VE Vet eBooks
VET-EBOOKS.COM

FREE · NO SIGN-UP

ANATOMY · TOPOGRAPHY · ILLUSTRATED GUIDE

BODY CAVITIES & SEROUS MEMBRANES

Body Cavities & Serous Membranes in Animals: The Regions and the Four Serous Sacs (PDF)

Veterinary anatomy names body cavities two different ways, and a student needs both. The regional cavities are named by where they are — thoracic, abdominal and pelvic, plus the cranial cavity and the vertebral canal. Inside: Six labelled figures, four reference tables and a 25-question self-test.

Contents

The 11 sections of this guide, in order.

Figures reproduced for educational reference from *Veterinary Anatomy of Domestic Animals: Textbook and Colour Atlas* and *Textbook of Veterinary Anatomy*; copyright remains with the original authors and publishers. Each figure is credited beneath it.

IN SHORT

Veterinary anatomy names body cavities two different ways, and a student needs both. The **regional** cavities are named by where they are — **thoracic**, **abdominal** and **pelvic**, plus the cranial cavity and the vertebral canal. The **serous** cavities are the closed sacs lying inside those regions, and there are **four**: **left** and **right pleural**, **pericardial** and **peritoneal**. Each is one continuous sheet that lines the wall as the **parietal layer**, folds back, and covers the organ as the **visceral layer**, with a **potential space** between. In the dog, cat and adult horse the two pleural sacs are not reliably separate. Free illustrated PDF.

KEY POINTS

1. **Two classifications, and both are correct. Regional** cavities — thoracic, abdominal, pelvic, plus the cranial cavity and vertebral canal — are named by where they are. **Serous** cavities are closed sacs lined by a serous membrane and lie *inside* the regions. The thoracic cavity is a region; a pleural cavity is a sac within it.
2. **One continuous sheet does both jobs.** It lines the wall as the parietal layer, folds back, and covers the organ as the visceral layer. The fold carries the vessels and nerves.
3. **The organ is not in the cavity.** The peritoneal cavity holds a few millilitres of fluid; the intestine is outside the sac, pushed into it — a fist in a balloon.
4. **There are four serous cavities** — left pleural, right pleural, pericardial and peritoneal. The two pleural sacs count separately because they are separate sacs.
5. **Except that in the dog and the adult horse they are not.** The mediastinum leaks, so most dogs given a unilateral pneumothorax show it bilaterally. The foal is the exception.
6. **The pericardium adds a fibrous coat outside its two serous layers** — and that coat resists distention in the short term, which is why a small fast effusion tamponades and a large slow one may not.
7. **Retroperitoneal organs sit behind the sac**, peritoneum on one face only — kidneys, ureters, terminal rectum. They can be approached without opening the peritoneal cavity.
8. **Disease is a potential space becoming an actual one.** Effusion, air, or adhesion — and the membrane's tendency to stick when inflamed is a defence before it is a complication.

About the images

The labelled plates are reproduced for educational reference from *Veterinary Anatomy of Domestic Animals: Textbook and Colour Atlas* (König & Liebich, 7th ed.) and *Textbook of Veterinary Anatomy* (Dyce, Sack & Wensing, 5th ed.). Each figure is credited beneath it; copyright remains with the original authors and publishers.

Ask a student to name the body cavities and you will hear "thoracic and abdominal", or perhaps three if the pelvis gets a mention. That is correct, and it is half the answer. Those are the **regional** cavities, named by where they are. Inside them sit the **serous** cavities — closed sacs lined by a membrane, four of them — and it is the sac, not the region, that fills with fluid, collapses a lung or tamponades a heart. A clinician needs both names and needs to keep them apart.

Every one is built the same way. A single sheet of membrane lines the body wall, turns back on itself at a fixed line, and wraps the organ. The organ is never *inside* the sac any more than your fist is inside a balloon you press it into: it is outside, pushed in, with two layers of membrane and a film of fluid between it and the wall. Understand that one picture and the pleura, the pericardium and the peritoneum stop being three topics.

This guide builds that pattern once, then follows it into the clinic — where the fluid volume, the species, and one anatomical detail about the membrane between the two pleural sacs decide what a chest tap, a pneumothorax and a pericardial effusion actually do. It is the general-anatomy companion to our comparative anatomy of seven domestic species, which covers which organs sit in which cavity across species, and to the canine abdominal anatomy and the peritoneum in surgery, which works through the approaches themselves. For the sections and planes these figures are cut in, see anatomical planes in animals.

01 What are the body cavities in animals?

Veterinary anatomy uses the phrase in **two different ways**, and a student needs both. **Regional body cavities** are named by where they are: the **thoracic**, **abdominal** and **pelvic** cavities of the trunk, together with the **cranial cavity** and the **vertebral canal**. **Serous cavities** are the closed sacs lined by a serous membrane that lie *inside* those regions: the **left** and **right pleural** cavities, the **pericardial** cavity and the **peritoneal** cavity. The thoracic cavity is a region of the body; a pleural cavity is a sac within it. Both names are correct, and they answer different questions.

CAVITY	WHICH KIND	WHAT DEFINES IT	WHAT IS IN IT
Cranial cavity	Regional	Enclosed by the bones of the skull	Brain and its meninges
Vertebral canal	Regional	The vertebral foramina in series	Spinal cord and its meninges
Thoracic cavity	Regional	Ribs, sternum and thoracic vertebrae; closed caudally by the diaphragm	Both pleural sacs, the pericardial sac, and the mediastinum between them
Abdominal cavity	Regional	Diaphragm in front, abdominal wall around; continuous caudally with the pelvic cavity	Most of the peritoneal sac and the organs invaginated into it
Pelvic cavity	Regional	Sacrum and first caudal vertebrae above, pelvic girdle below — **not** a separate serous sac	The caudal end of the peritoneal sac; rectum, bladder and genital tract
Left pleural cavity	**Serous**	A closed sac: parietal pleura on the wall and mediastinum, visceral pleura on the lung	A few millilitres of serous fluid — the lung itself is *outside* the sac
Right pleural cavity	**Serous**	The same arrangement on the right	As the left
Pericardial cavity	**Serous**	Between the visceral and parietal serous pericardium, with a fibrous coat outside	*Liquor pericardii*, a small volume — the heart is outside the sac
Peritoneal cavity	**Serous**	Parietal peritoneum on the abdominal and pelvic wall, visceral peritoneum on the organs	A small lubricating volume — the viscera are outside the sac

The relationship is containment, not synonymy. Open the thoracic cavity and you have not yet opened a pleural cavity; open a pleural cavity and you are in a space that normally holds a few millilitres of fluid and no lung. The rest of this guide is about the **serous** cavities, because they are the ones with a membrane, a potential space and a characteristic way of going wrong — but the regional names are the ones an examiner asks for first, and the two must not be blurred together.

> **Scope — domestic mammals**
>
> Everything below describes the domestic mammals: dog, cat, horse, ox, sheep and goat. Birds are organised differently — they have no muscular diaphragm, and the coelom is subdivided by septa rather than partitioned into the mammalian pattern — so the four-sac scheme here does not transfer to them. See our guide to avian anatomy and how bird bodies differ.

The lining is the point. König describes a serous membrane as a single layer of **pavement epithelium — the mesothelium** — on a thin bed of connective tissue. Dyce puts the same thing about the peritoneum: *a single layer of flattened mesothelial cells supported by a fibroelastic tissue*. One cell thick, over the entire inside of the abdomen.

That membrane is not passive. It **secretes and reabsorbs watery fluid**, and it reabsorbs gas — which is why the carbon dioxide used to inflate an abdomen for laparoscopy disappears on its own afterwards, and why a small pneumothorax can resolve without a drain.

