

## SMALL ANIMAL

# Treatment of patent ductus arteriosus by placement of intravascular coils in a pup

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- Patent ductus arteriosus is the most frequently recognized congenital heart disease in dogs.
- Intravascular embolization represents a new treatment method, which does not require thoracotomy.

A 3-month-old 5.4-kg female mixed-breed pup was referred to the small animal clinic with a diagnosis of patent ductus arteriosus (PDA). The dog had a history of exercise intolerance, seizures, and stunted growth. Physical examination revealed a systolodiastolic machinery-type murmur, with maximal intensity at the heart base on both sides of the thorax. A precordial thrill was palpable over the left and right thoracic areas. A 6-lead ECG revealed a heart rate of 170 beats/min and elongation of the P wave, which indicated left atrial enlargement as well as increased amplitude of the QRS complex, which indicated a left ventricular enlargement. Survey radiography revealed overcirculation of the lungs, a mixed interstitial and alveolar edema, a large left atrium, and a prominent aortic arch. Selective digital angiography was performed to confirm the diagnosis of PDA.

Preanesthetic medication of 50 µg of medetomidine hydrochloride/kg of body weight was administered iv. General anesthesia was induced by iv injection of 5 mg of thiopental/kg and maintained with 1.5% enflurane vaporized in 1 L of oxygen/min. Fluid maintenance was provided as a 5% glucose solution administered via a catheter in the cephalic vein (10 ml/kg/h). The right femoral area was aseptically prepared and a 5-F hemostatic valve<sup>a</sup> was placed percutaneous into the right femoral artery. A 5-F pigtail catheter<sup>b</sup> with a guide wire of 0.038 in<sup>b</sup> was passed into the aortic arch, which was outlined by an injection of 5 ml of iohexol<sup>c</sup> contrast medium. The left main pulmonary artery was opacified simultaneously with the aorta, confirming left-to-right shunting (Fig 1). The pigtail catheter was replaced by a 5-F cobra C1 catheter,<sup>d</sup> and a 4-cm long cone-shaped PDA with a large aortic base was outlined. Compression bandaging of the femoral area and administration of antibiotics (amoxicillin, 1.0 mg/kg, im) comprised the postoperative care.

Two weeks later, a second angiography was performed in an attempt to form an embolus that would functionally close the PDA. Thrombotic coils of Gianturco type<sup>e</sup> were introduced individually into a catheter positioned in the PDA. Each coil was pushed into the canal by flushing the catheter with 0.9% NaCl solution. Contrast medium (2 to 5 ml) was injected into the catheter after each coil placement to ascertain positioning. The first coil introduced was too small and migrated to the

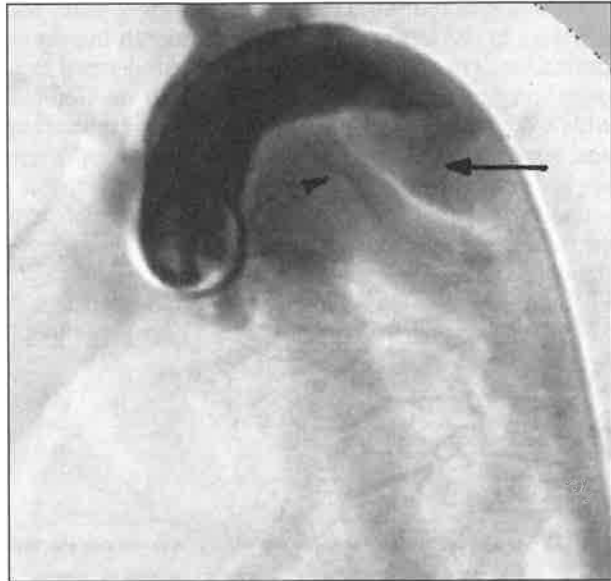


Figure 1—Oblique ventrodorsal angiographic view of a portion of the thoracic area of a 3-month-old pup with patent ductus arteriosus. With a catheter positioned in the aortic arch, opacification of the main pulmonary arteries (arrowhead) confirmed left-to-right patent ductus arteriosus shunting (arrow).

left pulmonary artery. It was believed that the coil was too small to cause thrombosis and, after contrast angiography to evaluate the permeability of the left pulmonary artery, the coil was left in place. Twenty coils (5 to 20 mm in diameter and 3 to 15 cm long) were necessary to cause complete thrombotic obstruction. After 11 coils had been positioned in the PDA, the thoracic thrill disappeared, but the canal was still patent. Complete embolization was obtained after placement of the 20th coil (Fig 2). Postoperative care again consisted of bandaging and administration of antibiotics.

