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CASE REPORT

Complete transposition of the great arteries with double outlet right ventricle in a dog[☆]



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Abstract A 2-year old intact male Collie dog presented to the cardiology service at Oregon State University for evaluation of cyanosis and suspected congenital cardiac disease. Echocardiography revealed a constellation of cardiac abnormalities including a single large vessel exiting the right ventricle with a diminutive left ventricular outflow tract, a ventricular septal defect, and marked concentric right ventricular hypertrophy with moderate right atrial dilation. Cardiac-gated computed tomography confirmed the previous anomalies in addition to supporting a diagnosis of complete transposition of the great arteries, double outlet right ventricle, and pulmonic hypoplasia with a single coronary ostium. Prominent bronchoesophageal collateral vessels were concurrently identified. Clinically, the dog was stable despite mild cyanosis that worsened with exercise; no intervention was elected at the time. This case report describes a rare combination of congenital cardiac defects and the usefulness of cardiac-gated cross-sectional imaging in the anatomic diagnosis.

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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

CT	computed tomography
DORV	double outlet right ventricle
LV	left ventricle
RV	right ventricle
TGA	transposition of the great arteries
VSD	ventricular septal defect

Case description

A 2-year old intact male Collie dog was referred to the cardiology service at Oregon State University for evaluation of suspected congenital cardiac disease. The owners reported exercise intolerance and resting lingual cyanosis that worsened with activity. A heart murmur had been noted since the birth but further investigation had not been pursued. On presentation, pertinent physical examination findings included mild generalized cyanosis and a grade III/VI left basilar systolic murmur with a regularly irregular rhythm. Femoral pulse quality was considered normal and no jugular distension appreciated. Unilateral cryptorchidism was also noted.

Initial diagnostics included blood pressure measurement, a resting 10-lead electrocardiogram, thoracic radiographs, echocardiogram, complete blood count, blood chemistry panel, and urinalysis. The blood pressure was normal (systolic 138 mmHg, diastolic 75 mmHg, mean arterial pressure 98 mmHg) using an oscillometric blood pressure measurement device.^a The electrocardiogram revealed a sinus arrhythmia with criteria for right ventricular (RV) enlargement and a wandering atrial pacemaker. Thoracic radiographs indicated moderate cardiomegaly comprised primarily of right-sided enlargement with no evidence of congestive heart failure. The pulmonary parenchyma and vasculature were considered normal.

Transthoracic echocardiography was subsequently performed, revealing a single vessel exiting from the RV and a large ventricular septal defect (VSD) (Video 1). Systolic flow velocities across this valve were normal at 0.9 m per second. Subjectively moderate concentric RV hypertrophy and right atrial enlargement was appreciated (Video 2). The left ventricle (LV) lumen was objectively decreased in size during

both systole and diastole. Septal and LV wall thicknesses were normal. Mitral inflow indicated normal velocities. The outflow portion of the LV culminated in a large VSD. Differential diagnoses considered from this examination included truncus arteriosus, pseudotruncus arteriosus, VSD with double outlet right ventricle (DORV), and transposition of the great arteries (TGA). Hematology revealed mild polycythemia (red blood cell (RBC) $9.24 \times 10^{12}/L$, reference range $5.5\text{--}8.5 \times 10^{12}/L$; hematocrit 61.3%, reference range 37%–55%) with normal total protein 6.6 g/dL (reference range 5.4–7.6 g/dL). Serum biochemistry and urinalysis were unremarkable and a heartworm antigen test was negative.

A contrast-enhanced^b cardiac-gated computed tomography (CT) scan^c was performed under general anesthesia to further evaluate the cardiac and great vessel malformations. The RV wall was concentrically hypertrophied and a large VSD was noted in the ventricular septum near the atrioventricular junction (Figs. 1 and 2). Prominent bronchoesophageal vessels were also noted in the region of the distal esophagus (Fig. 1). The left atrium, mitral valve, and LV appeared structurally normal. The LV outflow tract was comprised of a large overriding VSD. The aorta was observed to arise from the craniodorsal aspect of the RV (Fig. 3) and contrast medium was seen entering the aorta from both left and right ventricles. A second, diminutive vascular outflow tract was noted caudally to the malpositioned aorta, and arose predominantly from the RV. This vessel subsequently divided into two branches that extended into the lungs, consistent with the pulmonary trunk (Fig. 4, Video 3). In the sagittal plane, a single coronary artery arose from the anteriorly displaced aorta in the region of the right coronary sinus. This single coronary artery coursed caudally for a short distance until trifurcating into branches consistent with an anterior descending, left circumflex, and right coronary arteries (Fig. 5). Based on these findings, the dog was diagnosed with complete TGA, DORV, pulmonic hypoplasia with a single coronary ostium, and a large malalignment VSD. As the dog appeared stable with only mild resulting polycythemia, conservative monitoring was elected. Follow-up with the primary veterinarian three months post-diagnosis indicates the dog remains clinically stable without any treatment or lifestyle changes.

^a Cardell Veterinary Monitor 9401, CAS Medical Systems, Inc.; Branford, CT, USA.

^b Isovue 370, Bracco Diagnostics, Princeton, NJ, USA.

^c Toshiba Aquilion 64 CT, Toshiba America Medical Systems Inc., Tustin, CA, USA.

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