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Single left coronary ostium and an anomalous prepulmonic right coronary artery in 2 dogs with congenital pulmonary valve stenosis[☆]

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Abstract A coronary artery anomaly characterized by the presence of a single left coronary ostium with absence of the right coronary ostium and an anomalous prepulmonic right coronary artery course was observed in two dogs with concurrent congenital pulmonary valve stenosis. This unique coronary artery anatomy is similar to the previously described single right coronary ostium with anomalous prepulmonic left coronary artery, the so-called type R2A anomaly, in that an anomalous coronary artery encircles the pulmonary valve annulus. Both dogs of this report, a boxer and an English bulldog, were of breeds known to be at risk for the type R2A anomaly. As such, veterinarians should be aware that the echocardiographic presence of a left coronary ostium in a dog with pulmonary valve stenosis does not exclude the possibility of a prepulmonic coronary artery anomaly that may enhance the risk of complications during balloon pulmonary valvuloplasty. A descriptive naming convention for coronary artery anomalies in dogs is also presented, which may be preferable to the older coding classification scheme.

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[☆] A unique aspect of the Journal of Veterinary Cardiology is the emphasis of additional web-based images permitting the detailing of procedures and diagnostics. These images can be viewed (by those readers with subscription access) by going to <http://www.sciencedirect.com/science/journal/17602734>. The issue to be viewed is clicked and the available PDF and image downloading is available via the Summary Plus link. The supplementary material for a given article appears at the end of the page. Downloading the videos may take several minutes. Readers will require at least Quicktime 7 (available free at <http://www.apple.com/quicktime/download/>) to enjoy the content. Another means to view the material is to go to <http://www.doi.org> and enter the doi number unique to this paper which is indicated at the end of the manuscript.

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Abbreviations

BPV	balloon pulmonary valvuloplasty
Cx	circumflex branch coronary artery
CTA	computerized tomographic angiography
CA	coronary artery
Pc	paraconal interventricular branch coronary artery
PA	pulmonary artery
PV	pulmonary valve
PS	pulmonary valve stenosis
RV	right ventricle
TEE	transesophageal echocardiography

Case 1

A 3-month-old, intact, male Boxer dog weighing 11.4 kg was referred to The Ohio State University Veterinary Medical Center for severe pulmonary valve stenosis (PS) and balloon pulmonary valvuloplasty (BPV). The dog was asymptomatic for heart disease at the time of presentation and was receiving atenolol 6.25 mg PO q 12 h. Physical examination revealed a grade V/VI left basilar systolic heart murmur but was otherwise unremarkable.

A transthoracic two-dimensional and Doppler echocardiographic study^a was performed using a phased-array 3.1–8.0 MHz transducer.^b Two-dimensional views obtained from the right parasternal short axis basilar view revealed a dysplastic and stenotic pulmonary valve (PV) characterized by a hypoplastic PV annulus, mildly thickened leaflets, and commissural fusion with systolic doming. Additionally, a discrete subvalvular ridge and mild post-stenotic pulmonary artery (PA) dilatation were noted (Fig. 1A). Spectral Doppler of the PV demonstrated severe PS with a peak systolic velocity of approximately 6.4 m/s, corresponding to an instantaneous transpulmonary systolic pressure gradient of 164 mmHg and mild diastolic pulmonary insufficiency. A left coronary ostium was visualized leaving the left coronary cusp of the aortic root from a right parasternal short axis left basilar view (Fig. 1B). A right coronary ostium was not visualized. Mild right atrial enlargement and moderate-to-severe concentric right ventricular (RV) hypertrophy was apparent. Trace tricuspid valve regurgitation was present.

^a Vivid 7 Dimension with EchoPac software package, version BT09, GE Medical Systems, Milwaukee, WI, USA.

^b 7S (3.1–8.0 MHz) transducer, Vivid 7 Dimension, GE Medical Systems, Milwaukee, WI, USA.

A contrast study using agitated saline administered via a peripheral vein failed to show evidence of an intracardiac shunt. A 6-lead ECG revealed a normal sinus rhythm with mild right axis deviation of +105° in the frontal plane.

The following morning, with the dog under general anesthesia, transesophageal echocardiography^a (TEE) using a pediatric transducer^c also revealed a single coronary ostium in the aortic root. Cardiac catheterization and selective right ventriculography was performed under fluoroscopic guidance using a 6 Fr Berman angiographic catheter^d via a 9 Fr introducer sheath^e placed percutaneously into the right external jugular vein. Following inspection of the levophase of the RV angiogram, an absent right coronary ostium and a single left coronary ostium were suspected. In order to further clarify the coronary artery (CA) anatomy, selective aortic root angiography was performed with a 4 Fr Berman angiographic catheter^d via a 5 Fr micro-introducer sheath^f placed into the right common carotid artery via a surgical cut-down approach. Orthogonal aortic root angiograms displayed a single left coronary ostium and an anomalous right CA, seemingly arising from the paraconal interventricular branch CA (Pc) (Fig. 2A and B, Video 1). A simultaneous aortic root and RV angiogram in the lateral plane revealed that the anomalous right CA partially encircled the subvalvular, prepulmonic (cranial) region of the PV annulus (Fig. 2C; Video 1). Given the potential risks associated with BPV and anomalous CAs,^{1–3} the dog's owners were informed prior to proceeding. Conservative BPV (balloon-to-PV annulus ratio of approximately 1:1)⁴ was elected and was performed without event using a standard balloon dilation catheter.^g The dog recovered uneventfully and the following morning spectral Doppler interrogation of the PV revealed minimal reduction in the dog's peak transvalvular instantaneous systolic pressure gradient (approximately 150 mmHg). The dog was discharged to the client with instructions to continue the atenolol (1 mg/kg PO q 12 h).

The dog was rechecked 3 months after BPV at which time it weighed 20.6 kg and remained asymptomatic for cardiovascular disease. Doppler

^c 9T (4–10 MHz) transducer, Vivid 7 Dimension, GE Medical Systems, Milwaukee, WI, USA.

^d Berman Angiographic Balloon Catheter, Arrow International Inc., Reading, PA, USA.

^e Terumo® Pinnacle™ Introducer, Terumo Medical Corp., Elkton, MD, USA.

^f Check-Flo® Performer® Introducer Set, Cook Inc., Bloomington, IN, USA.

^g Tyshak II® Percutaneous Transluminal Valvuloplasty Catheter, 8 mm × 4 cm, NuMED Inc., Hopkinton, NY, USA.

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