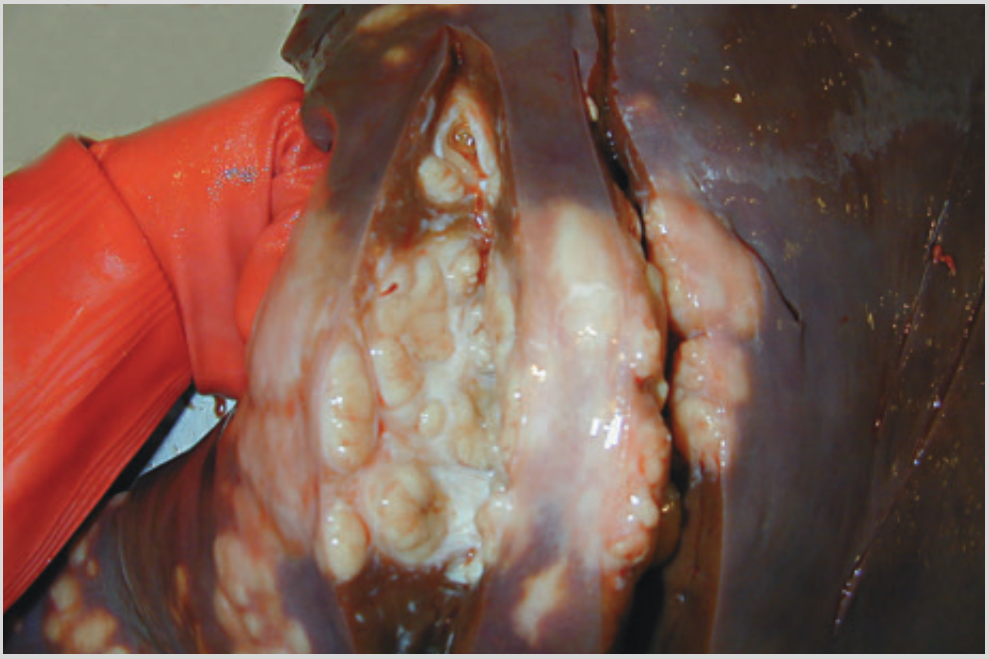
Animal species/Organ	Cattle/Peritoneum
Lesion	Chronic, confluating, granulomatous peritonitis (“pearl disease”)
Scoring	Total condemnation
Comments	Due to infection with *Mycobacterium bovis*

20.05



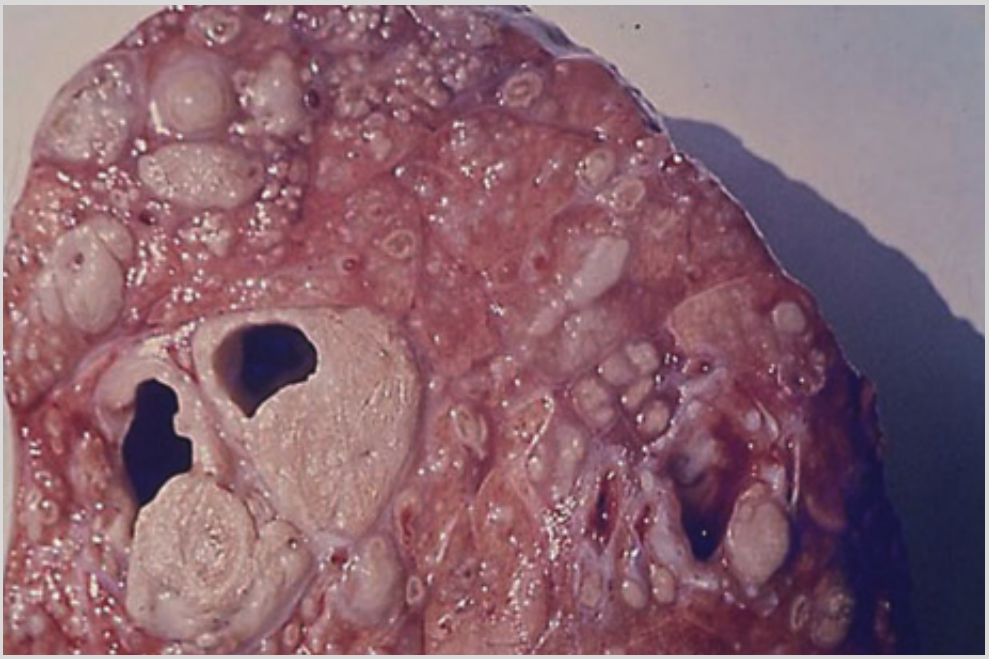
Animal species/Organ	Cattle/Liver
Lesion	Chronic, locally extensive, granulomatous hepatitis
Scoring	Partial condemnation
Comments	Unknown aetiology. Samples must be submitted for laboratory investigation

20.06



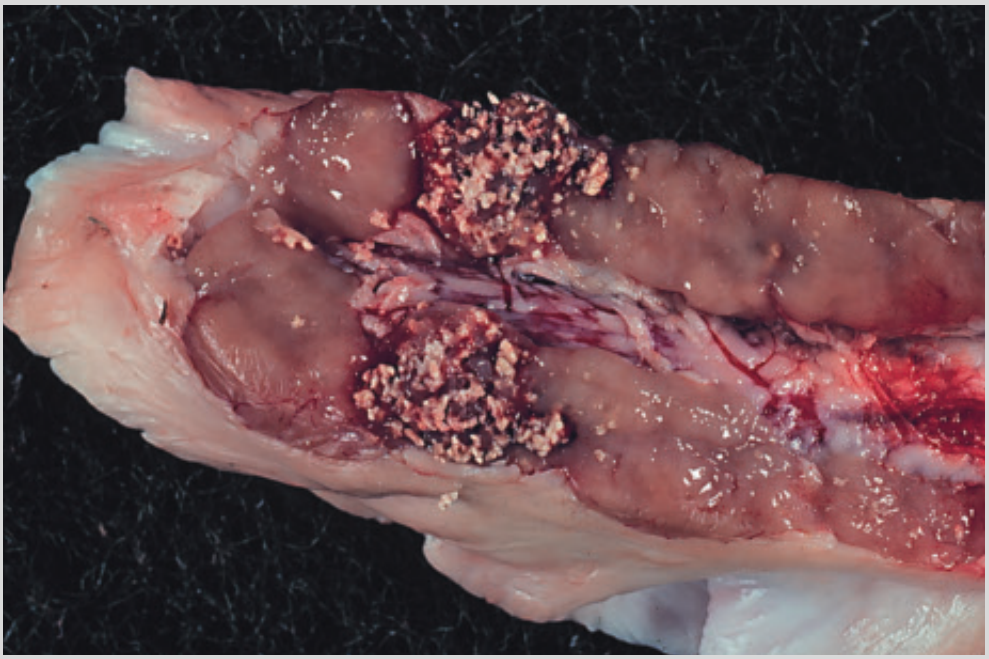
Animal species/Organ	Cattle/Liver (close-up of 20.05)
Lesion	Chronic, locally extensive, granulomatous hepatitis
Scoring	Partial condemnation
Comments	Unknown aetiology. Samples must be submitted for laboratory investigation

20.07



Animal species/Organ	Cattle/Lung
Lesion	Chronic, multifocal, caseous, and granulomatous pneumonia
Scoring	Total condemnation
Comments	Due to haematogenous spread of *Mycobacterium bovis*

20.08



Animal species/Organ	Pig/Mesenteric lymph node
Lesion	Chronic, caseous lymphadenitis
Scoring	Partial condemnation
Comments	Due to infection withh *Mycobacterium avium* subsp. *avium*

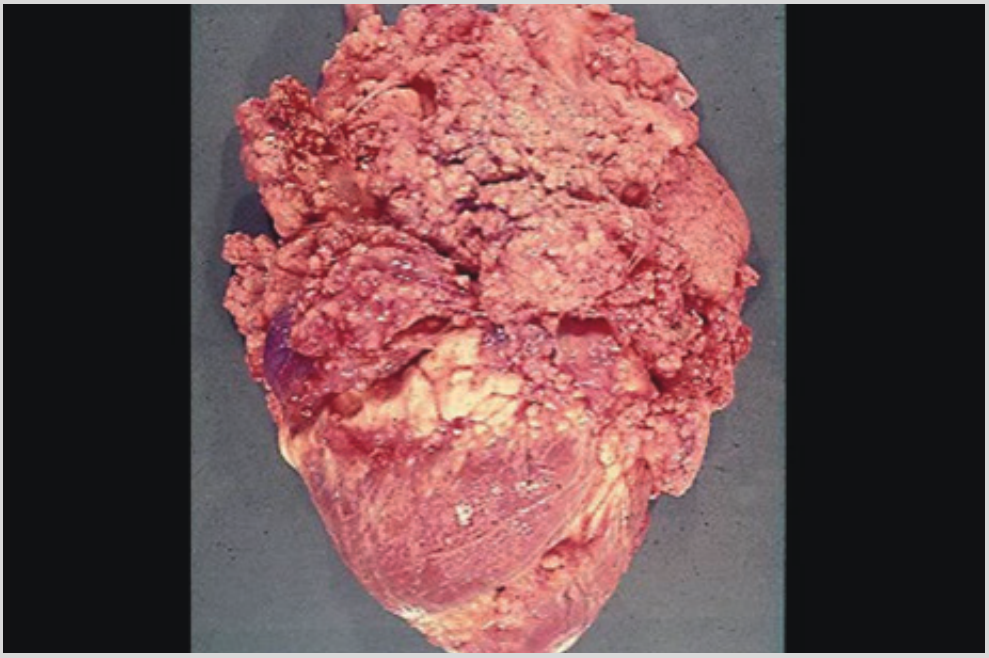
20.09



20.10

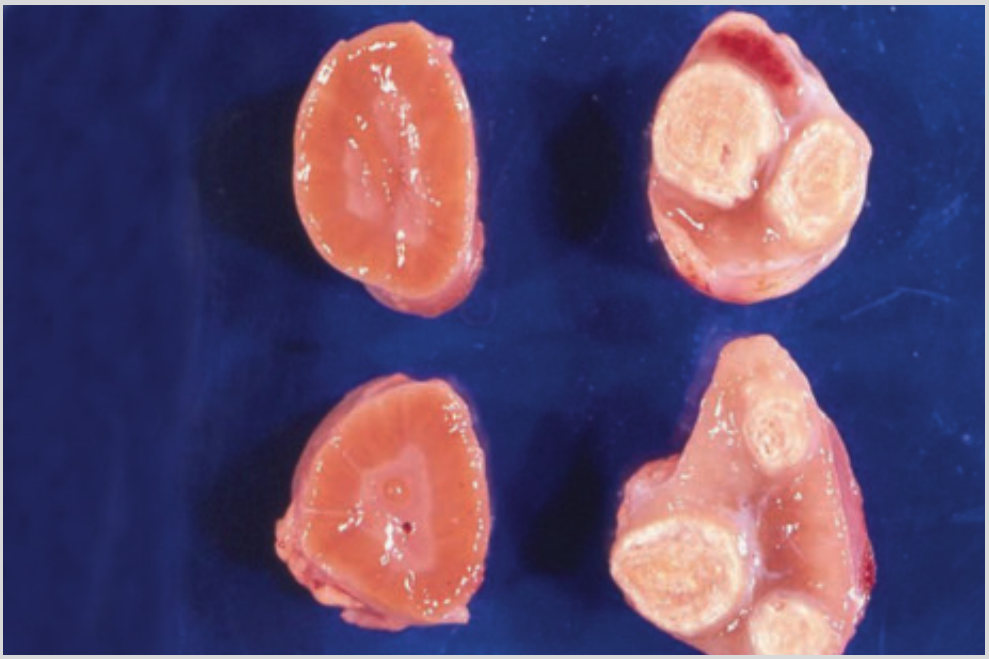
Animal species/Organ	Cattle/Peritoneum
Lesion	Chronic, diffuse, granulomatous peritonitis
Scoring	Total condemnation
Comments	Due to infection with *Mycobacterium bovis*

20.10



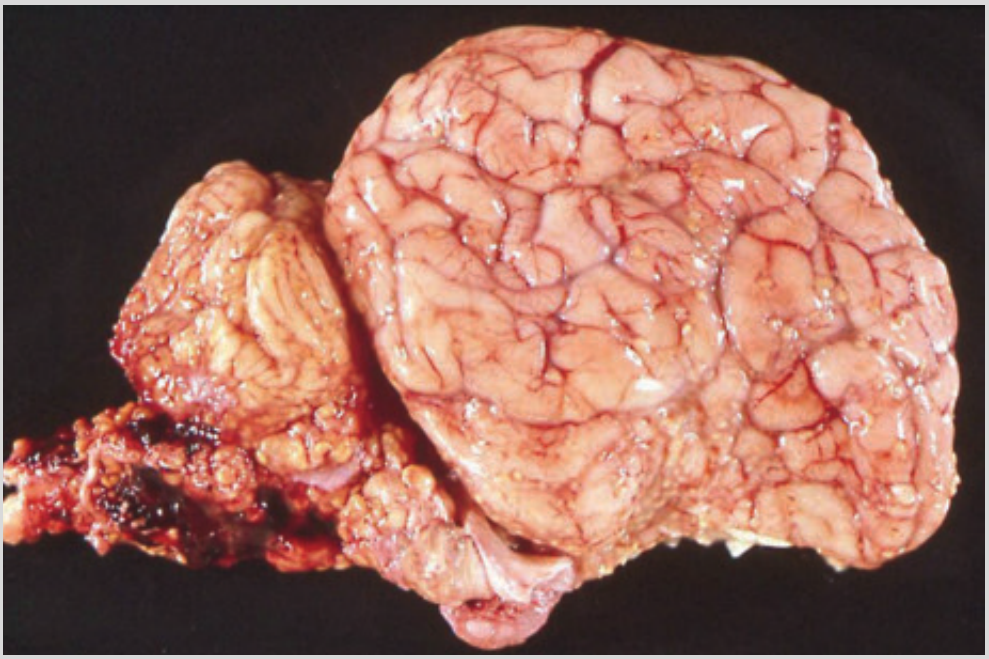
Animal species/Organ	Cattle/Heart
Lesion	Chronic, localised, granulomatous myo- and pericarditis
Scoring	Total condemnation
Comments	Due to infection with *Mycobacterium bovis*

20.11



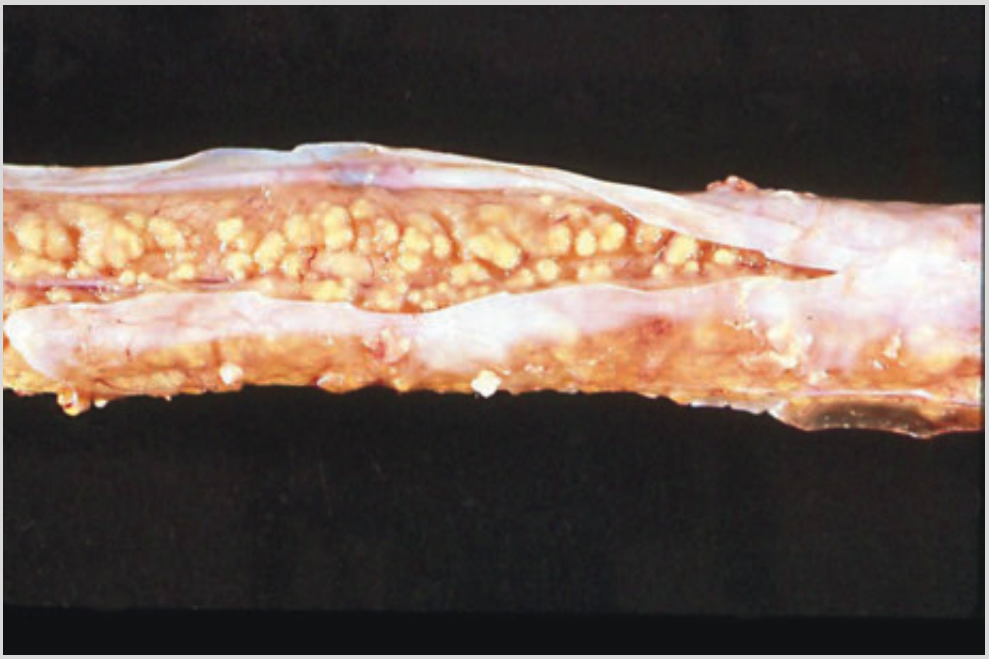
Animal species/Organ	Cattle/Adrenals (cross sections)
Lesion	Chronic, multifocal, caseous, and granulomatous adrenalitis
Scoring	Total condemnation
Comments	Due to infection with *Mycobacterium bovis*

20.12



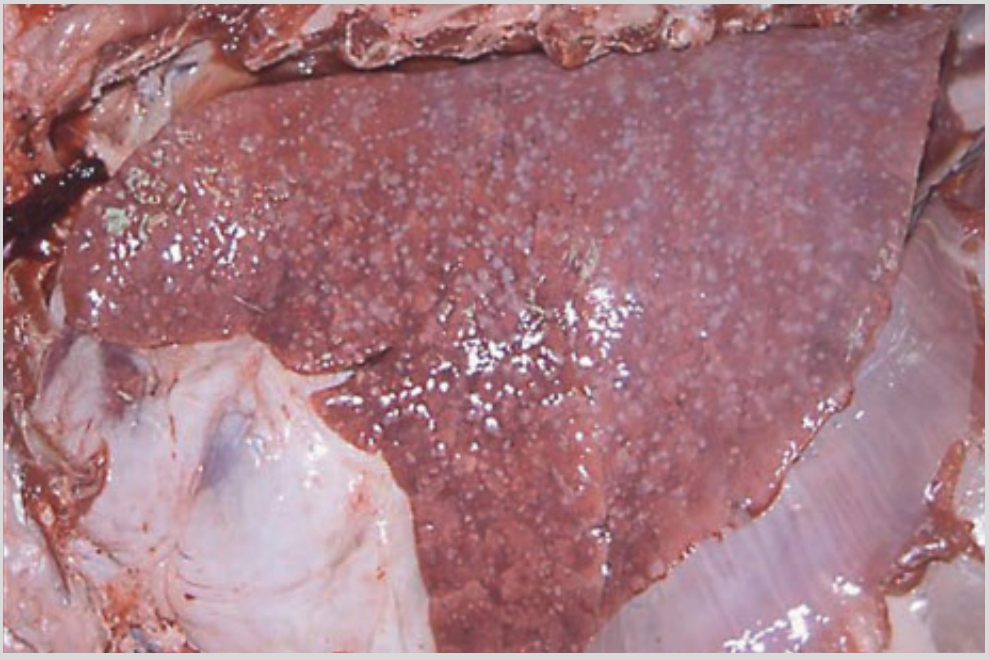
Animal species/Organ	Cattle/Brain
Lesion	Chronic, disseminated, granulomatous encephalitis and meningitis
Scoring	Total condemnation
Comments	Due to infection with *Mycobacterium bovis*

20.13



Animal species/Organ	Cattle/Spinal cord
Lesion	Chronic, disseminated, granulomatous meningitis
Scoring	Total condemnation
Comments	Due to infection with *Mycobacterium bovis*

20.14



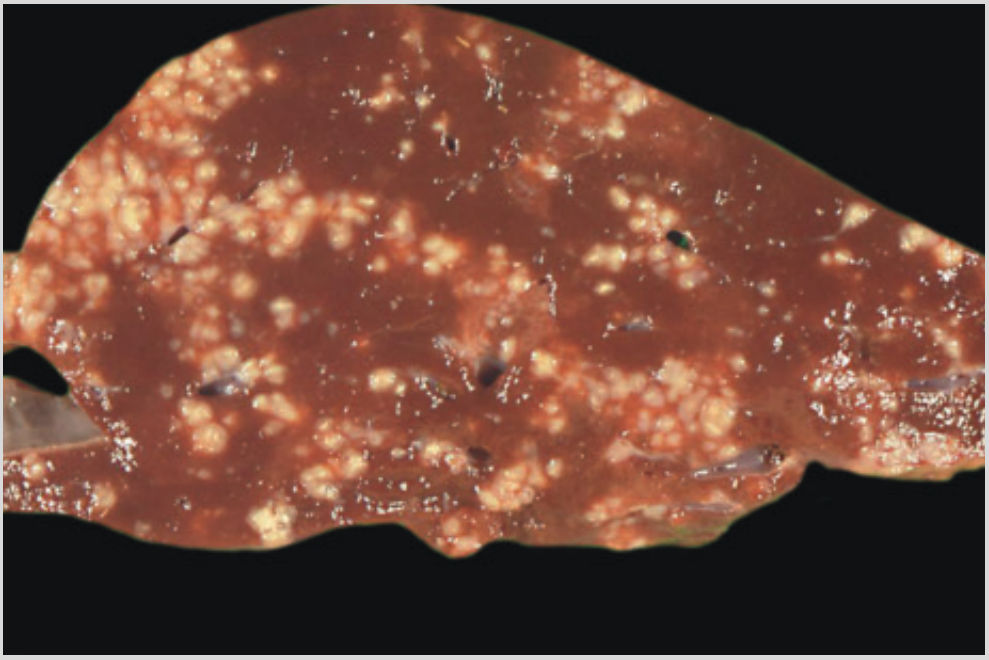
Animal species/Organ	Cattle/Lung
Lesion	Chronic, disseminated, granulomatous pneumonia
Scoring	Total condemnation
Comments	Due to haematogenous spread of *Mycobacterium bovis*

20.15



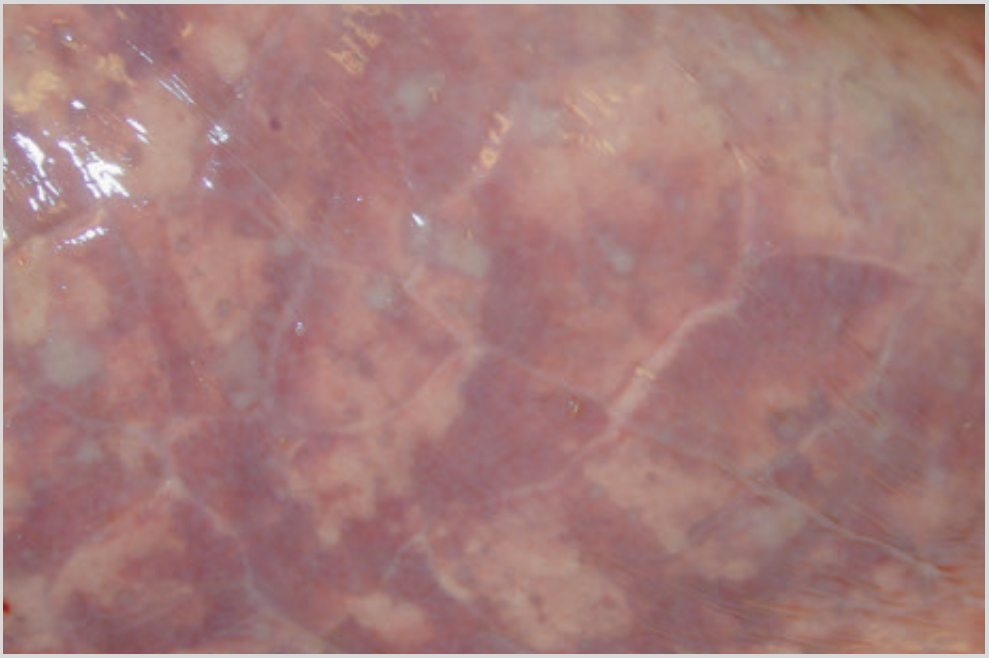
Animal species/Organ	Goat/Lung
Lesion	Chronic, localised, caseous, and granulomatous pneumonia
Scoring	Partial condemnation
Comments	Samples must be submitted for laboratory investigation

20.16



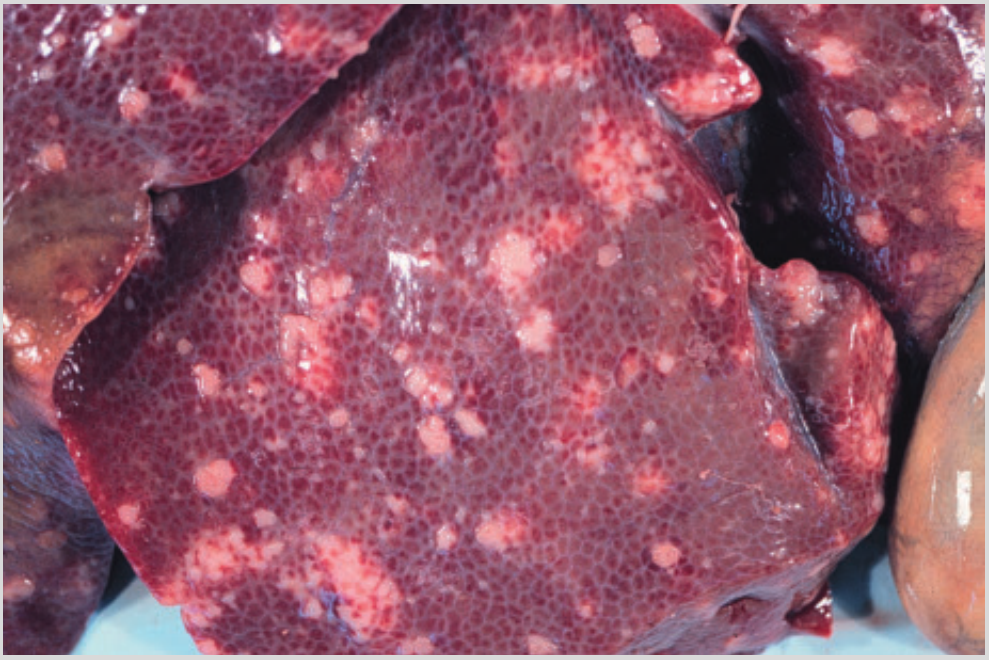
Animal species/Organ	Goat/Liver
Lesion	Chronic, disseminated, granulomatous hepatitis
Scoring	Total condemnation
Comments	Due to infection with *Mycobacterium bovis*

20.17



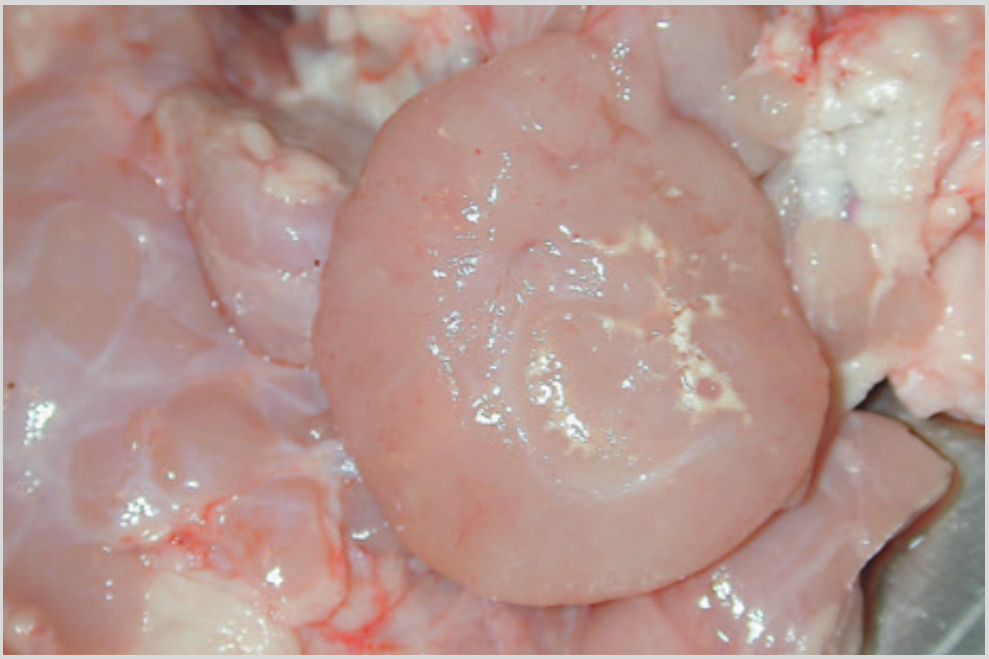
Animal species/Organ	Pig/Lung
Lesion	Chronic, disseminated, granulomatous pneumonia
Scoring	Total condemnation
Comments	Due to haematogenously spread infection with *Mycobacterium avium* subsp. *avium*

20.18



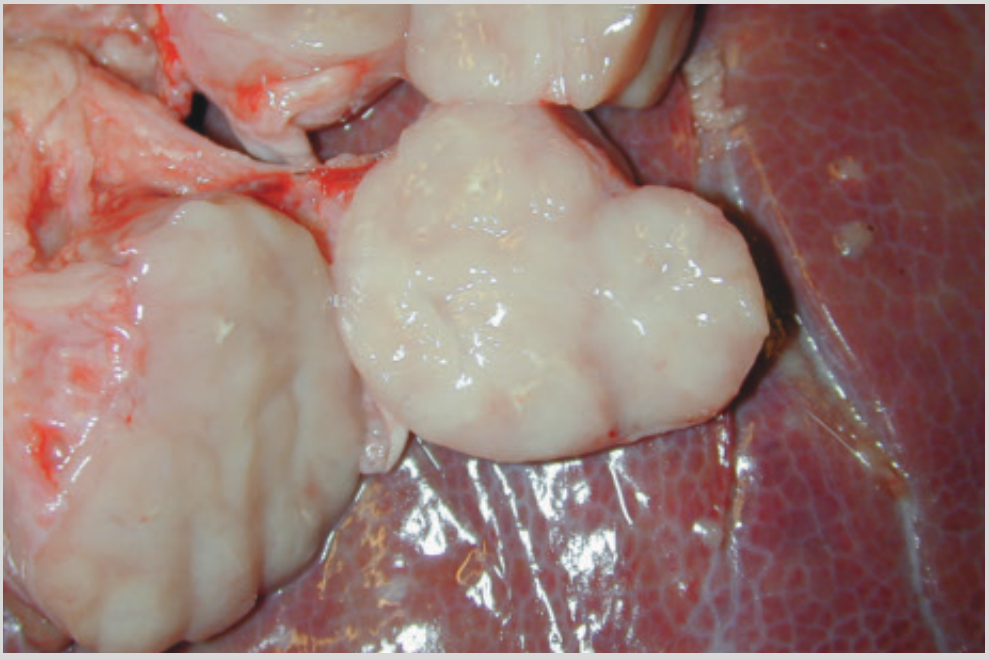
Animal species/Organ	Pig/Liver
Lesion	Chronic, disseminated, granulomatous hepatitis
Scoring	Partial condemnation
Comments	Due to infection with *Mycobacterium avium* subsp. *avium* (spread via the portal venous system)

20.19



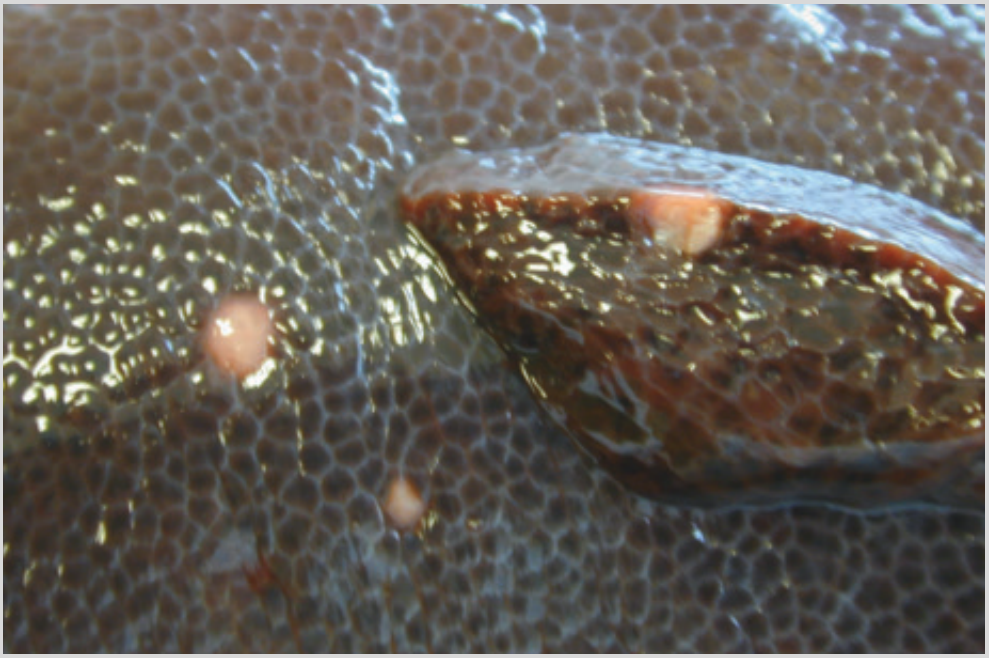
Animal species/Organ	Pig/Mediastinal lymph node
Lesion	Chronic, diffuse, granulomatous lymphadenitis
Scoring	Total condemnation
Comments	Due to infection with *Mycobacterium avium* subsp. *avium* (after haematogenous spread to the lungs)

20.20



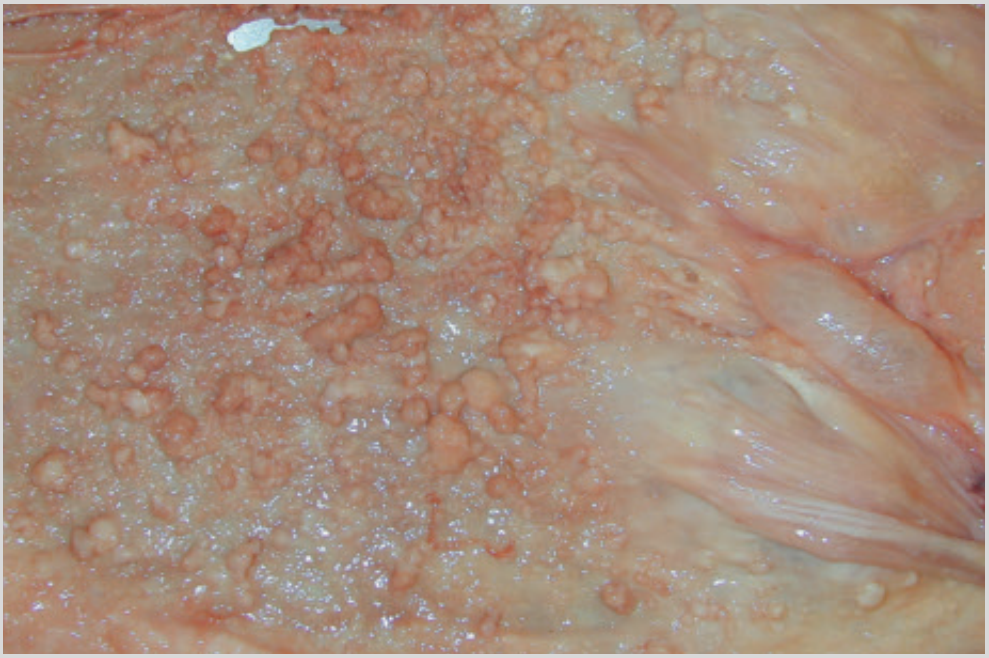
Animal species/Organ	Pig/Portal lymph node
Lesion	Chronic, diffuse, granulomatous lymphadenitis
Scoring	Partial condemnation
Comments	Due to infection with *Mycobacterium avium* subsp. *avium* (primary spread via portal venous system)

20.21



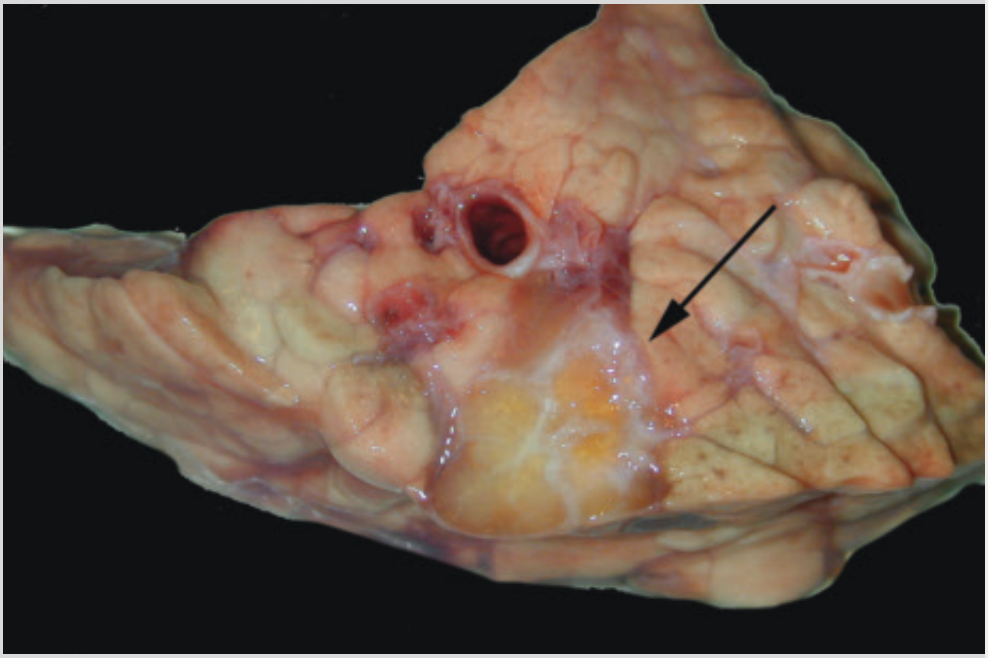
Animal species/Organ	Pig/Liver
Lesion	Lymphadenopathies
Scoring	Partial condemnation
Comments	An important differential diagnosis for mycobacteriosis caused by *Mycobacterium avium* subsp. *avium* in pigs