Twenty-four hours after the procedure, the murmur had completely disappeared; no thrill was evident on auscultation, and the heart rate had decreased to 100 beats/min. Findings on ECG, however, were unchanged. Survey radiography indicated that the pulmonary edema had resorbed, and the diameter of the vessels had markedly decreased. The dog was reexamined 1 month after the procedure and was found to be clinically normal. Radiography indicated that the coils were still in place, and the left atrium was slightly smaller. No signs of pulmonary thrombosis were detected (Fig 3).

Patent ductus arteriosus is the most frequently recognized congenital heart disease in dogs.<sup>1-3</sup> The usual surgical treatment involves thoracotomy, which is invasive and requires considerable postoperative care.<sup>4</sup> Medical treatment has been attempted by use of a prostaglandin antagonist in a dog.<sup>5</sup>

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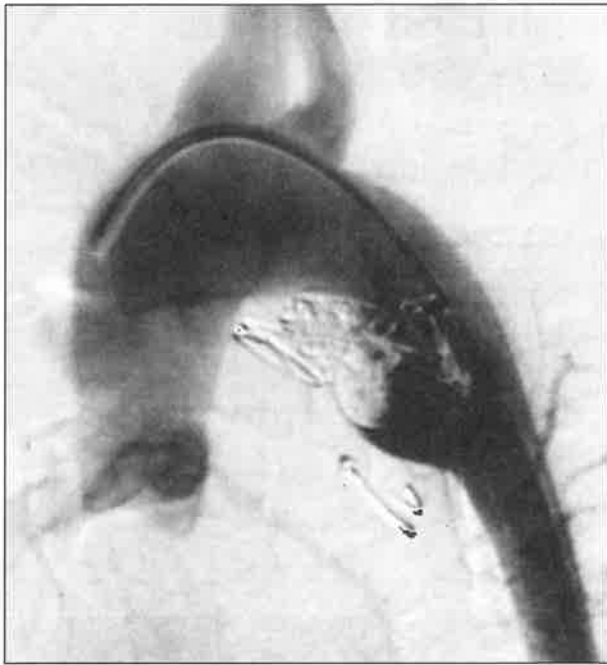


Figure 2—Oblique ventrodorsal angiographic view of the aortic arch area after placement of 20 coils into the patent duct. A complete embolus, blocking the duct, was created.

The technique described in this report has been used for treatment of patent ductus venosus in a dog.<sup>6</sup> Advantages of use of the coil embolic treatment include less invasiveness, quicker recovery, and minimal post-operative care, compared with that for conventional surgery. Two disadvantages of the technique are the requirement of specific angiographic equipment and the expense of the coils (US, \$60/coil). The number of coils needed depends on the shape of the PDA. The dislodgement of coils during placement may cause iatrogenic vascular foreign bodies, which are potentially fatal. Several percutaneous removal systems for unwanted migrating coils have been described in human interventional radiology.<sup>7</sup> In the case reported here, the coil in the left pulmonary artery did not appear to cause any problems.

<sup>a</sup>Check-Flo Intoducers Set, Cook Europe Sandet, Bjaeverskov, Denmark.

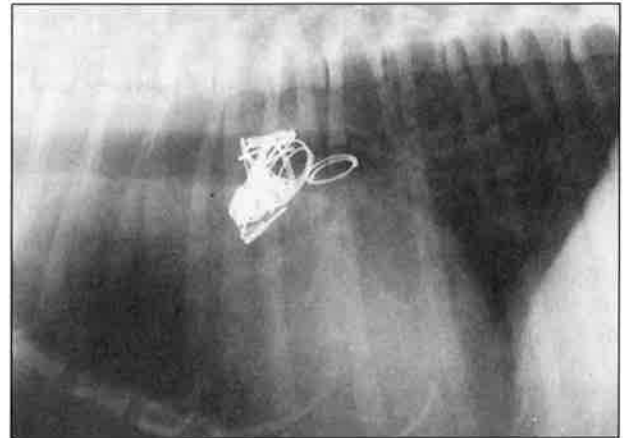


Figure 3—Lateral radiographic view of the thorax 1 month after the procedure. The coils are still in place, and the left atrium is slightly smaller, compared with that prior to the procedure. One coil was inadvertently positioned in the left pulmonary artery during the procedure. It was left in place after it was determined to cause no problem.

<sup>b</sup>High Flow Pigtail, Cook Europe Sandet, Bjaeverskov, Denmark.

<sup>c</sup>Omnipaque, Nycomed, Brussels, Belgium.

<sup>d</sup>Hoogewood cobra catheter, Cook Europe Sandet, Bjaeverskov, Denmark.

<sup>e</sup>Embolization Coil, Cook Europe Sandet, Bjaeverskov, Denmark.

## References

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