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Short Communication

Original investigation of right-to-left shunting patent ductus arteriosus in an Irish setter puppy

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Abstract

A six-month-old, entire female, Irish setter was presented with a two-month history of progressive hindlimb weakness and collapse on exercise. Thoracic auscultation revealed a soft systolic murmur and a split second heart sound. Differential cyanosis and polycythaemia were not observed. Right-to-left shunting patent ductus arteriosus (r-PDA) was confirmed on contrast echocardiography (''bubble study'') and selective right ventricular angiography. Comparison of blood gases from the metatarsal and auricular artery confirmed the presence of differential hypoxia. This technique is not known to have been described previously in the diagnostic investigation of r-PDA in dogs.

Keywords: Patent ductus arteriosus; Dogs; Arterial blood gases; Contrast echocardiography; Differential cyanosis

A fully vaccinated six-month-old, 12.2 kg, entire female Irish setter was presented with a two-month history of progressive hindlimb weakness and collapse on exercise. The dog's gait returned to normal after a few minutes of rest. On presentation, the dog appeared in poor bodily condition (body condition score 2/5) and the owners reported that the puppy was the smallest of a litter of five.

Physical examination did not show any significant abnormalities, except for the presence of jugular pulsation and positive hepato-jugular reflux. Furthermore, a grade II/VI mid-systolic heart murmur, with a point of maximum intensity over the left base, and loud splitting second heart sound (S2) were heard on thoracic auscultation. These findings were confirmed by electrophonocardiographic recording (Master Elite Analyzer; Welch Allyn) (Fig. 1). Full neurological and orthopaedic examination did not show any significant abnormalities.

Results of haematology and routine serum biochemistry were within normal range. Six-lead electrocardiography (ECG) showed sinus arrhythmia at 130 beats per minute with slightly depressed S waves in lead II, suggesting right ventricular enlargement (Fig. 2). Right-sided cardiomegaly and bulging of the main pulmonary artery were observed in thoracic radiographs (Fig. 3).

Echocardiography (Megas GP, Esaote) revealed concentric right ventricular hypertrophy, dilation of the main pulmonary artery and paradoxical motion of the interventricular septum. Doppler study showed marked pulmonic insufficiency (peak flow velocity 4.5 m/s) and tricuspid regurgitation (peak flow velocity 3.5 m/s) (Fig. 4). All these echocardiographic findings were consistent with pulmonary hypertension (PHT). Arterial blood gas analysis (metatarsal artery) showed low PaO_2 and low $PaCO_2$ (Table 1a), suggesting the presence of a mild metabolic acidosis. Although differential cyanosis and polycythaemia could not be observed in this patient, clinical signs and imaging findings were suggestive of a right-to-left shunting patent ductus arteriosus (r-PDA). Therefore, arterial blood gases from the auricular and metatarsal artery were measured both at rest and after exercise, to investigate the presence

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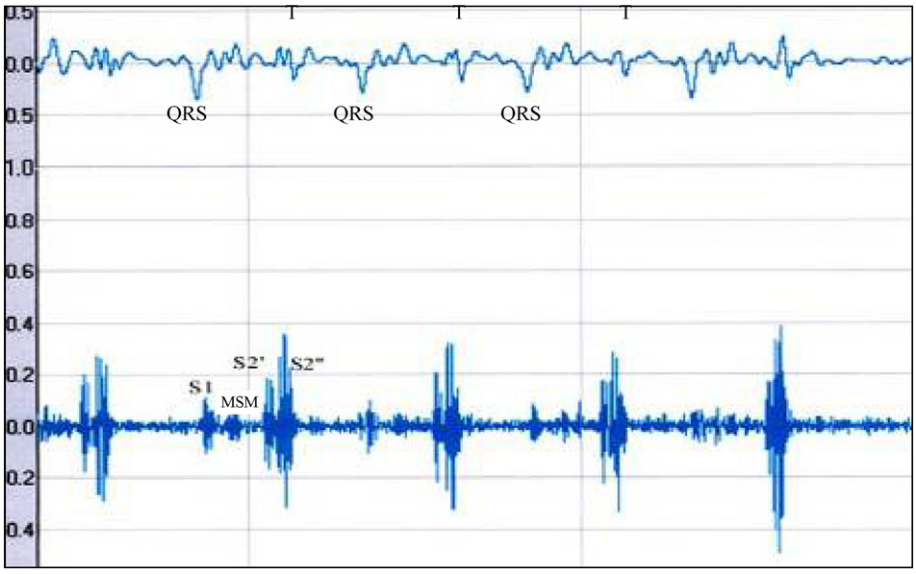

Fig. 1. Electrophonocardiogram recorded at the level of the left base. Persistent S2 splitting is identified by the presence of the two sound components S2′ and S2″ in late systole. A mid-systolic murmur (MSM) is occasionally present.