20.22



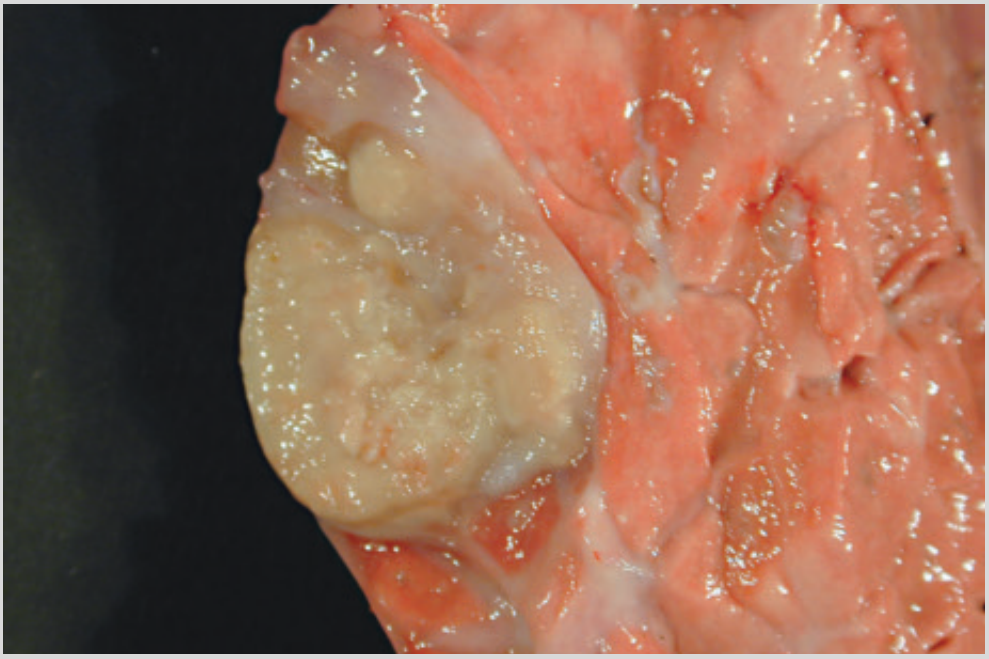
Animal species/Organ	Cattle/Peritoneum
Lesion	Chronic, diffuse, fibrous peritonitis
Scoring	Partial condemnation
Comments	The nodular appearance can be reminiscent of "pearl disease". An alternate differential diagnosis is mesothelioma

20.23



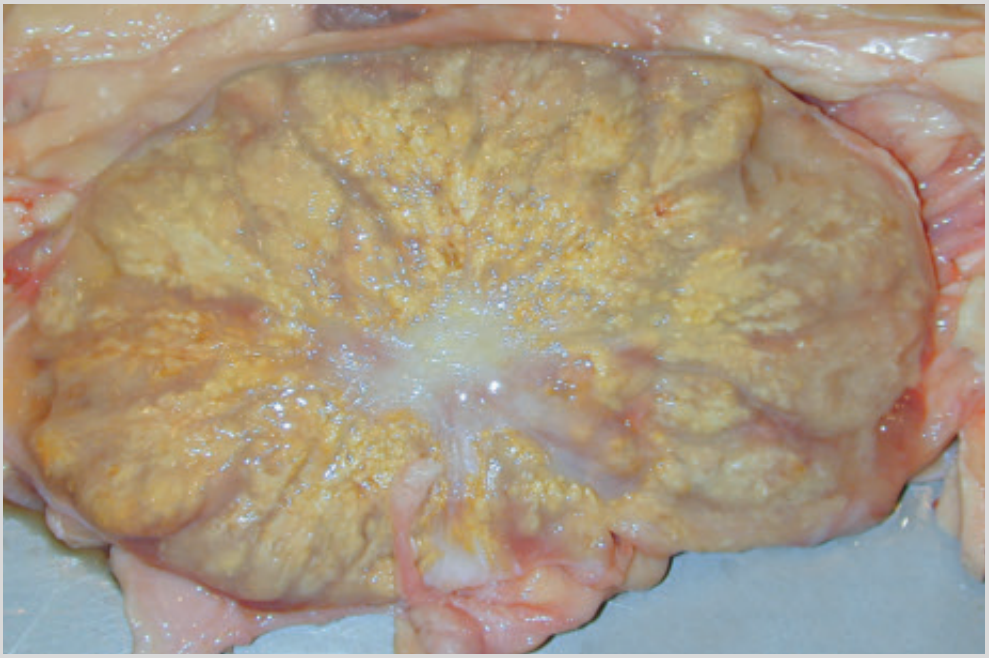
Animal species/Organ	Cattle/Lung
Lesion	Metastatic carcinoma (uterine carcinoma) (→)
Scoring	Total condemnation
Comments	Neoplastic metastases (note the yellow colour) can be confused with granulomatous inflammations

20.24



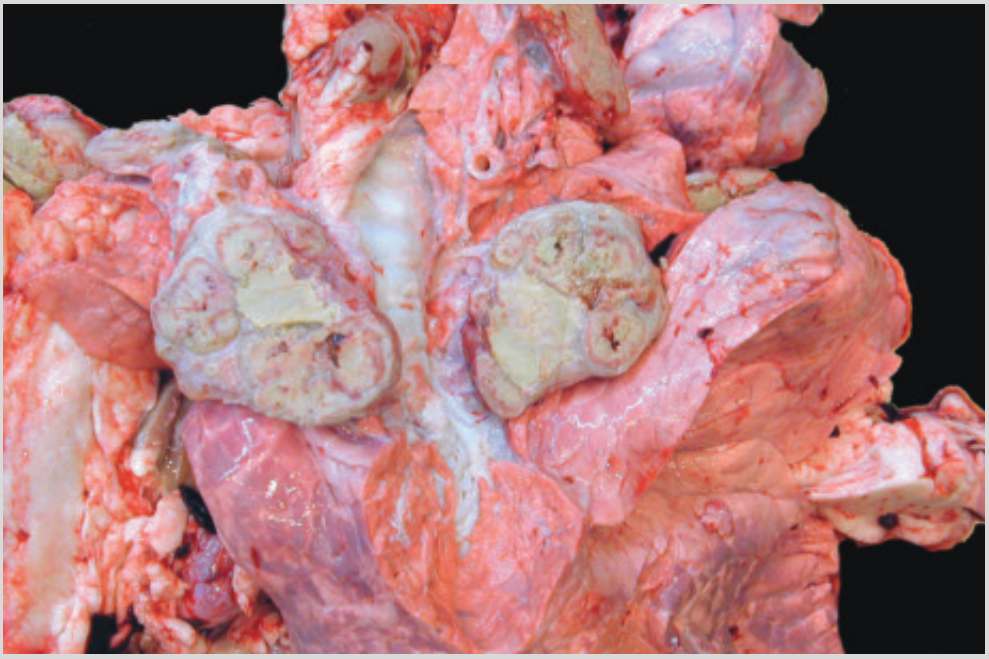
Animal species/Organ	Cattle/Lung
Lesion	Metastatic carcinoma (uterine carcinoma)
Scoring	Total condemnation
Comments	Neoplastic metastases can be confused with granulomatous inflammations

20.25



Animal species/Organ	Cattle/Lymph node (cross section)
Lesion	Metastatic carcinoma (uterine carcinoma)
Scoring	Total condemnation
Comments	Neoplastic metastases can be confused with granulomatous inflammations

20.26



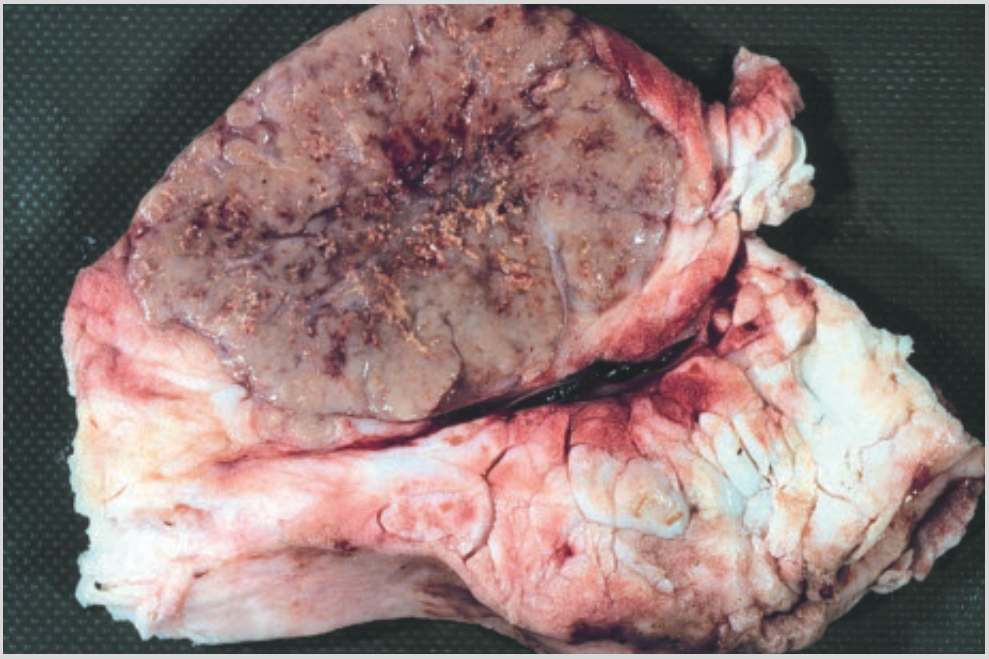
Animal species/Organ	Cattle/Lung with mediastinal lymph nodes
Lesion	Chronic, caseous, and granulomatous lymphadenitis
Scoring	Partial condemnation
Comments	Due to fungal infection

20.27



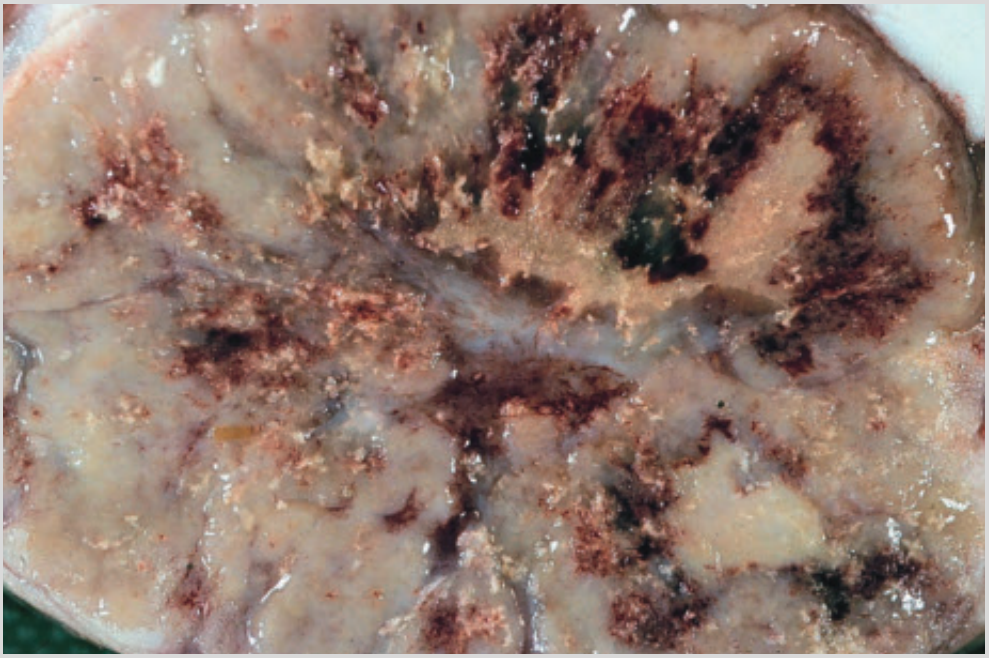
Animal species/Organ	Cattle/Lung (same case as in 20.26)
Lesion	Chronic, multifocal, caseous, and granulomatous pneumonia
Scoring	Partial condemnation
Comments	Due to fungal infection

20.28



Animal species/Organ	Cattle/Mesenteric lymph node (cross section)
Lesion	Chronic, caseous, and granulomatous lymphadenitis
Scoring	Partial condemnation
Comments	Due to fungal infection

20.29



Animal species/Organ	Cattle/Mesenteric lymph node (cut surface)
Lesion	Chronic, caseous, and granulomatous lymphadenitis
Scoring	Partial condemnation
Comments	Due to fungal infection

20.30



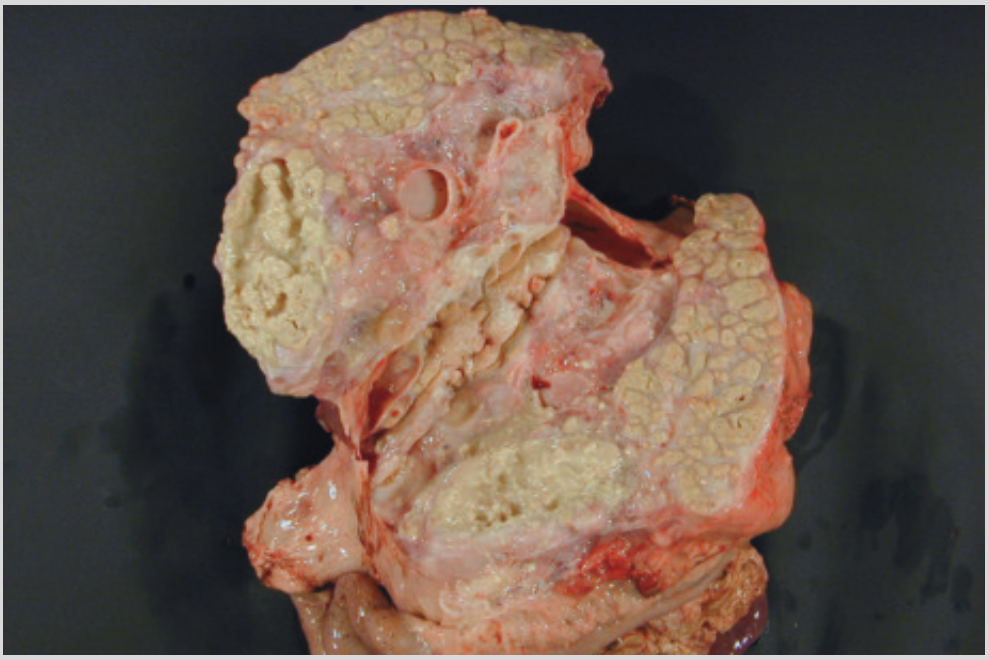
Animal species/Organ	Cattle/Uterus
Lesion	Chronic, caseous, and granulomatous endo- and myometritis
Scoring	Partial condemnation
Comments	Unknown aetiology. Samples must be submitted for laboratory investigation

20.31



Animal species/Organ	Cattle/Uterus (transverse section)
Lesion	Chronic, caseous, and granulomatous endo- and myometritis (same as in 20.30)
Scoring	Partial condemnation
Comments	Unknown aetiology. Samples must be submitted for laboratory investigation

20.32



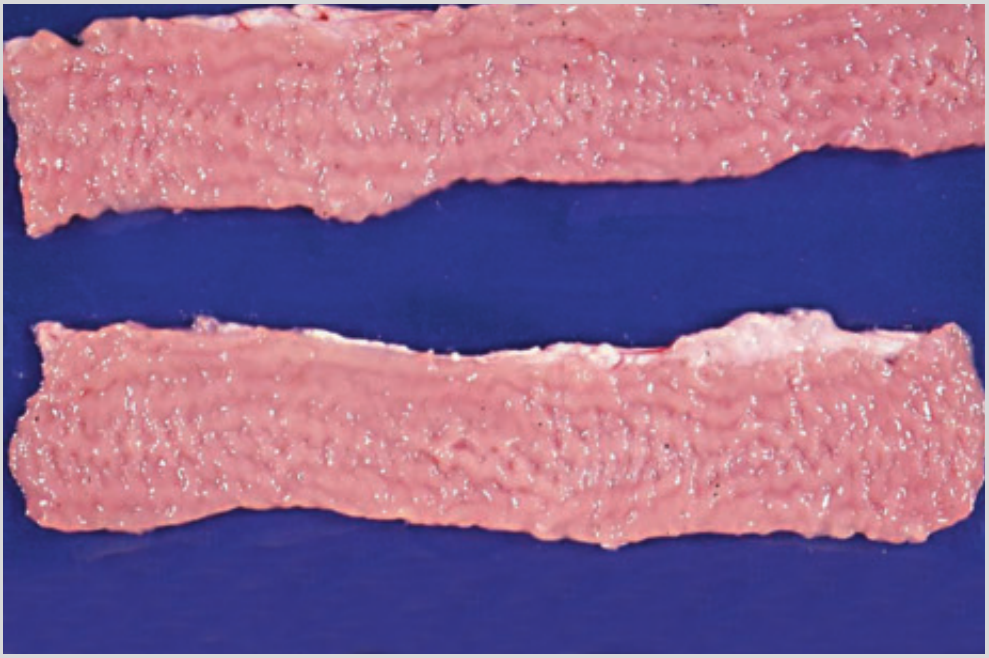
Animal species/Organ	Cattle/Mesenteric lymph node (cross section)
Lesion	Chronic, caseous, and granulomatous lymphadenitis
Scoring	Partial condemnation
Comments	Unknown aetiology. Samples must be submitted for laboratory investigation

20.33



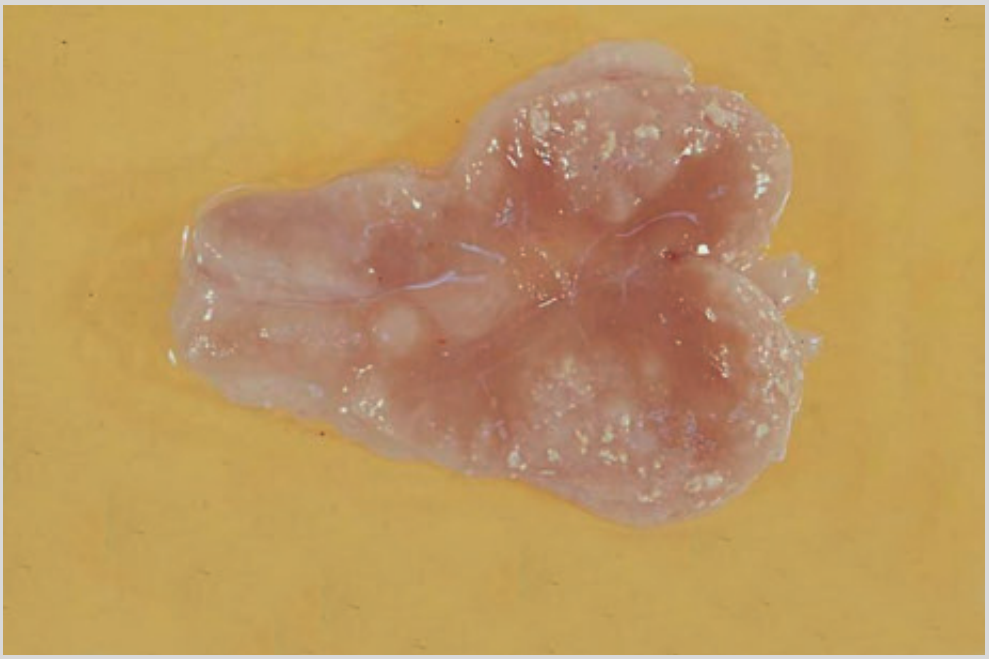
Animal species/Organ	Cattle/Mesenteric lymph node (close-up of 20.32)
Lesion	Chronic, caseous, and granulomatous lymphadenitis
Scoring	Partial condemnation
Comments	Unknown aetiology. Samples must be submitted for laboratory investigation

20.34



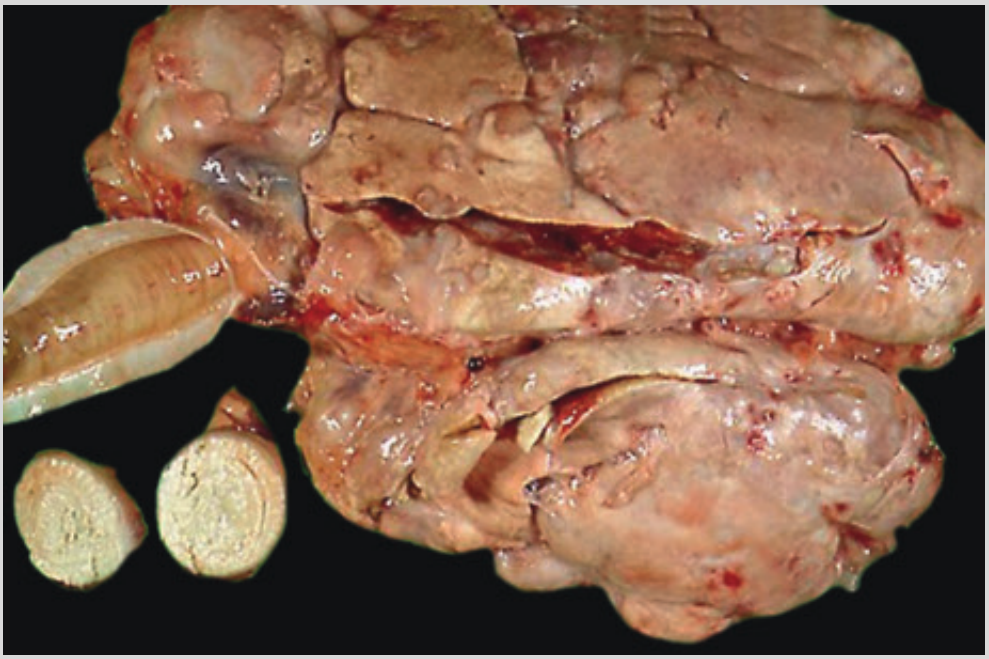
Animal species/Organ	Sheep/Jejunum
Lesion	Chronic, hyperplastic, granulomatous enteritis (lepromatous form) (Johne's disease)
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

20.35



Animal species/Organ	Sheep/Mesenteric lymph node
Lesion	Chronic, granulomatous lymphadenitis (Johne's disease)
Scoring	Partial condemnation
Comments	Presence of complications necessitates total condemnation

20.36



Animal species/Organ	Goat/Lungs with excised regional lymph nodes
Lesion	Chronic, disseminated, pneumonia with abscess formation, and regional, chronic, lymphadenitis with abscess formation (pseudotuberculosis)
Scoring	Approved for deboning
Comments	Due to infection with *Corynebacterium pseudotuberculosis*

20.37



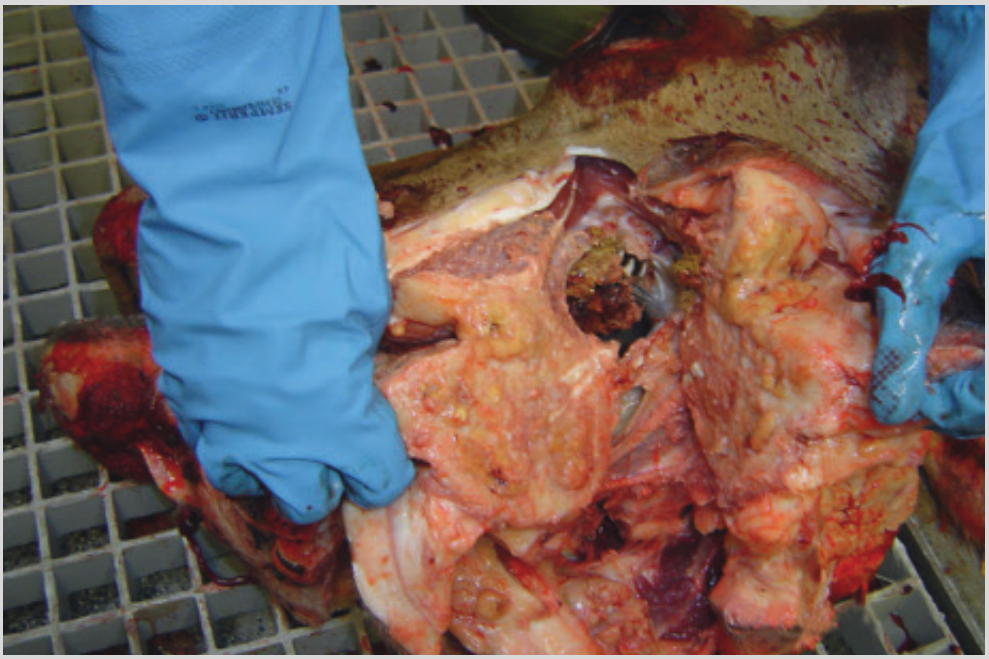
Animal species/Organ	Sheep/Superficial lymph node
Lesion	Chronic, lymphadenitis with abscess formation (pseudotuberculosis)
Scoring	Partial condemnation
Comments	Due to infection with *Corynebacterium pseudotuberculosis*

20.38



Animal species/Organ	Cattle/Head
Lesion	Chronic, pyogranulomatous, osteomyelitis in left mandible (lumpy jaw)
Scoring	Partial condemnation
Comments	Note the excessive salivation

20.39



Animal species/Organ	Cattle/Head (close-up of 20.38 with incision into the jaw)
Lesion	Chronic, pyogranulomatous, osteomyelitis in left mandible (lumpy jaw)
Scoring	Partial condemnation
Comment	Due to spread from the oral cavity

20.40



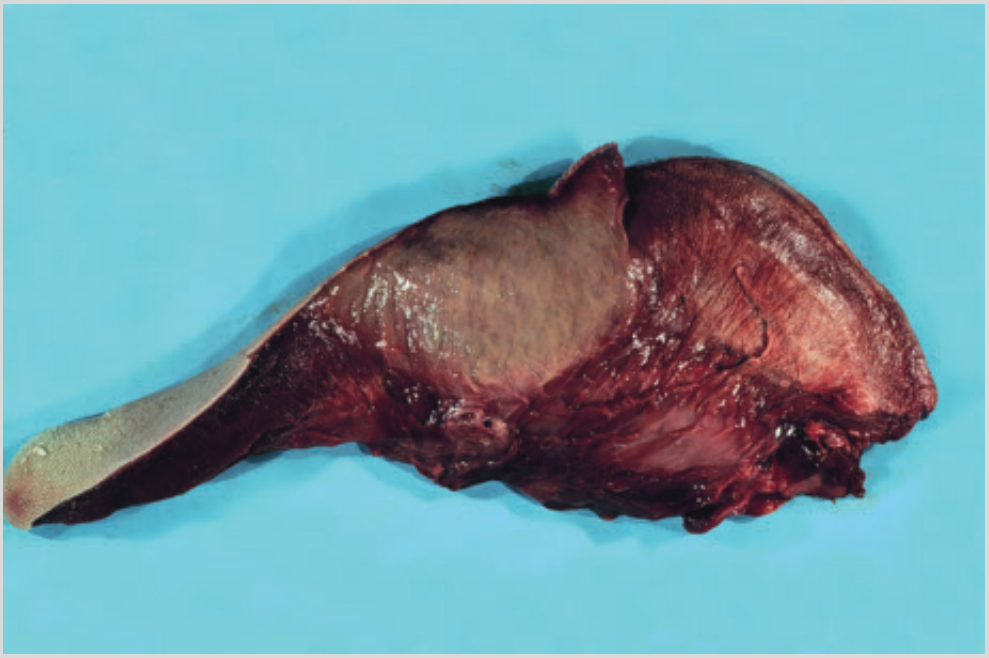
Animal species/Organ	Cattle/Rostral section of the head (cross section)
Lesion	Chronic, pyogranulomatous osteomyelitis (localised to one mandible)
Scoring	Partial condemnation
Comments	Due to spread from oral cavity lesions

20.41



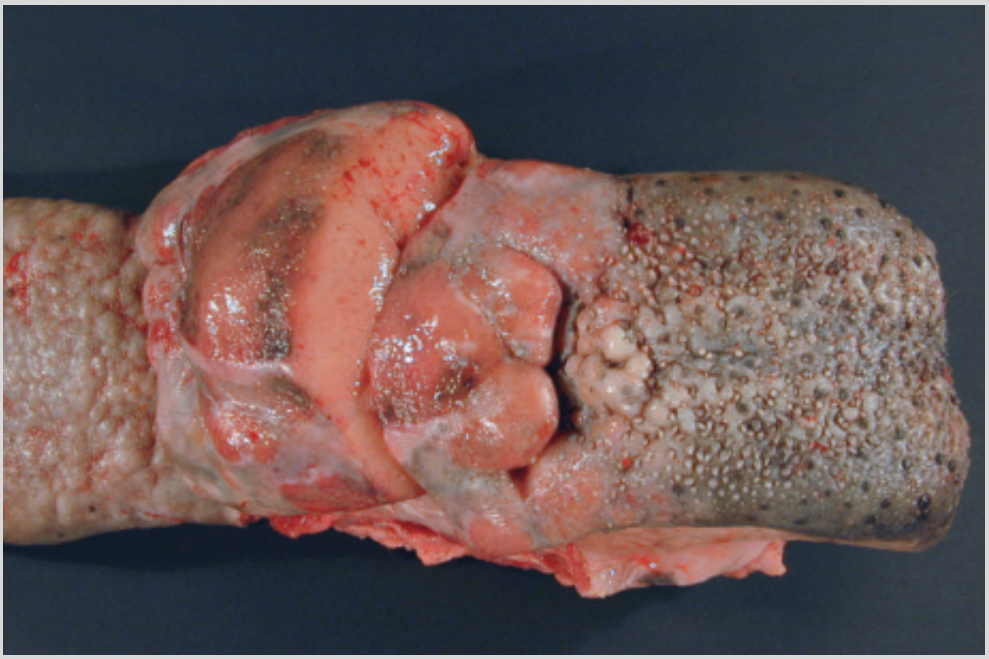
Animal species/Organ	Cattle/Mandible (close-up of 20.40)
Lesion	Chronic, pyogranulomatous osteomyelitis
Scoring	Partial condemnation
Comments	Due to spread from oral cavity lesions

20.42



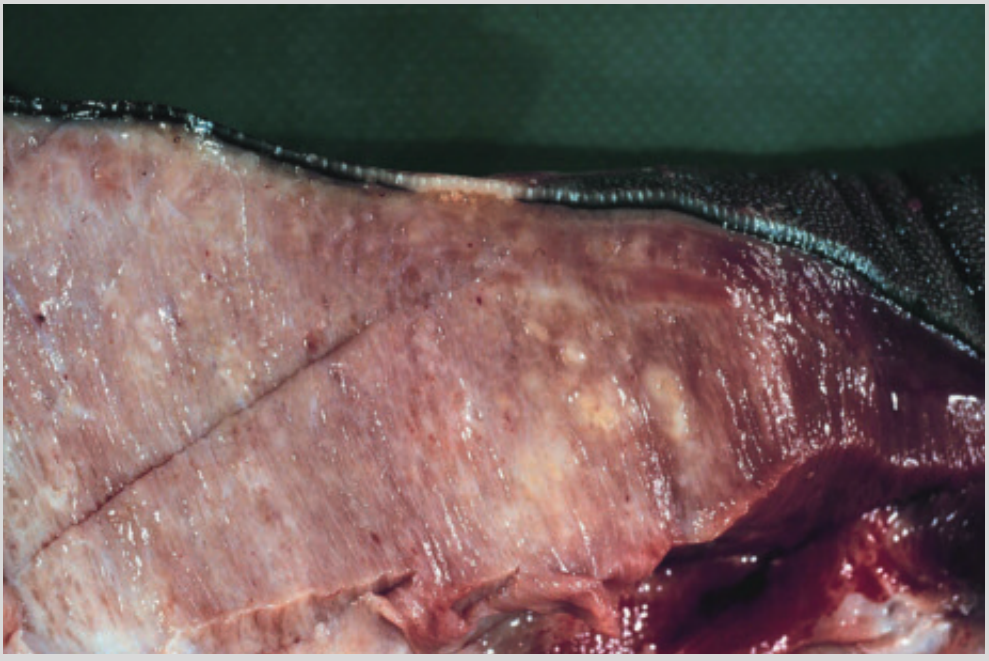
Animal species/Organ	Cattle/Tongue (cross section)
Lesion	Chronic, pyogranulomatous glossitis (“wooden tongue”)
Scoring	Partial condemnation
Comments	Due to infection with *Actinobacillus lignieresii*

20.43



Animal species/Organ	Cattle/Tongue
Lesion	Chronic, pyogranulomatous glossitis (“wooden tongue”)
Scoring	Partial condemnation
Comments	Due to infection with *Actinobacillus lignieresii*

20.44



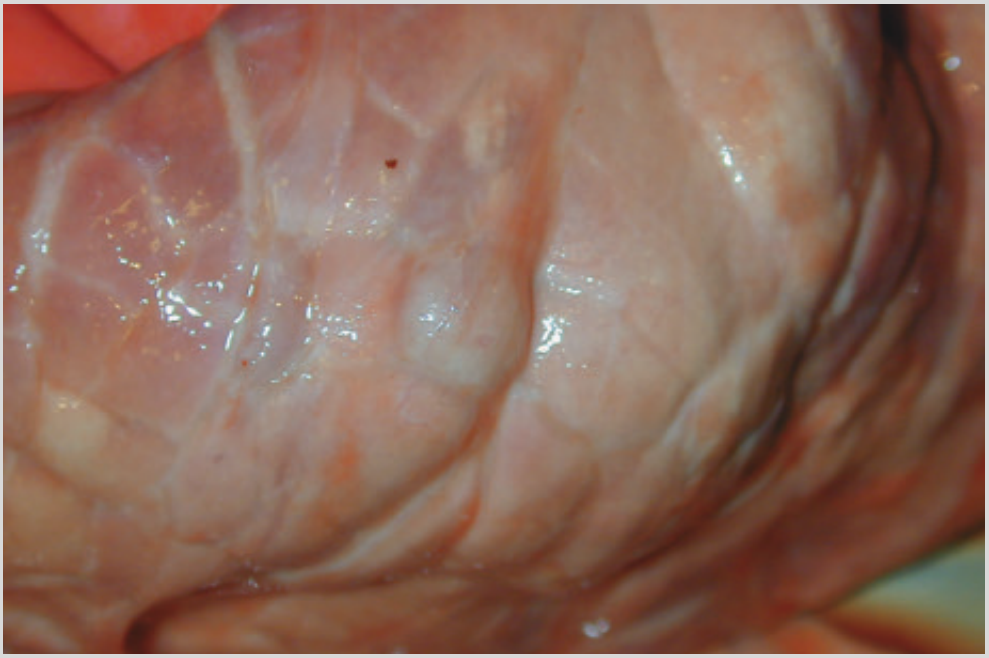
Animal species/Organ	Cattle/Tongue (cross section)
Lesion	Chronic, pyogranulomatous glossitis (“wooden tongue”)
Scoring	Partial condemnation
Comments	Due to infection with *Actinobacillus lignieresii*

20.45



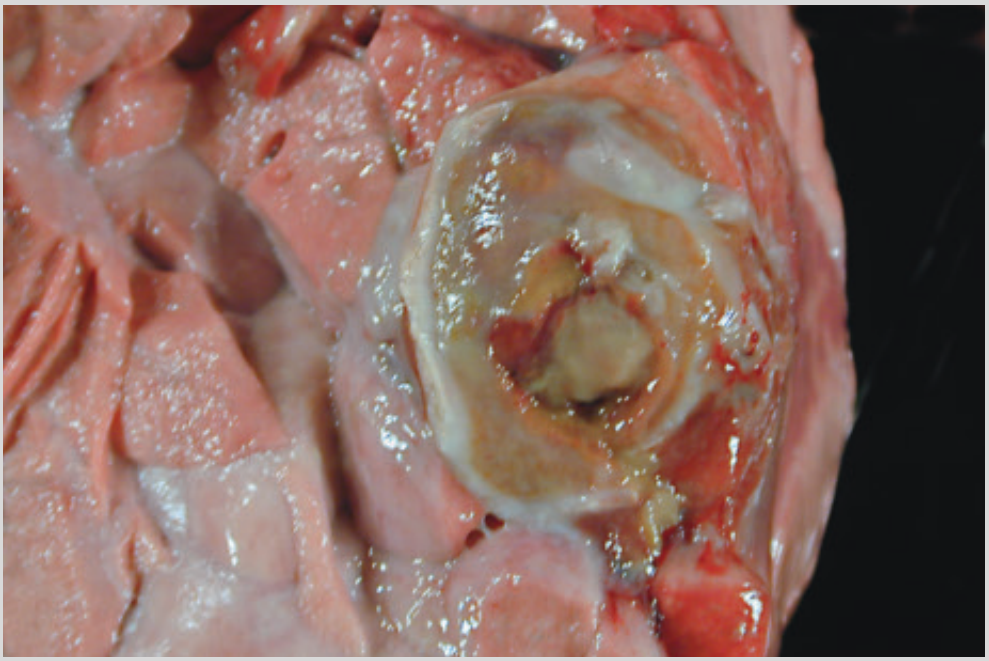
Animal species/Organ	Cattle/Masticatory muscles
Lesion	Chronic, pyogranulomatous myositis
Scoring	Partial condemnation
Comments	Due to infection with *Actinobacillus lignieresii*

20.46



Animal species/Organ	Cattle/Lung
Lesion	Chronic, disseminated, pyogranulomatous pneumonia
Scoring	Approved for deboning
Comments	Pyogranulomatous lesions can be confused with metastases from neoplasms

20.47



Animal species/Organ	Cattle/Lung
Lesion	Chronic, localised, pyogranulomatous pneumonia
Scoring	Partial condemnation
Comments	Pyogranulomatous lesions can be confused with metastases from neoplasms

20.48



Animal species/Organ	Pig/Distal section of front leg
Lesion	Chronic, fibrosing, pyogranulomatous dermatitis (elephantiasis)
Scoring	Partial condemnation
Comments	Due to infection with *Staphylococcus aureus* ("botryomycosis")

20.49



Animal species/Organ	Pig/Outer ear
Lesion	Chronic, fibrosing, pyogranulomatous dermatitis (auricular elephantiasis)
Scoring	Partial condemnation
Comments	Due to infection with *Staphylococcus aureus* (“botryomycosis”)

