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Double-outlet right atrium in a 9 year-old cat☆

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Abstract Double-outlet right atrium (DORA) is a type of atrioventricular septal defect that is described as an extreme leftward deviation of the lower portion of the interatrial septum, resulting in insertion into the atrial wall left and posterior to the mitral orifice. This rare anomaly, which has been reported in humans and only just recently in cats, was identified by transthoracic echocardiography in a 9 year-old cat that was presented for further evaluation of a tachyarrhythmia and cardiomegaly. This case report describes the diagnostic findings in this cat and summarizes the anatomy, classification and clinical consequences of this rare congenital heart defect.

A 9 year-old female spayed domestic shorthair cat was referred to the University of Florida Cardiology service for evaluation of a tachyarrhythmia and suspected cardiomyopathy. About one week prior to presentation, the cat was noted to be hiding and anorexic. Clinical findings from the referring veterinarian at that time included suspected atrial fibrillation with a heart rate of 300 bpm and subjective cardiomegaly based on thoracic radiographs. Baseline blood work, including a chemistry panel and CBC, was unremarkable. The patient was started on atenolol (0.75 mg/kg PO q24h), benazepril (0.625 mg/kg PO q24h) and aspirin (10 mg/kg PO twice weekly). When her heart rate was found to be

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Abbreviations

Ao	aorta
ASD	atrial septal defect
AV	atrioventricular
AVSD	atrioventricular septal defect
CT	computed tomography
DORA	double-outlet right atrium
FS	fractional shortening
LA	left atrium
LV	left ventricle
LVIDd	left ventricular diameter in diastole
LVIDs	left ventricular diameter in systole
MRI	magnetic resonance imaging
RA	right atrium
RV	right ventricle
VSD	ventricular septal defect

persistently increased three days later, her dose of atenolol was increased (1.5 mg/kg PO q24h) and she was started on mirtazapine (unknown dose PO) as an appetite stimulant.

On presentation, the cat was bright, alert and responsive. Her heart rate was 160bpm and an irregular rhythm with no audible murmur was auscultated. She was mildly tachypneic with a normal respiratory effort. Femoral pulses were fair and symmetric. The remainder of the physical exam was unremarkable. A six-lead ECG revealed a sinus rhythm with frequent atrial premature complexes, occasional second degree (atrioventricular) AV block, and right bundle branch block. We suspected the second degree AV block was secondary to atenolol therapy. Alternatively, the AV block could have been due to concealed conduction rendering the AV junction refractory following the atrial premature complexes. Interpretation of the referring veterinarian's radiographs confirmed generalized cardiomegaly as well as mild cardiogenic pulmonary edema.

A transthoracic echocardiogram was performed without sedation due to concern for the patient's safety. Due to the cat's temperament, a simultaneous ECG was not possible. The echocardiogram revealed extreme leftward deviation of the apical aspect of the interatrial septum and a small primum atrial septal defect (ASD) (Fig. 1A, Video 1) with continuous left-to-right flow as indicated by color flow Doppler (Fig. 1B, Video 2). Spectral Doppler confirmed the continuous nature of the shunt and identified a maximum pressure gradient of 20.3 mmHg. This defect was the only communication of the left atrium (LA) with any other cardiac chamber. The right atrium (RA) emptied into both

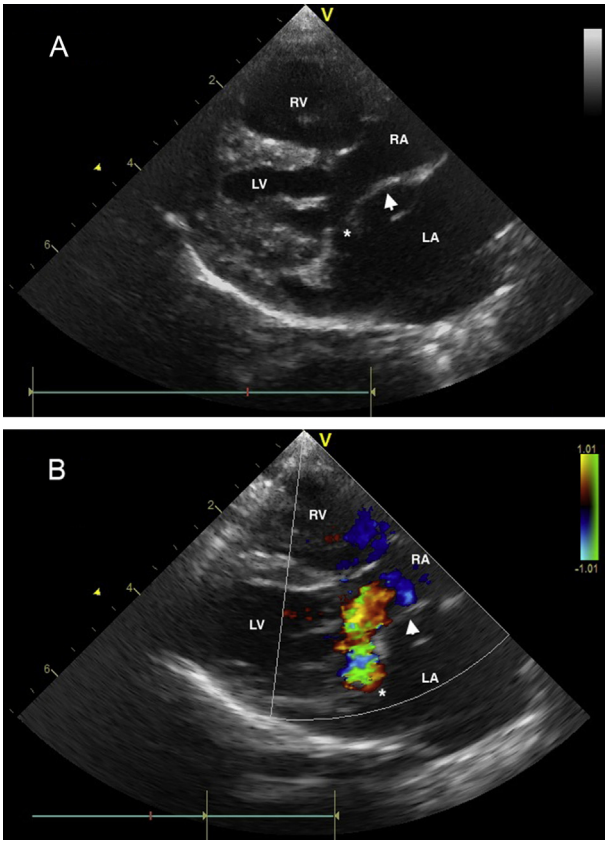

Figure 1 A. Right parasternal long-axis views show severe leftward deviation of the interatrial septum (arrow) resulting in communication between the right atrium (RA) and both the right ventricle (RV) and left ventricle (LV). A primum septal defect (asterisk) is also present. B. Doppler color flow reveals turbulent flow from the left atrium (LA) into the right atrium and left ventricle.

the right and left ventricles (RV, LV). There was one common AV annulus with bridging leaflets forming a common AV valve orifice and an inlet ventricular septal defect (VSD) (Fig. 2, Video 3). These findings are consistent with a specific form of a complete atrioventricular septal defect (AVSD) called a double-outlet right atrium (DORA). Moderate AV valve regurgitation was present with a maximum pressure gradient of 100 mmHg. Although this pressure gradient could represent LV pressure, the findings of moderately dilated main and branch pulmonary arteries and septal flattening support that the pressure gradient could be consistent with pulmonary hypertension. The RV was moderately enlarged with subjectively impaired systolic function. The RA was also moderately enlarged subjectively. Severe LA enlargement (LA/Ao = 3.33) was present and as noted previously, the LA did not connect to the LV inlet. The LV chamber size and