The serosa is also **absorptive**, over an enormous area — Dyce gives the peritoneum as roughly **2 m² in humans** and notes that the area *aids rapid removal*. One property, three consequences. It is what keeps a potential space potential, because fluid is taken up as fast as it is put out. It is why a drug can be given **intraperitoneally** — though not, as is often claimed, with a free pass around the liver: König specifies that substances absorbed by the *parietal* peritoneum reach their target organs without passing through the liver, while the *visceral* peritoneum drains largely into the **portal system**, so an intraperitoneal dose is **not** uniformly spared first-pass hepatic metabolism. And it is why **peritonitis is never regarded lightly**: what absorbs a drug absorbs a toxin, and Dyce adds that the warm, moist cavity offers ideal conditions for bacterial growth.

02 What are the parietal and visceral serous membranes?

Take one sheet of membrane. Line the inside of the body wall with it: that is the **parietal layer**. Where the sheet reaches the organ it folds back and runs over the organ's surface: that is the **visceral layer**. The fold connecting the two carries the organ's blood vessels, nerves and lymphatics, and where it is long enough to be a structure in its own right it gets a name — mesentery, mesocolon, mesovarium. König calls it the **connecting serosa**.

The consequence students most often get wrong: **the organ is not in the cavity.** The peritoneal cavity contains no intestine. It contains a few millilitres of fluid. The intestine is *outside* the sac, invaginated into it, covered by the visceral layer. An organ arranged this way is called **intraperitoneal** — a term Dyce himself flags as misleading, because it does not mean "inside the cavity", it means "slung from the wall by a serosal fold".

And the space between the layers is a **potential space**. Dyce, on the pleural cavity: *in the healthy animal the pleural cavity is a potential rather than an actual space, and it contains only a small amount — a few millilitres — of serous fluid, thinly spread*. The two layers are in contact and slide on each other. On a radiograph a normal serosal interface is a thin line, often only inferred from the contrast between the tissues either side of it; a serous cavity that is **widened, or outlined by abnormal air or fluid**, is the one that has gone wrong.

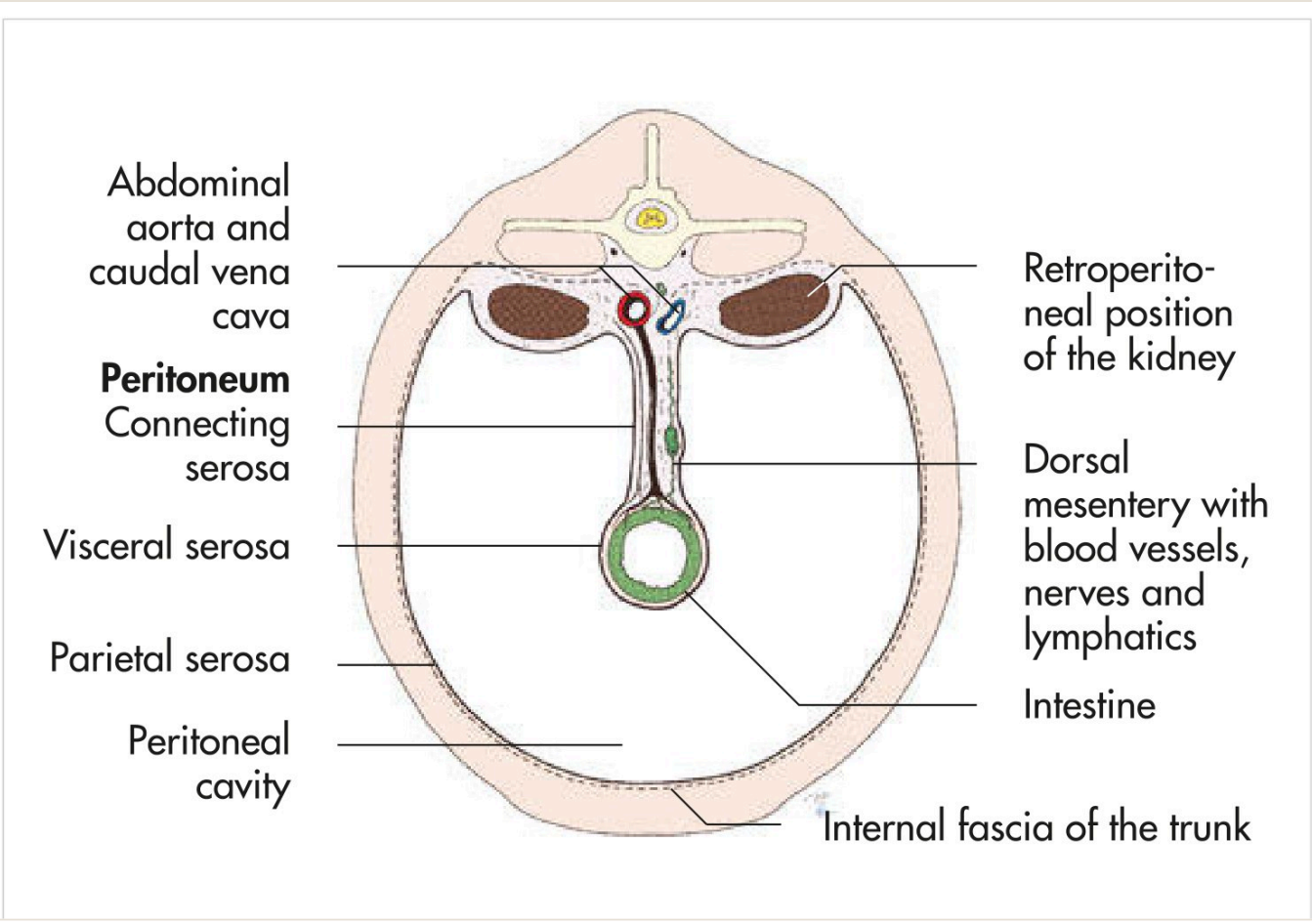

Fig 1 — The whole idea in one section. A transverse section of the abdomen with every part of the pattern labelled. The **parietal serosa** lines the wall; the **visceral serosa** wraps the intestine; the **connecting serosa** — here the **dorsal mesentery**, carrying blood vessels, nerves and lymphatics — joins the two. Between them is the **peritoneal cavity**. Note what sits *outside* the sac: the **kidney**, in its **retroperitoneal position**, and the **internal fascia of the trunk** beyond the parietal layer.

Image — König HE, Liebich H-G. Veterinary Anatomy of Domestic Animals: Textbook and Colour Atlas , 7th ed. Thieme — Fig. 1.62, schematic illustration of the serous membranes. Reproduced for educational reference.

The four sacs are built to one plan and differ in only three things: what the parietal layer lies against, what the visceral layer covers, and whether anything is wrapped around the outside.

SEROUS CAVITY	PARIETAL LAYER LINES…	VISCERAL LAYER COVERS…	EXTRA COAT?	NORMAL CONTENTS
Left pleural	Ribs, diaphragm, mediastinum, pericardium	The left lung	None	A few millilitres of serous fluid (Dyce, canine)
Right pleural	The same four surfaces on the right	The right lung	None	As the left
Pericardial	The inner face of the fibrous pericardium	The heart — this layer is the epicardium	**Yes** — a tough fibrous pericardium outside the parietal serous layer	*Liquor pericardii*, a small volume
Peritoneal	Abdominal and pelvic walls, and the diaphragm	Stomach, intestine, liver, spleen and the rest	None; outside it lies the internal fascia of the trunk	A small lubricating volume — it varies with species and body size

03 How many serous cavities are there?

Here is the count that textbooks blur, and note what is being counted: *serous* cavities, not regions. König is explicit: **there are four serosal cavities** — the **left pleural cavity**, the **right pleural cavity**, the **pericardial cavity** and the **peritoneal cavity**.

The left and right pleural sacs are counted separately because they *are* separate sacs. Each lung has its own, and the membrane between them — the mediastinum — is a partition, not a shared wall. Whether that partition holds is the single most clinically-loaded fact in this article, and it varies by species.

Note what is **not** on the list. The pelvic cavity is not a fifth serous cavity: the peritoneum simply runs on into it, and the abdominal and pelvic cavities are continuous through a wide opening. The vaginal cavity around the testis is a serosal space too, but it is an outpouching of the peritoneal sac carried down during descent, not an independent one.

Four words used as if they described position. Three of them describe *attachment* instead, which is exactly why they mislead.