20.50



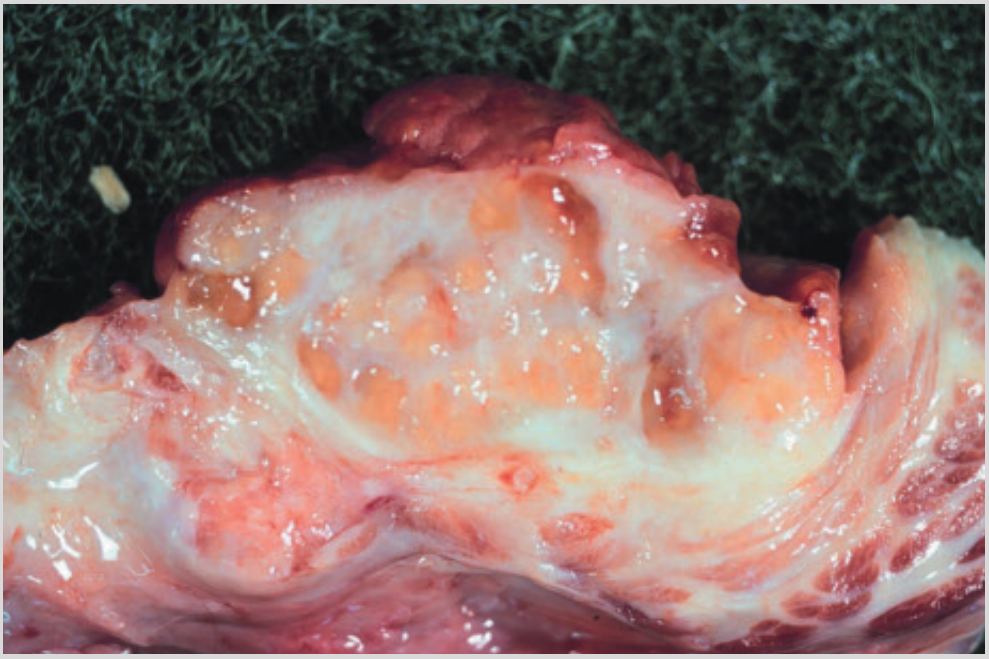
Animal species/Organ	Pig/Outer ear (cross section)
Lesion	Chronic, fibrosing, pyogranulomatous dermatitis (auricular elephantiasis)
Scoring	Partial condemnation
Comments	Due to infection with *Staphylococcus aureus* (“botryomycosis”)

20.51



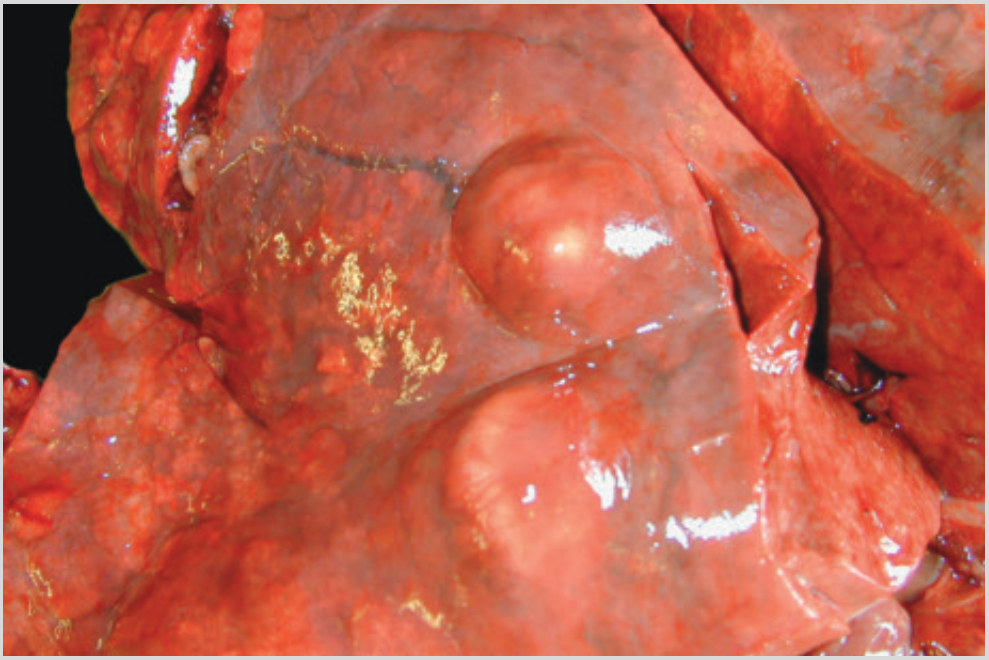
Animal species/Organ	Pig/Retropharyngeal and parotid lymph nodes
Lesion	Chronic, pyogranulomatous lymphadenitis
Scoring	Partial condemnation
Comments	Due to lymphatic spread of *Staphylococcus aureus* from auricular elephantiasis

20.52



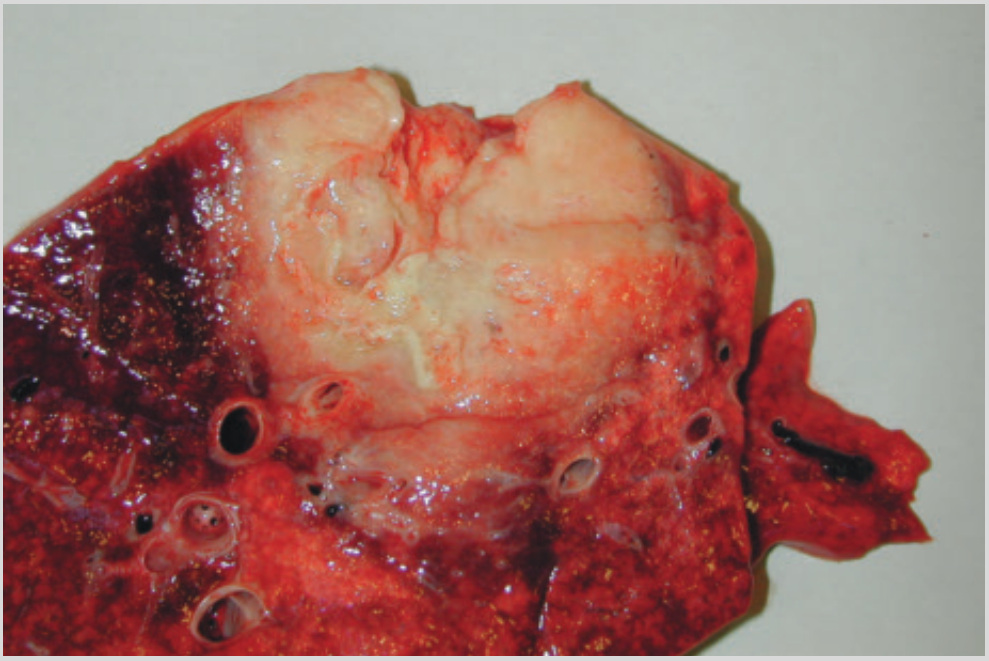
Animal species/Organ	Horse/Ductus deferens
Lesion	Chronic, pyogranulomatous funiculitis
Scoring	Partial condemnation
Comments	Due to infection with *Staphylococcus aureus* ("botryomycosis")

20.53



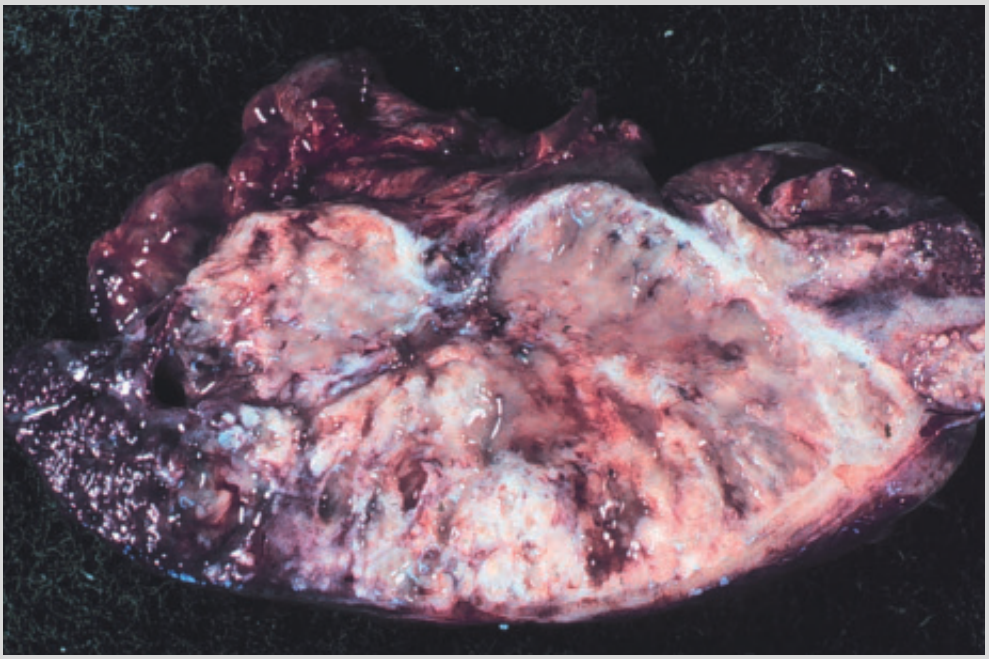
Animal species/Organ	Horse/Lung
Lesion	Chronic, pyogranulomatous bronchopneumonia
Scoring	Partial condemnation
Comments	Due to infection with *Rhodococcus equi*

20.54



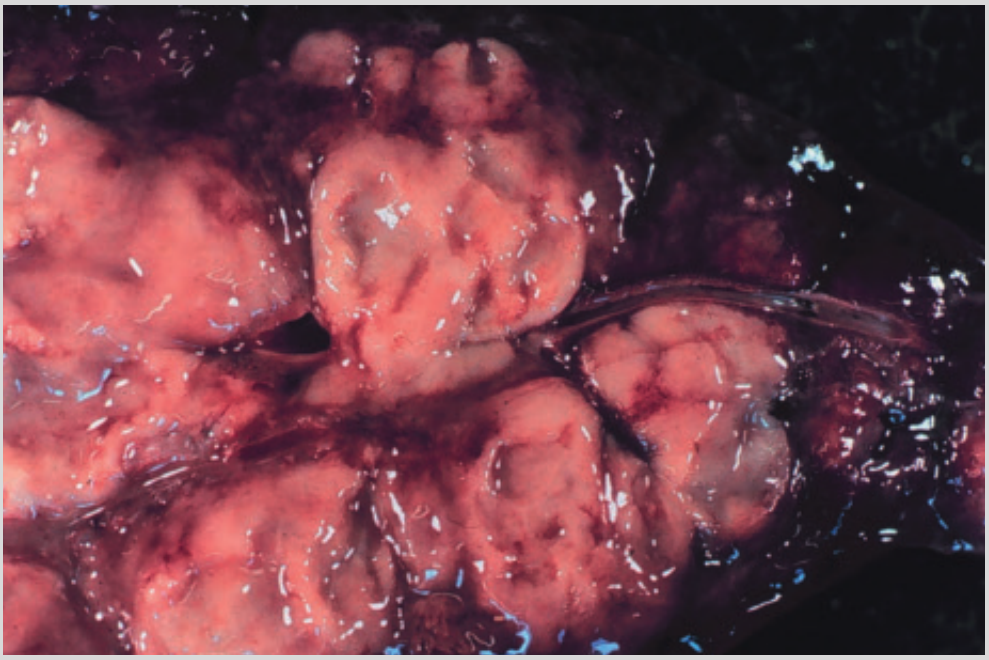
Animal species/Organ	Horse/Lung (cross section)
Lesion	Chronic, pyogranulomatous bronchopneumonia
Scoring	Partial condemnation
Comments	Due to infection with *Rhodococcus equi*

20.55



Animal species/Organ	Horse/Lung (cross section)
Lesion	Chronic, pyogranulomatous bronchopneumonia
Scoring	Partial condemnation
Comments	Due to infection with *Rhodococcus equi*

20.56



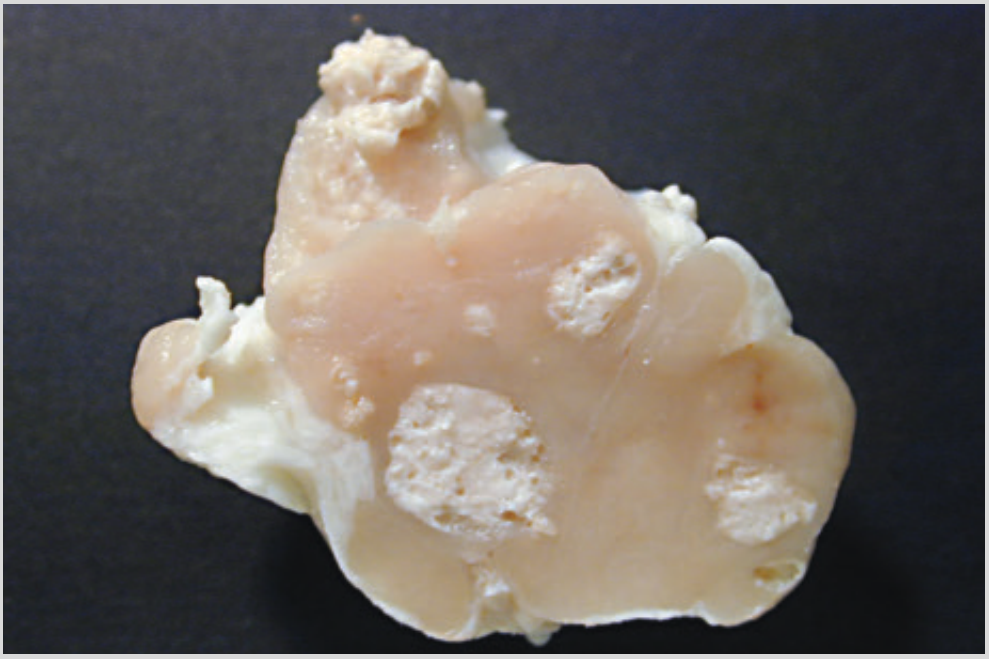
Animal species/Organ	Horse/Lung
Lesion	Chronic, pyogranulomatous bronchopneumonia
Scoring	Partial condemnation
Comments	Due to infection with *Rhodococcus equi*

20.57



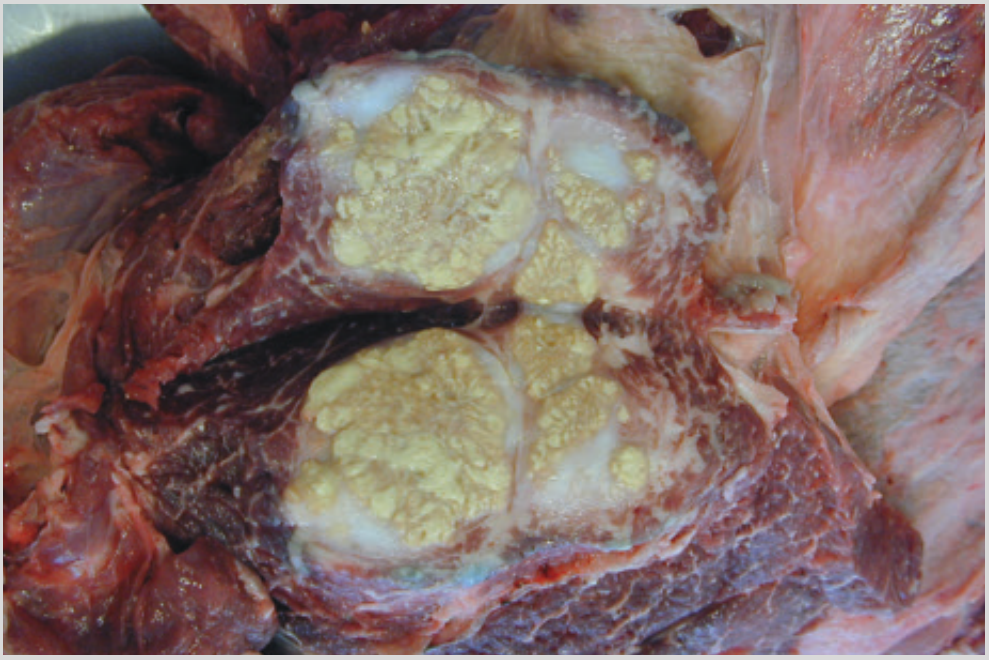
Animal species/Organ	Horse/Mesenteric lymph node
Lesion	Chronic, pyogranulomatous lymphadenitis
Scoring	Partial condemnation
Comments	Due to infection with *Rhodococcus equi*

20.58



Animal species/Organ	Pig/Mandibular lymph node (cross section)
Lesion	Chronic, caseous lymphadenitis
Scoring	Partial condemnation
Comments	Due to infection with *Rhodococcus equi* but can be confused with lesions caused by mycobacteria

20.59



Animal species/Organ	Cattle/Muscle
Lesion	Chronic, focal, necrotising and pyogranulomatous myositis
Scoring	Partial condemnation
Comments	Due to vaccination against Johne's disease

21 Neoplasms

Introduction p. 741
Benign neoplasms p. 742
Malignant neoplasms p. 743
Melanosis and melanomas p. 745

Introduction [21.01 – 21.14]

At meat inspection it is essential to be able to distinguish between benign and malignant neoplasms. The presence of malignant neoplasms always necessitates total condemnation. In contrast, the presence of benign neoplasms results in partial condemnation, conditional on the absence of complications. The most reliable macroscopic differentiation criteria are that benign neoplasms never grow invasively or metastasise. Conversely, a neoplasm that exhibits invasive growth or metastasis must always be classified as malignant sarcoma (mesenchymal origin) or carcinoma (epithelial origin). Metastases of neoplasms can occur via several routes and are characterised as haematogenous, lymphogenic, or canalicular. The latter category includes implantation metastasis on serous membranes. In regard to this, it is important to be aware of the phenomenon of multicentric benign neoplasms, which are not metastases but concomitant development of benign neoplasms at different sites. A typical example of multicentric benign neoplasms are schwannomas in older livestock.

Benign neoplasms do not normally affect the animal's general health unless their localisation impairs organ function, such as the presence of papillomas in the oesophagus or forestomachs in calves, which can result in emaciation. Malignant neoplasms do not necessarily affect the general health of the animal but compared to benign neoplasms, they frequently have some effect on the host such as development of anaemia and increased bleeding tendency, with perhaps emaciation as a result. The time course is of course also critical for the development of various sequelae. In addition to invasive growth and metastasis, other aspects of neoplasms can also be indicative of whether they are benign or malignant. One example is the rate of growth of the neoplasm. If the animal is not very young, and the neoplasm has been visible on the live animal, information on the rate of growth of the neoplasm will often be available from anamnestic data. In addition, certain types of malignant neoplasms are also more frequently the

site of necroses and haemorrhage than benign neoplasms. The surfaces of malignant neoplasms are more often ulcerative compared to benign neoplasms. However, it must be emphasised that neither the rate of growth nor the presence of necrosis as the only parameter can determine whether a neoplasm is malignant or benign.

The incidence of neoplasms in slaughter animals generally increases with age. Thus, in general, it can be said that neoplasms (other than very special types) occur more rarely in finisher pigs and calves than in sows and older cows. Another characteristic is that the neoplasms occurring most frequently in young slaughter animals are more often benign than malignant. Conversely, malignant neoplasms in young animals generally progress far more rapidly than equivalent malignant neoplasms in older animals.

In those cases in which it is not possible macroscopically to determine with high probability whether a neoplasm is benign or malignant, it is necessary to submit samples for laboratory investigation. The laboratory will typically perform microscopic evaluation of the specimen (cytology on smear slides or histology). Both fresh and formalin-fixed samples should be submitted for laboratory investigation. In addition, the submitted material must be representative of the macroscopic changes. Because the definition of a neoplastic cell is not based on morphologic characteristics ("A cell is neoplastic when its proliferation is not determined by normal growth regulation. A neoplasm is comprised of neoplastic cells and stroma, which by interaction are responsible for the characteristics of the neoplasm"), it is understandable that it is not always possible neither macroscopically nor histologically to determine whether a neoplasm is present or not, or whether the neoplasm is benign or malignant. This inability to differentiate between hyperplasia and benign neoplasia is not critical at meat inspection because both forms necessitate partial condemnation and stripping of the regional lymph nodes.

The neoplasms of significance at meat inspection are described in more details in the organ-specific chapters. Only those benign and malignant neoplasms of particular relevance in slaughter animals will be described in the present chapter.

Benign neoplasms [21.15 – 21.27]

Characteristic for benign neoplasms is their expansive proliferation and that they are well-defined and sharply demarcated from their surroundings. Furthermore, they never give rise to metastases.

Papillomas are regularly seen in the skin and on the cutaneous mucous membranes, particularly in calves and young bulls. The papillomas, which are often viral and of epithelial origin, normally disappear with age. The papillomas can either be flat or pedunculated. They can achieve a considerable size, but are often 5-10 cm in diameter. Larger papilloma formations can be subject to trauma with wound formation and possible subsequent infection. In young pigs, papillomas can occur on the genitals.

The most common neoplasm in finisher pigs is nephroblastoma, which originates from fetal renal tissue and is typically localised at the pole of one or both kidneys. Nephroblastomas vary in size, and on the cut surface appear with lobular formations. They are normally grey in colour and have the same texture as normal renal tissue.

Nephroblastomas in pigs are only very rarely malignant, and in these cases there will be metastasis to the regional lymph nodes.

A number of benign and malignant neoplasms occur regularly in older cows. Of the benign neoplasms, cortical adenomas (can also be malignant), which originate from the adrenal cortex, and schwannomas, which originate from the schwann cells surrounding the peripheral nerves, will be discussed. Macroscopically it is generally possible to differentiate between malignant and benign cortical neoplasms. The benign type will be clearly demarcated from the surroundings and can be either unilateral or bilateral. The neoplasm is very rarely functionally active. The neoplasm is often large, solitary, up to about 10 cm in diameter, and may be pale or yellow, or red in colour due to haemorrhage. The malignant form typically exhibits localised, infiltrative proliferation, with metastasis to the regional lymph nodes. In many cases it will penetrate the caudal vena cava, from where it will often metastasise to the lungs and other organs. Pheochromocytomas originating from the adrenal medulla may also be seen (see chapter 17). In bulls, the presence of pheochromocytomas is associated with the presence of neoplasia originating from C-cells in the thyroid gland.

Multicentric schwannomas appear macroscopically as a firm thickening of peripheral nerves. Incision of these formations reveals a yellow gelatinous mass. Schwannomas can in principal be found in all slaughter animals, but occur most frequently in older animals. They have a preference for localisation in the intercostal space, on the epicardium, in the mediastinum, in the thoracic and cervical sympathetic ganglia, on the surface of the liver, and in the brachial plexus. In some cases, the thickening of the nerve sheaths can reach the spinal canal, where their presence may generate clinical signs such as wobbling. Because this is a benign neoplasm, but with multicentric localisation, it will often be necessary to approve the carcase for deboning in order to ensure sufficient stripping. Schwannomas are rarely malignant.

Malignant neoplasms [21.28 – 21.56]

On surfaces, including the skin, malignant neoplasms will often be ulcerative and perhaps bleed. Because they exhibit invasive proliferation, they will typically be asymmetric, non-demarcated from the surroundings, and contain necroses. Metastasis will often occur to the regional lymph nodes and/or other tissues and organs. As previously noted, malignant neoplasms necessitate total condemnation.

Lymphosarcomas occur sporadically in all slaughter animals and the infiltrations in all slaughter animals resemble each other macroscopically. All cases necessitate total condemnation. In all species, the neoplastic tissue is typically pale, grey, and, because the content of connective tissue is low, the texture of the neoplastic tissue will be soft. Infiltrations can be either diffuse or nodular. Haemorrhage often occurs in the nodular infiltrations, particularly in pigs. Depending on where the infiltrations occur, the condition is called multicentric (manifests primarily in the lymph nodes), cutaneous, or thymic lymphosarcoma. In horses, further distinction is made between an alimentary and a splenic form. Cattle, in addition to the sporadic forms which occur in animals of all ages, also suffer from an infectious type (enzootic leukosis), which is caused by a

retrovirus. The enzootic form occurs typically in older animals. The infectious type in cattle has been eradicated in Denmark, but there is continuous monitoring of the disease. If enzootic leukosis is suspected in cattle, special regulations apply for submission of samples for laboratory investigation. Enzootic bovine leukosis should be suspected in cases of generalised swelling of the lymph nodes or swelling of lymph nodes in limited regions such as the pelvic cavity. Moreover, the presence of leukotic infiltrations in the heart, in the right auricle in particular, the abomasum, and the uterus should also trigger suspicion of enzootic leukosis. In addition to that noted above, the majority of animals with enzootic leukosis will also have neoplastic infiltrations in the liver and spleen.

In older cows uterine carcinomas are one of the most frequently occurring malignant neoplasms that are diagnosed at meat inspection. Mostly, the uterus is not the place where the neoplasm is first detected. The presence of metastases in organs, including the peritoneum, characteristically draws attention to the neoplasms. In the uterus the carcinoma, which originates in the uterine glands, will grow diffusively and infiltrate, and there are often no visible lesions on the surface of the uterus. The metastases are typical for carcinomas, and are therefore accompanied by varying degrees of fibrosis and necrosis. Because the metastases are often yellow in colour, and with central necrosis, they are frequently confused with disseminated, chronic pulmonary inflammatory lesions, particularly if they only occur in the lungs. The granulomatous and, to a certain extent, also the pyogranulomatous inflammations, can in particular give huge problems at differential diagnosis. Because of the relatively frequent occurrence of uterine carcinomas in older cows, in which disseminated metastases to the lungs are often observed, it is very important to differentiate these from actinomycotic lesions. The importance of correct diagnosis at meat inspection is reflected in the scoring of total condemnation for cases of uterine carcinoma, whereas chronic, disseminated (embolic) and encapsulated lesions of infectious character necessitate approval for deboning.

Cattle of the Hereford breed are particularly predisposed to develop squameous cell carcinoma in the corner of the eye, so-called "cancer eye". Because the actual carcinoma is preceded by a number of premalignant stages with epithelial plaque and papilloma formation before, finally, the so-called "carcinoma in situ" (most morphologic malignancy criteria are met, with the exception of local invasion and metastasis), it is very important to slaughter the animal at a time point when the neoplastic changes have not yet become malignant. However, it should be noted that about 50% of the premalignant changes can revert back to normal with complete restitution. At transition to the malignant form of "cancer eye" there is primarily invasive growth into the surrounding structures but, with time, metastasis to the regional lymph nodes and thoracic and abdominal organs occurs.

Apart from melanocarcinomas in white, grey and dappled horses, the most common malignant neoplasms in horses are the squamous cell carcinomas originating in the squamous epithelium on the glans penis and in the white part of the stomach. In both cases, the neoplasm often appears ulcerative, and there will be local invasion. In many cases of penis carcinoma there will also be metastasis to the regional lymph nodes and, in stomach carcinomas mestasis to the peritoneum (implantation metastasis). In both cases, there is often necrosis in the neoplasm in addition to the ulcerative lesions.

Melanosis and melanomas [21.57 – 21.75]

Differentiating between melanosis (congenital or acquired diffuse black pigmentation) and melanomas, regardless of whether the latter is malignant or benign, is extremely important at meat inspection.

Melanosis, which is not an expression of neoplasia, represents accumulation of melanin in parenchymal cells, macrophages, or erroneously localised melanocytes. This accumulation makes the affected areas appear more or less black. Melanosis characteristically does not change the tissue texture or form, and the condition cannot therefore be detected by palpation. In slaughter animals, melanosis occurs primarily as a congenital condition, which can manifest as several cm long black patches (melanosis maculosa) in the lungs, liver, and heart in pigs, lambs and calves. Another characteristic is that melanosis maculosa disappears with age. In pigs, melanosis is occasionally seen in the udder (see Chapter 13), and in cattle the vertebral periostium in particular can be a site of melanosis. In sheep, the cerebral membranes, particularly rostrally, and the uterine caruncles are normally sites for melanosis. In melanosis the regional lymph nodes may contain pigment due to the presence of melanin-containing macrophages. The presence of black-coloured lymph nodes in connection with melanosis and benign melanomas is not an expression of metastasis but an expression of melanin uptake in macrophages. Pigmentation of the macrophages in the lymph nodes can be due to either migration of pigment-containing macrophages to the lymph nodes from the site of melanosis/melanoma, or due to uptake of pigment by stationary macrophages in the lymph nodes (monocyte-macrophage system). Black-coloured lymph nodes due to melanin-containing macrophages are normal in size and texture, and do not have lesions. These factors also mean that the cut surface will not bulge abnormally.

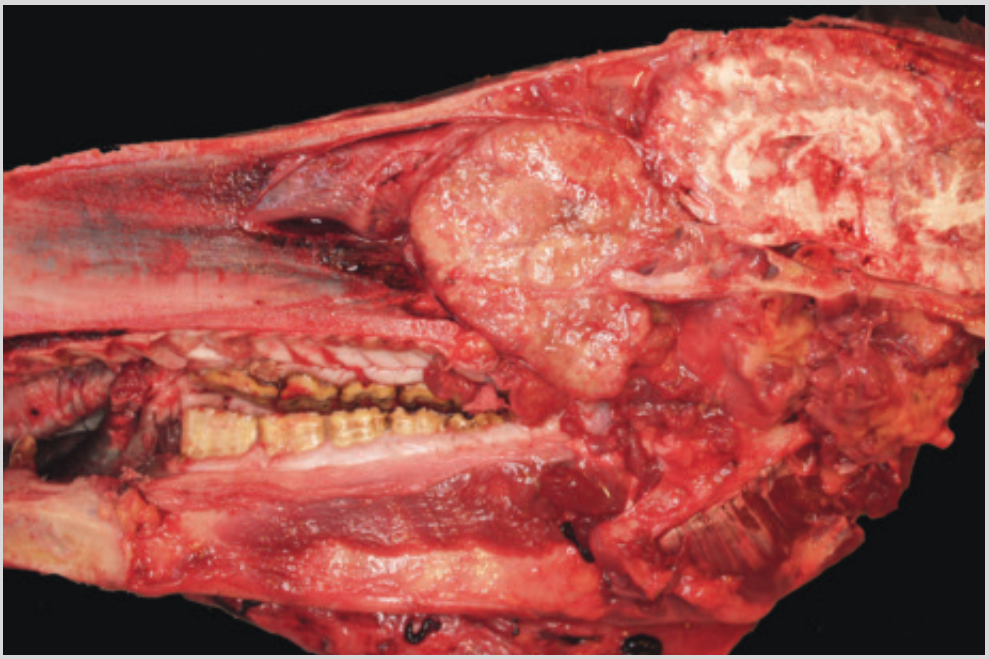
At meat inspection, melanosis is scored as discolouration with rejection of the affected tissues and the regional lymph nodes.

Melanomas, which are due to proliferation of melanocytes will, in contrast to melanosis, change the texture and form and therefore be palpatable. Furthermore, the lesions will typically project above the surfaces (e.g. in the skin or a cut surface). As with all other neoplasms it is critical to be able to differentiate between benign and malignant melanomas (melanocarcinomas). The same criteria apply for differentiation as for other neoplasms, where it is essential to decide whether the lesions are invasive or non-invasive, and whether metastasis has occurred. As discussed in connection with melanosis, regional lymph nodes in the presence of benign melanomas will also possibly contain pigment. The pigmentation will however, as is the case with melanosis, be diffusely deposited in macrophages and will not occur as distinct lesions.

Benign melanomas are found relatively frequently in the skin of certain pig breeds (Sinclair, Hormel, and Duroc) and in grey, white, and dappled horses (e.g. Arabian, Lipizzaner, and Andalusian), in which the incidence of melanomas increases with age. There is always a risk that benign melanomas will transform to malignant melanomas. In horses, melanomas are found particularly in the skin in the perineal region and under the tail. At meat inspection of white, grey or dappled horses, attention must always be paid to the regulations which stipulate that on these animals the shoulder must be

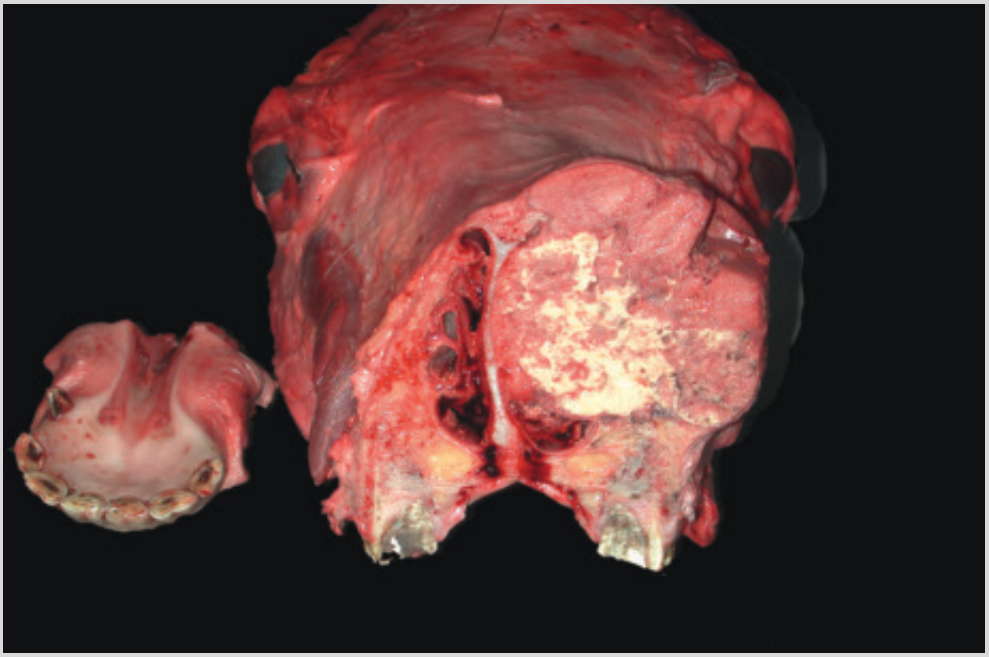
inspected so that the axillary lymph nodes and the muscles below the shoulder blade can be examined using deep incisions to reveal any melanocarcinomas or discolouration due to melanosis. Furthermore, it is emphasised that the kidneys must also be inspected and examined by an incision through the entire kidney because haematogenous metastasis of melanocarcinomas can be present in these horses. A common localisation for melanocarcinomas (and/or melanosis) in white, grey, and dappled horses is infiltrative growth into the perineal region, the intima of the pelvic vessels and the parotid region. Finally, the melanocarcinomas may also appear as multiple neoplasms in the subcutis, connective tissue, and muscles, and in various organs through haematogenous spread. In scientific literature on melanomas in white, grey, and dappled horses there is some uncertainty as to whether the occurrence of lesions in the regional lymph nodes and other tissues is an expression of benign multicentric growth and accumulation of melanin-containing macrophages (melanophages) or, as understood at meat inspection, is a true expression of a metastatic condition. In the event of lymphogenic spread the melanocarcinomas will manifest as lesions in the regional lymph node, and the entire lymph nodes may be involved. Thus the lymph node will not only appear black but will also exhibit formative changes. This will also be apparent on the cut surface where the neoplastic tissue will bulge out.

