香港獸醫專科服務

HONG KONG VETERINARY SPECIALTY SERVICES

Patent Ductus Arteriosus (PDA) in Dogs and Cats

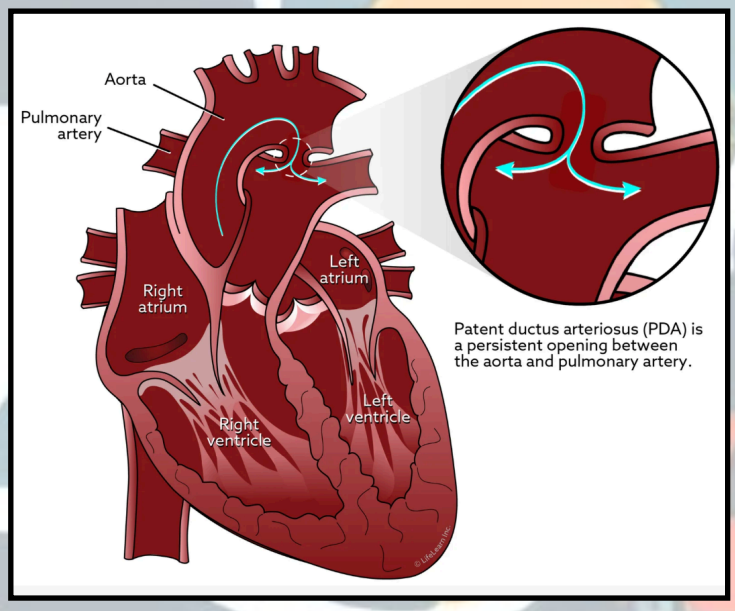
Quick take

A **patent ductus arteriosus** (PDA) is a **common congenital heart defect** where a foetal blood vessel ("ductus arteriosus") fails to close after birth. This creates **abnormal blood flow** that overloads the heart and lungs, and—**without closure—often leads to heart failure.**

The good news: **PDA is one of the most treatable congenital heart diseases.** When closed early, many pets go on to live normal lifespans.
Strong emphasis: In modern veterinary medicine, definitive closure is recommended in almost all left-to-right PDAs, using either:

- **Minimally invasive transcatheter device closure** (often preferred in dogs) but at a high cost,

- **Open surgical ligation** (especially when devices aren't possible, and still a very effective option)



1) What's going on inside?

<u>What the ductus is supposed to do</u>

<u>Before birth</u>, the lungs aren't used for oxygen, so foetal circulation "bypasses" the lungs through a short vessel connecting the **pulmonary artery (to lungs) and the aorta (to body)**

That vessel is the **ductus arteriosus.**

<u>After birth</u>, it should **close within hours** to days.

<u>What happens in PDA</u>

If it **stays open**, blood usually flows from the **high-pressure aorta → into the pulmonary artery** (left-to-right shunt).

This causes:
- Too much blood to the lungs (pulmonary overcirculation)
- Extra volume returning to the left heart, enlarging the left atrium/left ventricle

Over time: leaky mitral valve, arrhythmias, and left-sided congestive heart failure
The dangerous exception: “reversed” PDA

In some untreated cases, **long-term lung vessel damage increases pulmonary pressure so much that flow reverses (right-to-left shunt). This is called Eisenmenger physiology** and is not closed surgically because closure can be fatal.

2) What owners notice

Many puppies/kittens seem normal early, and **PDA is first suspected when a vet hears a classic continuous “machinery” murmur.**

Common signs (especially as disease progresses)

- Fast breathing, cough, exercise intolerance
- Poor growth (runty puppy/kitten)
- Tiring quickly during play
- Fainting episodes (less common)
- Signs of heart failure: breathing effort, restlessness at night, fluid in lungs

In right-to-left (reversed) PDA (less common)

- Weakness, collapse episodes
- Bluish/purple gums or tongue (cyanosis), especially in back end
- High red blood cell count symptoms (thick blood)

3) Diagnosis

A vet typically recommends confirmation by a cardiologist or imaging service:
- Echocardiogram (heart ultrasound): confirms PDA, measures size, direction of flow, heart enlargement, and rules out reversed PDA.
- Chest x-rays: show heart enlargement/pulmonary changes.
- Blood pressure, ECG: assess rhythm and stability.

This imaging also guides which closure method is safest.