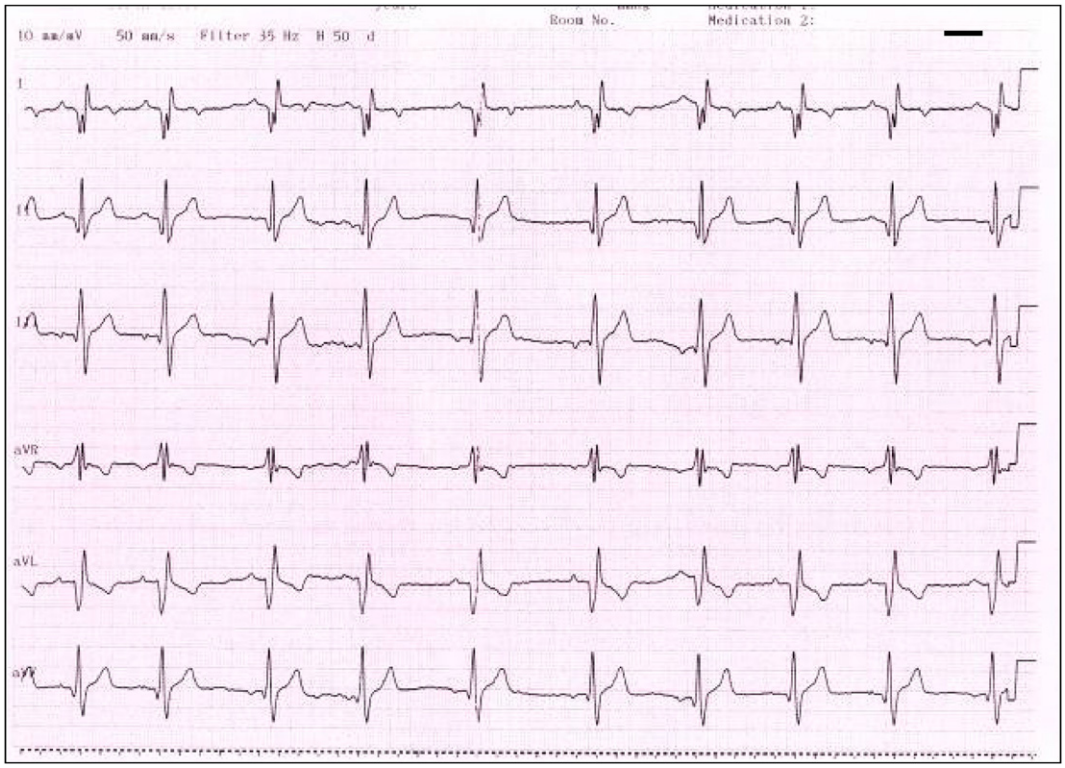

Fig. 2. Electrocardiographic recording (10 mm/mV, 50 mm/s, right lateral recumbency, filter 35 Hz; the bar on the top-right corner indicates 1 cm). The trace shows sinus arrhythmia at 130 bpm. In lead II, S waves appear slightly depressed suggesting right ventricular enlargement. Prolonged and notched QRS complexes with right axis deviation suggest an intraventricular conduction disturbance, such as right bundle branch block.

of differential hypoxia (Table 1b). Results showed significantly lower PaO_2 and $PaCO_2$ values in the samples from the metatarsal artery, supporting a diagnosis of r-PDA.

Contrast echocardiography (“bubble study”) was performed by injecting 10 mL of agitated colloid solution (Haemaccel, Hoechst) into the cephalic vein while observing the left outflow tract from the left cranial parasternal view. A few seconds after the injection, the contrast medium was observed in the descending aorta (Fig. 5). Selective right ventricular and pulmonary catheterisation and angiography, performed under general anaesthesia, showed