21.01



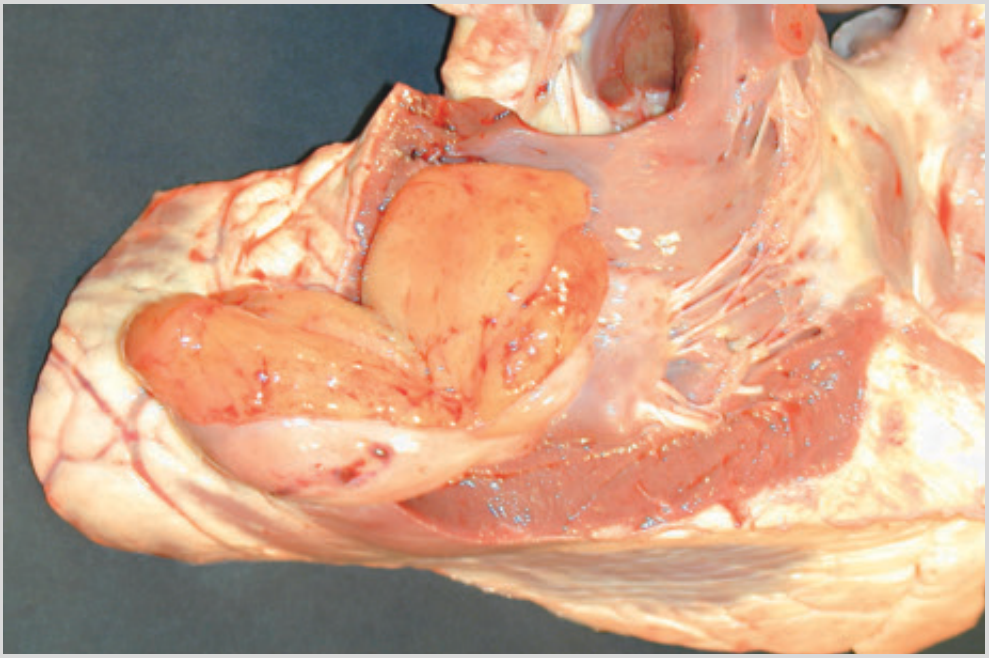
Animal species/Organ	Horse/Head (sagital section)
Lesion	Invasive proliferative carcinoma originating from the mucous membrane of the ethmoturbinals
Scoring	Total condemnation
Comments	All malignant neoplasms necessitate total condemnation

21.02



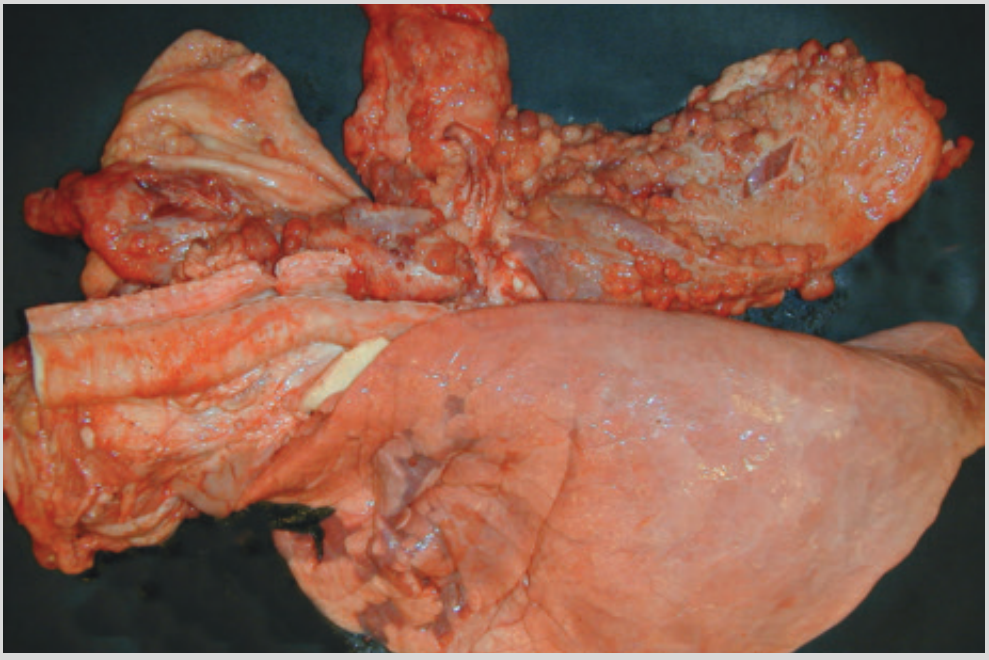
Animal species/Organ	Horse/Head (transverse section)
Lesion	Invasive proliferative carcinoma originating from the nasal cavity
Scoring	Total condemnation
Comments	All malignant neoplasms necessitate total condemnation

21.03



Animal species/Organ	Cattle/Heart
Lesion	Fibroma (fibroma molle)
Scoring	Partial condemnation
Comments	The tissue in the soft fibromas is often yellow and partly transparent

21.04



Animal species/Organ	Cattle/Lung
Lesion	Metastases from adenocarcinoma
Scoring	Total condemnation
Comments	The neoplasm exhibits implantation metastasis on the pleura

21.05



Animal species/Organ	Cattle/Lung (close-up of 21.04)
Lesion	Metastases from adenocarcinoma
Scoring	Total condemnation
Comments	The neoplasm exhibits implantation metastasis on the pleura

21.06



Animal species/Organ	Cattle/Sternum with attached lymph nodes
Lesion	Metastases from an adenocarcinoma to the sternal lymph node (lymphogenic spread)
Scoring	Total condemnation
Comments	Metastasis of neoplasms is always an indication that the neoplasm is malignant

21.07



Animal species/Organ Cattle/Lung
Lesion Disseminated, metastatic neoplasms (adenocarcinoma (→))
Scoring Total condemnation
Comments The disseminated distribution is indicative of embolic spread

21.08



Animal species/Organ Cattle/Lung (close-up of 21.07)
Lesion Disseminated neoplasms (adenocarcinoma (→))
Scoring Total condemnation
Comments The disseminated distribution is indicative of embolic spread

21.09



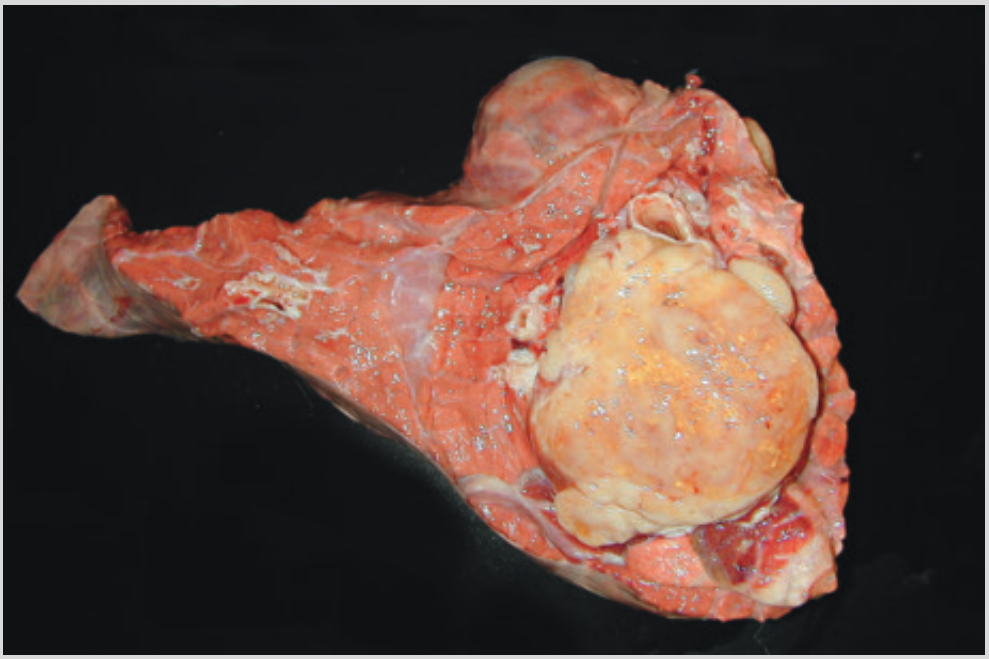
Animal species/Organ	Cattle/Distal part of a leg
Lesion	Invasive proliferative chondrosarcoma
Scoring	Total condemnation
Comments	Invasive proliferative neoplasms are always malignant

21.10



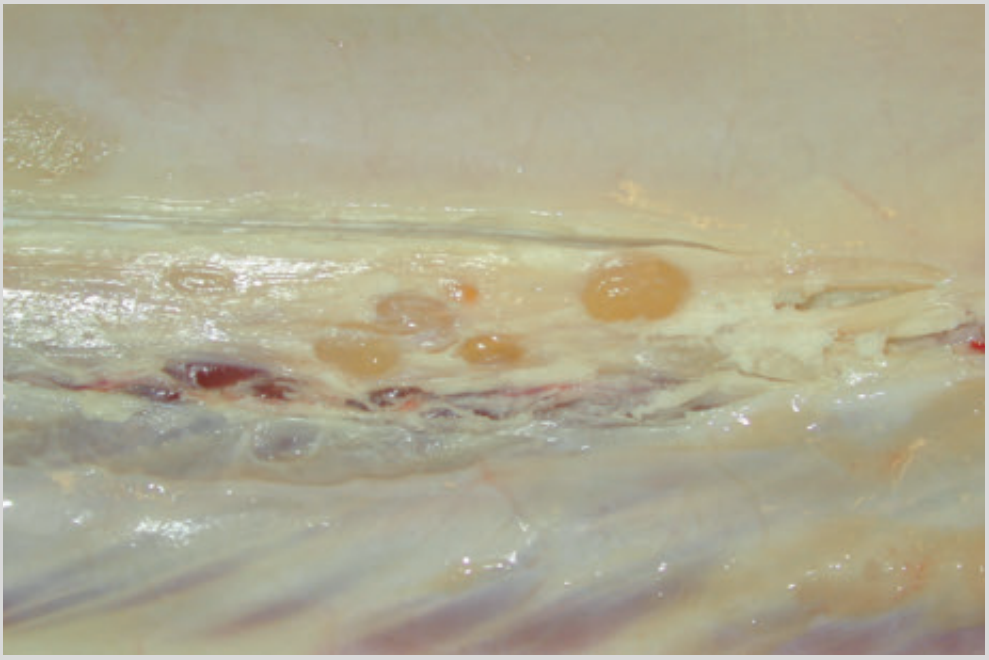
Animal species/Organ	Cattle/Lung
Lesion	Disseminated, metastatic neoplasms (chondrosarcoma (→))
Scoring	Total condemnation
Comments	The disseminated distribution is indicative of embolic spread

21.11



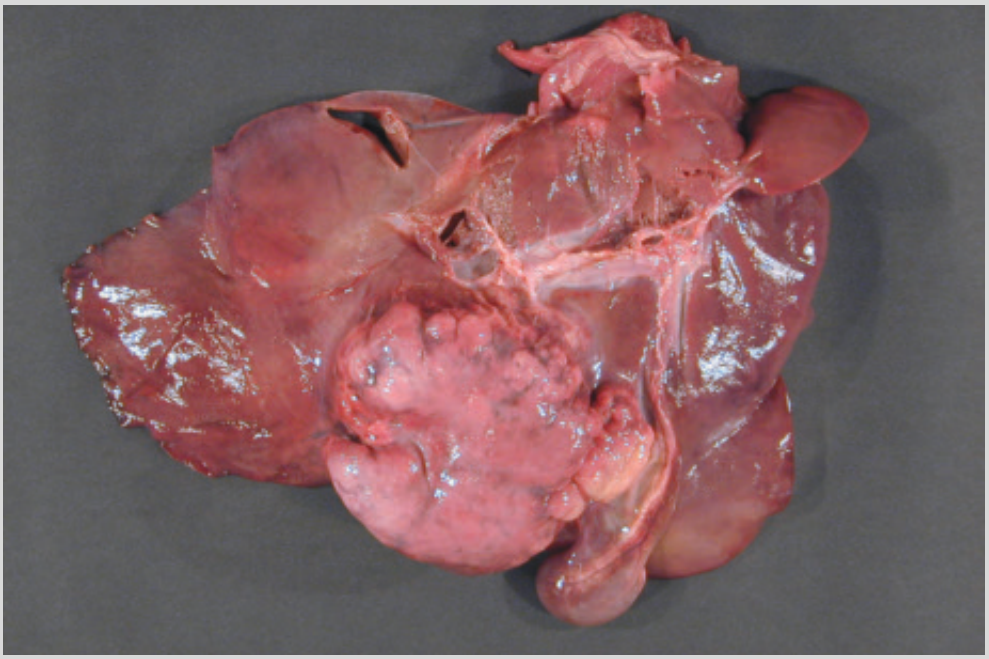
Animal species/Organ	Cattle/Lung
Lesion	Metastatic neoplasm (chondrosarcoma)
Scoring	Total condemnation
Comments	Metastasis of neoplasms is always an indication that the neoplasm is malignant

21.12



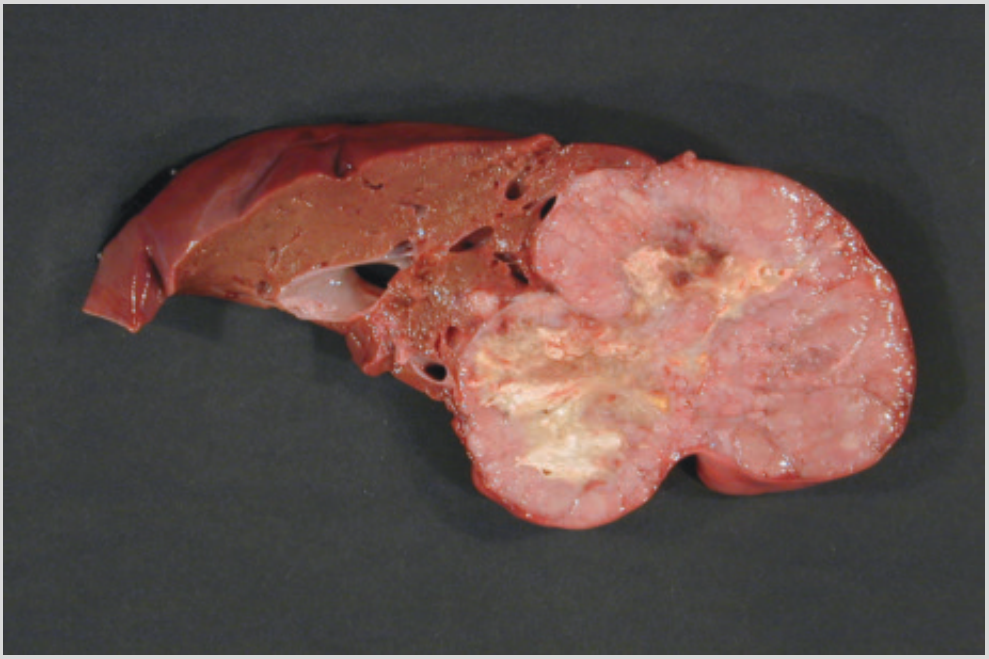
Animal species/Organ	Cattle/Thoracic wall with pleura
Lesion	Multicentric schwannoma
Scoring	Partial condemnation
Comments	Schwannomas occur typically in the chest region in older cattle

21.13



Animal species/Organ	Sheep/Liver
Lesion	Solitary carcinoma
Scoring	Total condemnation
Comments	Carcinomas in the liver can be either primary or secondary (metastases)

21.14



Animal species/Organ	Sheep/Liver (same organ as in 21.13)
Lesion	Solitary carcinoma
Scoring	Total condemnation
Comments	Necrosis can be seen centrally in the neoplasm

21.15



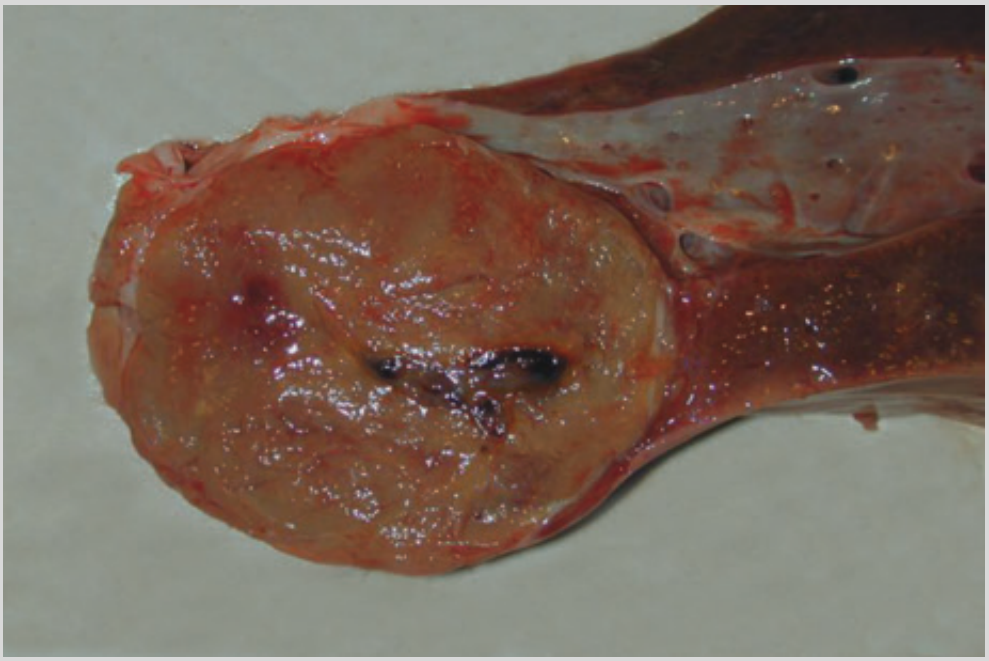
Animal species/Organ	Cattle/Penis
Lesion	Papillomas
Scoring	Partial condemnation
Comments	Papillomas occur regularly in the skin and on cutaneous membranes in young cattle

21.16



Animal species/Organ	Cattle/Liver
Lesion	Hepatoma
Scoring	Partial condemnation
Comments	Hepatomas are typically paler than the surrounding tissue and are well-defined

21.17



Animal species/Organ	Cattle/Liver (same as 21.16)
Lesion	Hepatoma
Scoring	Partial condemnation
Comments	Note the obvious demarcation

21.18



Animal species/Organ	Pig/Kidney
Lesion	Nephroblastoma
Scoring	Partial condemnation
Comments	Nephroblastomas are only very rarely malignant

21.19



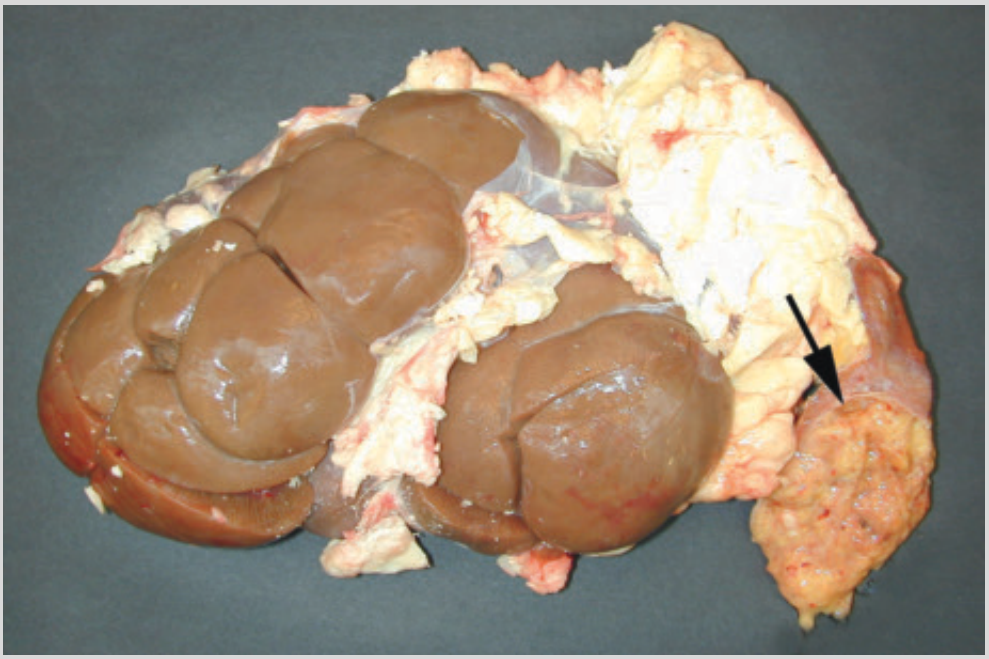
Animal species/Organ	Pig/Kidney
Lesion	Bilateral localised nephroblasomas
Scoring	Partial condemnation
Comments	The bilateral occurrence of the neoplasm is not indicative of malignancy

21.20



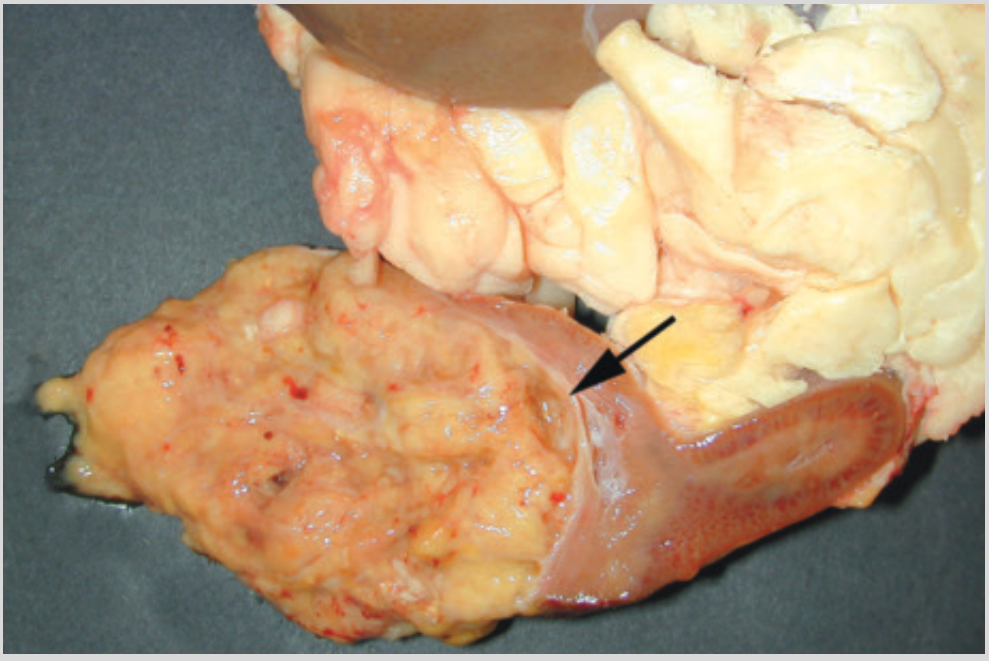
Animal species/Organ	Pig/Kidney
Lesion	Nephroblastoma with localisation to renal pelvis
Scoring	Partial condemnation
Comments	Nephroblastomas are however typically localised to the renal poles

21.21



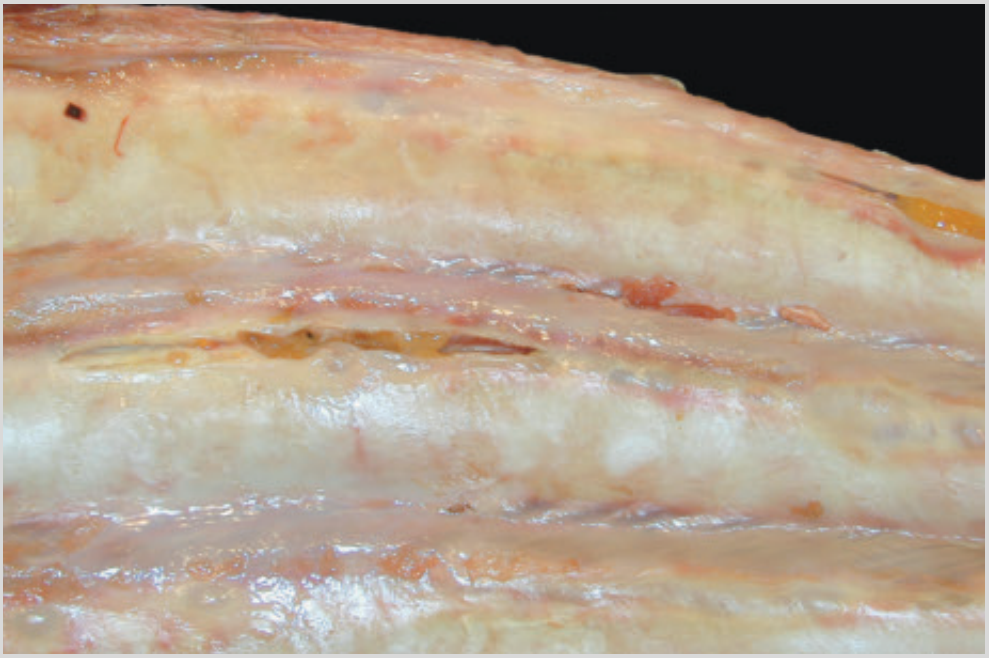
Animal species/Organ	Cattle/Kidney and adrenal gland
Lesion	Well-defined cortical adenoma (→)
Scoring	Partial condemnation
Comments	Invasive growth (including into the caudal vena cava) necessitates total condemnation

21.22



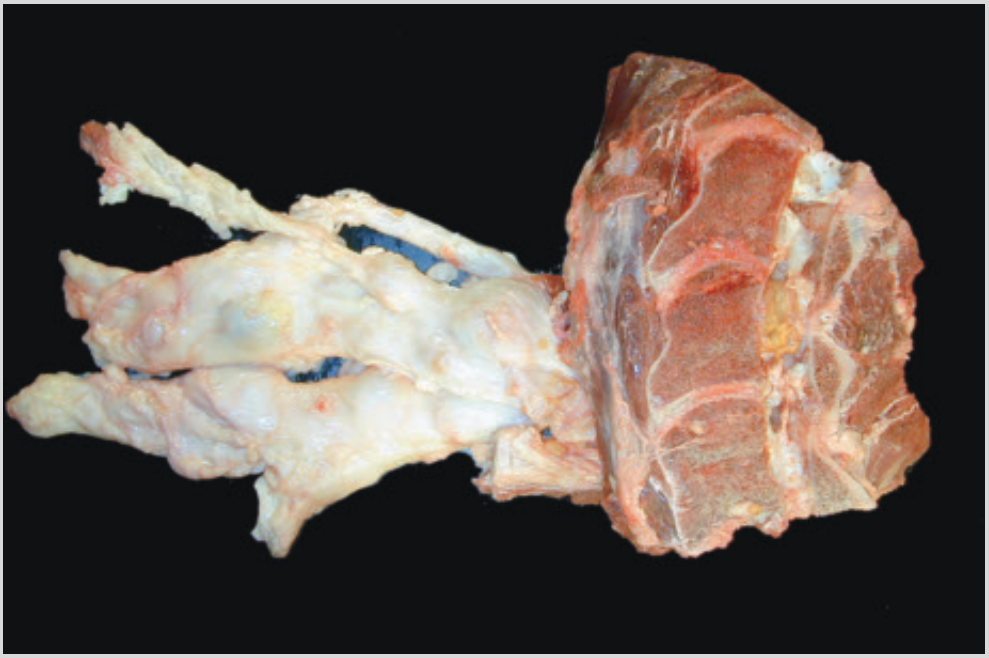
Animal species/Organ	Cattle/Adrenal gland (close-up of 21.21)
Lesion	Well-defined cortical adenoma (→)
Scoring	Partial condemnation
Comments	Invasive growth (including into the caudal vena cava) necessitates total condemnation

21.23



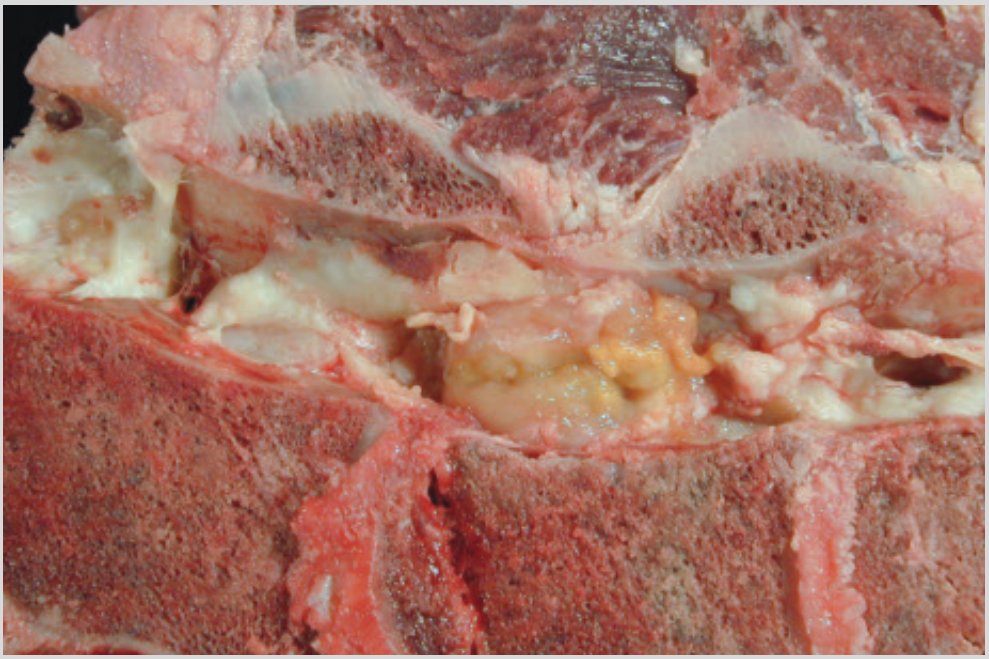
Animal species/Organ	Cattle/Thoracic wall with pleura
Lesion	Multicentric schwannoma
Scoring	Partial condemnation
Comments	Schwannomas (from Schwann cells) are typically found in the thoracic region

21.24



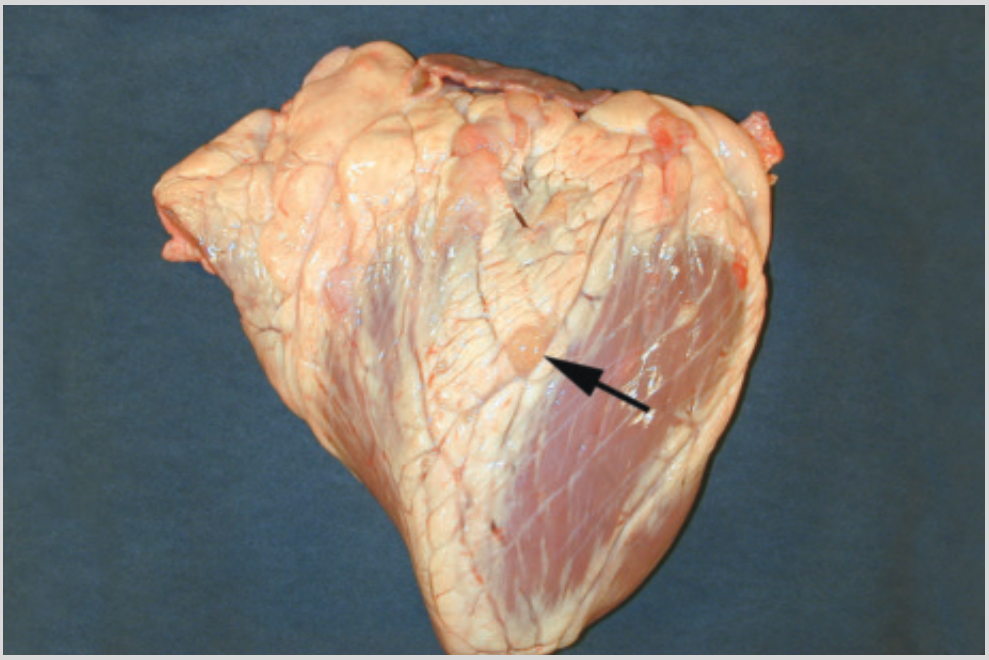
Animal species/Organ	Cattle/Plexus brachialis
Lesion	Multicentric schwannoma
Scoring	Partial condemnation
Comments	Schwannomas (from Schwann cells) are typically found in the thoracic region

21.25



Animal species/Organ	Cattle/Vertebral canal at the origin of the nerves of the brachial plexus
Lesion	Multicentric schwannoma
Scoring	Partial condemnation
Comments	Schwannomas (from Schwann cells) are typically found in the thoracic region

21.26



Animal species/Organ	Cattle/Heart
Lesion	Multicentric schwannoma located in the epicardium (→)
Scoring	Partial condemnation
Comments	Schwannomas (from Schwann cells) are typically found in the thoracic region

21.27



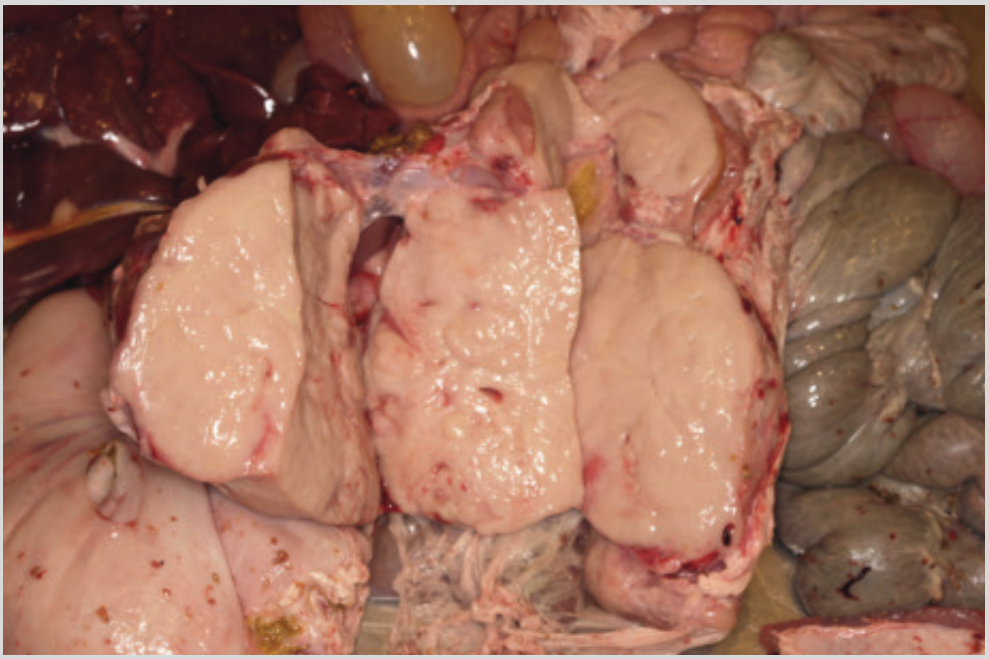
Animal species/Organ	Cattle/Heart (mitral valve)
Lesion	Multicentric schwannoma
Scoring	Partial condemnation
Comments	Schwannomas (from Schwann cells) are typically found in the thoracic region

21.28



Animal species/Organ	Pig/Lymph nodes of the pelvic inlet (lnn. iliofemorales, lnn. iliaci mediales)
Lesion	Multicentric lymphosarcoma (leukosis)
Scoring	Total condemnation
Comments	Leukotic infiltrations always necessitate total condemnation

21.29



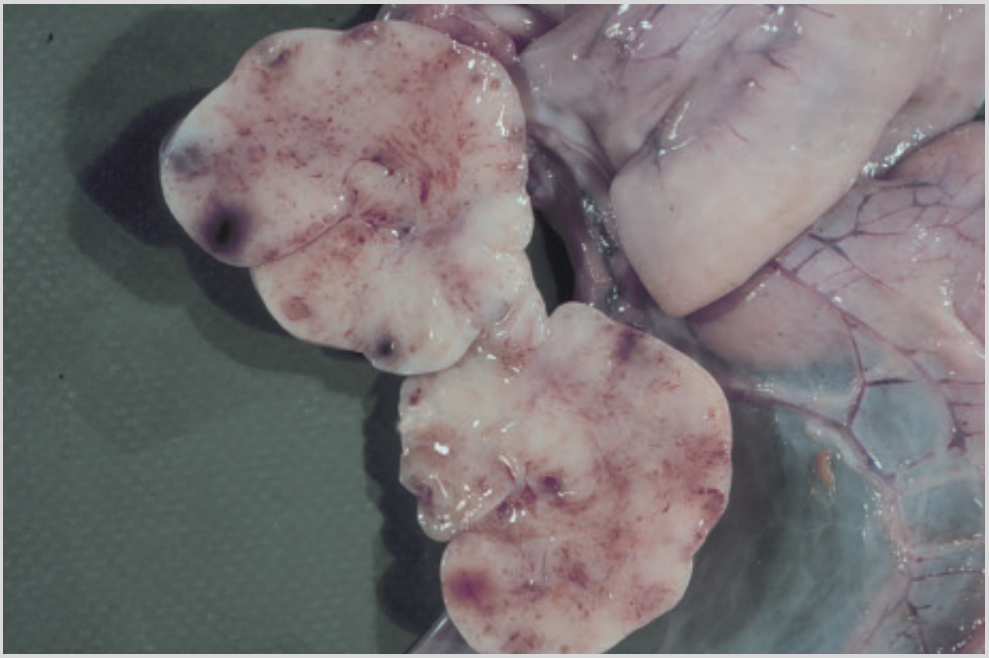
Animal species/Organ	Pig/Mesenteric lymph nodes (lnn. mesenterici)
Lesion	Multicentric lymphosarcoma (leukosis)
Scoring	Total condemnation
Comments	Leukotic infiltrations always necessitate total condemnation

21.30



Animal species/Organ	Cattle/Uterus
Lesion	Multicentric lymphosarcoma (leukosis)
Scoring	Total condemnation
Comments	Uterus is a predilection site for leukotic infiltrations in cows with enzootic leukosis

21.31



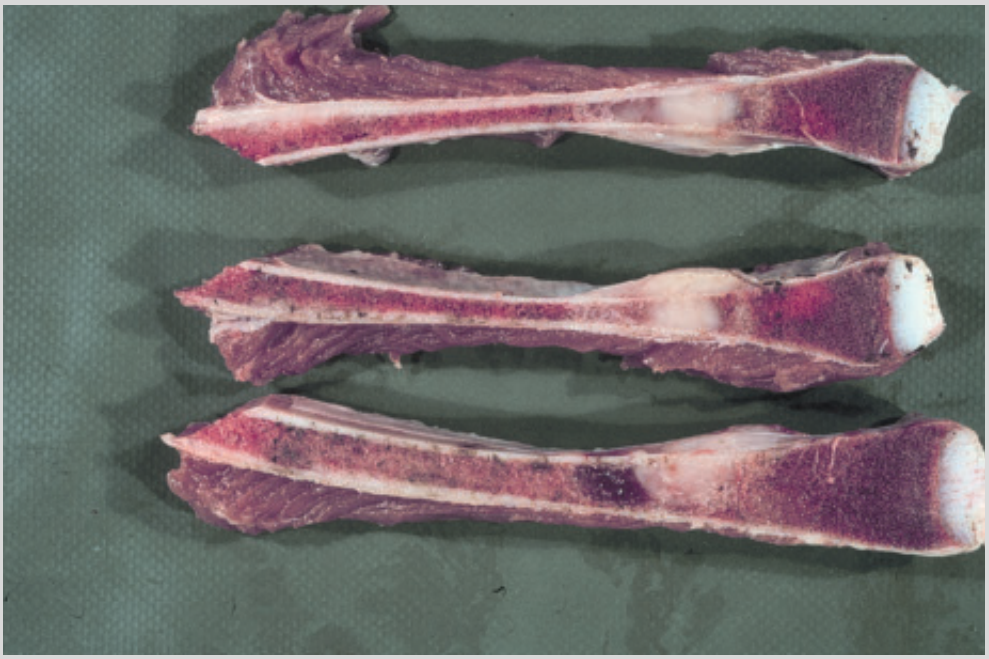
Animal species/Organ	Pig/Ovary
Lesion	Multicentric lymphosarcoma (leukosis)
Scoring	Total condemnation
Comments	Leukotic infiltrations always necessitate total condemnation