4) Treatment options

A) Medical therapy (supportive, not curative)

Medications (diuretics, pimobendan, etc.) may stabilise a pet in heart failure, but do not fix the defect. **PDA closure is still recommended once stable.**

B) Definitive closure (recommended for most left-to-right PDAs)
There are two main “definitive” ways to close a PDA:

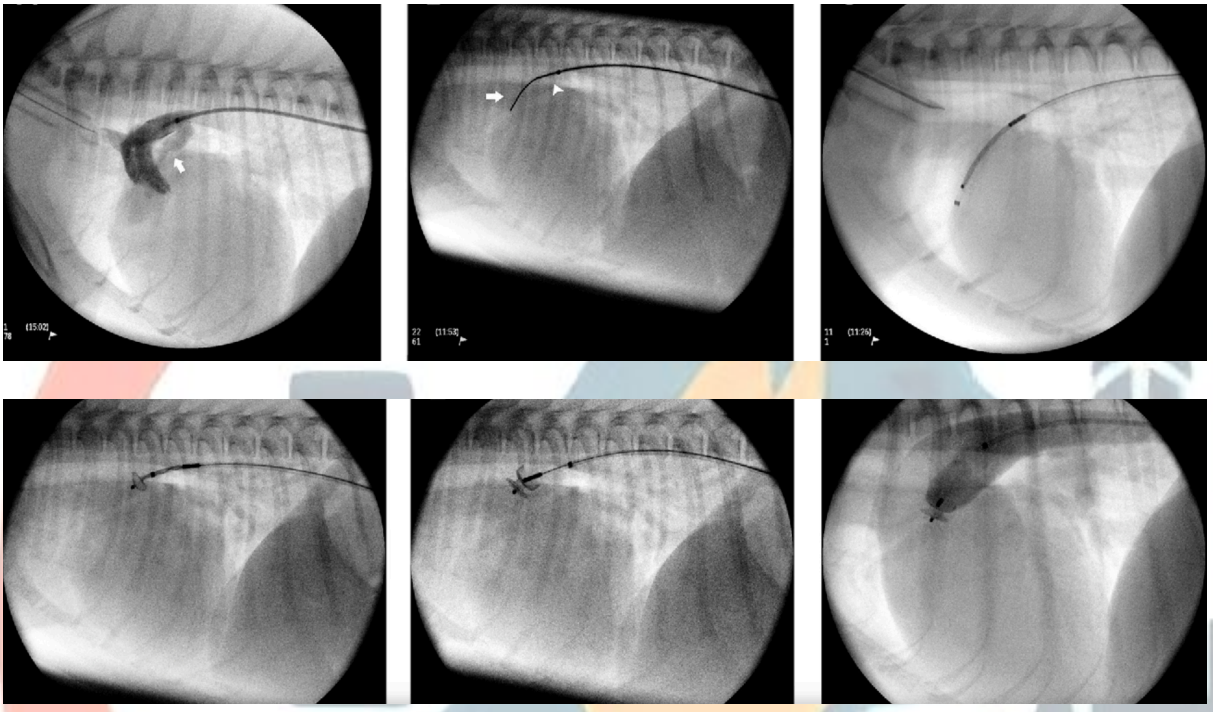
- Transcatheter device occlusion (minimally invasive)
- Open surgical ligation (thoracotomy)

5) Preferred modern option in many dogs: Transcatheter device closure

What it is?

A specialist places a **closure device through a catheter** (usually from the femoral artery/vein or jugular vein) and **deploys it across the PDA so blood can't pass through.**

Common devices



- Canine ductal occluder (CDO/ACDO) — widely used; often considered the treatment of choice for many canine PDAs.
- Vascular plugs (e.g., Amplatzer-type devices) — useful in small dogs when vessel access is challenging.
- Coils — often used for very small PDAs; success rates are good but can have more residual flow than occluder devices in some cases.

Why owners like it

- No chest incision (usually)
- Often faster recovery
- Excellent closure rates in appropriate patients

Why owners don't like it

- **Cost can be twice the cost of a surgical ligation in a routine multidisciplinary centre, approximately three times the cost with our service**

Success & complication rates (dogs)

Studies comparing methods show **very high success and low major complication rates** for device closure. For example, one JAVMA study reported major complications 0% for canine ductal occluder implantation versus 10% for surgical ligation, with overall survival to discharge 99%.

Large series and reviews consistently describe high procedural success and low complication rates for ACDO-type devices.

