Journal of Veterinary Cardiology (2017) ■, ■–■

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Journal of Veterinary Cardiology
ESVC

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Case Report

Successful balloon angioplasty of pulmonary artery stenosis in two cats and associated complications

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Received 29 January 2016; received in revised form 11 June 2017; accepted 4 September 2017

KEYWORDS
Feline;
Flash pulmonary edema;
Acute lung injury;
Dynamic right ventricular outflow tract obstruction

Abstract Two cats (2.5 months and 8 months old) were each evaluated due to a loud systolic murmur, and each was diagnosed with severe pulmonary artery stenosis at the bifurcation of the main pulmonary artery. Echocardiograms confirmed significant right atrial dilation and right ventricular dilation and/or hypertrophy that was progressive in one cat. Atenolol was initiated and the cats were referred for interventional therapy. Balloon angioplasty was performed via the jugular vein. In case 1, the pressure gradient across the stenosis was reduced from 169.7 mmHg to 23.6 mmHg and 52.4 mmHg across the left and right branch pulmonary arteries, respectively. In case 2, the stenotic echocardiographic gradient was reduced from 64 mmHg to 38.0 mmHg and 35.3 mmHg across the left branch and right-branched pulmonary arteries respectively. Both patients developed moderate to severe dynamic right ventricular outflow tract obstruction post angioplasty. Case 2 developed hypotension, desaturation, and ventricular arrhythmias intra-operatively. Case 1 was discharged but appeared to develop acute lung perfusion injury approximately 36 h after procedure that was manifested by radiographic pulmonary congestion and pulmonary infiltrate of the left lung fields. The congestion was successfully managed medically. Serial echocardiograms over the following 4 years in case 1 showed near complete resolution of the stenosis and associated right heart enlargement.

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https://doi.org/10.1016/j.jvc.2017.09.001
1760-2734/

Please cite this article in press as: Schrope DP, et al., Successful balloon angioplasty of pulmonary artery stenosis in two cats and associated complications, Journal of Veterinary Cardiology (2017), https://doi.org/10.1016/j.jvc.2017.09.001

Abbreviations

DRVOTO	Dynamic right ventricular outflow tract obstruction
PA	Pulmonary artery
PAS	Pulmonary artery stenosis
PMI	Point of maximum intensity
PTE	Pulmonary thromboembolism
RAD	Right atrial dilation
RVH	Right ventricular hypertrophy

Case 1

A 2.5-month-old male castrated domestic shorthair kitten weighing 1.2 kg was referred due to a new heart murmur that was reportedly not present during the kitten's initial examination. The kitten was reported to be asymptomatic. Physical examination revealed a heart rate of 220 bpm, a split S2 sound, and a grade IV/VI pansystolic murmur with point of maximal intensity (PMI) over the left cranial sternal border. The remainder of the physical examination was unremarkable. An initial echocardiogram revealed moderate to severe apical right ventricular hypertrophy (RVH) and moderate right atrial dilation (RAD). Moderate high-velocity tricuspid regurgitation was present along with mild (49 mmHg gradient) dynamic right ventricular outflow tract obstruction (DRVOTO). Severe pulmonary artery stenosis (PAS) was present just proximal to the main pulmonary artery bifurcation (100 mmHg gradient). It was difficult to discern if the PAS was affecting the main pulmonary artery itself or primarily the right or left main pulmonary artery branches. Atenolol was prescribed (0.83 mg/kg once daily) with instructions to titrate the dose upward as the kitten continued to grow, to maintain an approximate dosage of 1 mg/kg orally once daily. The kitten was rechecked four months later and had remained asymptomatic. A repeat echocardiogram revealed progressive RVH, persistent DRVOTO (49 mmHg gradient), and progressive PAS (169 mmHg gradient). The kitten had also now developed severe systolic anterior motion of the mitral valve with a left ventricular outflow tract gradient of 97.2 mmHg, and mild left ventricular hypertrophy but no left atrial dilation. Prognosis was discussed and it was decided to refer the patient for interventional therapy.

At evaluation for possible interventional therapy, physical exam revealed a grade V/VI systolic murmur with a PMI over the right parasternal region with prominent radiation to the left parasternal region. The physical exam was otherwise unremarkable, including a lack of increased visibility of jugular pulsation. Echocardiography confirmed findings similar to that seen before referral (Fig. 1A). The orifice of the stenosis appeared eccentrically positioned to a greater degree over the right pulmonary artery branch, although a difference in the degree of stenosis across the left or right branch could not be defined with Doppler imaging. Diastolic flow across the stenosis was identified. Owing to the severe stenosis and significant and progressive right heart changes, a decision was made to attempt balloon angioplasty. The patient was continued on oral atenolol as previously initiated.

The procedure was performed approximately 4 weeks later. The patient was premedicated with hydromorphone (0.05 mg/kg IV) and diazepam (0.25 mg/kg IV) and induced with etomidate IV (total dosage of 0.7 mg/kg given to effect). Anesthesia was maintained with sevoflurane. The patient was also premedicated with cefazolin at 22 mg/kg IV.

A surgical incision was made over the right jugular vein, and a 5 Fr catheter introducer[d] was placed via needle puncture. A 5 Fr balloon wedge pressure catheter[e] was passed into the right ventricle, right atrium, and proximal pulmonary artery (PA) where pressures were assessed (Table 1 and Fig. 2). Due to concern for obstruction of the small stenotic orifice, distal PA pressures were not initially obtained. Angiography was then performed by the injection of 4 ml of iodinated contrast[f] into the right ventricular via a 5 Fr Berman angiographic catheter[b] (Fig. 3A). The angiogram revealed a thin fibrotic shelf just proximal to the bifurcation. The main pulmonary artery and the pulmonary artery branch diameters were estimated at 6 mm. The stenotic orifice was estimated at 3 mm. The infundibular region appeared mildly narrowed with evidence of mild dynamic obstruction, although no gradient was identified during initial cardiac pressure evaluation. A 5 Fr balloon wedge pressure catheter was advanced to the stenotic lesion. The catheter could not be easily passed across the stenosis, therefore a 0.025 × 260 cm flexible J-tip exchange wire[g] was passed through the orifice and the tip placed in the right pulmonary artery branch. The wedge pressure catheter was then exchanged for a

[d] Cordis, Miami Lakes, FL.
[e] Arrow, Reading, PA.
[f] Omnipaque 240, GE Healthcare, Princeton, NJ.
[g] Emerald Guidewire, Cordis, Miami Lakes, FL.

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