TERM	WHAT IT ACTUALLY MEANS	WORKED EXAMPLE
Intraperitoneal	Slung from the wall by a serosal fold and covered on nearly all sides by visceral peritoneum. **Not** "inside the cavity" — Dyce flags the term as misleading	Jejunum, on its mesentery
Retroperitoneal	Pressed against the dorsal wall, with peritoneum on one face only	Kidneys and both ureters; the terminal rectum
Parietal layer	The half of the membrane lining the wall	Costal pleura against the ribs
Visceral layer	The half of the same membrane covering the organ	Pulmonary pleura on the lung; epicardium on the heart

Named subdivisions you meet next

The four sacs are subdivided further, and these are the names an examiner reaches for once the basic pattern is in place. In the abdomen, the main part of the peritoneal cavity is the **greater sac**. When the dorsal mesogastrium folds on itself to build the greater omentum it encloses a pouch, the **omental bursa** — potential rather than actual, its walls in contact — which communicates with the greater sac through one narrow gap, the **epiploic (omental) foramen**. In the dog that foramen lies medial to the caudate process of the liver, bounded dorsally by the caudal vena cava and ventrally by the portal vein, and it matters because small intestine can incarcerate in it: Dyce lists it beside the vaginal ring as a ready-made hole. In the thorax, the **cupula pleurae** is the dome where costal and mediastinal pleura meet at the thoracic inlet — it may reach in front of the first rib, where it is exposed to injury — and the **costodiaphragmatic recess** is the part of the pleural sac the lung does not fill, which is where fluid collects first.

04 How do the body cavities form in the embryo?

So far the four sacs have been presented as a fact to accept. They are easier to hold on to once you know they began as **one**.

In the embryo the mesoderm splits and the scattered spaces inside it run together into a single continuous cavity: the **coelom**. Dyce puts what happens next in one sentence — the coelom is *afterward divided to yield the pericardial and pleural spaces of the thorax and the peritoneal space of the abdomen and pelvis*. One space, partitioned. That is why every serous cavity has the same wall, the same mesothelium and the same behaviour: they are pieces of the same original.

It also answers the question the fist-in-a-balloon picture leaves hanging — though the real sequence is tidier than the analogy. The lateral plate mesoderm **splits into two layers**, and the cavity opens between them. The outer (**somatic**) layer, against the body wall, becomes the **parietal serosa**. The inner (**splanchnic**) layer, against the gut tube, becomes the **visceral serosa**. So the organ was never inserted into a finished sac: cavity and both linings arose together, and the organ has been covered by its own layer from the start. Keep the fist and balloon for picturing the geometry, not for the embryology.

The partition that matters most is the **diaphragm**, and it is not one primordium but four. It starts as the **septum transversum**; to that are added the **pleuroperitoneal folds**, which close the last communication between the pleural and peritoneal spaces, the **dorsal mesentery of the oesophagus**, which becomes the crura, and a rim of **body-wall mesoderm**. The muscle is an immigrant: myoblasts arrive from **cervical somites**, which is why Dyce gives the phrenic nerve as formed by the **fifth, sixth and seventh cervical nerves** rather than by thoracic ones. Four parts that have to meet and fuse is also the reason a **congenital** defect has somewhere to happen. Its job in the adult is stated as plainly by Dyce: *the diaphragm separates the thoracic and abdominal cavities*. It is the wall between the pleural sacs and the peritoneal sac, and in health the two never communicate.

Which is exactly why they matter when they do. A **diaphragmatic hernia** is the passage of abdominal viscera through a diaphragmatic defect, which may be **congenital** or acquired. The acquired form is the one you will meet in an emergency, and it is, in Dyce's definition, *the entry of abdominal viscera into the thoracic cavity*, and it happens when the diaphragm is **torn by a sudden rise in abdominal pressure** — the dog struck by a car being the everyday example. König adds the reason it is an emergency twice over: the displaced viscera compromise the lungs, and at the defect itself **the intestine may become incarcerated and its blood supply obstructed**. A breach between two cavities is not a leak. It is a strangulation risk and a respiratory one at the same time.

Why a diaphragmatic hernia is two emergencies

The displaced viscera compress the lungs, and at the defect itself the intestine can be **incarcerated and lose its blood supply**. Respiratory compromise and strangulating obstruction, from one defect.

05 What is the pleural cavity, and what is the mediastinum?

Each pleural sac is named by what its parietal layer is lying against, which is why the same membrane collects four names in one paragraph. Against the ribs it is **costal** pleura; against the diaphragm, **diaphragmatic**; facing its opposite number in the midline, **mediastinal**; and where it covers the pericardium, **pericardial** pleura. All four are parietal pleura. Only the layer on the lung itself is **visceral (pulmonary)** pleura.

The **mediastinum** is what you get when the left and right mediastinal pleurae meet in the midline: a partition running from spine to sternum, with everything that has to cross the chest — heart, oesophagus, aorta, trachea, thoracic duct — sandwiched between its two sheets. It is not a wall with organs in it so much as two sheets of cling film with the organs pressed between them.

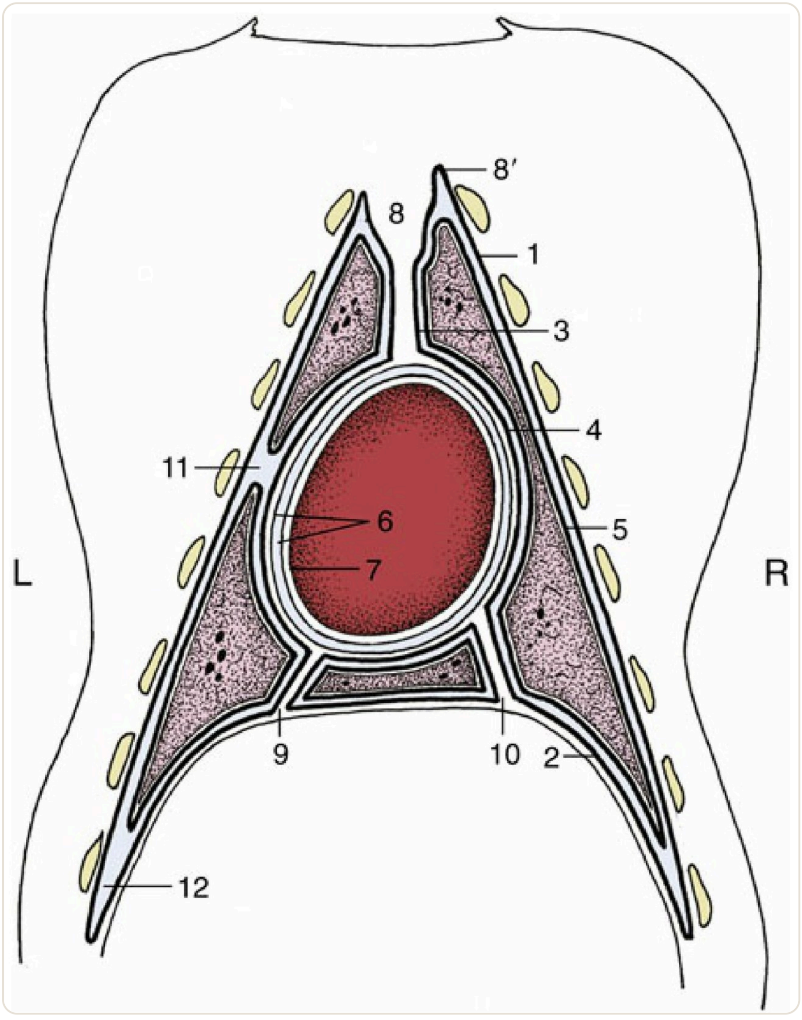

Fig 2 — Pleura and pericardium in one schematic. The heavy lines are pleura. **1–4** are the parietal pleura, subdivided by what each part lies against: **1 costal**, **2 diaphragmatic**, **3 mediastinal**, **4 pericardial**. **5** is the visceral (pulmonary) pleura on the lung. **6** is the parietal pericardium, whose outer fibrous layer adheres tightly to its inner serous layer, and **7** the visceral pericardium on the heart itself.

