# Transcatheter coil embolisation of a patent ductus arteriosus in a dog

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## INTRODUCTION

The ductus arteriosus is a normal foetal structure that shunts blood from the pulmonary artery to the aorta. In the pup, the ductus arteriosus functionally closes within days after birth. Patent Ductus Arteriosus (PDA) is due to failure of closure and is one of the most commonly recognised congenital cardiac lesions in dogs. Currently accepted therapies for PDA are surgical ligation (requiring thoracotomy) and transcatheter coil embolisation (via femoral artery/vein).

## CLINICAL PRESENTATION

A one-year-old female neutered Bichon Frisé presented for the investigation of a murmur detected as an incidental finding at routine vaccination. The dog was completely asymptomatic.

## DIAGNOSIS

On physical examination she seemed small for the breed standard. Mucous membranes were pink and capillary refill time was less than two seconds. On auscultation the heart rate was 96 beats per minute. The rhythm appeared to be a sinus arrhythmia with very occasional premature beats. A grade 5/6 continuous murmur, associated with a precordial thrill, was audible over the left heart base. The murmur radiated cranially and to the right side. The respiratory rate was 16 breaths/min and the lungs were normal on auscultation. The pulses were bounding. The remainder of the clinical examination was unremarkable.

Electrocardiography showed a sinus arrhythmia at 115 BPM with occasional atrial premature complexes. Tall R-waves and deep Q-waves were measured in lead II (Fig.1). Thoracic radiographs demonstrated mild cardiomegaly, a prominent aortic bulge and hypervascular lung fields suggestive of overcirculation.

Two-dimensional and M-Mode echocardiography demonstrated volume overload of the left atrium and left ventricle. Colour flow Doppler echocardiography showed the presence of continuous turbulent retrograde flow in the pulmonary artery consistent with PDA flow (Fig. 2). The ductus was visualised (estimated 3 mm in diameter at the pulmonary artery side) and no other congenital abnormalities were found.

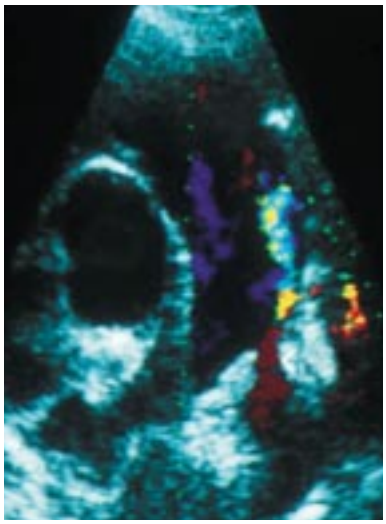

**Fig. 2:** *Right parasternal short-axis view at the heart base level showing retrograde flow (red) in the pulmonary artery (blue).*

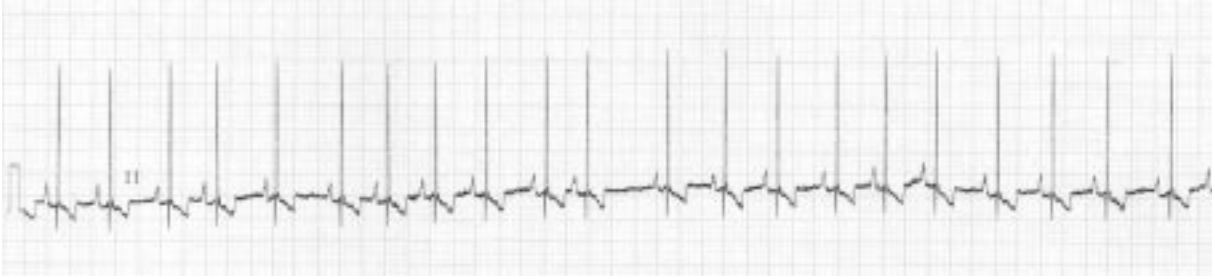

**Fig. 1:** *An electrocardiographic strip (Lead II) showing an occasional atrial premature complex*

Routine haematology and biochemistry were unremarkable.

## TREATMENT

The dog was sedated with an intramuscular injection of 0.025 mg/kg acepromazine (ACP®; C-Vet Veterinary Products) and 0.3 mg/kg morphine (Morphine Sulphate®; Martindale). Intravenous fluids (Compound Sodium Lactate, Isolec®; IVEX Pharmaceuticals) were administered at a rate of 5 ml/kg/hr.

General anaesthesia was induced with thiopentone (Thiovet,; C-Vet Veterinary Products) 8.3 mg/kg intravenously. She was then intubated and maintained with a combination of oxygen and isoflurane (Isoflo®; Mallinckrodt). Anaesthesia was monitored throughout the procedure by electrocardiography, indirect blood pressure, oesophageal stethoscope, pulse oximetry and routine manual monitoring. Prophylactic antimicrobial treatment was given in the form of 20 mg/kg cefazolin sodium IV (Kefzol®, Lilly).

The right inguinal area was prepared as for routine surgery with the animal in right lateral recumbency and the left hind leg pulled out of the way. An incision was made in the femoral triangle and the right femoral artery was exposed by dissection (Fig. 3). An introducer sheath (5-French; Cook®) was inserted by the Seldinger technique in the artery (Fig. 4). Under fluoroscopic guidance a 5-French gauge pigtail catheter (Cook®) was positioned in the aortic root via the introducer sheath in the femoral artery. An angiogram was performed with injection of contrast agent sodium lothalamate (Conray 420®; Mallinckrodt) into the aortic root (Fig. 5). This confirmed the diagnosis of a PDA and enabled the diameter at the pulmonary artery side to be measured (3 mm) by comparison with a 2 cm marker on the pigtail catheter.