21.32



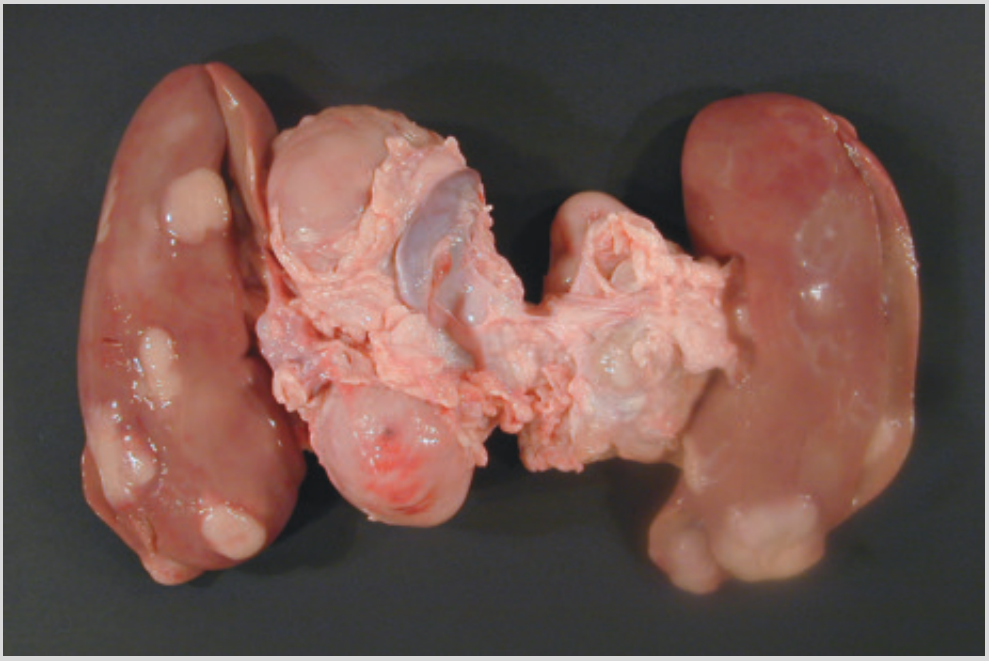
Animal species/Organ	Pig/Thoracic wall
Lesion	Multicentric lymphosarcoma (leukosis)
Scoring	Total condemnation
Comments	Leukotic infiltrations always necessitate total condemnation

21.33



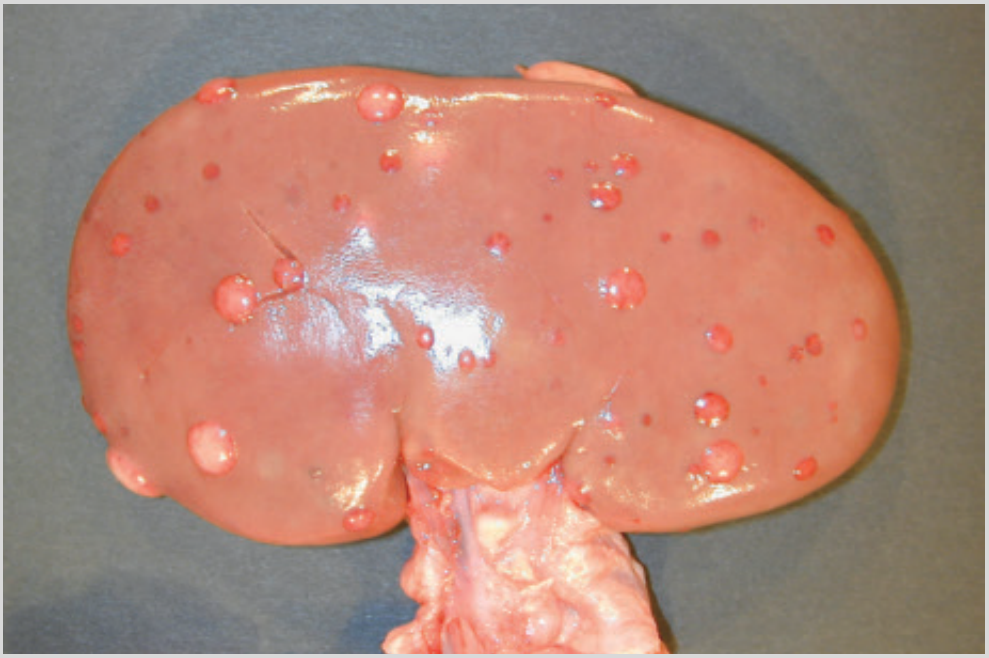
Animal species/Organ	Pig/Ribs
Lesion	Multicentric lymphosarcoma (leukosis)
Scoring	Total condemnation
Comments	Note the invasive growth into the compact bone

21.34



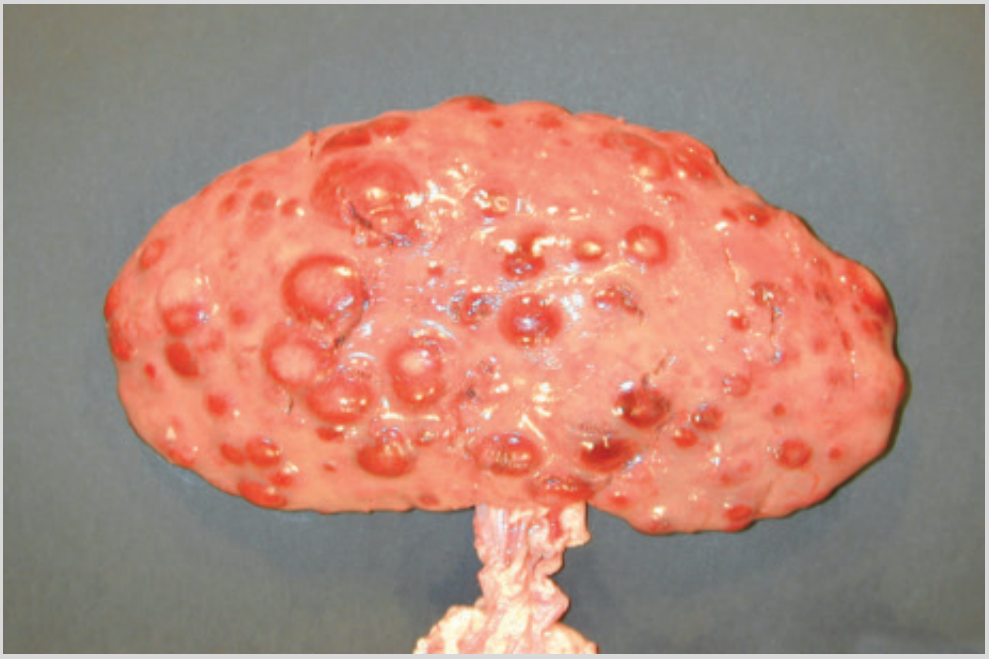
Animal species/Organ	Pig/Kidney
Lesion	Multicentric lymphosarcoma (leukosis)
Scoring	Total condemnation
Comments	Note the extremely enlarged regional lymph nodes

21.35



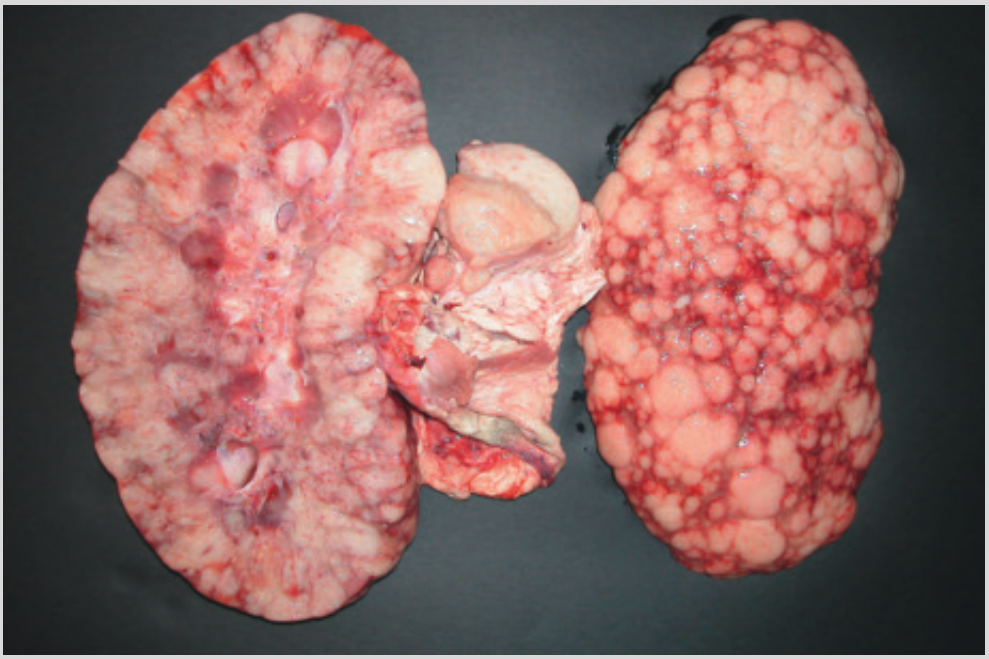
Animal species/Organ	Pig/Kidney
Lesion	Multicentric lymphosarcoma (leukosis)
Scoring	Total condemnation
Comments	Haemorrhage often occurs in the leukotic infiltrations, particularly in pigs

21.36



Animal species/Organ	Pig/Kidney
Lesion	Multicentric lymphosarcoma (leukosis)
Scoring	Total condemnation
Comments	Haemorrhage often occurs in the leukotic infiltrations, particularly in pigs

21.37



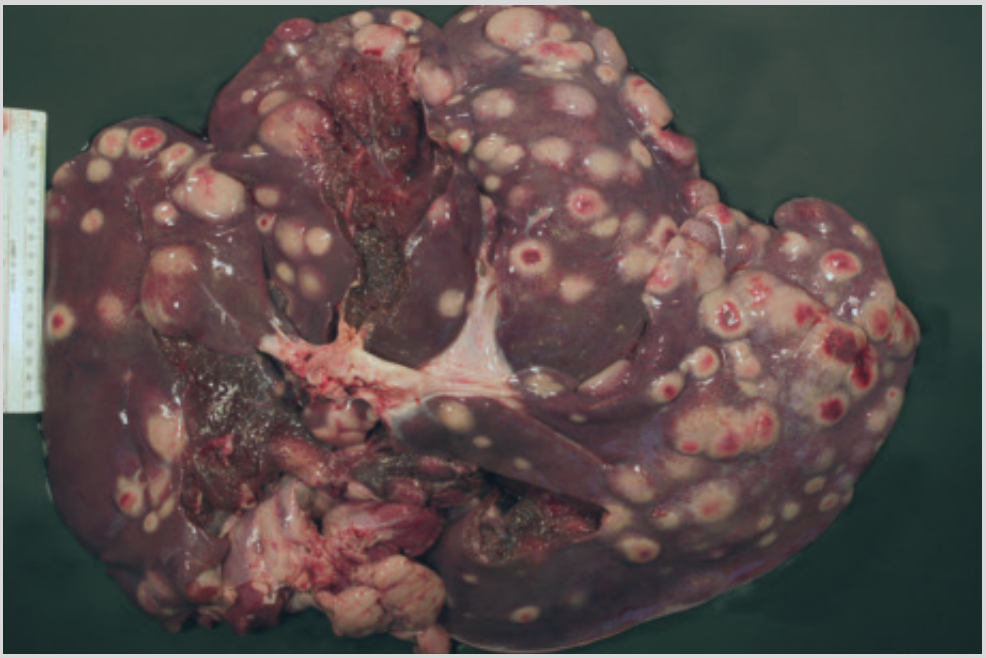
Animal species/Organ	Pig/Kidney
Lesion	Multicentric lymphosarcoma (leukosis)
Scoring	Total condemnation
Comments	Note the leukotic infiltrations in the regional lymph nodes

21.38



Animal species/Organ	Pig/Liver
Lesion	Multicentric lymphosarcoma (leukosis)
Scoring	Total condemnation
Comments	The infiltrations are nodular and diffuse

21.39



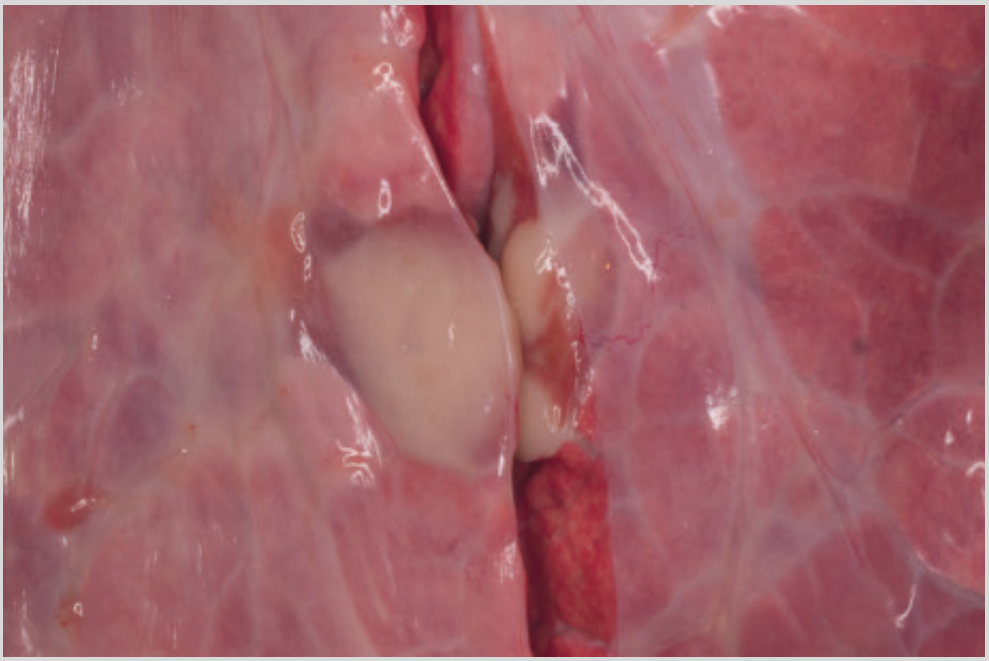
Animal species/Organ	Pig/Liver
Lesion	Multicentric lymphosarcoma (leukosis)
Scoring	Total condemnation
Comments	The infiltrations are disseminated

21.40



Animal species/Organ	Goat/Spleen
Lesion	Multicentric lymphosarcoma (leukosis)
Scoring	Total condemnation
Comments	The infiltration in the spleen is diffuse

21.41



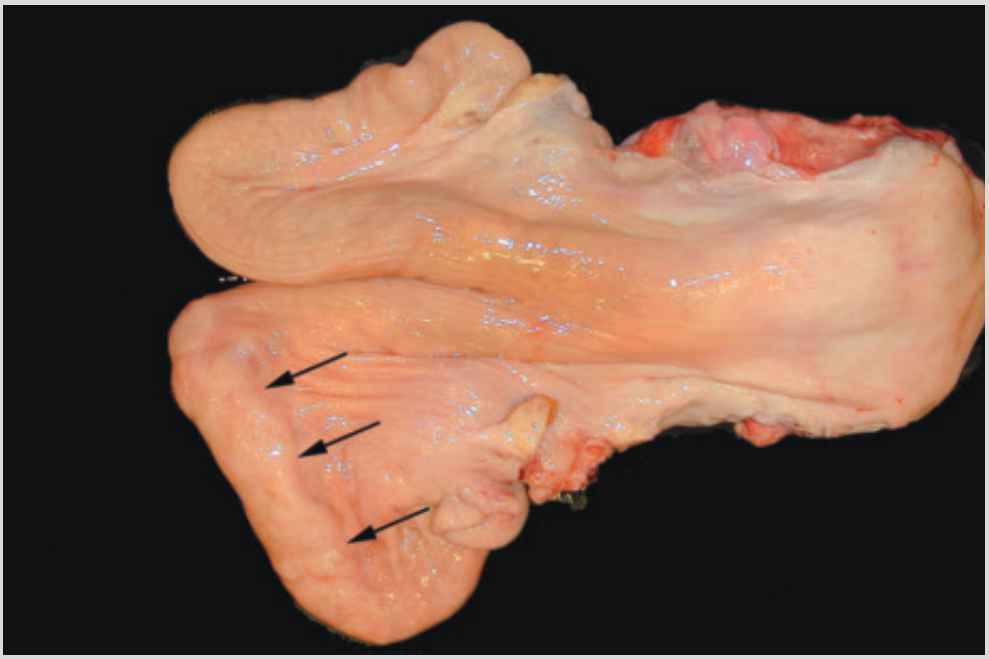
Animal species/Organ	Pig/Lung
Lesion	Multicentric lymphosarcoma (leukosis)
Scoring	Total condemnation
Comments	Infiltrations in the lungs are rare

21.42



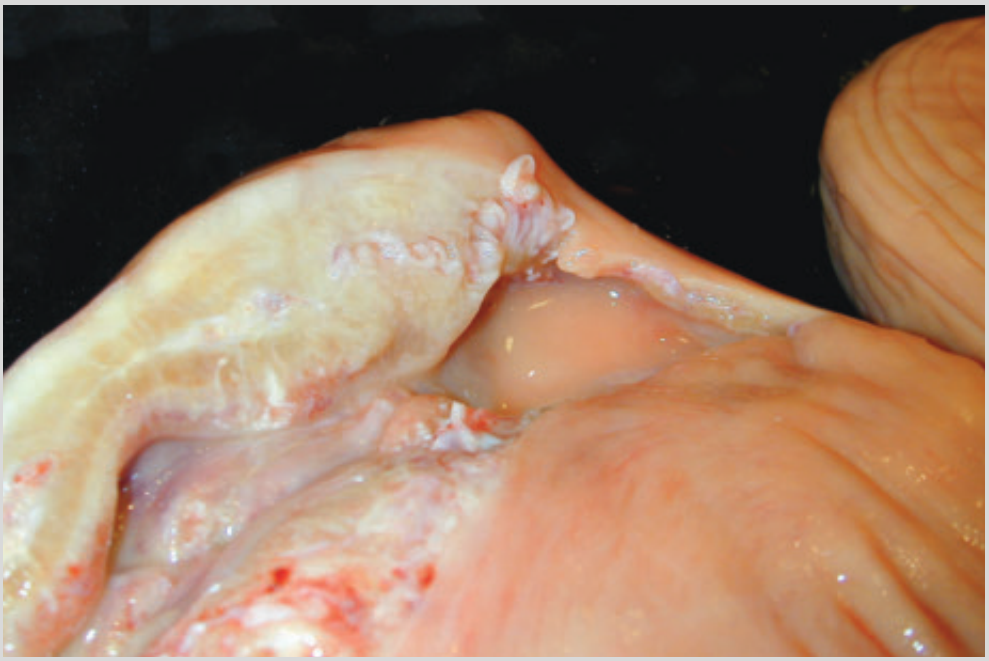
Animal species/Organ	Pig/Muscle
Lesion	Multicentric lymphosarcoma (leukosis)
Scoring	Total condemnation
Comments	An unusual localisation of leukotic infiltrations

21.43



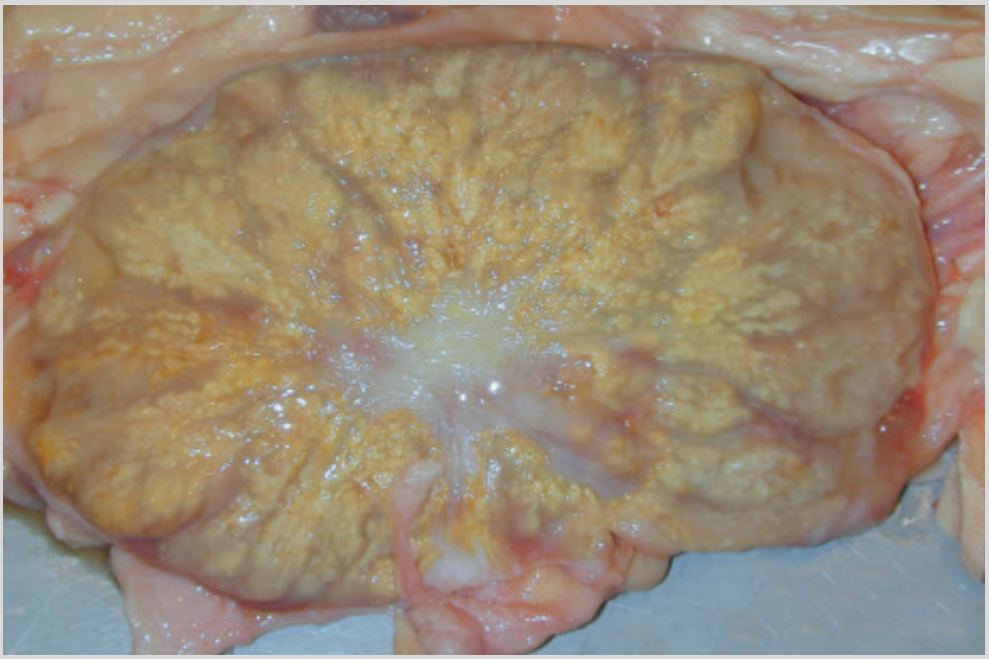
Animal species/Organ	Cattle/Uterus
Lesion	Invasive carcinoma (→)
Scoring	Total condemnation
Comments	Uterine carcinomas are relatively frequent in older cows

21.44



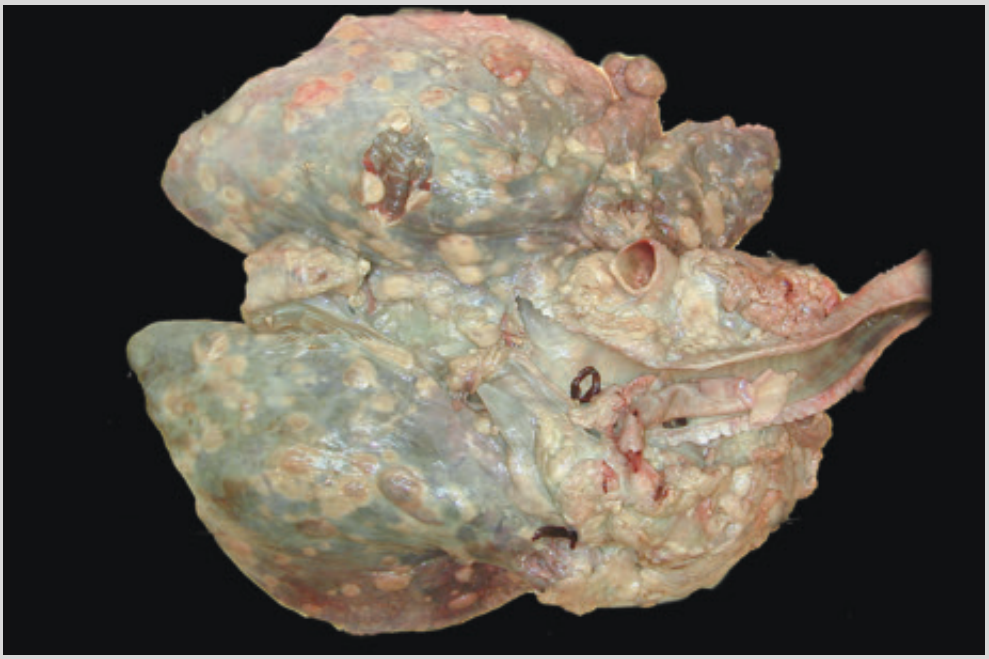
Animal species/Organ	Cattle/Uterus
Lesion	Invasive carcinoma
Scoring	Total condemnation
Comments	There is obvious thickening of the uterine wall

21.45



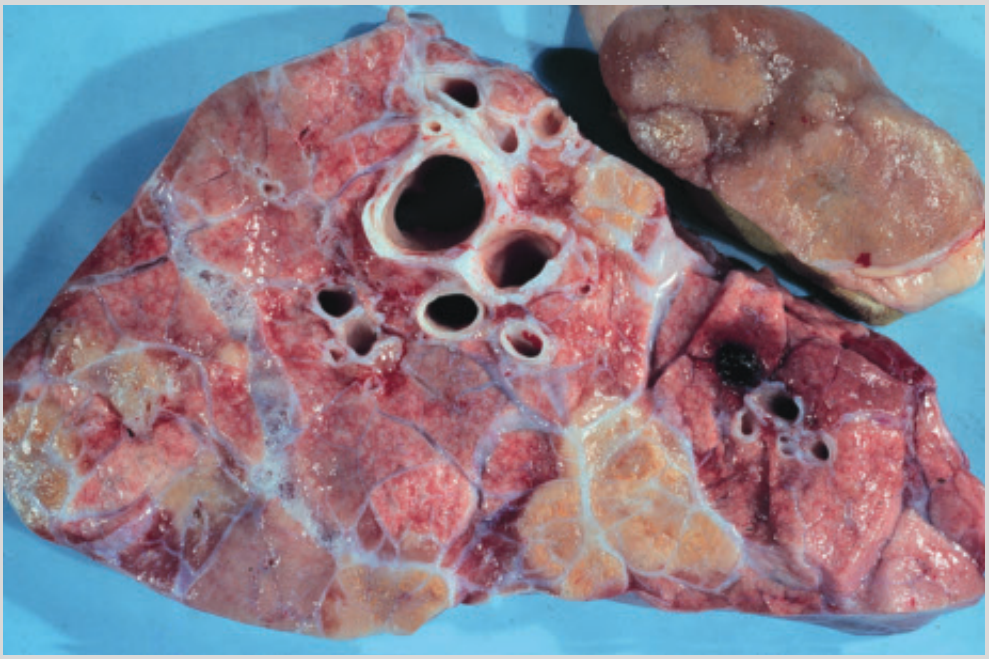
Animal species/Organ	Cattle/Ln. ileofemoralis
Lesion	Metastases from uterine carcinoma
Scoring	Total condemnation
Comments	Uterine carcinomas often spread to the regional lymph nodes, liver and lungs

21.46



Animal species/Organ	Cattle/Lung
Lesion	Disseminated metastases from a uterine carcinoma
Scoring	Total condemnation
Comments	Uterine carcinomas often spread to the regional lymph nodes, liver and lungs

21.47



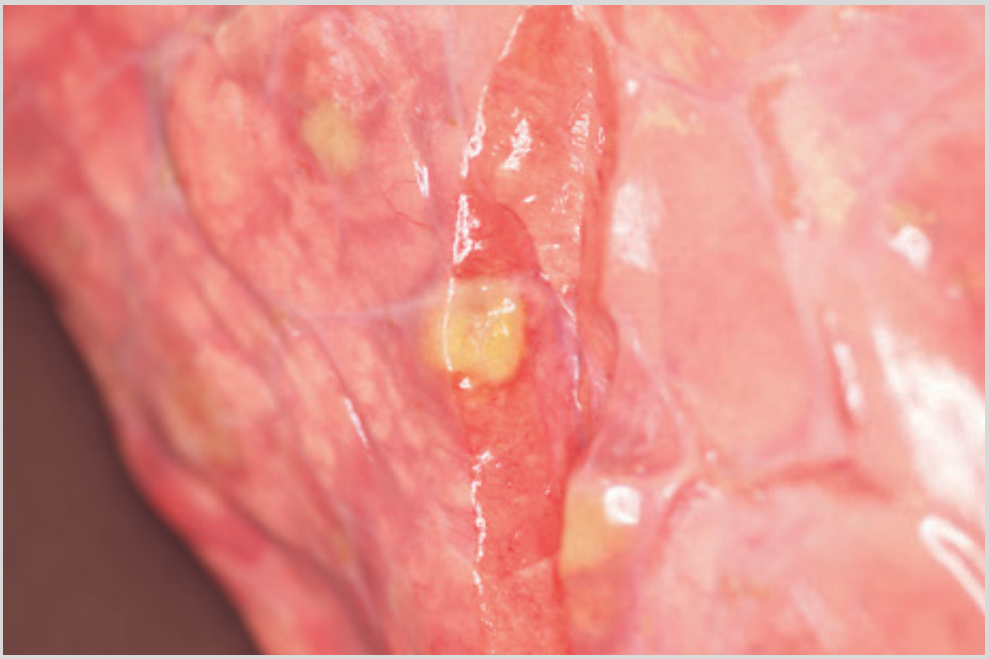
Animal species/Organ	Cattle/Lung
Lesion	Metastases from uterine carcinoma
Scoring	Total condemnation
Comments	Uterine carcinomas often spread to the regional lymph nodes, liver and lungs

21.48



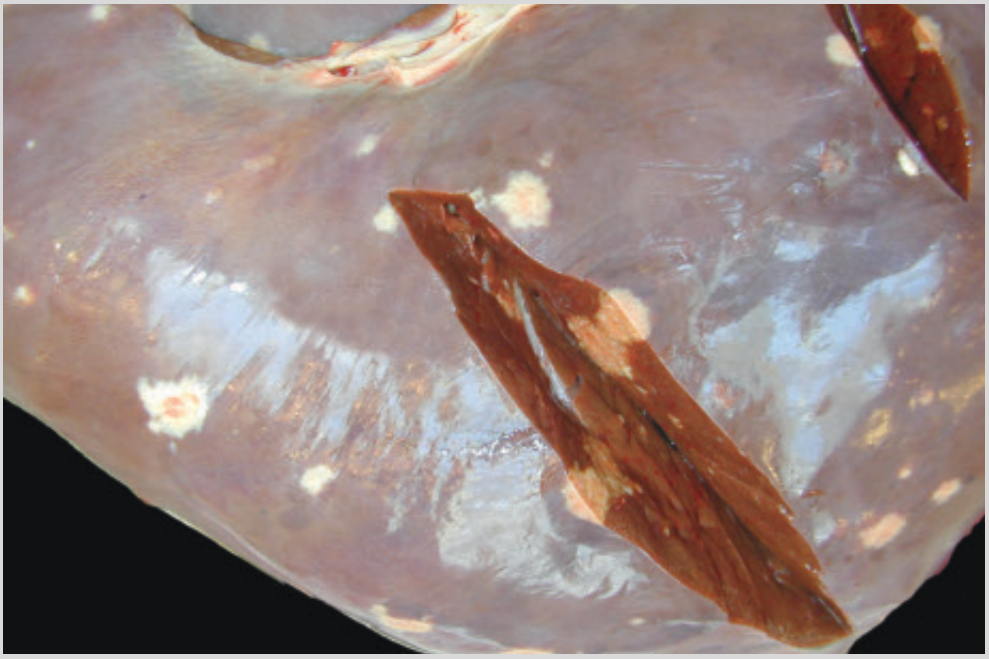
Animal species/Organ	Cattle/Lung
Lesion	Metastases from uterine carcinoma (sclerotic)
Scoring	Total condemnation
Comments	Uterine carcinomas often spread to the regional lymph nodes, liver and lungs. Note the yellow colour

21.49



Animal species/Organ	Cattle/Lung
Lesion	Metastases from uterine carcinoma
Scoring	Total condemnation
Comments	Must be differentiated from actinomycotic lesions. Note the yellow colour

21.50



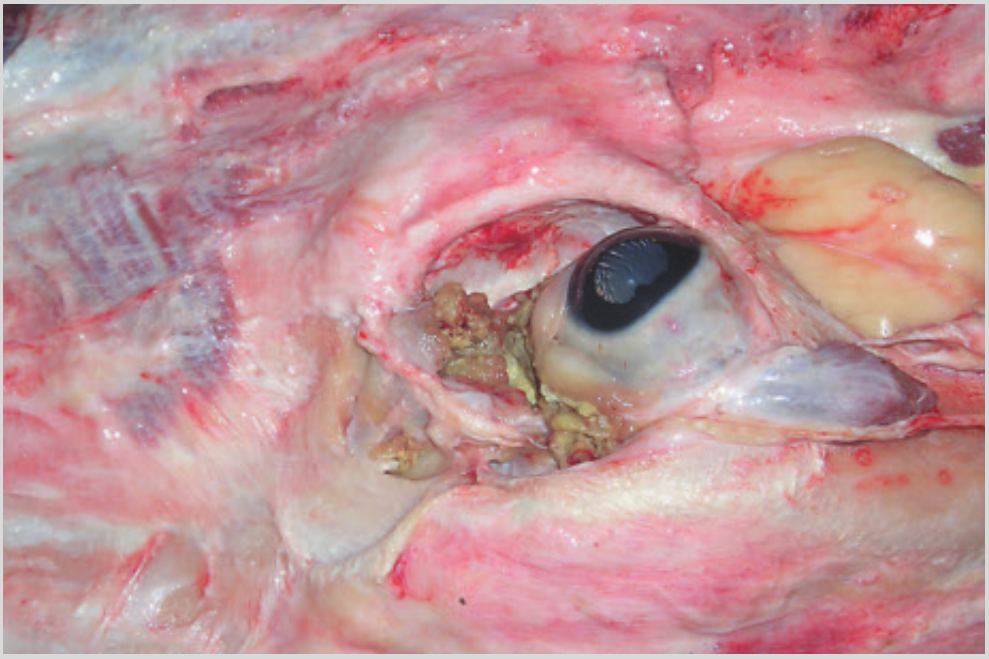
Animal species/Organ	Cattle/Liver
Lesion	Metastases from uterine carcinoma
Scoring	Total condemnation
Comments	Uterine carcinomas often spread to the regional lymph nodes, liver and lungs

21.51



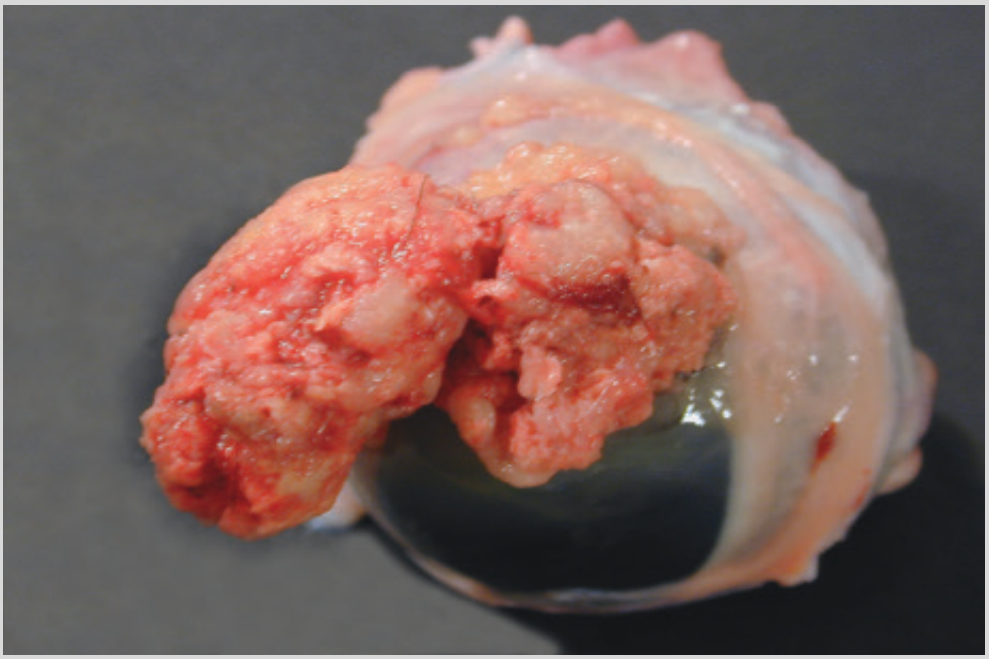
Animal species/Organ	Cattle/Eye area (left side)
Lesion	Ulcerative squamous cell carcinoma ("cancer eye")
Scoring	Total condemnation
Comments	Any suspected breach of the Animal Welfare laws must be notified

21.52



Animal species/Organ	Cattle/Eye area
Lesion	Invasive proliferative squamous cell carcinoma in the corner of the eye
Scoring	Total condemnation
Comments	Late stages of "cancer eye" can give rise to metastases

21.53



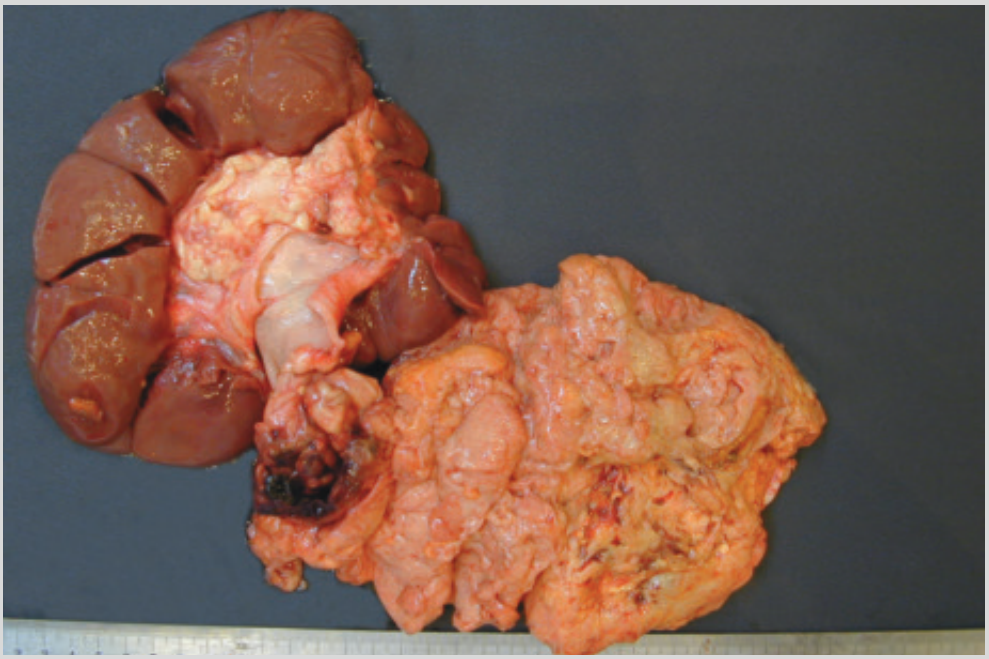
Animal species/Organ	Cattle/Eye
Lesion	Invasive proliferative squamous cell carcinoma ("cancer eye")
Scoring	Total condemnation
Comments	Late stages of "cancer eye" can give rise to metastases

21.54



Animal species/Organ	Horse/Glans penis
Lesion	Squamous cell carcinoma
Scoring	Total condemnation
Comments	Local invasive growth is frequent

