



A case of an unexplained eosinophilic myocarditis in a dog[☆]



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Abstract An 8-year-old spayed female Munsterlander was evaluated for a chronic low grade fever and a two month history of exercise intolerance. On physical examination, tachycardia and a grade II/VI right systolic heart murmur were detected. Echocardiography revealed marked thickening of the atrial and ventricular walls with mixed echogenicity and concentric hypertrophy of the left and right ventricles and equivocal systolic dysfunction. Serum cardiac troponin I level was markedly elevated. Endomyocardial biopsy was attempted; however, the patient arrested during the procedure and resuscitation was unsuccessful. Post-mortem examination revealed severe, chronic atrial and ventricular eosinophilic myocarditis associated with marked interstitial fibrosis. Serological testing, histopathology and immunohistochemistry staining did not reveal an underlying infectious agent or neoplasm. To our knowledge, this is the first reported case of

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primary eosinophilic myocarditis in the absence of a peripheral eosinophilia and multi-organ eosinophilic inflammation in a dog.
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An 8-year-old spayed female Munsterlander weighing 23.8 kg was referred to the University of Minnesota Veterinary Medical Center for evaluation of a one month history of low grade fever ranging from 102.6 to 103.0 F (39.2–39.4 °C) and a two month history of exercise intolerance. The symptoms were characterized by frequent breaks during walks, reluctance to perform tricks, and intermittent thoracic limb weakness. The dog presented to its regular veterinarian one month before evaluation with a normal physical examination other than the fever and an elevated alanine transaminase value of 284 U/L (range 10–118 U/L). Additional diagnostics were declined by the owners, and the patient was prescribed doxycycline (7.7 mg/kg [3.5 mg/lbs] q12 h). The clinical signs and fever did not improve with treatment and the doxycycline was subsequently discontinued after three weeks. The patient had no history of travel outside of Northern Midwest USA.

On physical examination, tachycardia with a heart rate of 200 beats per minute with synchronous femoral pulses and a grade II/VI right systolic murmur were noted. The patient was markedly depressed and lethargic and had a low grade fever of 102.6 F. Complete blood count revealed increased neutrophils at $12.11 \times 10^3/\mu\text{L}$ (range $2.1\text{--}11.2 \times 10^3/\mu\text{L}$), decreased lymphocytes at $0.58 \times 10^3/\mu\text{L}$ (range $0.78\text{--}3.36 \times 10^3/\mu\text{L}$), and a normal number of eosinophils at $0.87 \times 10^3/\mu\text{L}$ (range $0.0\text{--}1.2 \times 10^3/\mu\text{L}$). Serum biochemistry analysis revealed an elevated creatine kinase at 2398 U/L (range 36–348 U/L), alanine transferase at 139 U/L (range 22–92 U/L), and aspartate transferase at 158 U/L (range 16–44 U/L). Urinalysis was unremarkable. SNAP 4DX Plus Test (Idexx) was negative for *Dirofilaria immitis*, *Anaplasma* spp., *Ehrlichia* spp., and *Borrelia burgdorferi*. Urine blastomycosis antigen testing and Toxoplasma serology were also negative. Systolic blood pressure was considered normal at 130 mmHg. ECG revealed a sinus tachycardia with a heart rate of 200 BPM and left bundle branch block.

A transthoracic echocardiographic study was performed using a 4–2 MHz phased-array transducer. The interventricular septum and left and right ventricular free walls were markedly increased in thickness. The myocardium within the thickened walls was mottled with mixed echogenicity in conjunction with subendocardial

myocardial hyperechogenicity and subepicardial hypoechogenicity (Fig. 1A, Videos 1 and 2). Systolic left ventricular wall motion appeared diminished globally. The myocardium of the right atrium and auricle was also severely thickened and irregular with an echogenicity similar to the ventricles (Fig. 1B, Video 3). The left ventricular chamber diameter on M-mode was diminished in size during diastole (2.7 cm; range 3.3–4.8 cm) and systole (2.0 cm; range 2.0–3.5 cm) with a low normal fractional shortening value of 25%. The left atrial dimension appeared subjectively normal relative to the aorta and measured within reference range on M-mode at 2.3 cm (range 1.8–2.9 cm). Mitral inflow profiles were summated secondary to the patient's heart rate. There was a mild amount of effusion present within the pericardium. Serum cardiac Troponin-I^d was measured due to the above echocardiographic findings and was markedly elevated at 20.9 ng/mL (range <0.03 mg/dL).

Based on the clinical suspicion of an infiltrative inflammatory or neoplastic disease of the myocardium, an endomyocardial biopsy was recommended. The patient was induced with intravenous diazepam (0.1 mg/kg) and etomidate (1 mg/kg) following premedication with morphine (0.5 mg/kg) and maintained on inhaled sevoflurane. The right jugular vein was isolated via a cut down, and a 10 Fr Vascular access sheath^e was inserted into the vessel. A 7 Fr sheath with dilator^f in place was then directed into the right atrium under fluoroscopic guidance. A number 18 bronchoscopic biopsy forceps^g were then inserted into the sheath lumen after removal of the dilator. As the biopsy forceps were moved adjacent to the myocardium within the right ventricular apex, the patient underwent cardiopulmonary arrest characterized by pulseless electrical activity with a normal sinus rhythm seen on electrocardiogram. Cardiopulmonary resuscitation was immediately performed; however the patient was unable to be revived.

The dog was subsequently submitted to University of Minnesota Veterinary Diagnostic Laboratory for post-mortem examination. The most

^d Advia Centaur CP Ultra-Tnl, Erlangen Germany.

^e Percutaneous Sheath Introducer Set, Arrow International Inc., Reading, PA.

^f Flexor Check Flo Cook, Bloomington IN.

^g Olympus Biopsy Forceps, Olympus Japan.

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