Image — Dyce KM, Sack WO, Wensing CJG. Textbook of Veterinary Anatomy , 5th ed. Elsevier — Fig. 4.21, the distribution of the pleura and pericardium. Reproduced for educational reference.

06 Do the pleural cavities communicate in dogs and horses?

In a textbook diagram the mediastinum is a solid partition and the two pleural cavities are independent. In a real dog it is, in Dyce's words, *a thin transparent membrane consisting only of apposed right and left pleural sheets*, and **it ruptures easily**.

The consequence is stated plainly and it is the reason this section exists: *although the two pleural sacs may be regarded as normally independent,* ***most dogs in which pneumothorax has been induced unilaterally show bilateral pneumothorax*** *radiographically*. Put air into one side of a dog's chest and you have usually put it into both.

The horse is the same by a different route. Dyce, on the equine mediastinum: *except in foals, small openings in the mediastinum place the two pleural cavities in communication* — and it is *very fragile*, so fragile that dissection itself creates more holes than were there to begin with. König adds the condition that makes it worse: **in horses and emaciated dogs the caudal mediastinum is fenestrated**.

So the diagram is the wrong mental model — but the correction is about *expectation*, not about treatment. **Expect a unilateral lesion to present bilaterally**, particularly in the dog, and do not be reassured by a clean-looking contralateral side.

What does *not* follow is that one drain will empty both sides. Anatomical communication is not functional drainage: the openings are variable, and in disease they are readily **sealed by fibrin**. In equine pleuropneumonia bilateral thoracocentesis is usually required. **Assess and drain each hemithorax on its own evidence**, and never assume that draining one has drained the other.

Dyce names the species explicitly, and the split is not the one a diagram suggests: delicate in the **dog, cat and horse**, thick in the **ruminants**. What follows changes what you *expect* on the contralateral side — not how many drains you place.

SPECIES	THE MEDIASTINUM	ARE THE TWO PLEURAL CAVITIES SEPARATE?	WHAT THAT MEANS CLINICALLY
Dog	A thin transparent membrane of apposed pleural sheets that **ruptures easily**; the caudal part is fenestrated in emaciated animals	Nominally yes, functionally often no	**Most dogs given a unilateral pneumothorax show it bilaterally.** Expect a one-sided lesion to appear on both sides
Cat	Grouped with the dog and horse by Dyce as **very delicate**	Nominally yes, functionally unreliable	Expect the same bilateral behaviour as the dog
Horse (adult)	**Very fragile**, with small openings routinely found; the caudal part is fenestrated	Often not — but the openings are **variable**	A one-sided lesion commonly presents on both sides. The openings are readily sealed by fibrin in disease, and **bilateral thoracocentesis is usually required** in pleuropneumonia
Foal	Intact — the openings are an adult finding	**Yes**	The one group in which the textbook diagram actually holds
Ox, sheep, goat	**Thick and complete** — able to withstand a pressure difference between the two sides	Yes	Unilateral disease can genuinely stay unilateral, and one lung can potentially collapse while the other keeps working

What the anatomy does and does not tell you

Anatomical communication is not the same as functional drainage. In the dog, expect a unilateral lesion to present bilaterally and do not be reassured by a normal-looking contralateral side on a first radiograph. In the **adult horse** the fenestrations are variable and, in disease, are readily sealed by fibrin — so the two hemithoraces must be **assessed and drained independently**. Bilateral thoracocentesis is usually required in equine pleuropneumonia. Never assume draining one side has drained the other.

07 What are the layers of the pericardium?

The heart follows the same pattern with one addition. Working outward from the muscle: the **visceral layer of the serous pericardium** is stuck to the heart (you know it better as the epicardium); then the **pericardial cavity**, a potential space with a little *liquor pericardii* in it; then the **parietal layer of the serous pericardium**; and then the extra ingredient — a tough **fibrous pericardium** of interlacing collagen, fused to the serous layer beneath it.

That fibrous coat is why pericardial disease behaves as it does. Dyce notes that although the pericardium distorts to follow the heart through the cardiac cycle, **its fibrous component prevents any significant distention in the short term**. A small volume arriving quickly therefore raises pressure steeply and tamponades the heart, while a much larger volume arriving over months stretches the sac and may not. Rate matters more than volume.

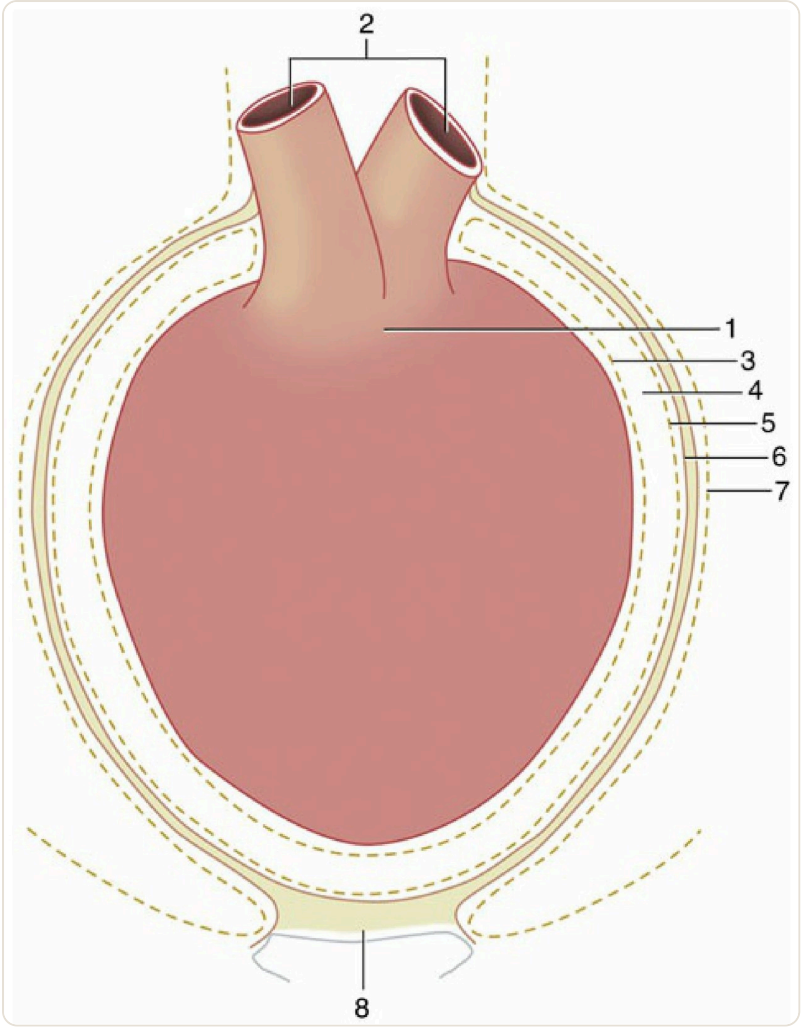

Fig 3 — The pericardial layers, drawn apart. Read the key outward from the muscle. **1** heart, **2** great vessels, **3 visceral pericardium (epicardium)** on the myocardium, **4** the **pericardial cavity**, **5 parietal pericardium**, **6** its **connective tissue layer** — the fibrous coat — then **7** mediastinal pleura and **8** the sternopericardial ligament. One caution the source states and the drawing cannot: the cavity at **4** is *exaggerated in size*. In life it is a potential space holding only *liquor pericardii*.

Image — Dyce KM, Sack WO, Wensing CJG. Textbook of Veterinary Anatomy , 5th ed. Elsevier — Fig. 7.5, schematic illustration of the pericardium. Reproduced for educational reference.

08 What is the peritoneal cavity, and is it closed?

The peritoneal sac is the largest of the four and the pattern is unchanged: parietal peritoneum on the wall, visceral peritoneum on the organs, connecting folds carrying the vessels, and a potential space between. Outside it lies the **internal fascia of the trunk**, which is where the sac ends and the body wall proper begins.