21.55



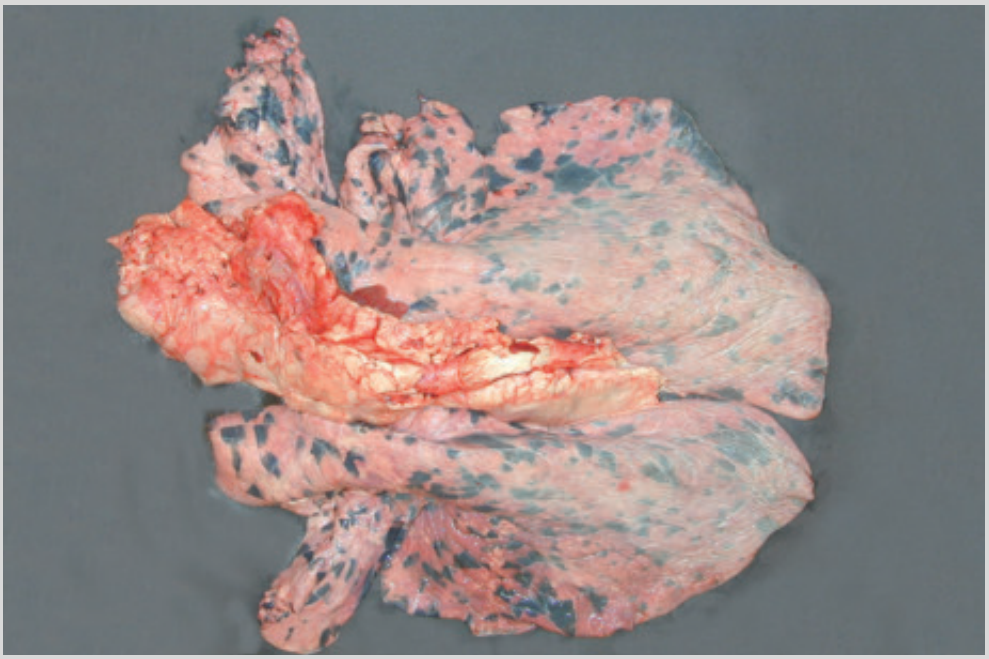
Animal species/Organ	Cattle/Kidney and adrenal gland
Lesion	Invasive cortical carcinoma
Scoring	Total condemnation
Comments	In the absence of invasive growth or metastasis the scoring is partial condemnation

21.56



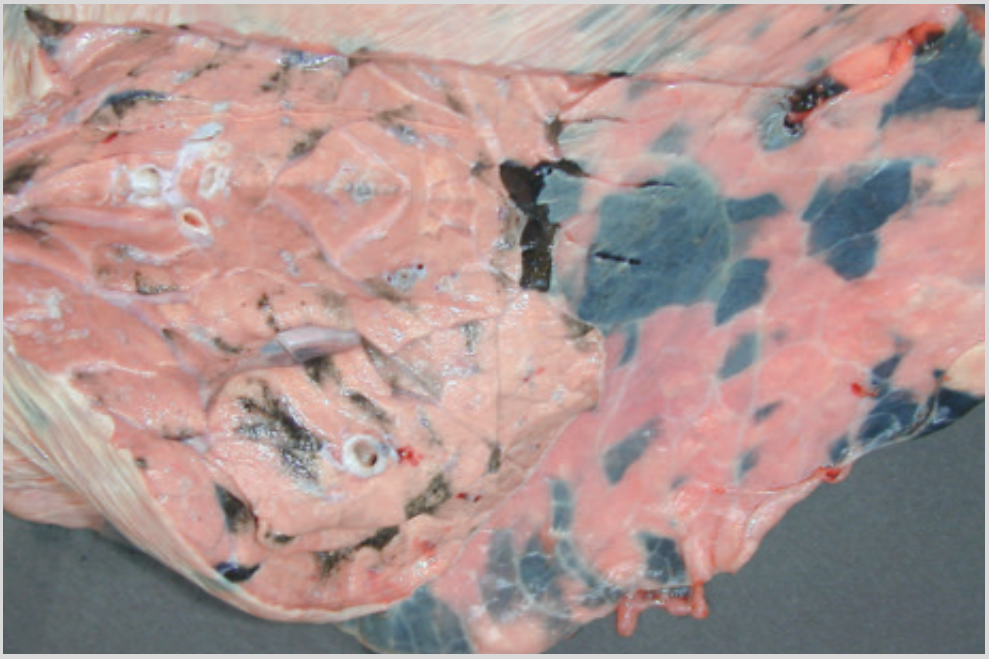
Animal species/Organ	Cattle/Adrenal gland and caudal vena cava
Lesion	Invasive growth of cortical carcinoma
Scoring	Total condemnation
Comments	Adrenal cortical carcinomas are seen most frequently in cattle

21.57



Animal species/Organ	Cattle/Lung
Lesion	Melanosis maculosa
Scoring	Partial condemnation
Comments	The lesions, which cannot be detected at palpation, typically disappear with age

21.58



Animal species/Organ	Cattle/Lung
Lesion	Melanosis maculosa
Scoring	Partial condemnation
Comments	The lesions, which cannot be detected at palpation, typically disappear with age

21.59



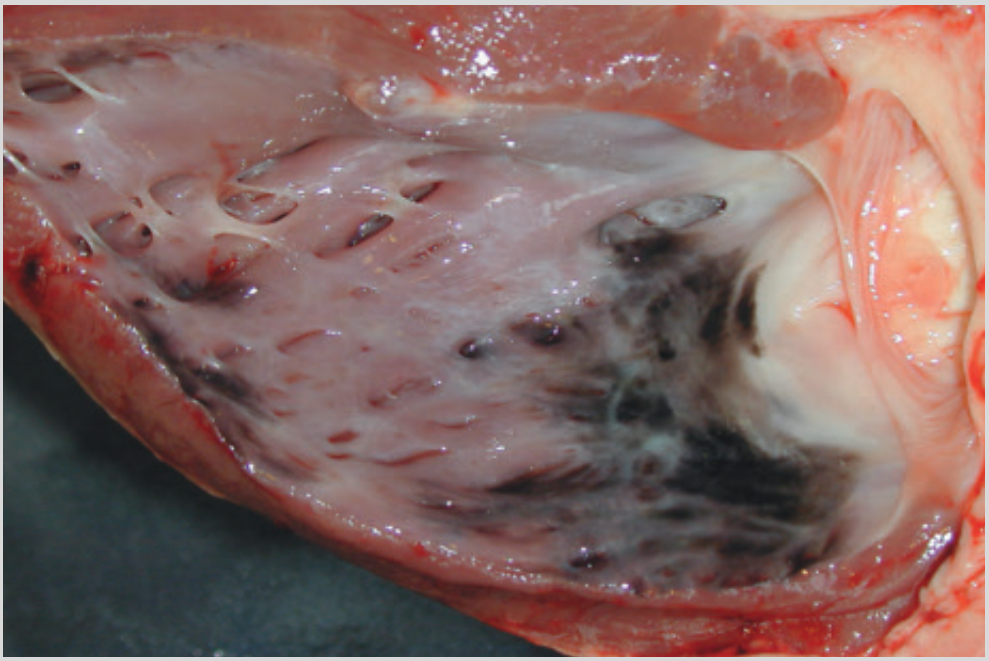
Animal species/Organ	Cattle/Lung
Lesion	Melanosis maculosa
Scoring	Partial condemnation
Comments	The lesions, which cannot be detected at palpation, typically disappear with age

21.60



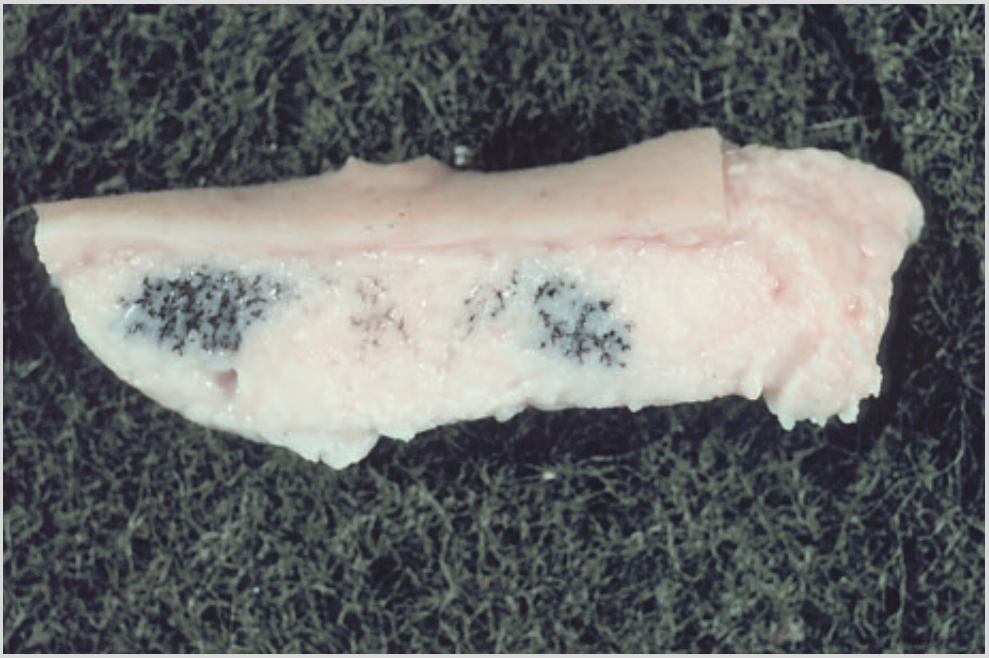
Animal species/Organ	Cattle/Heart (epicardium)
Lesion	Melanosis maculosa
Scoring	Partial condemnation
Comments	The changes typically disappear with age

21.61



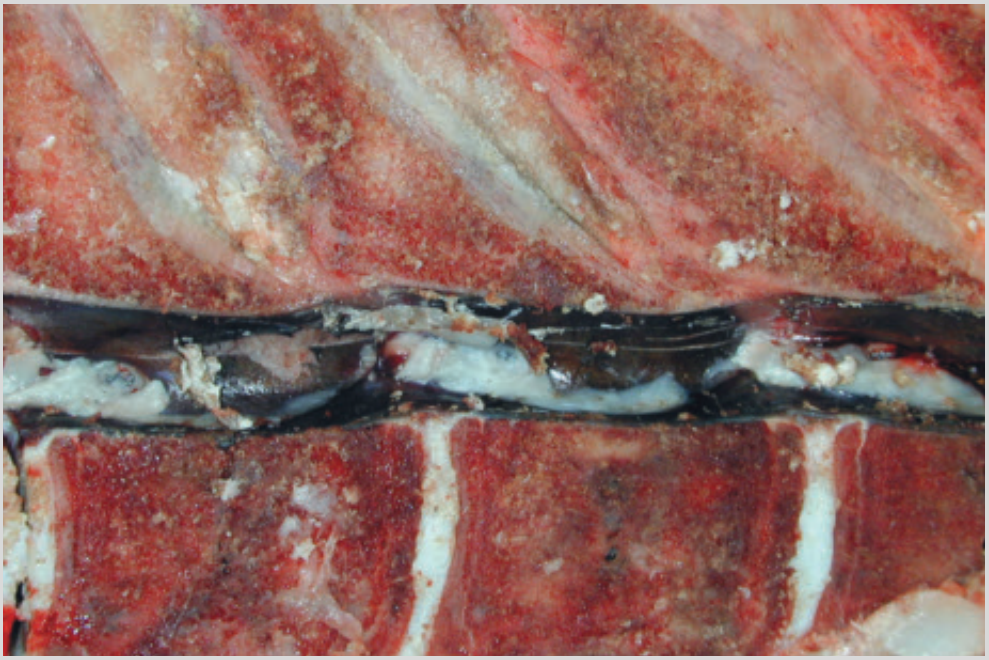
Animal species/Organ	Cattle/Heart (endocardium)
Lesion	Melanosis maculosa
Scoring	Partial condemnation
Comments	The changes typically disappear with age

21.62



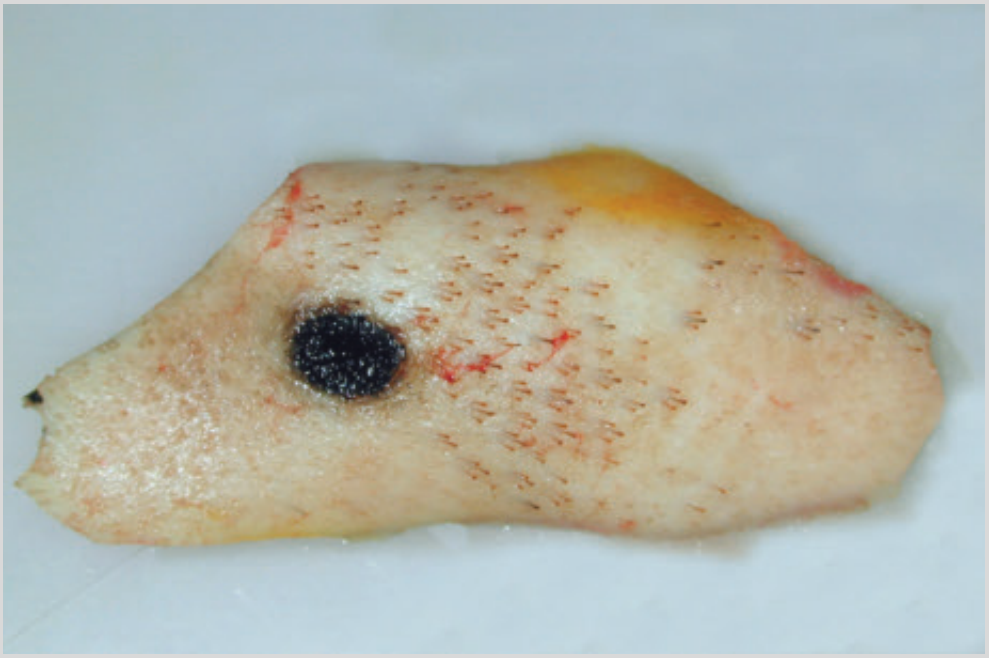
Animal species/Organ	Pig/Udder tissue
Lesion	Melanosis
Scoring	Partial condemnation
Comments	The lesions cannot be detected by palpation

21.63



Animal species/Organ	Sheep/Bone, opened vertebral canal
Lesion	Melanosis in the meninges surrounding the spinal cord
Scoring	Partial condemnation
Comments	In cattle the periosteum in the vertebral canal is typically the site of melanosis

21.64



Animal species/Organ	Pig/Skin
Lesion	Melanoma
Scoring	Partial condemnation
Comments	Regional lymph nodes can be black due to the melanin-containing macrophages

21.65



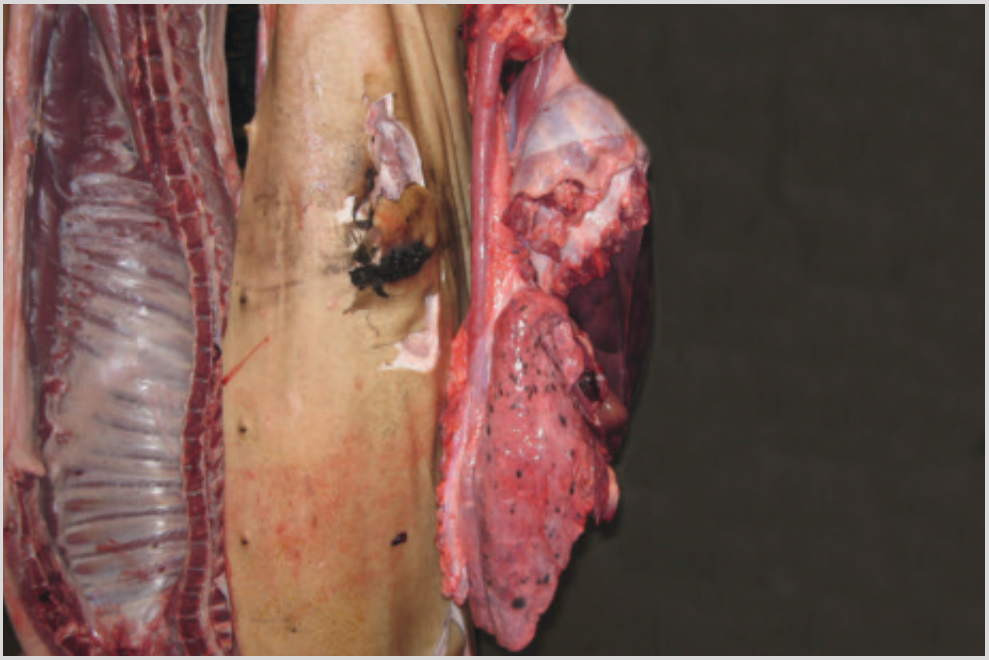
Animal species/Organ	Pig/Skin
Lesion	Melanoma
Scoring	Partial condemnation
Comments	Lymphatic spread of melanin may result in black pigmentation of the regional lymph nodes

21.66



Animal species/Organ	Cattle/Distal part of leg
Lesion	Melanoma
Scoring	Partial condemnation
Comments	Regional lymph nodes can be black due to the melanin-containing macrophages

21.67



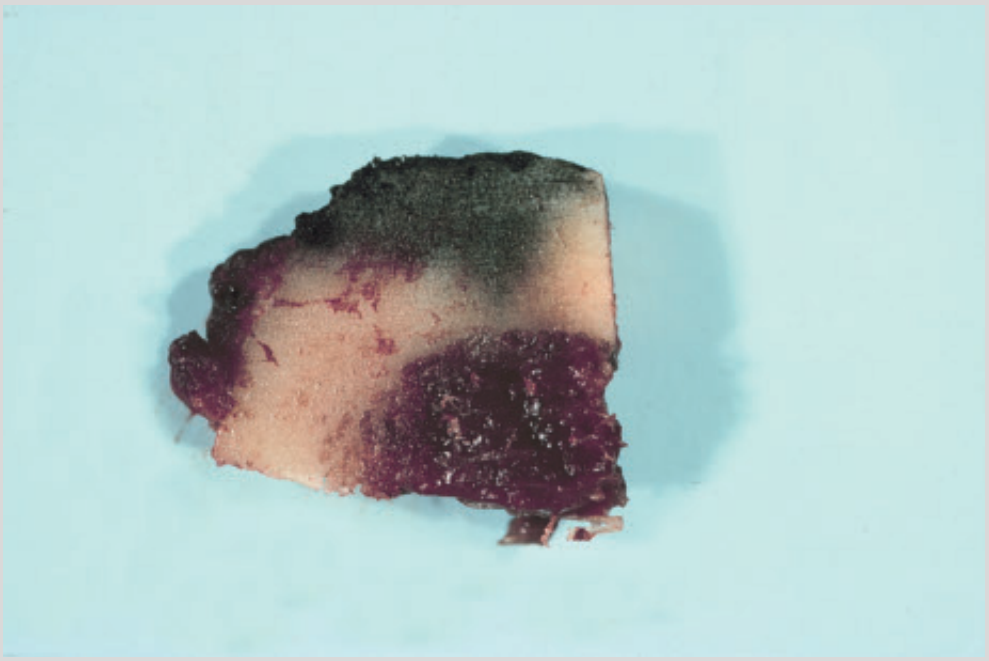
Animal species/Organ	Pig/Body with skin, lungs, heart and esophagus
Lesion	Invasive growth (skin) and metastatic melanocarcinoma (lung)
Scoring	Total condemnation
Comments	Both invasive growth and metastasis are signs of malignancy

21.68



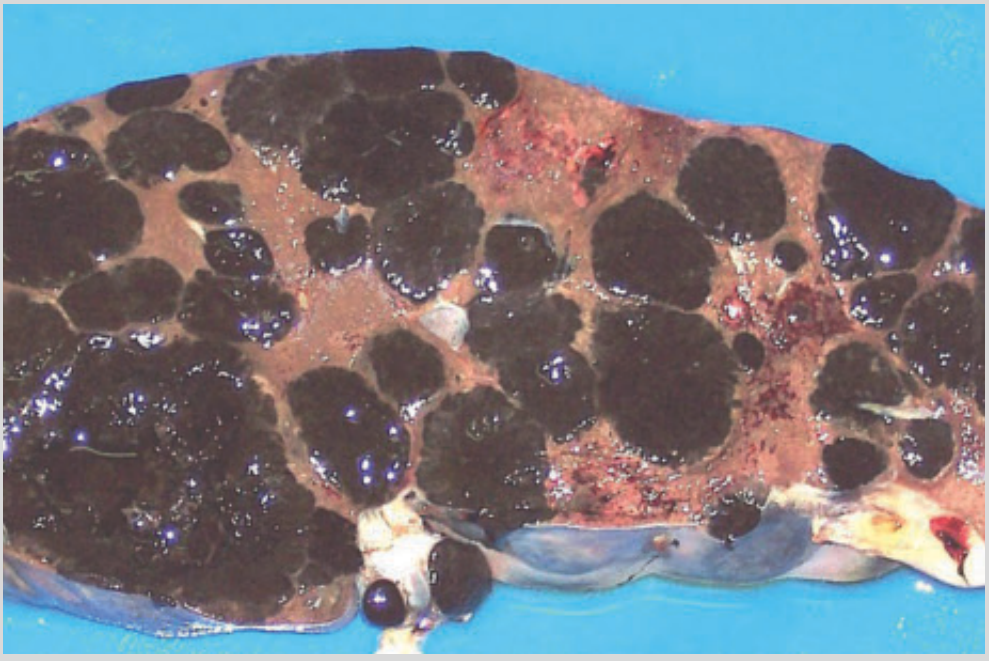
Animal species/Organ	Pig/Lymph node
Lesion	Metastatic melanocarcinoma (malignant melanoma)
Scoring	Total condemnation
Comments	If neoplasms are present, the regional lymph nodes must be examined

21.69



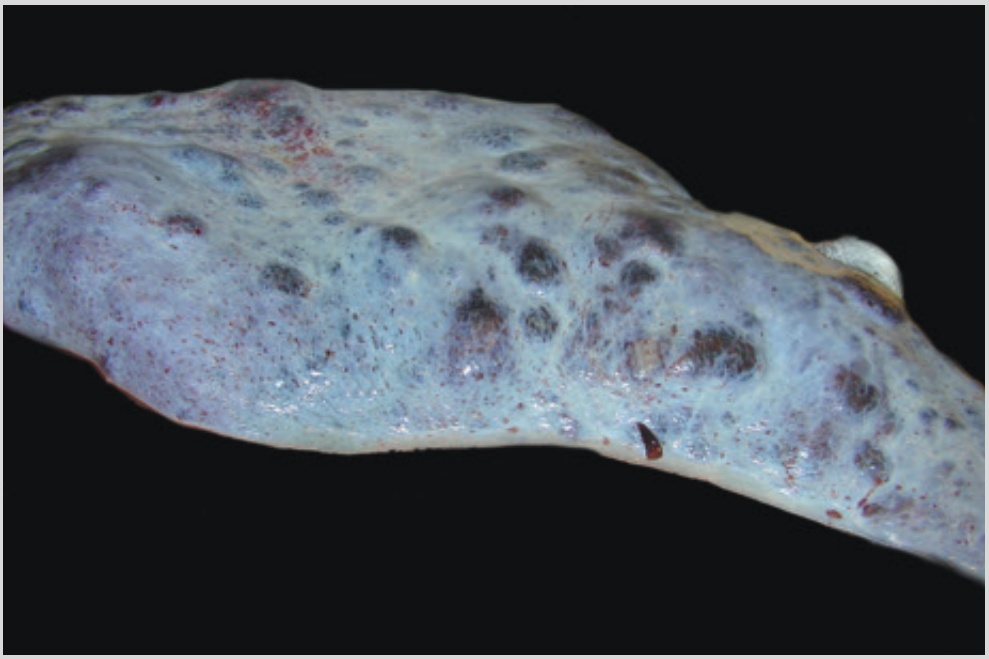
Animal species/Organ	Horse/Femur (part of cross section)
Lesion	Invasive melanocarcinoma (malignant melanoma)
Scoring	Total condemnation
Comments	Invasive growth is a sign of malignancy

21.70



Animal species/Organ	Sheep/Liver
Lesion	Disseminated melanocarcinoma (malignant melanoma)
Scoring	Total condemnation
Comments	Occurred by embolic spread to the liver

21.71



Animal species/Organ	Horse/Spleen
Lesion	Multiple melanocarcinomas (malignant melanomas)
Scoring	Total condemnation
Comments	The pathogenesis of melanomas in grey, white, and dappled horses is unclear

21.72



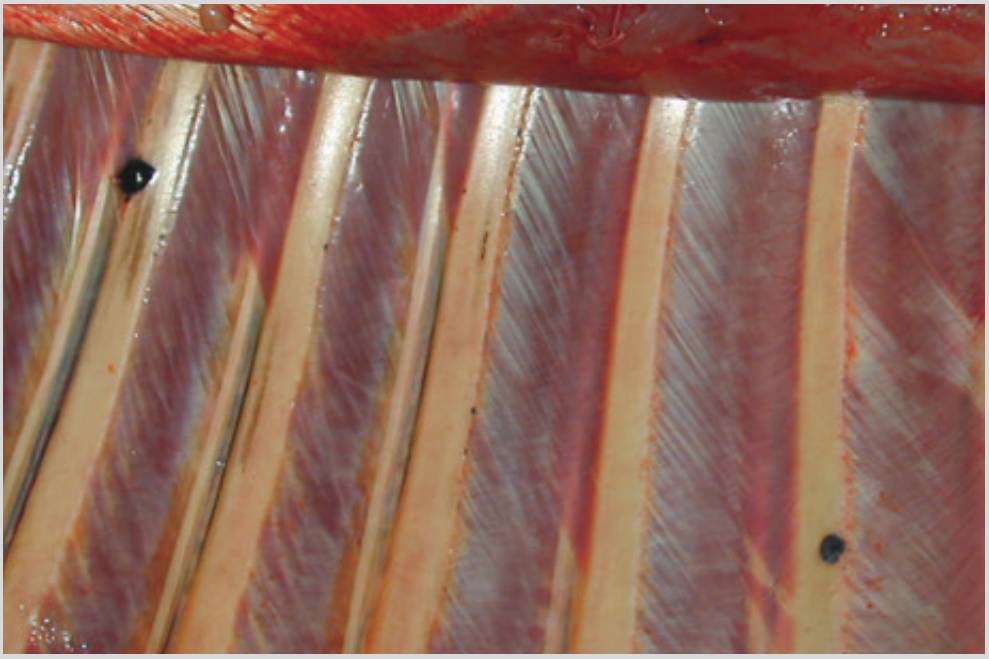
Animal species/Organ	Horse/Skin (below the tail)
Lesion	Multiple melanocarcinomas (malignant melanomas)
Scoring	Total condemnation
Comments	The pathogenesis of melanomas in grey, white, and dappled horses is unclear

21.73



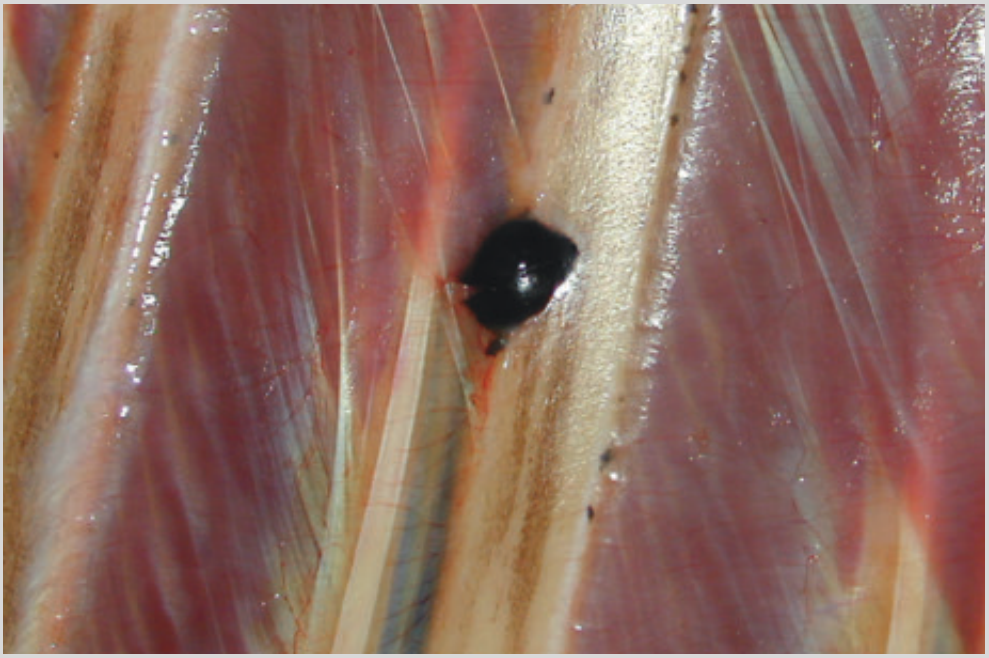
Animal species/Organ	Horse/Lymph node
Lesion	Metastatic melanocarcinoma (malignant melanoma)
Scoring	Total condemnation
Comments	The pathogenesis of melanomas in grey, white, and dappled horses is unclear

21.74



Animal species/Organ	Horse/Thoracic wall with pleura
Lesion	Multiple melanocarcinomas (malignant melanomas)
Scoring	Total condemnation
Comments	The pathogenesis of melanomas in grey, white, and dappled horses is unclear

21.75



Animal species/Organ	Horse/Thoracic wall with pleura (close-up of 21.74)
Lesion	Multiple melanocarcinomas (malignant melanomas)
Scoring	Total condemnation
Comments	The pathogenesis of melanomas in grey, white, and dappled horses is unclear

22 Animal Welfare and Forensic Investigations

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Reporting conditions harmful to animal welfare p. 786
Transport of animals to the slaughterhouse p. 787
Transport and slaughter of highly pregnant livestock and horses p. 789
Overgrowth, bruises, etc. p. 791
Nutritional state p. 791
Age-determination of lesions p. 792

Introduction

The legislation governing humane treatment of animals in connection with slaughter, including transport to slaughter, is regulated via the Animal Welfare Act (Consolidation Act no. 1150 of 12th September 2015) and Executive Order no. 1729 of 21st December 2006 concerning protection of animals during transport. In this respect it must be pointed out that the provisions of the Animal Welfare Act always take precedence over other legislation. In addition, the EU regulations concerning this area apply via the Council regulation (EF) No. 1255/97 and No 1/2005 concerning protection of animals during transport and related operations.

In general, the most frequently observed conditions registered as inhumane at slaughterhouses can be grouped as:

- Animals that are not suitable for transport or only partially suitable for transport
- Animals that are suitable for transport but which at arrival at the slaughterhouse display signs of having been exposed to inhumane conditions

The Veterinary Health Council has issued several statements in a number of areas which stipulate specific interpretations relating to frequent breach of the Animal Welfare Act, for example within the following areas:

1) Transport of sick or injured livestock including horses
2) Transport of slaughter animals with pelvic fracture and/or displaced hip
3) Transport of late pregnant animals
4) Lairage of animals taken to slaughter: Assembling at markets, collecting yards, and slaughterhouses
5) Lairage and moving of pigs at slaughterhouses

6) Pigs with large, complicated umbilical and inguinal hernias
7) Shoulder ulceration in sows
8) Ingrowing canine teeth in boars
9) Overgrown hoofs in livestock
10) Excessive use of a tattooing hammer

Reporting conditions harmful to animal welfare

The Veterinary Health Council regularly receives cases requiring a statement on matters of animal health and welfare. Some of these cases are based on reports submitted by veterinarians at the veterinary meat inspection. As a result of this, on 17th of February 2009, the Veterinary Health Council proposed the following recommendations and precautionary measures which should be complied with in cases of improper treatment of animals, or where there is reason to believe that there is violation of the Animal Welfare Act. This is intended to provide maximum objectivity in these cases. It must be further emphasised that, pursuant to the Animal Welfare Act, the veterinarian has a duty to notify any gross negligence to the appropriate authorities. In other words, it is the responsibility of the inspecting veterinarian to report such conditions.

In cases of breach or justified suspicion of breach of the Animal Welfare Act, the report must contain the following as a minimum:

1) An objective clinical description of the condition of the animal(s) at ante-mortem inspection or at assessment of the herd. The description must in particular provide objective information to enable an assessment of the degree of pain, suffering, distress, permanent injury, and significant harm, with respect to the provisions of the Animal Welfare Act.

   The Council thus finds it of the utmost importance that the notifying veterinarian bases the report not only on a thorough clinical examination (including visual examination and palpation) but also a thorough description of the findings relating to loss of function, pain, and other conditions important for the assessment, e.g. swelling, skin turgor, palpable structures, signs of and type of repair processes which could assist in assessing the age of the condition, and degree of pain.

2) In relevant cases, a pathologic-anatomic description of the condition in question, including an estimate of how long the condition has been ongoing.

   In order to secure the optimal basis for the Council's assessment of these cases, it is necessary that the lesions are described in detail both qualitatively and quantitatively to ensure objectivity.

   Relevant material should if possible be stored frozen for use in later investigations
   The descriptions under 1) and 2) should be supplemented with photographic evidence of the relevant material.

3) With regard to reporting conditions in herds, or housing areas, these reports should include a detailed description of the animal, its housing, and conditions relevant to feed, drinking water, and care in general.

At post-mortem examination of animals which have prompted notification to the appropriate authorities, it is important that, other than the standard meat inspection investigations, only a minimum number of incisions/sections are made on the lesion(s) on which the report is to be based. This is of particular importance for possible subsequent investigations. For optimal examination of bone and joint lesions, sawing preparations, sawing in the sagittal plane is recommended.

Transport of animals to the slaughterhouse [22.01 – 22.26]

Legislation covering assessment of cases concerning transport of sick or injured animals is stipulated in the Animal Welfare Act (Consolidation Act No. 1150 of 12th September 2015) and Executive Order No. 1729 of 21st of December 2006 concerning protection of animals during transport.

The Veterinary Health Council has issued the statement of 17th of February 2009 concerning transport of injured livestock including horses, which stipulates that the following recommendations should be complied with regarding transport of sick or injured animals to slaughter or to production.

1) Animals, which cannot walk or stand unassisted, or animals which have non-weight-bearing lameness, severe weight-bearing lameness, or severe mobility problems due to diagnosed or presumed bone fractures, joint displacement, painful inflammatory conditions in the limbs (joint inflammation, tenosynovitis, and similar) as well as animals suffering from general weakness, must not be transported alive to slaughter or to production, but must be euthanized or undergo emergency slaughter on site. See in addition item 3 on recommendations relating to transport of sick or injured livestock and horses to veterinary hospitals or clinics.

2) Animals with serious open wounds or animals with rectal or vaginal prolapse are not considered to be suitable for transport.

3) The Veterinary Health Council considers finisher pigs with hernias larger than 15 cm and with complications such as lesions on the hernial sac, restricted movement, affected general health, or signs of other complications such as incarceration, peritoneal inflammation and similar as unsuitable for transport. Finisher pigs with umbilical or inguinal hernias larger than 15 cm without the above-mentioned complications can be transported if they are kept separate from other animals and are provided with an extra thick layer of appropriate bedding. Prior to, during, and after transport, the animals must be kept separated from healthy animals by means of robust partitions, and the vehicle must be equipped with a non-slip surface. See

in addition the Veterinary Health Council's "Statement of 2nd December 2008 concerning pigs with large/complicated umbilical or inguinal hernias".

4) Animals must not be transported to slaughter or to production in the last tenth of gestation; similarly cattle are not considered suitable for transport for 14 days after calving. Special rules apply for internal transportation at production sites.

5) Animals with good general health, or minimally-affected general health, suffering from less painful conditions such as injury, healed, or local inflammatory conditions, as well as mild lameness and any resultant mobility problems, may be transported alive but only if the animal does not suffer further as a result of the transport. A veterinary certificate must be obtained in cases of doubt as to whether the animal would endure unnecessary suffering at transport. Loading and unloading as well as moving of the animal must take place separately, and the animal must be able to walk unassisted. Transport of sick, injured or emaciated animals must only take place if the floor of the vehicle is supplied with an extra thick layer of appropriate bedding. These animals must not be transported across markets or similar.

6) Similarly, prior to transport an appraisal must be made, with expert assistance if necessary, of whether the animal(s) in question is/are suitable for slaughter, or whether it/they should be euthanized and sent for destruction.

7) Animals which become sick or injured during transport must be given immediate first aid. They must be treated by a veterinarian and, if necessary to protect against further pain and suffering, may be euthanized or undergo emergency slaughter.

In 2005, the The Danish Veterinary and Food Administration issued a notification concerning tightening the transport suitability assessment of animals at collecting yards, and at export. Even though the provisions are not directly intended for transport of animals to slaughterhouses, sections of the recommendations can serve as guidelines for assessment of those conditions and types of lesions necessitating stricter assessment of transport suitability. In connection with the notification, it is emphasised that any doubt about the suitability of the animal to be transported must always benefit the animal. Specific conditions which necessitate that the animal is euthanized immediately (emergency slaughter or destruction) or transported on thick bedding to slaughter at a nearby slaughterhouse (within a radius of about 30 km) separated from other animals and accompanied by a slaughter certificate, include:

– Lean animals, including thin sows.
– Animals presenting with positional anomalies of the limbs, mobility problems, jerky walking, tripping, and weight-bearing lameness with resulting restricted movements.
– Animals with open, larger wounds (> 3 cm in diameter), in which the wounds are not dry and undergoing healing with formation of granulation tissue. Typical examples include ear bite ulcers, hernial wounds, and vulvar wounds.

- Animals with open tail bite ulcers, in which the sore is not dry or undergoing healing with formation of granulation tissue.
- Animals with rectal prolapse and/or vaginal prolapse regardless of whether the condition is intermittent or persistent.
- Pigs with aural haematoma ("blood ear"), unless the condition has passed the resorption phase and in all probability is irreversible.
- Abscesses (boils) if they are a problem for the animal, e.g. in relation to pain, movement and orientation ability, or because there is an immediate risk that they will rupture as a result of injury during transport.
- Animals with hernias taking into consideration the animal's general well-being and the localisation, appearance, and size of the hernia.

Transport and slaughter of highly pregnant livestock and horses

Transport of pregnant livestock and horses in the last tenth of gestation is regulated by the Regulation concerning protection of animals during transport and related operations and the amendments of Directive 64/432/EEC and 93/119/EF and Regulation (EF) No. 1255/97 (EF) No. 1/2005 and the law on prohibition of slaughter and destruction of pregnant livestock and horses in the last tenth of gestation Consolidation Act No. 258 of 8th March 2013 and Act no. 269 of 21st of April 2004. Based on the recommendations from the Veterinary Health Council, transport of the above-mentioned animals regardless of distance and time is not permitted. Special rules apply for internal transportation at production sites. Prohibition of slaughter and destruction of highly pregnant animals is effected through Act no. 269 of 21 April 2004 concerning prohibition of the slaughter and destruction of pregnant livestock and horses in the last tenth of gestation. It can be mentioned that the Veterinary Health Council has not recommended prohibition of the slaughter of highly pregnant animals.