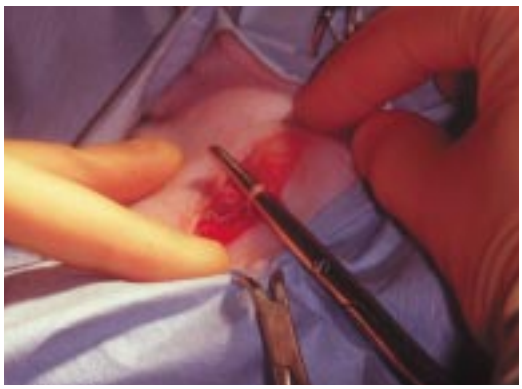

**Fig. 3:** *Surgical exposure of the femoral artery.*

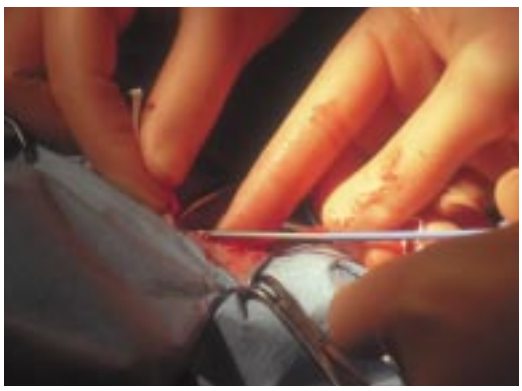

**Fig. 4:** *Positioning of the introducer sheath in the femoral artery.*

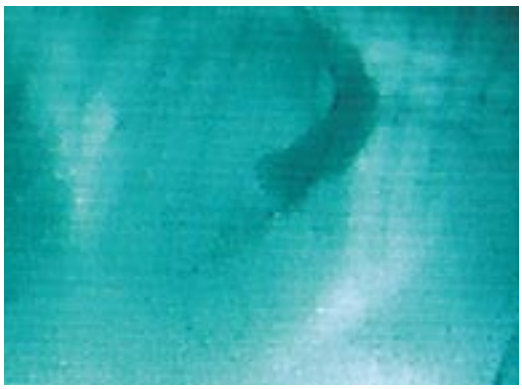

**Fig. 5:** *A selective aortic angiogram showing the patent ductus arteriosus.*

The duct was crossed by a retrograde arterial approach with a 5-F multipurpose catheter (Cook®). A 6.5 mm (MWCE-6.5-PDA 3) embolisation coil (MR eye™ detachable coil; Cook®) (Fig. 6), attached to a delivery wire (Jackson detachable wire Cook®), was introduced

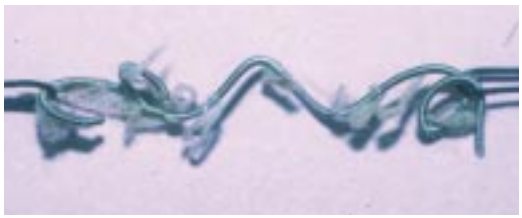

**Fig. 6:** *Cook® coil device.*

and the coil was advanced to the tip of the catheter. One full loop (360°) of the coil was pushed out of the catheter tip in the pulmonary artery and then the catheter was withdrawn anchoring this loop at the pulmonary artery side of ductus. All the other loops were released in the ductus ampulla itself. Once the coil seemed stable in place

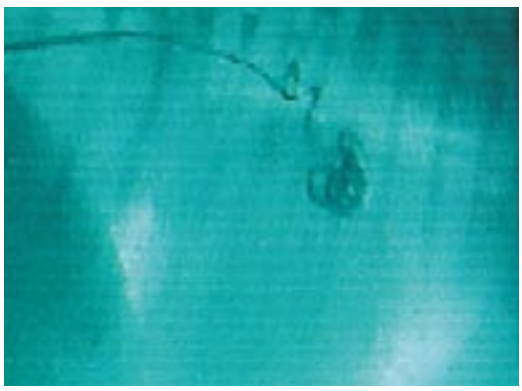

**Fig. 7:** *Fluoroscopic image of the coil embolisation technique.*

the delivery wire was rotated to detach it from the coil. The second coil (MWCE-5.0-PDA 3; Cook®) was placed in a similar way by passing the guide wire through the loops of the first coil. The loops anchored nicely in the previously placed coil (Fig. 7). An angiogram showed the presence of only a very small amount of residual flow through the ductus but no murmur could be detected by the oesophageal stethoscope.

The catheters and introducers were removed and the femoral artery was fully ligated (silk 2/0, Mersilk®; Ethicon). The wound was closed routinely. The dog made an uneventful recovery and the post-operative care comprised of two further IV injections of Kefzol, at 8-hour intervals. Thoracic radiographs documented coil placement.

## OUTCOME

No flow was visible across the ductus 3 days and 1-year post intervention and the dog remained completely asymptomatic.

## DISCUSSION

Many dogs with a left-to-right shunting PDA have no history of clinical problems. However, several do present in left heart failure and, if left untreated, up to 65% die of left-sided heart failure within the first year of life. In some dogs, clinical signs are not apparent until they are mature, but there usually are signs before the dog is 3 years old. Closure of the patent ductus arteriosus has been established as mandatory in veterinary cardiology. Coil embolisation is now a widely accepted alternative method for the closure of a PDA in the dog. It avoids an invasive thoracotomy and the recovery from the intervention is very fast (within hours). Possible complications include excessive protrusion of the coils in the pulmonary artery or aorta, pulmonary artery or aortic embolisation, residual shunting, haemolysis, and haemorrhage at the introducer site. The fatality rate is extremely low.

## CONCLUSION

Veterinarians should be aware of the possibility and benefits of closure of a Patent Ductus Arteriosus by coil embolisation.

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