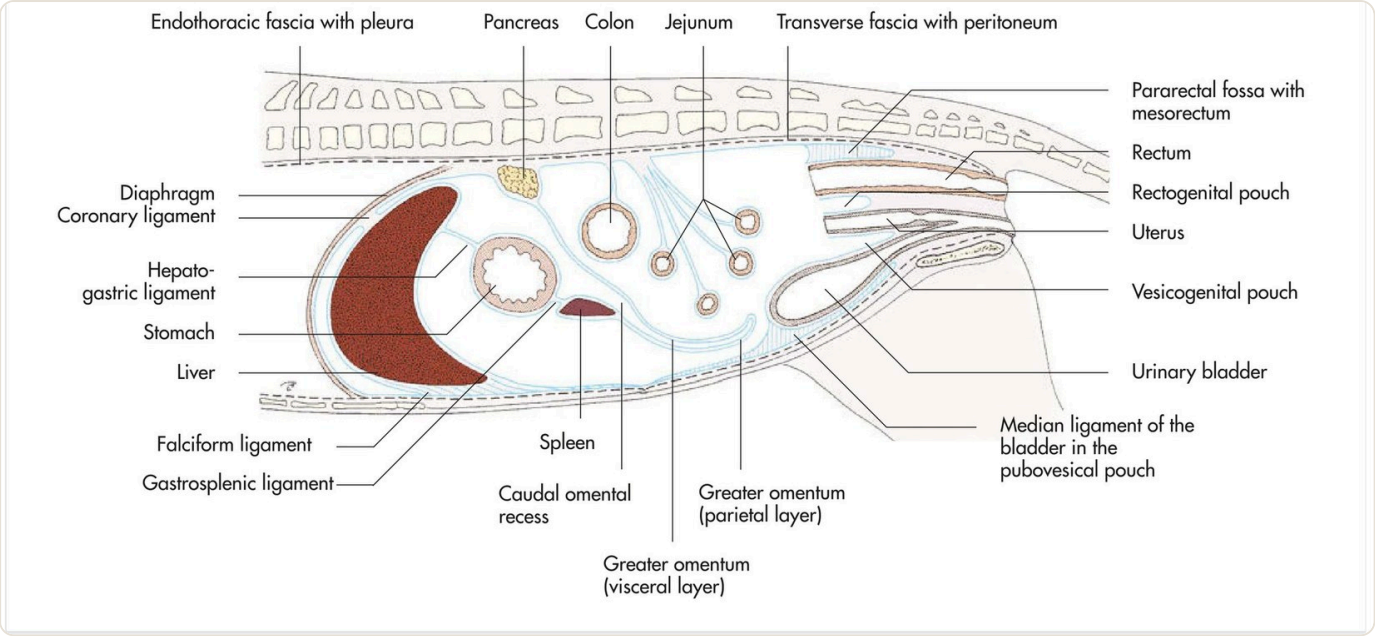

Fig 4 — The peritoneum followed from diaphragm to pelvis. A median section of a **female cat** — the uterus is labelled, and the pouches are drawn around it — with the peritoneum traced as a single line. It runs from the **endothoracic fascia with pleura** at the diaphragm, over liver and stomach through the **coronary**, **hepatogastric** and **gastrosplenic ligaments**, along the **greater omentum** in its parietal and visceral layers, and on into the pelvis to form the **rectogenital**, **vesicogenital** and **pubovesical pouches**. The plate also names the **falciform ligament** below the liver, the **caudal omental recess** behind the stomach and the **pararectal fossa** beside the rectum. Every one of those named ligaments, pouches and recesses is the same sheet, folded — which is the entire point of the plate. It is a wide, label-dense atlas figure, so on a phone it is served as two stacked halves — cranial above, caudal below — and as one plate on a wider screen. Every structure it labels is also named here in the caption.

Image — König HE, Liebich H-G. Veterinary Anatomy of Domestic Animals: Textbook and Colour Atlas , 7th ed. Thieme — Fig. 7.4, the peritoneum in the abdominal and pelvic cavity of the cat. Reproduced for educational reference.

One asymmetry is worth carrying into practice. Dyce: the peritoneal cavity is **completely enclosed in the male, but in the female a potential communication with the exterior exists** — and the route is longer than that phrase suggests. It begins at the **abdominal ostium** of each uterine tube, which opens directly into the peritoneal cavity, and runs on through the **uterine tube**, the **uterus**, the **cervix**, the **vagina** and the **vestibule** to the exterior. In the male the sac is sealed. In the female there is a route, however narrow, from the outside world to the peritoneum, and ascending infection uses it.

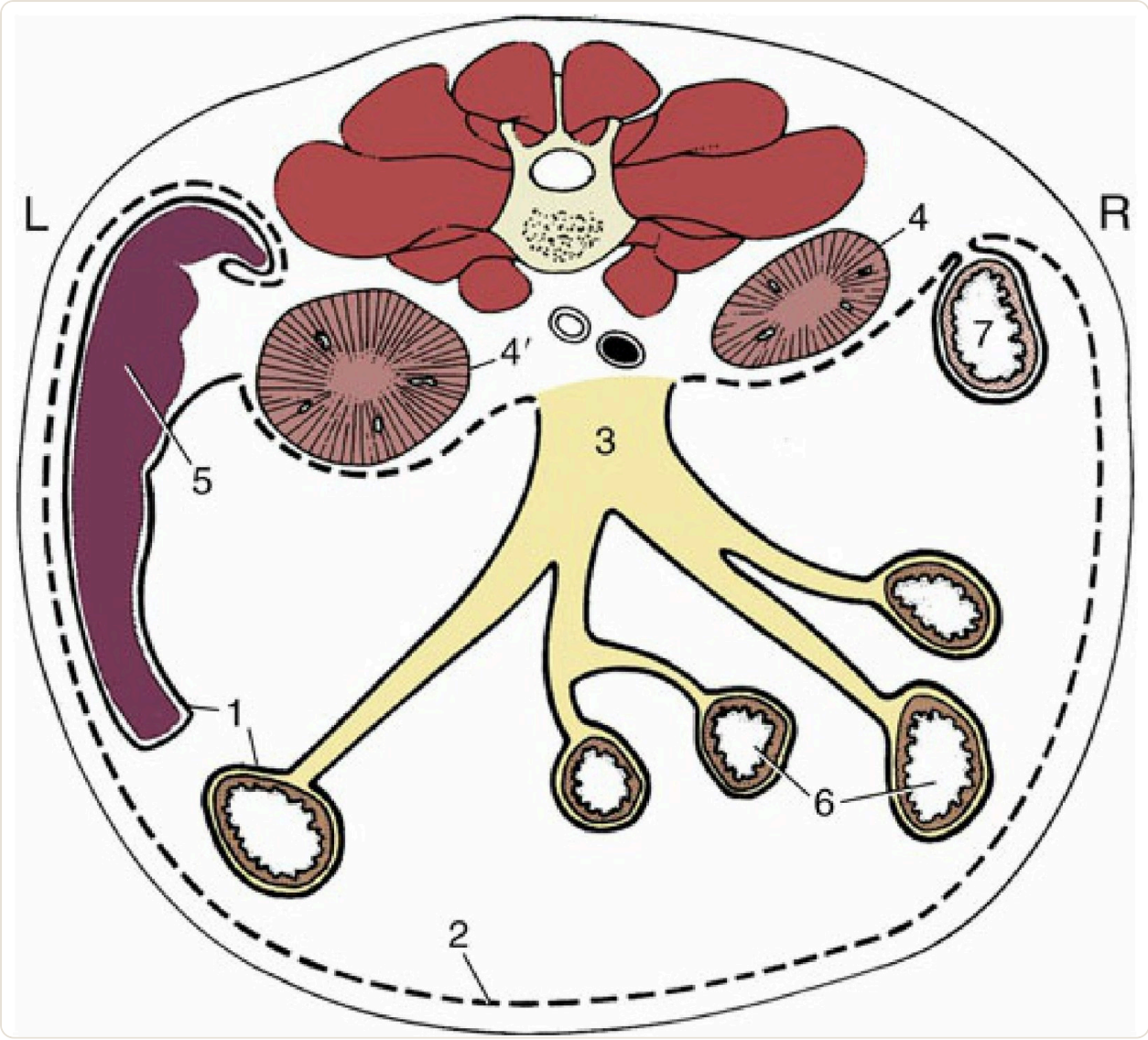

Fig 5 — The same section, in a real dog. A transverse section of the canine abdomen. **1** is the visceral peritoneum, drawn as a continuous line; **2** is the parietal peritoneum, drawn broken; **3** is the root of the mesentery, where the two become one. **4** and **4'** are the right and left kidneys, *retroperitoneal* — outside the broken line. **5** spleen, **6** jejunum, **7** descending duodenum — each invaginated into the sac and *invested by visceral peritoneum*, not lying loose inside it.