Referring to the Council Regulation concerning protection of animals during transport and related operations it is apparent that transport of animals is not permitted in the following number of days prior to the expected birth:

Solipeds:	34 days
Cattle:	28 days
Sheep:	15 days
Goats:	15 days
Pigs:	11 days

The Council Regulation furthermore states that livestock and horses are not considered suitable for transport for 14 and 7 days, respectively, after they have given birth. It is further stipulated that animals that are less than two weeks old are not considered suitable for transport.

Exceptions to the law concerning slaughter and destruction of highly pregnant animals include emergency slaughter at the farm; cases where the animal has been incor-

rectly transported to a slaughterhouse; destruction as part of official countermeasures against disease; and in connection with technical and scientific studies.

There will always be some uncertainty associated with age determination of the foetus. The most accurate determination of the gestational age is provided by the farmer's documentation of when the animal became pregnant. As guidelines for assessment of the gestational age in cattle, the Danish Veterinary and Food Administration on 24th of October 2008 issued "Vejledning vedr. vurdering af om kvæg er i den sidste tiendedel af drægtighedsperioden" [Guidelines relating to assessment of whether cattle are in the last tenth of gestation]. The guidelines stipulate that the age of the foetus can be assessed at post-mortem, when the data below relating to cattle foetuses can be applied (Table 22-1); however, there can be a large variation in the figures given. The variation in the foetus weight primarily depends on the size of the mother. The newborn calf weighs from 1/13 to 1/16 of the mother's weight, the latter being weighed immediately prior to birth, i.e. the calf foetus will weigh about 30 kg (range from 20-50 kg). As is apparent from the table, the foetus becomes fully developed during the last month with a coat and erupted incisors

The Veterinary Health Council has in a recommendation further emphasised that the calf's gender, weight (kg with 1 decimal point), and breed should be recorded immediately after the foetus has been removed. The foetal crown rump length (in cm), which is measured from midway between the ears to the start of the tail root defined as the place on the spinal column that lies above the anal fold (i.e. where the tail can be seen to begin). Furthermore, the calf's head with neck should be sent for further investigation.

Table 22-1. Gestation-specific parameters for the last tenth of the gestation period in cattle

Days of gestation	Volume of amniotic fluid (ml)	Fetus length (cm)	Fetus weight (kg)	Diameter of uterine placentomas* (cm)	Diameter of middle uterine artery (cm)	Fetus characteristics
240	8,000-12,000	60-85	15-25	6-9	1.25-1.7	Fine, short hair everywhere on the body. Incisors not erupted
270	12,000-20,000	70-100	20-50	8-12	1.5-1.9	Coat developed to normal length, large fetus, incisors erupted

* The figures are guidelines only; there can be large variation.

Overgrowth, bruises, etc. [22.27 – 22.50]

As noted earlier, it is the responsibility of the veterinarian to report any gross negligence which is not immediately remedied in accordance with the Animal Welfare Act. Intentional disregard of this duty to report is punishable with a fine in accordance with the Animal Welfare Act. This also applies to conditions at transport to slaughterhouses that in themselves do not mean that the animal is not suitable for transport or has limited suitability for transport (separated from healthy animals by robust cubicles and non-slip surfaces). Examples of such conditions include the presence of bruises; overgrown canines in boars with penetration of lips, cheeks, gums and jaw bones; growth of horn tips into the head particularly in cattle; deep shoulder ulcerations in sows; elephantiasis in ears; and large hernias.

Nutritional state [22.51 – 22.54]

Assessment of the animal's nutritional state must distinguish between thinness and emaciation. In thinness, there is only a sparse layer of fat, typically localised in the orbital region, around the large joints, around the coronary vessels of the heart and in the subserous tissue. In thin animals, the fatty tissue is normal in appearance with normal texture. Emaciation is a pathologic condition in which there is serous atrophy of the fat tissue, possibly also with atrophy of other tissues. Emaciation typically occurs as a complication to chronic disease, but can also occur as a result of malnutrition. In emaciated animals, subcutaneous fatty tissue depots will be absent as will depots around the coronary vessels, in the subserous tissues, or intramuscularly. Serous fatty tissue atrophy is characterised macroscopically by discolouration, and an oedematous and gelatinous texture. In bone marrow, serous atrophied fatty tissue will appear as a red, wet, slimy, gelatinous mass. Extreme emaciation, in which in addition to fatty tissue atrophy there is atrophy of other organs such as muscles and the liver, is traditionally called cachexia. Histologically, the appearance of the serous fat atrophy is the result of atrophy of fat cells and increased production and accumulation of glycosaminoglycans. The muscles in cachexia will be floppy, pale, and moist because the atrophy primarily involves the muscle cells, and the connective tissue thus becomes relatively prominent. The pale colour is partly due to the relative over-representation of connective tissue and partly due to the fact that cachexia is often accompanied by anaemia. In cachexia, the liver and heart muscles will also typically undergo atrophy, but in these organs the atrophy, in addition to reducing the organ volume, will often also cause dark discolouration of the organs due to accumulation of lipofuscin. In some cases of cachexia, lipofuscin accumulates in the skeletal muscles which means that the muscles do not become pale but darker.

At meat inspection, thin animals necessitate unconditional approval. This applies of course only in the absence of other conditions that would necessitate stricter judgement. Emaciated/cachectic animals however always necessitate total condemnation. Delivering these animals to slaughter is not acceptable regardless of the underlying cause, because some sort of intervention should have occurred earlier.

Age-determination of lesions [22.55 – 22.68]

Age-determination of a given lesion depends on numerous factors, including the type of tissue injured (in general, reactions in bony tissue take a longer time than corresponding reactions in soft tissues), the grade of the lesion, complications at healing which includes the animal's age (restitution is much faster in young animals than adult animals), constitution, hormonal disorders, nutritional state, the local blood supply, microbial contamination, etc. In general, the problem when dating lesions in slaughter animals is whether the lesion was present before transport of the animal to the slaughterhouse, or whether the injury occurred during transport or at the slaughterhouse prior to slaughter.

Macroscopically, there are generally no problems of dating chronic lesions in which inflammatory and reparatory changes are present, for example, granulation and/or connective tissue formation; periostal bone formation; bone sequestration; and hyperplasias. Furthermore, the presence of visible atrophy of muscles and bones due to lack of use is an expression of long-term inactivity (inactivity atrophy). Neither is dating normally a problem in cases of overgrowth of horn, hoof, and teeth. All the listed tissues have very slow growth, for example, the hoof grows at a rate of about 7 mm a month. This also applies to swellings regardless of whether these are due to neoplastic growth, hyperplasias, or hernias. In these types of changes, it is generally possible to determine definitely that these lesions are several days, weeks or even months old. Because neoplasms can have a very high growth rate, dating in some cases will be associated with great uncertainty unless it is possible to obtain anamnestic information on the time of onset of the growth. In other cases, histologic examination can aid in dating. In these cases, the development of supporting tissue in particular, and changes in surrounding tissue (e.g. atrophy and fibrosis), can provide a basis for better clarification of the time point. In contrast, it is generally not possible to give a definite upper limit for the length of time the lesion has been present. This is due to retraction phenomena and the fact that we do not have information on the maximum inflammatory/reparatory response, for example. It is quite difficult on a macroscopic basis to determine the age of the early stages of the lesions in which reparatory changes are not yet visible. Even though discolouration due to bleeding, blood resorption to the regional lymph nodes, the amount of exudate and similar can indicate that the lesion has been present for several hours or days, a histologic examination will always be the most reliable way to determine the age of that type of lesion. Histologic examination will enable determination of the stage of the inflammatory or reparatory sequence which, in principle, is established simultaneously with onset of the injury. The approximate times for the cellular and extracellular observations associated with wound healing in the skin and in established granulation tissue are listed in Tables 22-2 and 22-3. In connection with the inflammatory response the reactions in the different tissues will often also be of great help in dating a given lesion. This applies for example when establishing soft callus and muscle regeneration phases at examination of fresh bone fractures and surrounding laceration of the muscles. Thus the osteogenic reactions in healing of an uncomplicated fracture of a long bone will undergo the following changes: 1) There is

immediate hematoma formation, fracture-end necrosis, and invasion by macrophages (remove debris and necrotic fracture ends); 2) In the following 5 days or so, there is onset of granulation tissue formation and proliferation of endostal and periostal chondroblasts and osteoblasts; 3) The soft callus is established from about day 3 to day 7, when the fracture ends are joined by granulation tissue containing islands of cartilage; 4) In the next 2-4 weeks, a hard callus is established between the fracture ends, and osteoid trabercles with mineralisation can be seen; 5) Subsequently, the hard callus is remodelled by re-establishment of the bone marrow.

In injured muscle, in addition to reparatory changes such as granulation tissue formation and fibrosis, it will be possible to see the following changes conditional on an intact basement membrane and the presence of satellite cells: 1) Within 24 hours, necrosis and perhaps mineralisation of the injured muscle fibres will be seen; 2) From day 1 to day 3, macrophages will invade the necrotic fibres, and neutrophils will be present in limited numbers. At the same time as the macrophage invasion, the satellite cells, which are localised between the basal membrane and the muscle cells' plasma membrane, hypertrophy and undergo mitosis; 3) Hereafter, the satellite cells migrate in towards the centre of the muscle fibres where there is an ongoing, simultaneous removal of necrotic debris and plasma membrane by the macrophages; 4) The satellite cells are transformed to muscle cells, which merge and send cytoplasmic processes out into the "empty" muscle fibres. These merge later with adjacent processes, whereby basophilic-staining, new, muscle fibres with centrally positioned nuclei are formed; 5) 2-3 weeks after onset of injury, the centrally-localised muscle nuclei migrate to the periphery and striation is re-established.

The outlined regeneration of an injury to a striated muscle is, as noted, conditional on the presence of an intact basement membrane and viable satellite cells in the muscle fibres. If these are not present, a muscle injury will be repaired by fibrosis. Similar tissue-specific reaction patterns also occur in other tissues, in which the reparatory process is, once again, under certain tissue specific conditions decisive in determining whether repair takes place by regeneration or substitution with granulation/connective tissue (scar tissue).

Standard timing for a number of reactions in an open wound at healing *per primam* (clean, non-infected wound with close-lying wound edges) and an inflammatory granulation tissue are listed in Tables 22-2 and 22-3. In established granulation tissue (about 6-8 days old) the maximum growth rate, deducted for retraction due to formation of myofibroblasts, will be about 0.5 mm per day. Because a large number of factors are important in the repair process, and thus for the time of progression, it must be pointed out that in all cases it is only possible to give an approximated age of a lesion. The listed cellular and extracellular changes in wound healing and granulation tissue formation must therefore always be assessed in relation to the animal's age, constitution, nutritional state, etc. as well as complications such as concomitant infection, tissue loss, and instability of the lesion area. It must be pointed out that the listed timing for repair of a wound in the skin does not apply for example to stratified epithelial mucous membranes (e.g. in the oral cavity, and forestomachs of ruminants), in which the repair response progresses far more rapidly.

Table 22-2. Expected duration of cellular and extra-cellular changes in an open, uncomplicated lesion in the skin at healing *per primam*

Duration after onset of lesion	**Cellular and extra-cellular changes**
Less than 4 hours	Bleeding, thrombosis, and fibrin formation.
After 4 hours	Neutrophilic granulocytes are present in the perivascular space. Sporadic mononuclear cells.
From 8 to 12 hours	Neutrophilic granulocytes, macrophages, and activated fibroblasts. The granulocytes are over-represented compared to macrophages (ratio about 5:1).
From 16 to 24 hours	The relative number of macrophages increases, and the relative number of neutrophilic granulocytes falls (ratio about 0.4:1).
From 24 hours to about 2-3 days	Maximum number neutrophilic granulocytes. Onset of epithelial growth into the wound. After about 2 days there is a maximum number of macrophages.
From 2 to 4 days	Migration of fibroblasts towards the wound edge.
From 3 to 4 days	Epithelialisation of small wounds is complete, and thickening may be present. There is growth of capillaries. A granulation tissue is established.
From 4 to 5 days	Massive capillary growth and formation of collagen fibres.
From 5 to 7 days	The epithelial thickening recedes to normal height and there is maximum infiltration of lymphocytes in the periphery of the wound.
From 8 to 12 days	The numbers of all inflammation cells, fibroblasts, and capillaries drop, and the thickness of collagen fibre increases.
After 12 to 14 days	Vascularisation in the dermis normalises. Fibroplasia is at a maximum with restitution of the collagen fibres. The epithelium has a definite basal membrane.
More than 14 days	Gradual retraction in connection with maturation of the connective tissue.

Table 22-3. Expected duration of cellular and extra-cellular changes in inflammatory granulation tissue

Time of first onset	Presence of elements
1 hour	Extravasal blood
2 hours	Neutrophilic granulocyte
2 hours	Monocytic macrophage
2 days	Histiocytic macrophage
2 days	Fibroblast
3 days	Collagen fibre
5 days	Collagen threads
3-5 days	Capillary growth
7 days	Lymphocyte
5-10 days	Plasma cell
3-7 days	Epitheloid cell
3-7 days	Giant cell
4-7 days	Canalised capillaries
1 month	Elastic fibers
3 months	Double light refracting collagen fibers

22.01



Animal species/Organ	Cattle/Entire cadavers
Lesion	The animals were severely debilitated prior to euthanasia
Scoring	Must be taken immediately to be destroyed
Comments	Animals suffering from general debilitation must not be transported alive to slaughter

22.02



Animal species/Organ	Cattle/Entire cadaver
Lesion	The animal was generally debilitated and emaciated prior to euthanasia
Scoring	Must be taken immediately to be destroyed
Comments	Animals suffering from general debilitation must not be transported alive to slaughter

22.03



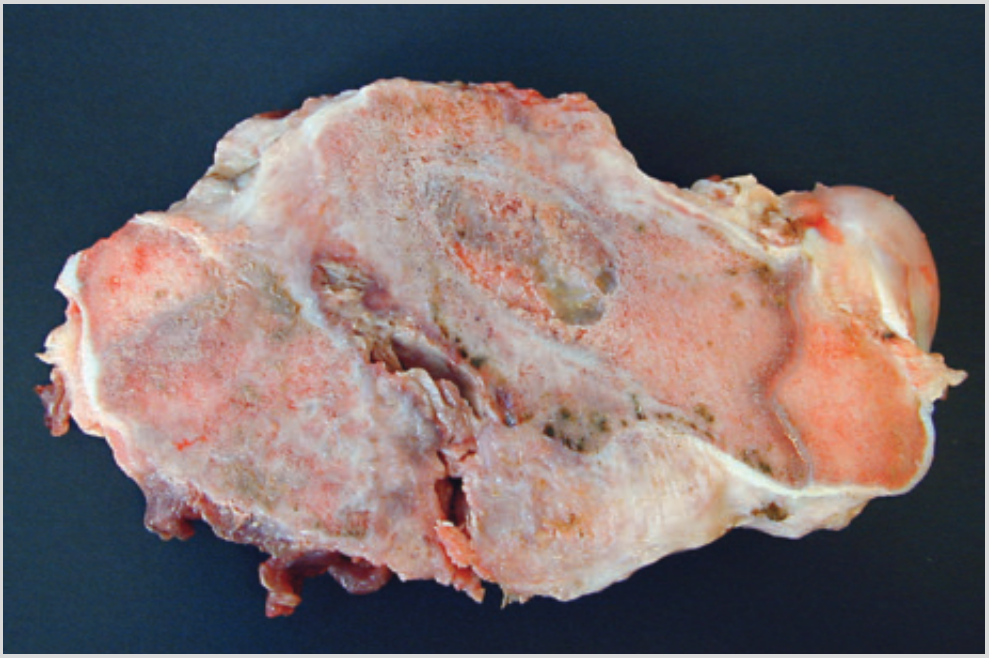
Animal species/Organ	Cattle/Entire cadaver
Lesion	The animal was generally debilitated and emaciated prior to euthanasia
Scoring	Must be taken immediately to be destroyed
Comments	Animals suffering from general debilitation must not be transported alive to slaughter

22.04



Animal species/Organ	Pig/Live sow
Lesion	The animal was generally debilitated at arrival at the slaughterhouse
Scoring	The animal can be kept under observation for up to 2 hours if this does not cause unnecessary suffering
Comments	Debilitated animals are generally euthanized and sent immediately to be destroyed

22.05



Animal species/Organ	Cattle/Femur
Lesion	Chronic, dislocated fracture, resulting in severe weight-bearing lameness
Scoring	Partial condemnation
Comments	Animals with severe weight-bearing lameness must not be transported alive to slaughter

22.06



Animal species/Organ	Pig/Distal section of hindleg
Lesion	Swelling and ulceration in the pastern area. The animal was severely lame
Scoring	Must be sawn through prior to judgement. The sawn section is reproduced in 22.07
Comments	Animals with severe weight-bearing lameness must not be transported alive to slaughter

22.07



Animal species/Organ	Pig/Distal section of hindleg (sawn through)
Lesion	Chronic, purulent osteomyelitis, arthritis and periarthritis
Scoring	Approved for deboning
Comments	Animals with severe weight-bearing lameness must not be transported alive to slaughter

22.08



Animal species/Organ	Cattle/Distal part of both forelegs
Lesion	Overgrown claw. The animal had mild mobility problems
Scoring	Partial condemnation
Comments	Animals with mild mobility problems can, under special conditions, be transported

22.09



Animal species/Organ	Cattle/Distal part of the foreleg
Lesion	Overgrown claw with deep fissure in the heel. The animal had mild mobility problems
Scoring	Partial condemnation
Comments	Animals with mild mobility problems can, under special conditions, be transported

22.10



Animal species/Organ	Horse/Distal part of hindleg
Lesion	Overgrown hoof. The animal had mobility problems
Scoring	Partial condemnation
Comments	Should have been trimmed earlier

22.11



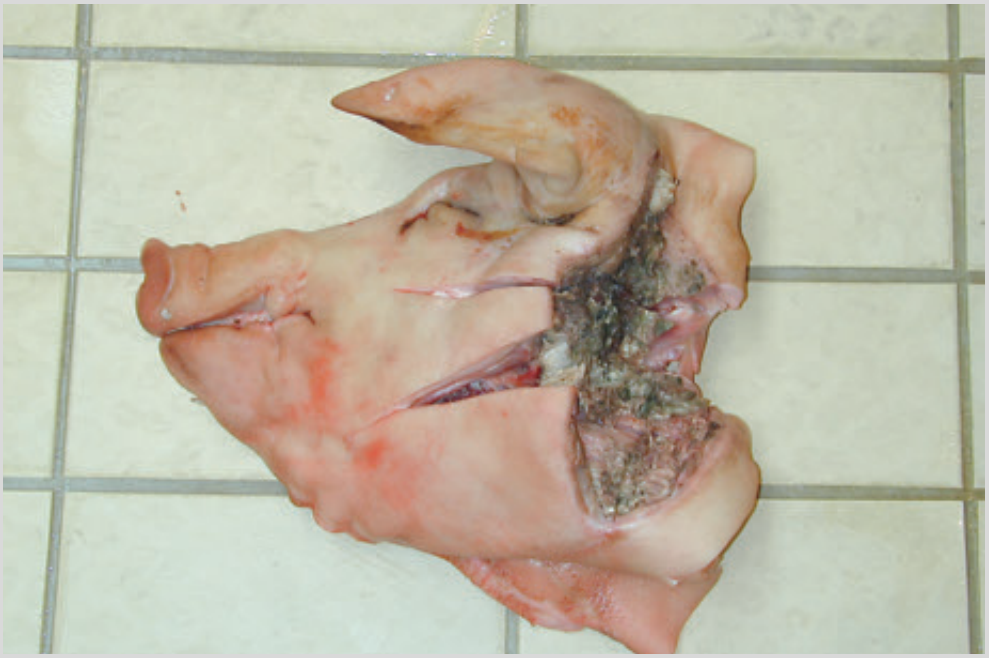
Animal species/Organ	Horse/Distal part of the hindleg (sawn through, the same as 22.10)
Lesion	Overgrown hoof. The animal had mobility problems
Scoring	Partial condemnation
Comments	Should have been trimmed earlier

22.12



Animal species/Organ	Horse/Distal part of the foreleg
Lesion	Ligated necrosis. The animal had non-weight-bearing lameness
Scoring	Partial condemnation
Comments	Animals that have non-weight-bearing lameness must not be transported to slaughter. Should have been destroyed earlier

22.13



Animal species/Organ	Pig/Head
Lesion	Very large and deep ulceration caudoventrally to the ear
Scoring	Partial condemnation
Comments	Animals with larger lesions can, under special conditions, be transported

22.14



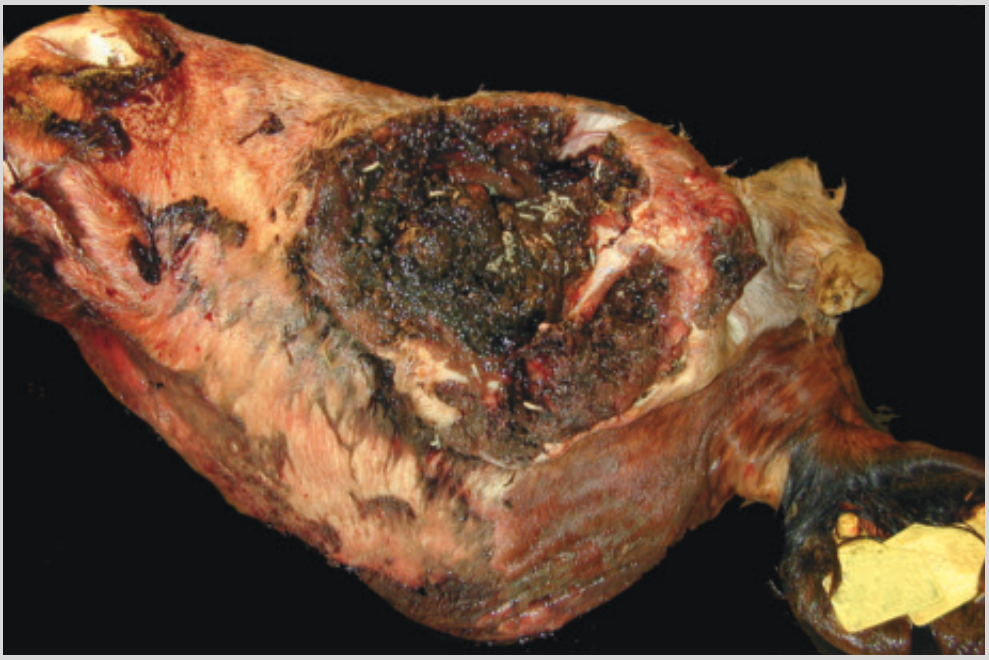
Animal species/Organ	Pig/Head, close-up of 22.13
Lesion	Very large and deep ulceration caudoventrally to the ear
Scoring	Partial condemnation
Comments	Animals with larger lesions can, under special conditions, be transported

22.15



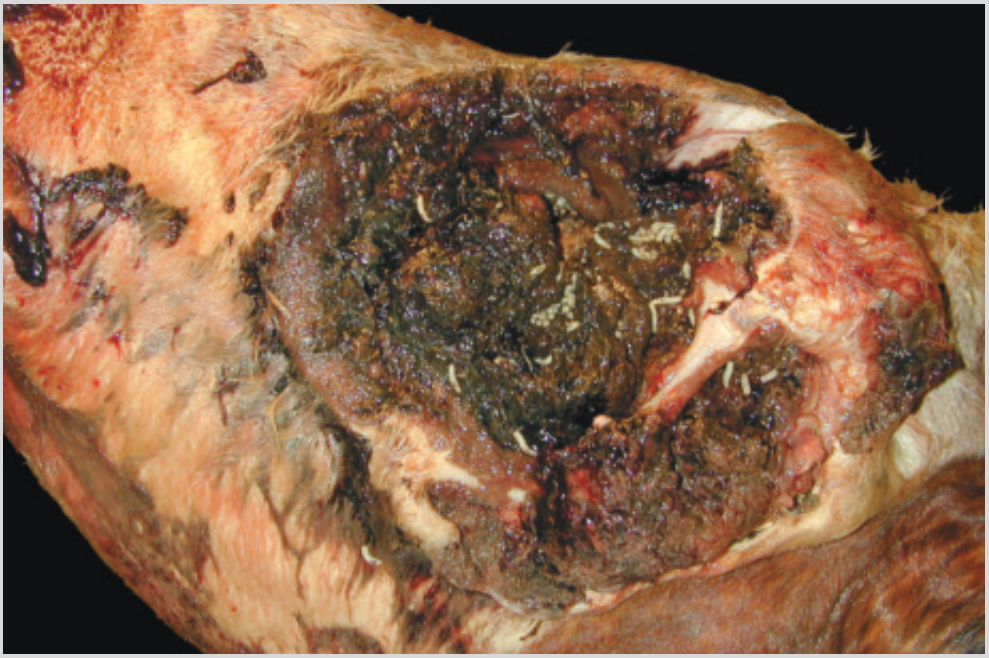
Animal species/Organ	Pig/Distal section of hindleg
Lesion	Extensive, necrotising, ulcerating dermatitis. The animal had severe weight-bearing lameness
Scoring	Partial condemnation
Comments	Animals with severe weight-bearing lameness must not be transported alive

22.16



Animal species/Organ	Cattle/Head
Lesion	Ulcerative squamous cell carcinoma ("cancer eye")
Scoring	Total condemnation
Comments	The animal should have been euthanized earlier

22.17



Animal species/Organ	Cattle/Area around the eye (close-up of 22.16)
Lesion	Ulcerative squamous cell carcinoma (“cancer eye”)
Scoring	Total condemnation
Comments	The animal should have been euthanized earlier

22.18



Animal species/Organ	Cattle/Head
Lesion	Ulcerative squamous cell carcinoma (“cancer eye”)
Scoring	Total condemnation
Comments	The animal should have been euthanized earlier

22.19



Animal species/Organ	Pig/Umbilical area
Lesion	Large hernia with ulceration
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.20



Animal species/Organ	Pig/Umbilical area
Lesion	Large hernia with ulceration
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.21



Animal species/Organ	Pig/Rectum and vagina
Lesion	Combined vaginal and rectal prolapse with acute necrosis of the mucous membrane
Scoring	Total condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.22



Animal species/Organ	Pig/Rectum
Lesion	Chronic, necrotising, rectal prolapse (proctitis)
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.23



Animal species/Organ	Cattle/Vagina
Lesion	Acute, vaginal prolapse with necrosis of the mucous membrane
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.24



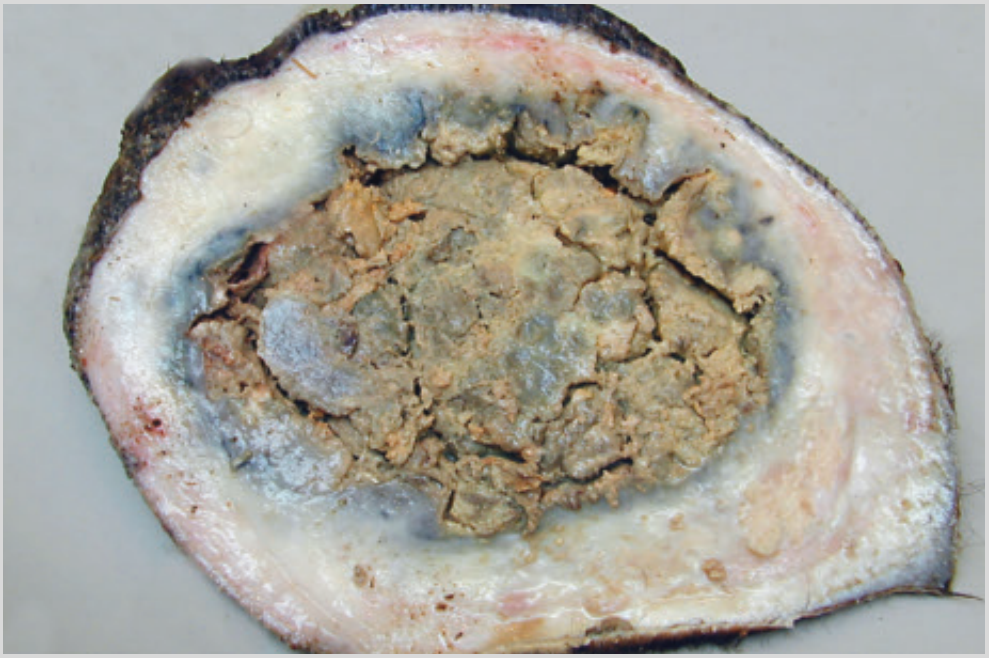
Animal species/Organ	Pig/Entire animal
Lesion	Large, chronic, pyogranulomatous dermatitis localised to the udder skin
Scoring	Partial condemnation
Comments	Animals with larger abscesses or similar can, under special conditions, be transported

22.25



Animal species/Organ	Cattle/Distal part of the hindlegs
Lesion	Chronic abscess formation in the tarsal area. The animal had mild mobility problems
Scoring	Partial condemnation
Comments	Animals with larger abscesses or similar can, under special conditions, be transported

22.26



Animal species/Organ	Cattle/Distal part of the hindleg (same lesion as in 22.25, cut section)
Lesion	Chronic abscess formation in the area of the tarsal joint
Scoring	Partial condemnation
Comments	Animals with larger abscesses or similar can, under special conditions, be transported

22.27



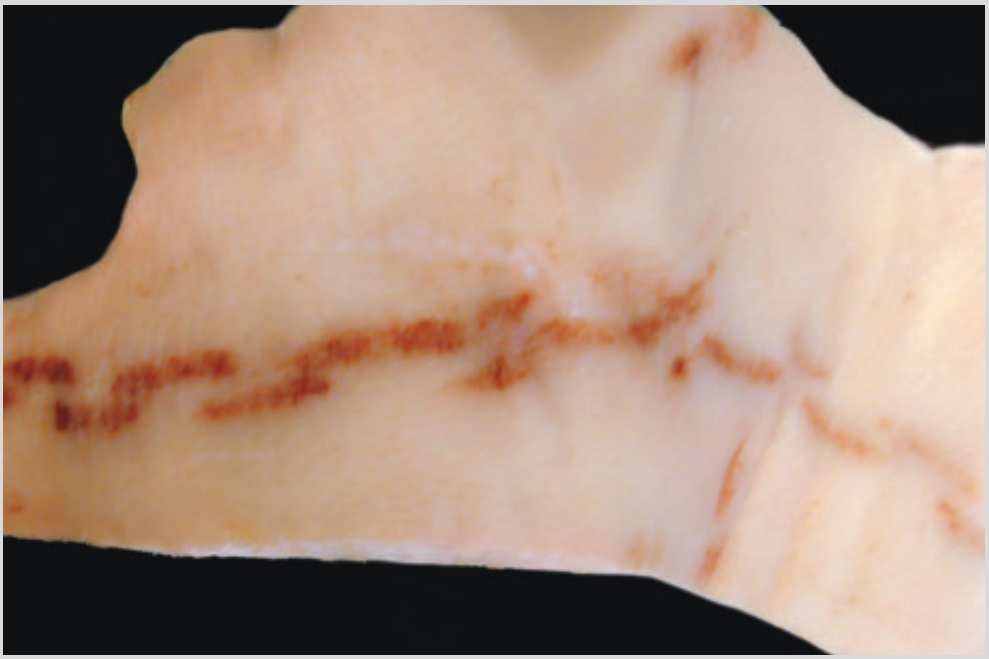
Animal species/Organ	Pig/Ear
Lesion	Auricular elephantiasis
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.28



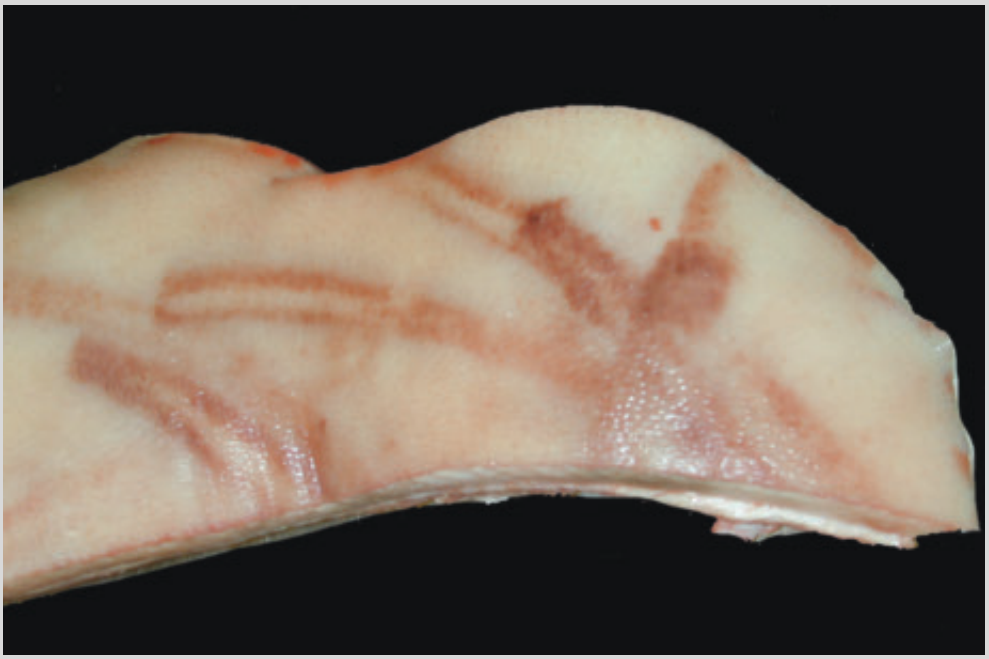
Animal species/Organ	Pig/Ear (cut section, same as in 22.27)
Lesion	Auricular elephantiasis
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.29



Animal species/Organ	Pig/Skin
Lesion	Bruises with distinct haemorrhage
Scoring	Partial condemnation
Comments	The bruises have a distinct chain configuration

22.30



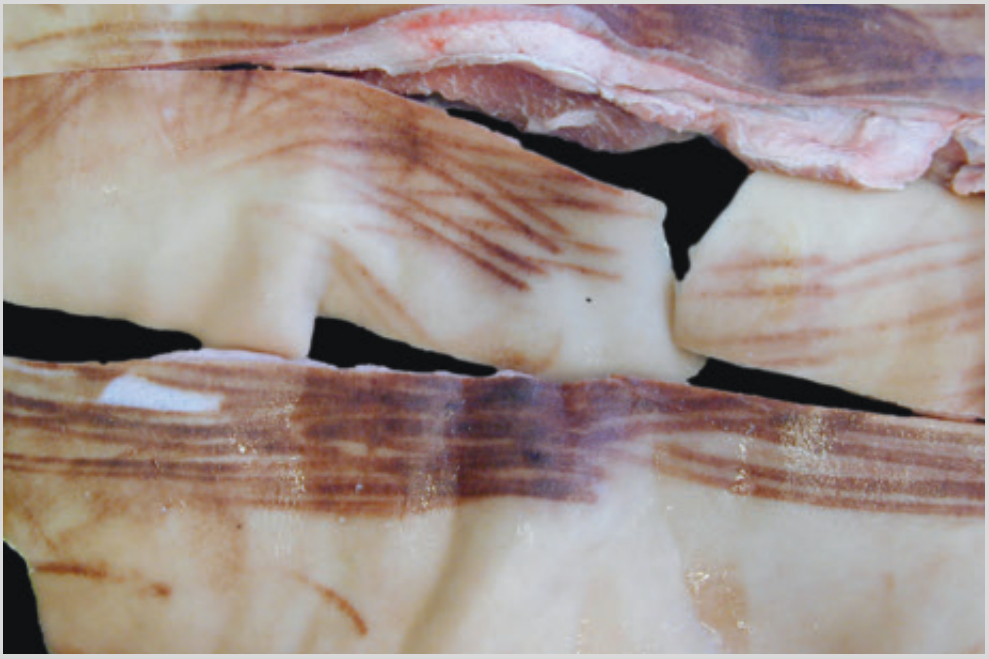
Animal species/Organ	Pig/Skin
Lesion	Bruises with distinct haemorrhage
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.31



Animal species/Organ	Pig/Skin
Lesion	Bruises with distinct haemorrhage
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.32



Animal species/Organ	Pig/Skin
Lesion	Multiple bruises with distinct haemorrhage
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.33



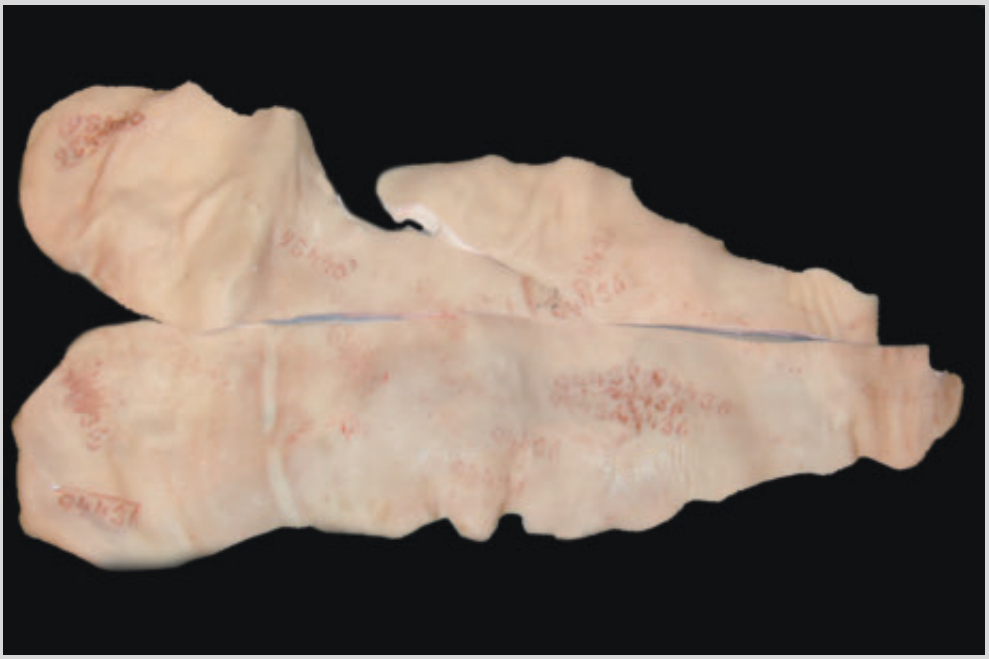
Animal species/Organ	Pig/Skin (cross-section of bruise in 22.32)
Lesion	Bruise with distinct haemorrhage down into the fat layer (subcutis)
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.34