Possible complications (device closure)

- Device movement/embolisation (rare in experienced hands)
- Bleeding/haematoma at vessel entry site
- Residual flow ("tiny leak") that may close over time or require a second device
- Arrhythmias during the procedure (usually transient)

6) Surgical treatment: Open PDA ligation (still very important)

Surgical ligation remains a critical option when:

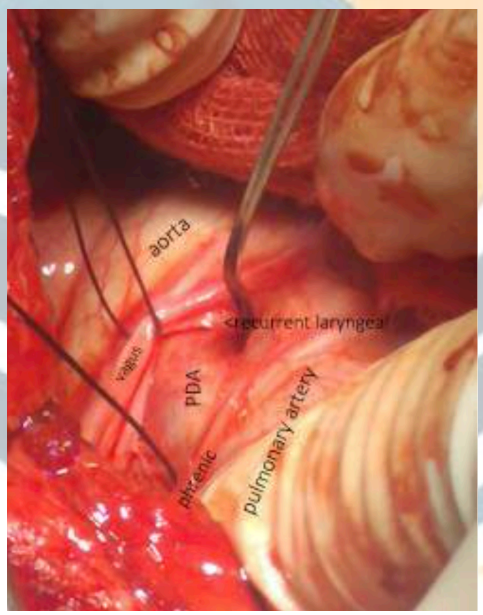
- The patient is too small for available catheters/devices
- PDA anatomy isn't suitable for device placement
- Device closure isn't available locally/urgently
- There is a device complication or residual shunt needing surgical backup
- **Cost matters: transcatheter occlusion = 2 x surgical ligation at multidisciplinary hospital**
  = 3 x surgical ligation with HKVSS

What the surgery involves

A surgeon performs a **left thoracotomy** (incision between ribs)
The **PDA is carefully isolated** and tied off (ligated) or clipped. At HKVSS, we tend to ligate them
Blood flow through the PDA stops immediately

Surgical success & complication rates

Open ligation is **highly effective**, but it carries a known risk of major complications due to the PDA's fragile wall and proximity to vital structures. Major complications are reported around 6–10% in dogs.



Mortality reported for surgical ligation is reported in **0 – 7%** across sources/case series.

A major comparative study found 10% major complications in surgical ligation versus 0% for device closure (with similar discharge survival overall).

Surgical complications owners should be briefed on:

- Haemorrhage (bleeding) from duct tear (the most feared complication)
- Residual shunt if ligation isn't complete (sometimes fixable later)
- Post-op pain and temporary breathing discomfort
- Rare nerve irritation affecting voice/bark/swallow (due to nearby nerves)

7) Special notes for cats

PDA is less common in cats than dogs, but it absolutely occurs, and closure is still recommended for left-to-right PDAs.

Important: **Surgical ligation in cats has historically had higher complication rates** than in dogs in some reports (including haemorrhage), with perioperative/intraoperative complication rates cited in the range of **~15 – 26.7%.**

Because feline blood vessels are small, some cats may be better served by specialised approaches (including carefully selected device closure or clip ligation in expert hands).

The "best" method in cats depends heavily on:
- body size
- PDA shape
- availability of tiny catheters/devices
- surgeon/cardiologist experience

8) What happens after PDA closure

Immediate changes
Once the PDA is closed, the heart suddenly experiences less volume overload. Many pets improve quickly, but some may need short-term monitoring for:

- Temporary arrhythmias
- Short-term cough or breathing changes
- Blood pressure shifts

Recovery timeline (typical)

Device closure:
often home same day or next day;
activity restriction ~1–2 weeks

Open surgery:
usually 2–4 days hospitalisation;
activity restriction ~4–6 weeks (incision and rib healing)

Follow-up

Recheck exam and echo to confirm closure and measure heart remodelling.
Many dogs' enlarged hearts shrink toward normal after closure.

9) Prognosis

- If a left-to-right PDA is closed early

Excellent. Many dogs and cats live normal, active lives.

- If closure is delayed until heart failure

Still often very good once stabilised and closed, but risk is higher.

• If PDA is reversed (right-to-left)
Closure is typically not performed; management focuses on pulmonary hypertension and complications.

10) Selected veterinary references

1. Comparative complications and outcomes of surgical ligation vs canine ductal occluder in dogs (JAVMA).
2. Review/series supporting ACDO as a safe and effective option (PubMed/JSAP sources).
3. Device approaches and success rates in canine PDA occlusion (J Vet Intern Med).
4. Surgical ligation complication ranges discussed in veterinary surgery literature.
5. Cat-specific complication discussion and context (Frontiers in Veterinary Science).

Bottom line

- PDA is usually curable if treated early.
- For most left-to-right PDAs, definitive closure is strongly recommended.
- Transcatheter device closure is often preferred in dogs due to very low major complication rates in published comparisons.
- Open surgical ligation remains a vital, effective treatment—especially when devices aren't feasible—though it has a higher risk of major intraoperative complications in many reports.
- In cats, closure is still strongly recommended for left-to-right PDAs, but technique selection is especially dependent on patient size and specialist experience.