Image — Dyce KM, Sack WO, Wensing CJG. Textbook of Veterinary Anatomy , 5th ed. Elsevier — Fig. 3.32, schematic transverse section through the abdomen of the dog. Reproduced for educational reference.

09 What does retroperitoneal mean?

Not every abdominal organ is slung in a fold. Some are pressed against the dorsal wall and covered by peritoneum on their ventral surface only. These are **retroperitoneal** — behind the sac rather than invaginated into it. König places the **kidneys and both ureters** in the retroperitoneal space; Dyce adds that the terminal rectum is wholly retroperitoneal.

Treat that as the general rule and not a law. The plate below is in the book precisely because it is a **contrast** — the right kidney retroperitoneal, the left **intraperitoneal and pendulous**. The floating left kidney of the adult ruminant is the species exception every student meets, and it is the reminder that "the kidneys are retroperitoneal" is a starting point, not a guarantee about the animal in front of you.

The distinction is surgical, not academic. A retroperitoneal organ can often be reached, and its disease can often be contained, without opening the peritoneal cavity at all — which is why a kidney approached through the flank is a different operation from one approached ventrally, and why retroperitoneal haemorrhage does not necessarily give you a positive abdominocentesis.

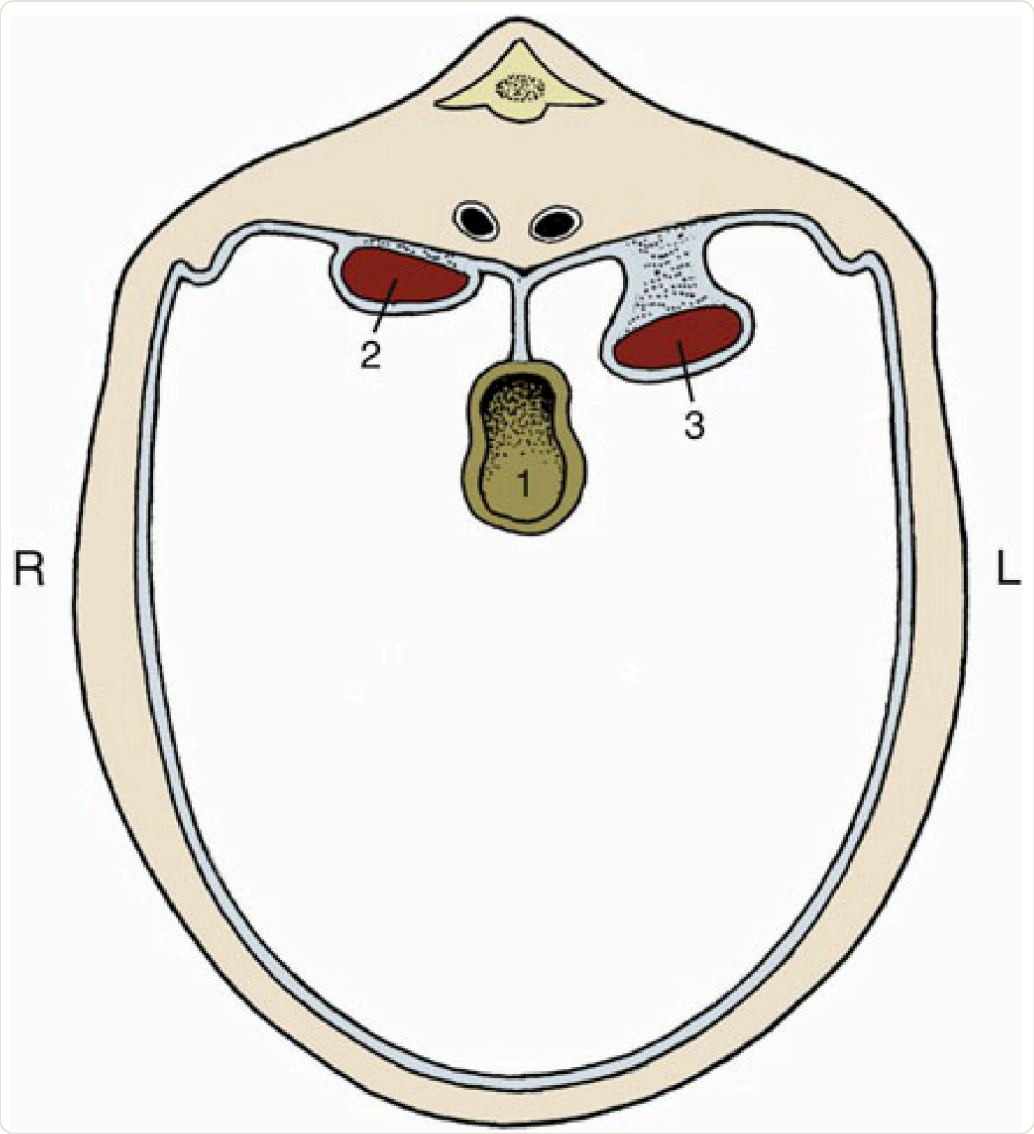

Fig 6 — Two kidneys, two arrangements — in the same animal. This plate is a **contrast**, not an illustration of one rule. **1** is gut, slung in the sac. **2** is the **right kidney, retroperitoneal** — pressed against the dorsal wall with peritoneum over its ventral face only, no mesentery, no fold to cut. **3** is the **left kidney, intraperitoneal** and, in Dyce's words, *pendulous or "floating"*. The retroperitoneal arrangement is why a flank approach can reach a kidney without entering the peritoneal cavity — but which kidney you get that with is a question about the individual and the species, not a universal.

Image — Dyce KM, Sack WO, Wensing CJG. Textbook of Veterinary Anatomy , 5th ed. Elsevier — Fig. 5.22, position of the kidneys in relation to the peritoneal cavity. Reproduced for educational reference.

10 Is the space around the testis part of the peritoneal cavity?

This is not a fifth cavity. It is the **peritoneal** cavity, in the last place a student expects to find it — and the one a student will meet with a scalpel in hand long before meeting most of this article.

As the testis descends it does not tunnel through the abdominal wall on its own. The gubernaculum is *invaded by an extension of the peritoneal lining of the abdomen*, and that extension — the **vaginal process** — is what Dyce describes as providing *the space into which the testis will be drawn*. The testis does not then lie loose in that pouch. It **invaginates the pouch's wall** — the same manoeuvre the intestine performs on the peritoneal sac — so the layer stuck to the testis and cord is the **visceral (proper) vaginal tunic**, the layer outside it is the **parietal vaginal tunic**, and the **vaginal cavity** is the potential space between the two. That cavity is continuous with the peritoneal cavity through the **vaginal ring**.

Read that again with a knife in mind. **The vaginal cavity around a testis is continuous with the peritoneal cavity**, reaching down into the scrotum through a ring in the abdominal wall.

That single fact is the whole logic of castration technique. In the **closed** method the testis is *brought to the exterior within the vaginal tunic before the cord is severed*, so the tunic is never opened and the abdomen is never entered. In the **open** method the parietal tunic is incised — and at that moment the surgical field is continuous with the peritoneal cavity, as it is deliberately in a canine ovariohysterectomy. It is also why the vaginal ring is a ready-made route for an **inguinal hernia**, and why intestine can arrive alongside a testis in a species where the ring stays generous.