Animal species/Organ	Pig/Skin
Lesion	Stamping lesion with distinct haemorrhage. The animal had 10-15 similar lesions
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.35



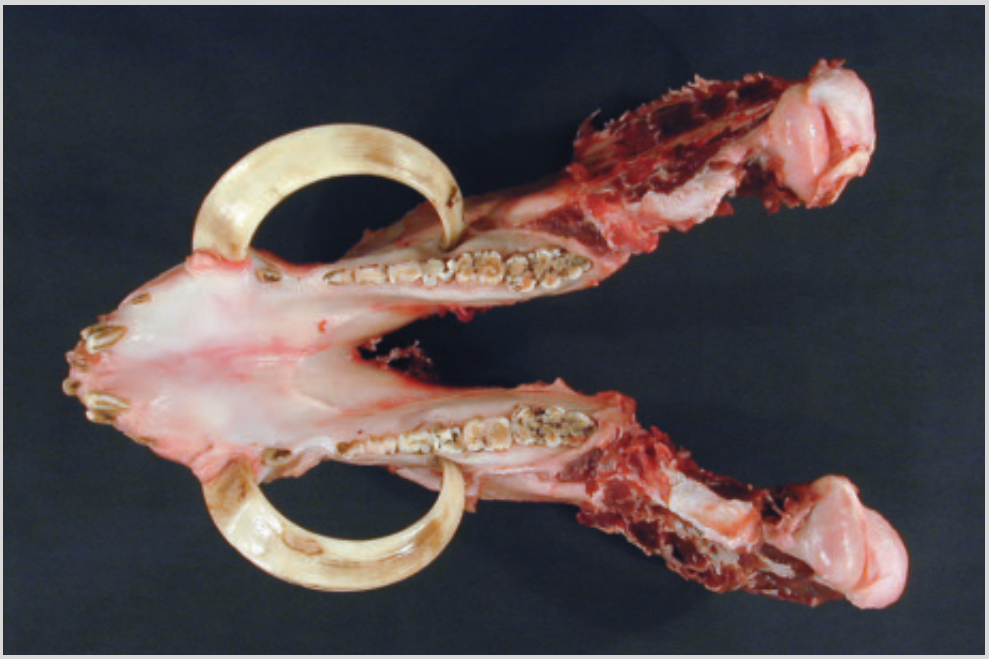
Animal species/Organ	Pig/Skin (ham and back)
Lesion	Multiple bruises induced by tattoo hammer
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.36



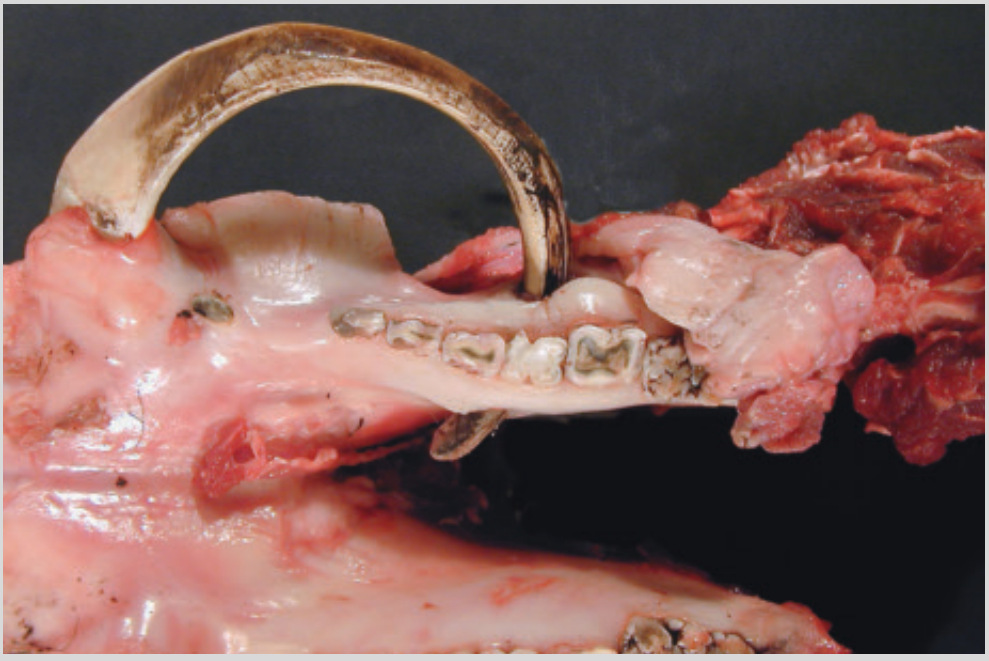
Animal species/Organ	Pig/Skin (ham region)
Lesion	Multiple bruises induced by tattoo hammer. Haemorrhage is clearly apparent
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.37



Animal species/Organ	Pigs/Lower jaw
Lesion	Growth of the canines into the mandibles
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.38



Animal species/Organ	Pig/Mandibles (same as 22.37)
Lesion	Penetration by the canines
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.39



Animal species/Organ	Pig/Mandibles (same as 22.37)
Lesion	In-growth of the canines
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.40



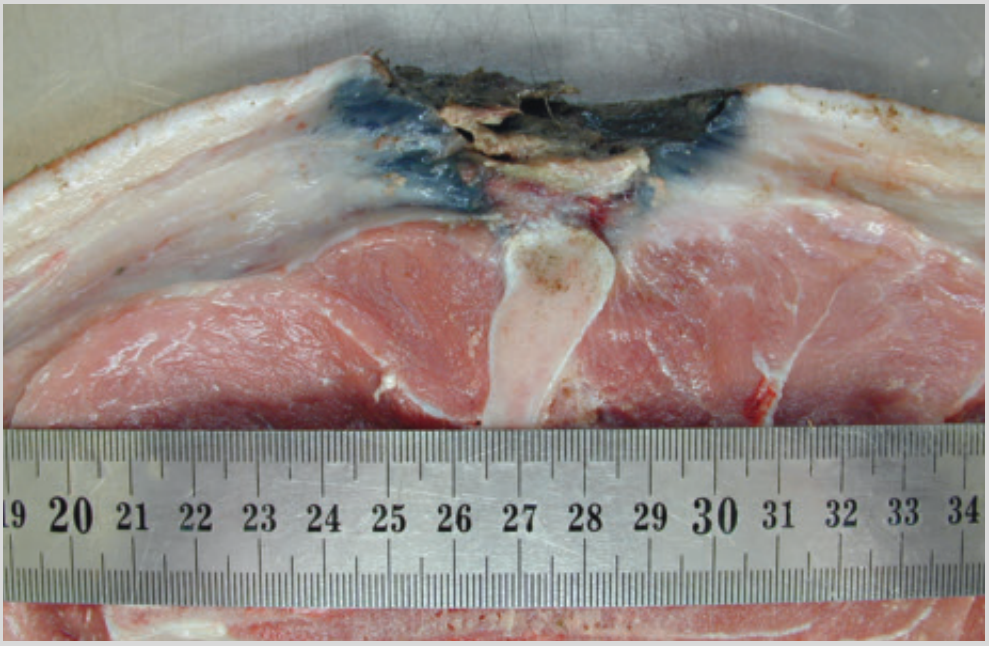
Animal species/Organ	Pig/Mandibles (same as 22.37)
Lesion	Penetration by the canines
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.41



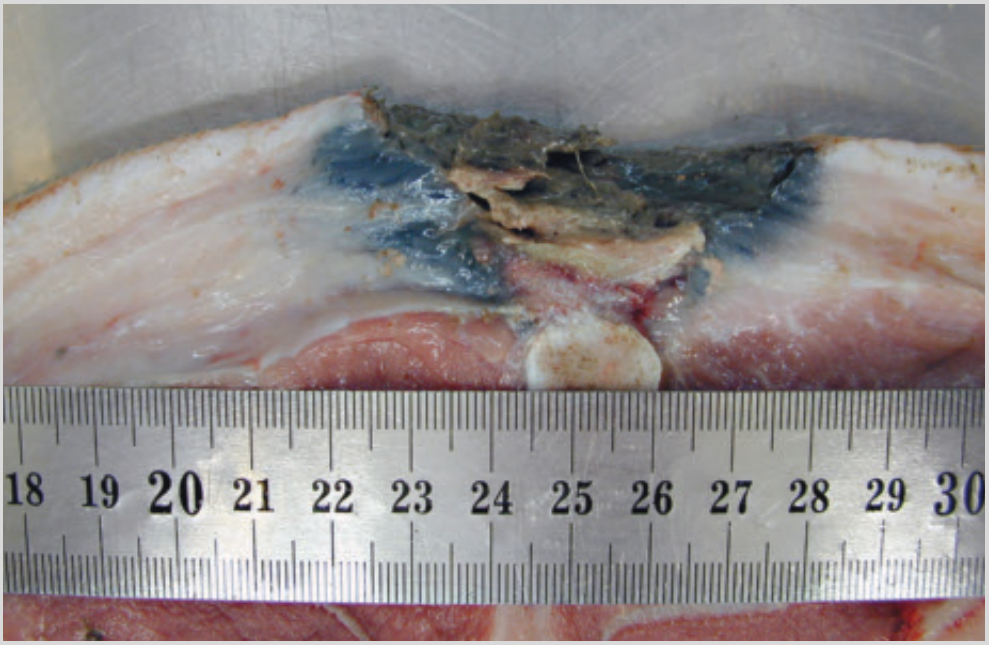
Animal species/Organ	Pig/Shoulder region
Lesion	Shoulder ulceration
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.42



Animal species/Organ	Pig/Shoulder region, cut section (same as in 22.41)
Lesion	Ulcer formation (shoulder ulceration grade 3)
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.43



Animal species/Organ	Pig/Shoulder region, cut section (same as in 22.41)
Lesion	Ulcer formation (shoulder ulceration grade 3)
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.44



Animal species/Organ	Pig/Skin and underlying structures in the shoulder region
Lesion	Chronic ulceration with exposed bony tissue (shoulder ulceration grade 4)
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.45



Animal species/Organ	Pig/Skin and underlying structures in the shoulder region (cut/split section)
Lesion	Chronic ulceration with exposed bony tissue (shoulder ulceration grade 4)
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.46



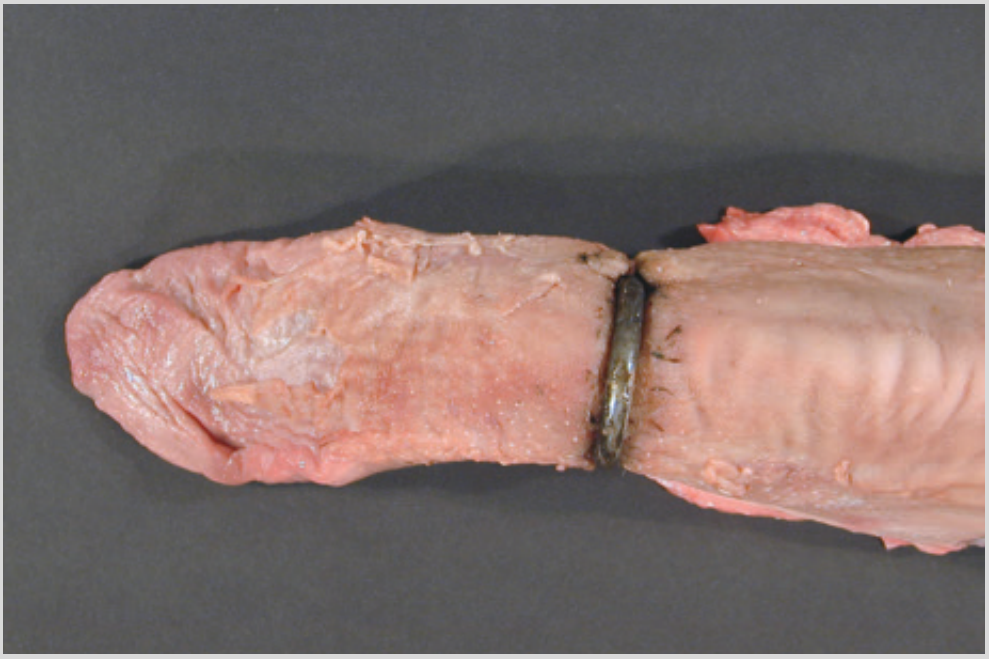
Animal species/Organ	Pig/Skin and underlying structures in the shoulder region
Lesion	Chronic ulceration with massive granulation tissue formation (shoulder ulceration grade 4)
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.47



Animal species/Organ	Pig/Skin and underlying structures in the shoulder region
Lesion	Chronic ulceration (shoulder ulceration grade 3) with chronic osteomyelitis with sequestration
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.48



Animal species/Organ	Pig/Tongue
Lesion	Tongue piercing
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.49



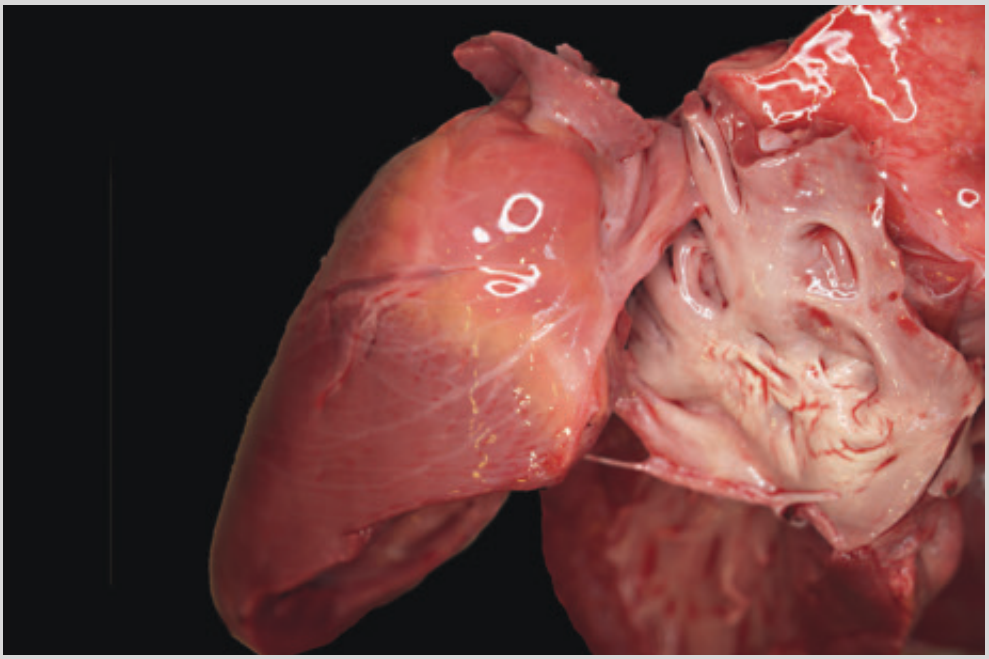
Animal species/Organ	Pig/Tongue (close-up of 22.48)
Lesion	Tongue piercing
Scoring	Partial condemnation
Comments	Note that this is not a question of ligation; the metal ring penetrates the tongue

22.50



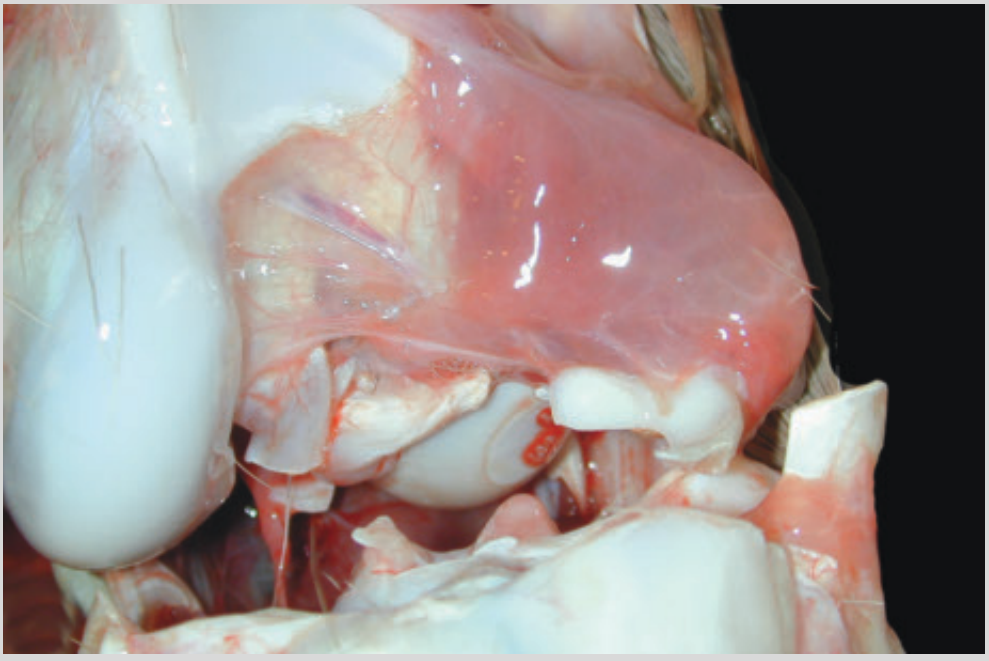
Animal species/Organ	Cattle/Tail (sawn through)
Lesion	Acute fracture. Occurred when attempting to move the animal
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.51



Animal species/Organ	Sheep/Heart
Lesion	Serous fatty tissue atrophy around the coronary vessels
Scoring	Total condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.52



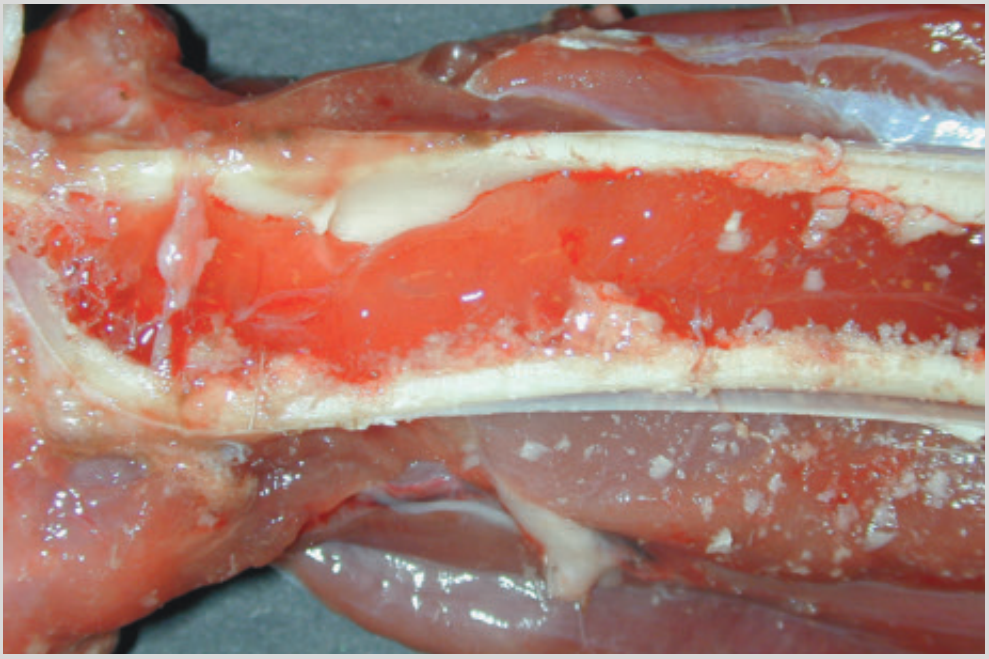
Animal species/Organ	Sheep/Knee joint (opened)
Lesion	Serous fatty tissue atrophy
Scoring	Total condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.53



Animal species/Organ	Cattle/Femur (split)
Lesion	Serous fatty tissue atrophy in the bone marrow
Scoring	Total condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.54



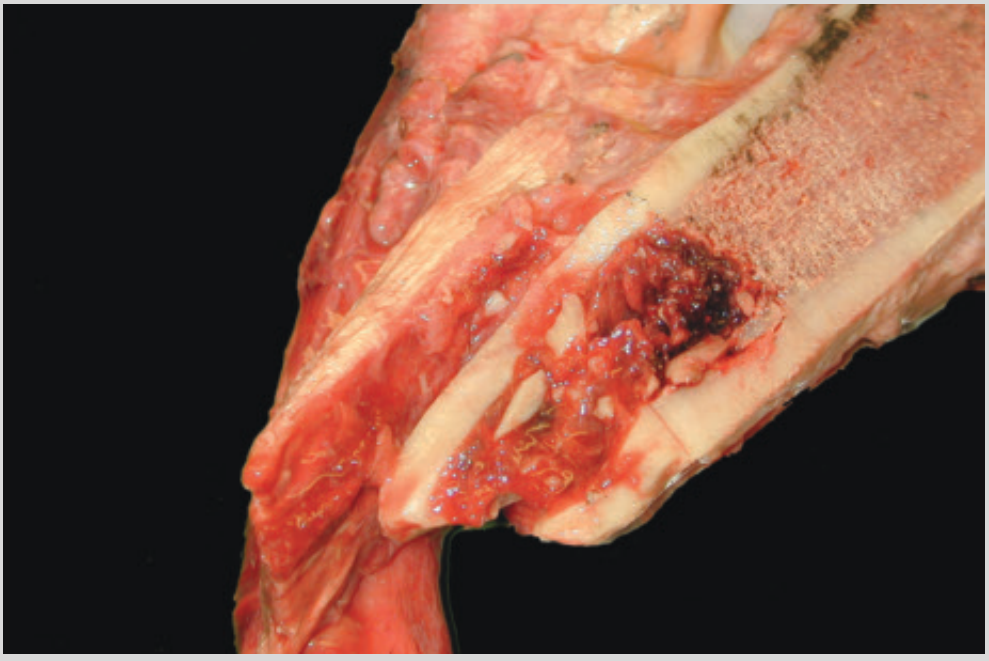
Animal species/Organ	Cattle/Femur (split) Close-up of 22.53
Lesion	Serous fatty tissue atrophy in the bone marrow
Scoring	Total condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.55



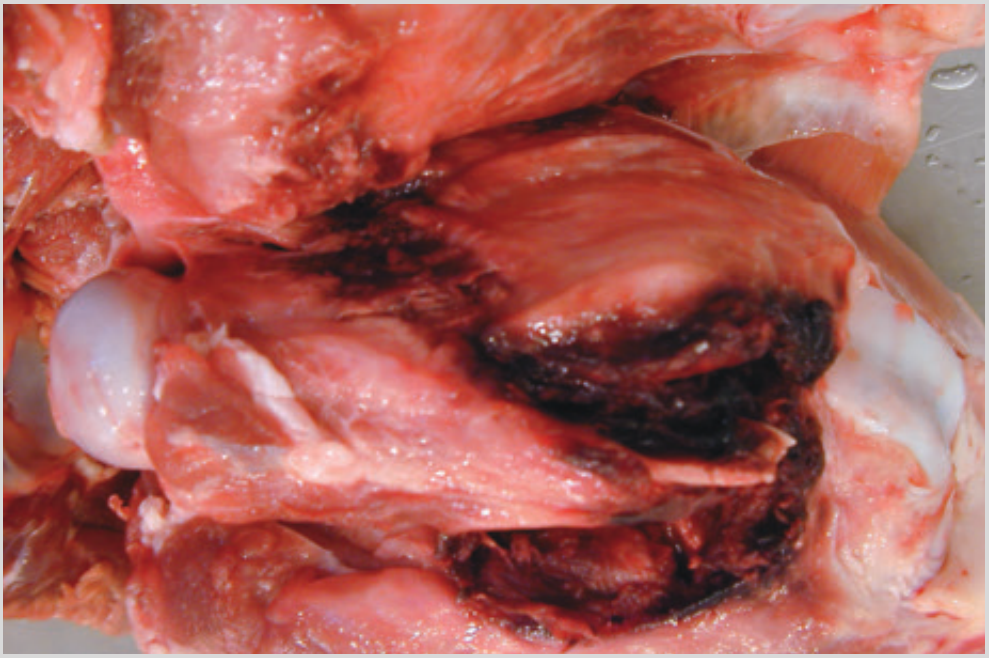
Animal species/Organ	Pig/Femur (exposed by medial incision)
Lesion	Acute, comminuted fracture. The animal had non-weight-bearing lameness at arrival at the slaughterhouse
Scoring	Partial condemnation
Comments	The fracture displays no reparatory reactions. Occurred during transport to slaughter

22.56



Animal species/Organ	Pig/Femur (close-up of fracture in 22.55)
Lesion	Acute fracture. The animal had non-weight-bearing lameness at arrival at the slaughterhouse
Scoring	Partial condemnation
Comments	The fracture exhibits no reparatory reactions. Occurred during transport to slaughter

22.57



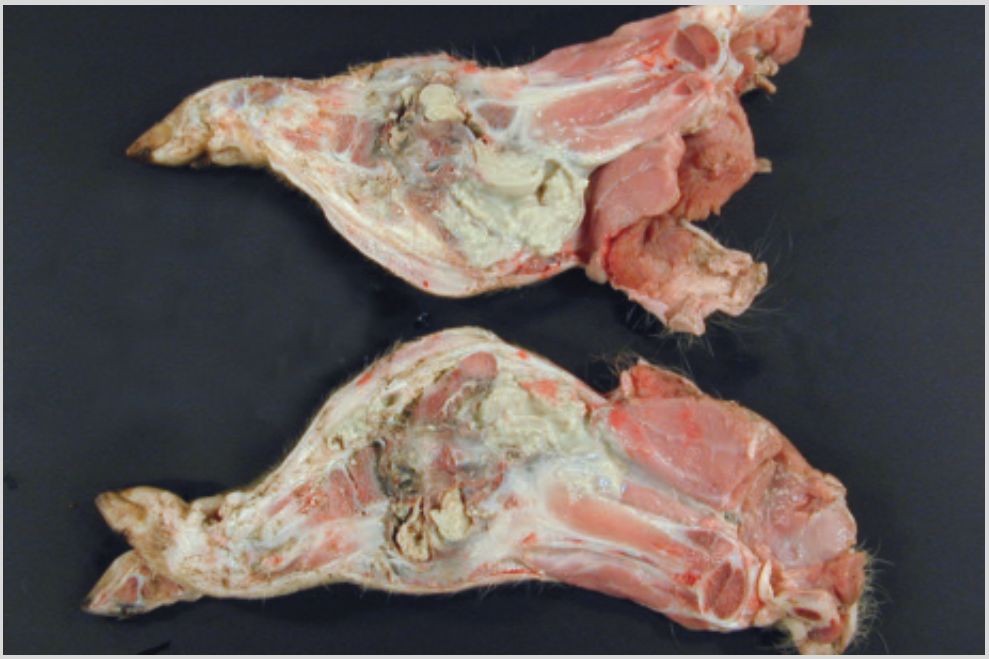
Animal species/Organ	Pig/Femur (exposed by medial incision)
Lesion	Chronic, complete fracture. The animal had non-weight-bearing lameness at arrival at the slaughterhouse
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.58



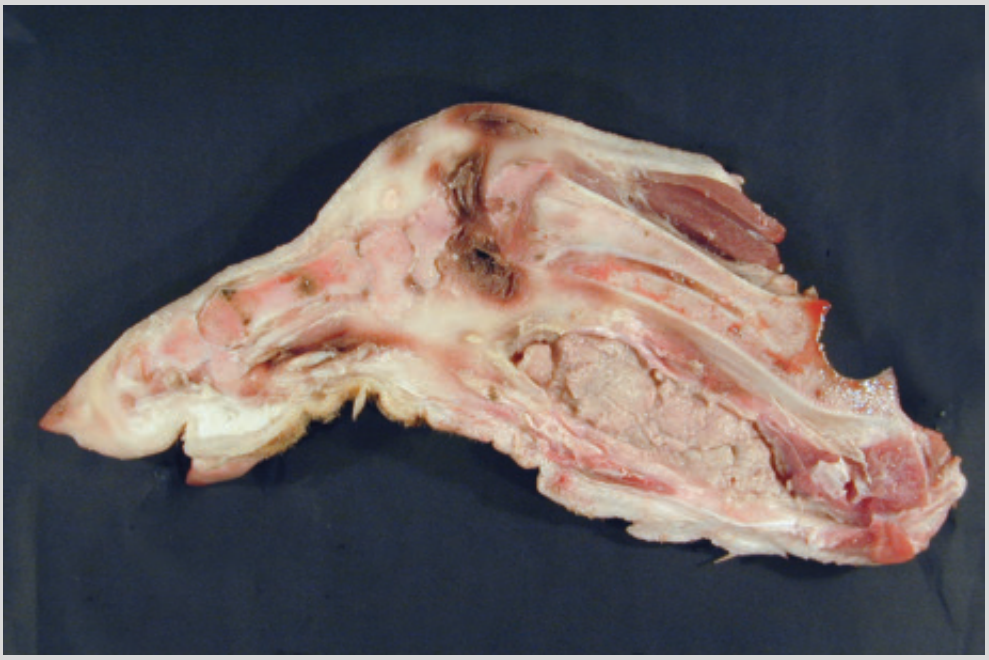
Animal species/Organ	Pig/Distal section of hindleg
Lesion	Swelling with fistula formation in the tarsal region. The animal had non-weight-bearing lameness at arrival at the slaughterhouse
Scoring	The sawn through preparation can be seen in 22.59
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.59



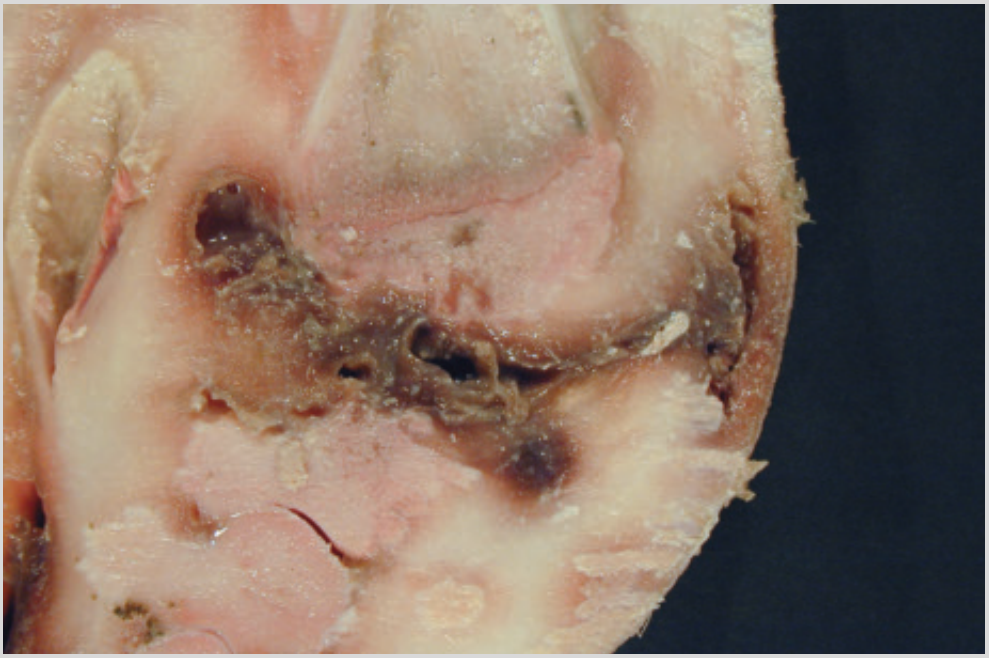
Animal species/Organ	Pig/Distal section of hindleg sawn through (same preparation as in 22.58)
Lesion	Chronic, necrotising, and purulent arthritis and periarthritis
Scoring	Partial condemnation
Comments	Any suspected breach of the Animal Welfare Act must be notified

22.60



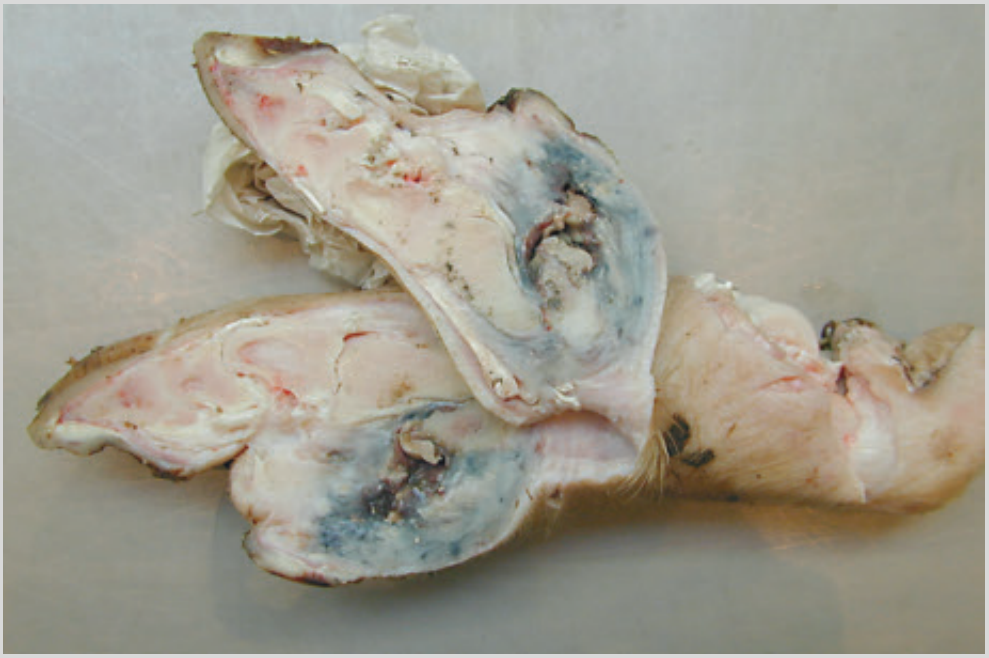
Animal species/Organ	Pig/Distal part of foreleg
Lesion	Chronic, ulcerative, purulent arthritis and purulent periarthritis
Scoring	Partial condemnation
Comments	Because the animal had non-weight-bearing lameness it should not have been transported to slaughter

22.61



Animal species/Organ	Pig/Distal part of foreleg (proximal carpal joint)
Lesion	Chronic, ulcerative, purulent arthritis and purulent periarthritis
Scoring	Partial condemnation
Comments	Because the animal had non-weight-bearing lameness it should not have been transported to slaughter

22.62



Animal species/Organ	Pig/Distal section of hindleg
Lesion	Chronic, purulent, osteomyelitis with sequestra formation and secondary bone fracture
Scoring	Approved for deboning
Comments	Because the animal had non-weight-bearing lameness it should not have been transported to slaughter

22.63



Animal species/Organ	Pig/Distal part of hindleg (close-up of 22.62)
Lesion	Chronic, purulent, osteomylitis with sequestra formation
Scoring	Approved for deboning
Comments	Because the animal had non-weight-bearing lameness it should not have been transported to slaughter

22.64



Animal species/Organ	Pig/Distal part of forelimbs
Lesion	Overgrown hooves. The animal had severe mobility problems
Scoring	Partial condemnation
Comments	The hooves should have been trimmed months earlier

22.65



Animal species/Organ	Pig/Tail
Lesion	Gangrene of the outermost part due to ligation using an elastrator
Scoring	Partial condemnation
Comments	Ligation is not a legal amputation method

22.66



Animal species/Organ	Pig/Tail (same preparation as in 22.65, sawn through)
Lesion	Gangrene of the outermost part due to ligation. There is connective tissue growth proximal to the ligation point
Scoring	Partial condemnation
Comments	The presence of connective tissue formation indicates the lesion is a few weeks old

22.67



Animal species/Organ	Pig/Distal section of fore leg
Lesion	The distal part of the toe has been cut off during transport (lorry)
Scoring	The animal must be euthanized immediately
Comments	Any suspected breach of the Animal Welfare Act must be notified. The fault on the lorry must be rectified before it can be used for animal transport again

22.68



Animal species/Organ	Pig/Head
Lesion	The rostral part of the snout and jaws has been cut off during transport (lorry)
Scoring	The animal must be euthanized immediately
Comments	Any suspected breach of the Animal Welfare Act must be notified. The fault on the lorry must be rectified before it can be used for animal transport again

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Meat Inspection – The Pathoanatomic Basis is the most comprehensive book covering the subject of meat inspection in today's market. The pathoanatomic basis of the book combined with concise explanations of pathogenesis and aetiology are supplemented by almost 1500 colour illlustrations and matching texts, making this book an indispensable tool for professionals and veterinarians who work with assessing and diagnosing lesions in production animals.

The book provides a foundation for the uniform assessment of lesions based on current meat hygiene legislation and is vital to anyone interested in pathobiological issues.

Chapters 1 and 2 cover general conditions of production animals while the following 16 chapters describe lesions in the various organ systems. The remaining 4 chapters cover cross-disciplinary areas of meat inspection such as pyaemia, granulomatous and pyogranulomatous inflammations, forensic pathology and animal welfare, and neoplasms. The comprehensive index guarantees quick reference searches on specific subjects.

Each chapter begins with a descriptive text followed by colour illustrations. Each photo is accompanied by captions describing animal species, organ, lesion, scoring and comments.

Meat Inspection – The Pathoanatomic Basis focuses on diseases and types of lesions most commonly found in production mammals at meat inspection. Diseases in game and poultry are not discussed, but the principles described may be applied to mammalian game in general. Therefore, this book is a valuable tool to hunters, researchers and other persons with an interest in these animals.

All the authors of this book are presently or previously employed at the Department of Veterinary Disease Biology, Faculty of Health and Medical Sciences, University of Copenhagen.