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CASE REPORT

Hypovolemia induced systolic anterior motion of the mitral valve in two dogs[☆]

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Abstract Systolic anterior (septal) motion of the mitral valve (SAM) is a common secondary phenomenon in hypertrophic cardiomyopathy (HCM) in people and cats. In humans, it is increasingly recognized that SAM may be found in other cardiac and non-cardiac disease states. In small animal cardiology, SAM unassociated with HCM has been described in dogs with mitral valve dysplasia and right ventricular pressure overload. In this report, we describe two cases of dogs where transient SAM was caused by hypovolemia. When SAM was present both dogs showed pseudohypertrophy and tachycardia. Important factors in the genesis of SAM in this scenario are probably hypovolemia induced changes in left ventricular geometry affecting the orientation of the mitral valve apparatus combined with elevated catecholamine levels. SAM associated with increased wall thickness is not pathognomonic of HCM; this

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observation is of particular clinical importance when extrapolated to species where HCM is highly prevalent, e.g., cats. An echocardiographic diagnosis should always be evaluated together with full clinical assessment of history and physical examination.
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Abbreviations

Ao	aorta
HCM	hypertrophic cardiomyopathy
IVSd	interventricular septum in diastole
LA	left atrium
LV	left ventricle
LVDd	left ventricular diameter in diastole
LVOT	left ventricular outflow tract
LVWd	left ventricular free wall in diastole
MR	mitral regurgitation
rr	reference range
SAM	systolic anterior motion of the mitral valve
V_{\max}	peak velocity

Case 1

An 8-year-old Papillon (body weight 6 kg) was seen in a private practice for the primary complaint of gait abnormalities. Clinical examination had revealed a heart murmur, weak pulse quality, and lethargy. In-house laboratory examinations had revealed a markedly elevated hematocrit of 77% and phlebotomy had been performed (60-mL blood removed and subsequently 180-mL lactated Ringer solution infused). Subsequently, the dog was referred to the Division of Cardiology, Vetsuisse Faculty, University of Zurich, for further evaluation of suspected heart failure.

On physical examination at our hospital the dog was lethargic; the mucous membranes were pale-pink and tacky, suggesting around 5–6% dehydration. The respiration pattern and rate (24 breaths/min) were normal, the femoral pulse was weak, and pulse and heart rate were 240 bpm. Thoracic auscultation revealed normal respiratory sounds and a grade IV/VI systolic heart murmur with the point of maximal intensity at the left apex. Serum biochemical and hematological variables were within normal limits. The hematocrit at the time of examination was 38%.

Two-dimensional qualitative echocardiography showed marked underloaded ventricular chambers, prominent wall thickness of both ventricles

and a small left atrium (LA) [LA quantitatively [1], long axis, LA_{\max} 1.4 cm; short axis, ratio of LA to aorta (Ao), (LA/Ao) $1.2/1.3 = 0.9$]. The combination of these abnormalities was suggestive of hypovolemia and pseudohypertrophy rather than true concentric hypertrophy. There was marked systolic anterior (respectively septal) motion of the mitral valve (SAM) with associated moderate mitral regurgitation (MR) with an eccentric jet and turbulent flow in the left ventricular outflow tract on color Doppler examination, but no abnormal pressure gradient on continuous wave Doppler (peak velocity [V_{\max}]: 1.6 m/s; Video 1, Fig. 1). In addition, there was mild dynamic right ventricular outflow tract obstruction (V_{\max} 1.9 m/s). On M-Mode (right parasternal short axis), quantitative measurements were left ventricular diameter in diastole (LVDd) 1.8 cm (reference range [2] (rr) 2.1–2.3 cm) and left ventricular diameter in systole (LVDs) 1.1 cm (rr 1.2–1.4 cm); right ventricular free wall in diastole 0.4 cm, interventricular septum in diastole (IVSd) 0.8 cm (rr 0.6–0.8 cm) and left ventricular wall in diastole (LVWd) 0.8 cm (rr 0.5–0.6 cm). Continuous ECG recording during echocardiography revealed constant sinus tachycardia at a heart rate of 180–220 bpm.

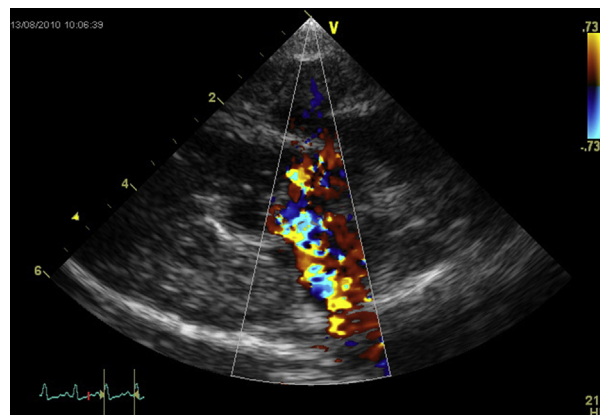


Figure 1 Color Doppler echocardiographic image from the right parasternal 5-chamber view in the same 8-year old Papillon from Videos 1 and 2 (case 1). There is mitral insufficiency and turbulent flow in the left ventricular outflow tract.

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