11 What happens when a body cavity fills with fluid or air?

Everything above converges on one idea: these spaces are *potential*. Disease is what happens when one becomes actual.

Effusion. Fluid accumulates because the membrane's secretion and reabsorption stop balancing — the same Starling forces that govern every capillary bed, covered in our the Starling forces that move fluid across a membrane. The tap is diagnostic before it is therapeutic: **protein concentration, cellularity and cytology** together classify an effusion and narrow the differential. They do not settle the mechanism on their own — the categories overlap, and a modified transudate in particular can arise several different ways.

Where to tap. Treat what follows as anatomical orientation, not as a procedural rule. The site depends on the **species**, on whether you are after **air or fluid** — air collects dorsally and fluid ventrally, so they are not tapped at the same height — and on what imaging shows. For the chest of the dog and cat the usual region is the **seventh to ninth intercostal spaces**, ventral for fluid and dorsal for air, and Dyce gives the lower part of the **seventh intercostal space, ventral to the margin of the lung**, as the safest single point for pleural fluid. König places abdominocentesis in the **umbilical region**, which holds for the small-animal patient; the equine and bovine sites are different. Follow the protocol for the species in front of you, and use ultrasound guidance where it is available.

Adhesion. Serous membranes share, in Dyce's phrase, a *common tendency to adhere when inflamed*. That is a defence before it is a complication — the greater omentum is regularly found stuck over a site of infection, walling it off, and surgeons exploit it deliberately by stitching omentum to a repair. The same tendency, in the wrong place, is what turns a laparotomy into a re-laparotomy.

Air. Because the mesothelium reabsorbs gas, a small pneumothorax can resolve unaided. Because the mediastinum of the dog, cat and horse is delicate, a unilateral one often will not stay unilateral.

12 Quiz: test yourself

Twenty-five questions across the two classifications, the membrane, the four sacs, the embryology, the mediastinum, the pericardium, castration and the clinic. Answers are beneath each question — cover them and work down.

1. What are the two senses of "body cavity", and how do they relate?**Answer: Regional** cavities are named by where they are — thoracic, abdominal, pelvic, plus the cranial cavity and vertebral canal. **Serous** cavities are closed sacs lined by a serous membrane, and they lie inside the regions. A serous cavity is completely enclosed, which is why the nasal cavity, the conjunctival sac and the gut lumen are not serous cavities: they all open to the outside.2. How many serous cavities are there, and what are they?**Answer: Four** — the **left** and **right pleural** cavities, the **pericardial** cavity and the **peritoneal** cavity. The two pleural sacs count separately because they are separate sacs.3. What is a serous membrane made of?**Answer:** A single layer of flattened **mesothelium** on a thin bed of connective tissue — one cell thick over the entire inside of the abdomen.4. Is the intestine inside the peritoneal cavity?**Answer: No.** The cavity holds only a few millilitres of fluid. The intestine lies outside the sac, invaginated into it and covered by the visceral layer — like a fist pressed into a balloon.5. What does "potential space" mean here?**Answer:** The two layers are **in contact and sliding**, not separated. Dyce: the pleural cavity is *a potential rather than an actual space* holding **a few millilitres** of fluid. A normal serosal interface is a thin line on a radiograph, often only inferred; a cavity **widened or outlined by abnormal air or fluid** is the one that has gone wrong.6. What are the four parts of the parietal pleura?**Answer: Costal** (against the ribs), **diaphragmatic**, **mediastinal** (facing the midline) and **pericardial**. Only the layer on the lung itself is visceral or pulmonary pleura.7. Why does a unilateral pneumothorax usually become bilateral in a dog?**Answer:** The canine mediastinum is **a thin transparent membrane of apposed pleural sheets that ruptures easily**. Dyce records that **most dogs** given a unilateral pneumothorax show it bilaterally on radiographs.8. How does the adult horse differ from the foal here?**Answer: Except in foals**, small openings in the equine mediastinum place the two pleural cavities in communication. The foal is the one age group in which the two sacs really are separate.9. Which animals have a fenestrated caudal mediastinum?**Answer: Horses and emaciated dogs**. Body condition changes the anatomy.10. What are the layers from heart muscle outward?**Answer: Visceral serous pericardium** (the epicardium) → the **pericardial cavity** with its *liquor pericardii* → **parietal serous pericardium** → **fibrous pericardium**. Three layers plus the space, not two.11. Why does a small, fast pericardial effusion tamponade when a larger slow one may not?**Answer:** The **fibrous pericardium prevents significant distention in the short term**. Rate matters more than volume — given months, the sac stretches.12. In which sex is the peritoneal cavity completely closed, and why does it matter?**Answer:** The **male**. In the female a potential communication with the exterior runs from the **abdominal ostium** of each uterine tube through tube, uterus, cervix, vagina and vestibule — a route ascending infection can use.13. Which organs are retroperitoneal?**Answer:** The **kidneys and both ureters**, and the terminal rectum. They sit against the dorsal wall with peritoneum on one face only.14. What decides where you tap a chest? **Answer:** The **species**, whether you are after **air or fluid** (air dorsal, fluid ventral), and what imaging shows. For the dog and cat the usual region is the **seventh to ninth intercostal spaces**; Dyce gives the lower seventh space, ventral to the lung margin, as the safest single point for pleural fluid. Abdominocentesis in small animals is performed in the umbilical region — equine and bovine sites differ.15. Why can a small

pneumothorax resolve without a drain?**Answer:** Because the mesothelium **reabsorbs gas** as well as fluid — the same property that clears the CO_2 used to insufflate an abdomen for laparoscopy.16. Serous membranes adhere when inflamed. Is that good or bad?**Answer: Both.** It is a defence — the greater omentum is found walling off infection, and surgeons stitch omentum to a repair deliberately. The same tendency in the wrong place turns a laparotomy into a re-laparotomy.17. What was the coelom, and what became of it?**Answer:** The single continuous cavity formed when the embryonic mesoderm split. It is **afterward divided** to yield the pericardial and pleural spaces of the thorax and the peritoneal space of the abdomen and pelvis — which is why all four sacs share the same wall and the same behaviour.18. If the organ is outside the sac, how did it get there?**Answer:** It never went in, and neither was the sac finished first. The **lateral plate mesoderm splits into two layers** and the cavity opens between them: the outer (**somatic**) layer becomes the parietal serosa, the inner (**splanchnic**) layer becomes the visceral serosa on the developing organ. Cavity and both linings arise together. The fist-in-a-balloon picture is for the geometry, not the embryology.19. What separates the thoracic from the abdominal cavity, and where does it come from?**Answer:** The **diaphragm**, which is built from four contributions: the **septum transversum**, the **pleuroperitoneal folds**, the **dorsal mesentery of the oesophagus** and a rim of **body-wall mesoderm**. Its muscle migrates in from **cervical somites**, which is why the phrenic nerve comes from the fifth to seventh cervical nerves. In health the pleural sacs and the peritoneal sac never communicate.20. What is a diaphragmatic hernia, and why is it an emergency twice over?**Answer: The passage of abdominal viscera into the thoracic cavity** through a diaphragmatic defect that may be **congenital** or acquired; the acquired form follows a tear, typically from a **sudden rise in abdominal pressure**. It compromises the lungs, and at the defect the **intestine may be incarcerated and its blood supply obstructed**.21. What is the vaginal process, and what is the space inside the vaginal tunic continuous with?**Answer:** An extension of the peritoneal lining that invades the gubernaculum and provides **the space into which the testis will be drawn**. The testis then **invaginates the wall** of that pouch, so the **vaginal cavity** between the visceral and parietal vaginal tunics — not a space the testis floats in — is what is continuous with the **peritoneal cavity**, through the **vaginal ring**.22. What is the anatomical difference between closed and open castration?**Answer:** In the **closed** method the testis is brought out **within the vaginal tunic** and the tunic is never opened, so the abdomen is never entered. In the **open** method the tunic is incised — and the field is then continuous with the peritoneal cavity.23. Why can a drug be given intraperitoneally, and what does it avoid?**Answer:** The serosa is **absorptive** over a very large area — about **2 m²** for the human peritoneum. Substances absorbed by the **parietal** peritoneum **reach their target without passing through the liver**. That is not a blanket bypass: the **visceral** peritoneum drains largely into the portal system, so an intraperitoneal dose is not uniformly spared first-pass hepatic metabolism.24. What keeps a potential space potential?**Answer:** Absorption keeping pace with secretion. The same large absorptive area that **aids rapid removal** of an injected drug is removing the fluid the membrane produces.25. Why is peritonitis never regarded lightly?**Answer:** The same absorptive surface takes up **toxins** just as readily as drugs, and the warm, moist cavity offers **ideal conditions for bacterial growth**.

13 Body cavities and serous membranes — frequently asked questions

How many body cavities does an animal have?

It depends which kind you are counting, and both counts are correct. By **region** the trunk has three — thoracic, abdominal and pelvic, the last two continuous with each other — with the cranial cavity and vertebral canal in addition. By **serous sac** there are four: the left and right pleural cavities, the pericardial cavity and the peritoneal cavity. The regions contain the sacs; they are not the same thing.

What is a serous membrane?

A single layer of flattened mesothelial cells on a thin bed of connective tissue, lining a closed cavity. It secretes and reabsorbs a small volume of watery fluid, and it reabsorbs gas as well.

What is the difference between the parietal and visceral layers?

They are two parts of **one continuous sheet**. The parietal layer lines the body wall; the sheet folds back and the visceral layer covers the organ. The fold between them carries the organ's vessels and nerves.

Does the peritoneal cavity contain the intestines?

No. It contains only a few millilitres of serous fluid. The intestines lie outside the sac, pushed into it and covered by visceral peritoneum — which is why "intraperitoneal" describes attachment, not position.

Why does a dog get a bilateral pneumothorax from a one-sided injury?

Because the canine mediastinum is a thin membrane of two apposed pleural sheets that ruptures easily. Dyce records that **most dogs** in which pneumothorax is induced on one side show it on both radiographically.

Are a horse's two pleural cavities separate?

In an adult, no — except in foals, small openings place them in communication, and the caudal mediastinum is fenestrated. In a foal they are separate.

Why is pericardial effusion dangerous even in small volumes?

The fibrous pericardium prevents significant distention in the short term, so a small volume arriving quickly raises pressure steeply. A larger volume accumulating over months may stretch the sac and compromise the heart less.

Where do you tap a chest or an abdomen?

There is no single answer, and that is the point: the site depends on the species, on whether you are after air or fluid, and on what imaging shows. In the dog and cat the chest is usually tapped around the **seventh to ninth intercostal spaces** — ventrally for fluid, dorsally for air — and Dyce gives the lower seventh space, ventral to the lung margin, as the safest single point for pleural fluid. Abdominocentesis in the small-animal patient is performed in the umbilical region; equine and bovine sites differ. Use the species protocol and ultrasound guidance where available.

Where do the body cavities come from in the embryo?

From a single space. The mesoderm splits and the scattered gaps run together into the **coelom**, which is then divided to yield the pericardial and pleural spaces of the thorax and the peritoneal space of the abdomen and pelvis.

What is a diaphragmatic hernia?

The passage of abdominal viscera into the thoracic cavity through a diaphragmatic defect, which may be **congenital** or acquired. The acquired form is the common one and follows a tear, usually after a sudden rise in abdominal pressure such as a road accident. It compromises the lungs, and intestine caught at the defect can be incarcerated and lose its blood supply.

Is the space around a testis part of the peritoneal cavity?

Effectively yes: the testis invaginates the wall of a peritoneal outpouching, the vaginal process, so the **vaginal cavity** between the visceral and parietal vaginal tunics is continuous with the peritoneal cavity through the vaginal ring. That is why open castration opens a route to the peritoneal cavity and closed castration does not.

Why can drugs be injected into the peritoneal cavity?

Because the serous lining is absorptive over a very large surface. Substances absorbed by the *parietal* peritoneum reach their target organs without first passing through the liver — but the *visceral* peritoneum drains largely into the portal system, so an intraperitoneal dose is not uniformly spared first-pass hepatic metabolism.

Sources

1. Dyce KM, Sack WO, Wensing CJG. *Textbook of Veterinary Anatomy*, 5th ed. Elsevier — the pleural cavity as a potential rather than an actual space holding a few millilitres of fluid (p259); the parietal pleura subdivided, and the pericardial layers (Fig. 4.21, p263); the canine mediastinum as a thin, easily ruptured membrane and bilateral pneumothorax after unilateral induction (p708); the equine mediastinum communicating except in foals (p928); the peritoneum as a single mesothelial layer on fibroelastic tissue (p195); intraperitoneal versus retroperitoneal, and the retroperitoneal kidney (p194, Fig. 3.32); the peritoneal cavity closed in the male and potentially open in the female (p194); serous membranes adhering when inflamed and the omentum walling off infection (p196); the fibrous pericardium resisting short-term distention (p367, Fig. 7.5); pleural centesis in the seventh intercostal space (p926).
2. König HE, Liebich H-G. *Veterinary Anatomy of Domestic Animals: Textbook and Colour Atlas*, 7th ed. Thieme — the four serosal cavities, and the serous membrane as mesothelium over a lamina propria with its capacity to resorb fluid and gas (p70); the serous membrane scheme — parietal, visceral and connecting serosa (Fig. 1.62, p71); the retroperitoneal space containing the kidneys and ureters (p70); the peritoneum of the abdominal and pelvic cavity (Fig. 7.4, p320); the fenestrated caudal mediastinum in horses and emaciated dogs (p318); the pericardium divided into fibrous and serous parts with *liquor pericardii* (pp472–473); the sites for abdominocentesis and thoracocentesis (p72).

Sources

1. Dyce KM, Sack WO, Wensing CJG. *Textbook of Veterinary Anatomy*, 5th ed. Elsevier — the pleural cavity as a potential rather than an actual space holding a few millilitres of fluid (p259); the parietal pleura subdivided, and the pericardial layers (Fig. 4.21, p263); the canine mediastinum as a thin, easily ruptured membrane and bilateral pneumothorax after unilateral induction (p708); the equine mediastinum communicating except in foals (p928); the peritoneum as a single mesothelial layer on fibroelastic tissue (p195); intraperitoneal versus retroperitoneal, and the retroperitoneal kidney (p194, Fig. 3.32); the peritoneal cavity closed in the male and potentially open in the female (p194); serous membranes adhering when inflamed and the omentum walling off infection (p196); the fibrous pericardium resisting short-term distention (p367, Fig. 7.5); pleural centesis in the seventh intercostal space (p926).
2. König HE, Liebich H-G. *Veterinary Anatomy of Domestic Animals: Textbook and Colour Atlas*, 7th ed. Thieme — the four serosal cavities, and the serous membrane as mesothelium over a lamina propria with its capacity to resorb fluid and gas (p70); the serous membrane scheme — parietal, visceral and connecting serosa (Fig. 1.62, p71); the retroperitoneal space containing the kidneys and ureters (p70); the peritoneum of the abdominal and pelvic cavity (Fig. 7.4, p320); the fenestrated caudal mediastinum in horses and emaciated dogs (p318); the pericardium divided into fibrous and serous parts with *liquor pericardii* (pp472–473); the sites for abdominocentesis and thoracocentesis (p72).

Vet-eBooks.com · free veterinary study guides · the full illustrated article, with every figure at full size, is at vet-ebooks.com/articles/body-cavities-serous-membranes/

Vet eBooks
VET-EBOOKS.COM

MORE FREE STUDY GUIDES · RESOURCES

More free veterinary study guides

This is one of a growing library of free veterinary study guides on vet-ebooks.com — written for practising vets and students, sourced from the standard veterinary texts, and every one free with a downloadable PDF and no sign-up.

3,400+
veterinary books

400+
drug profiles

Study guides
a free PDF with each

All free
no sign-up needed

www.vet-ebooks.com

For educational use. Always confirm doses and clinical decisions against current authoritative texts and your own clinical judgment. © vet-ebooks.com — share freely, do not modify.