



## CASE REPORT

# Foxtail-associated endocarditis in a cat

**Crystal G Doyle DVM\***, **Justin W Allen DVM, DACVIM (Cardiology)<sup>a</sup>**,  
**Stephen J Ettinger DVM, DACVIM (Internal Medicine and Cardiology)**

California Animal Hospital,  
1736 S. Sepulveda Blvd. Suite B,  
Los Angeles, CA, 90025, USA

An adult female neutered domestic shorthair cat developed right heart failure 1 week after having surgical drainage of a neck abscess of unknown etiology established at our hospital. Echocardiography revealed a large vegetative mass adhered to the tricuspid valve. Post-mortem examination revealed fibrinous endocarditis and myocarditis associated with the presence of a grass awn (*Hordeum* species) foreign body. Foxtail migration with subsequent thrombus and endocarditis formation on the tricuspid valve is considered a very unusual sequel to foxtail migration.

Date accepted: 19 August 2010

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Infectious (bacterial) and non-infectious endocarditis are rare in cats, with an estimated incidence of 6–18 cases per 100,000 cats presented for evaluation.<sup>1–3</sup> The most common bacterial cause of endocarditis in the dog is *Streptococci* species.<sup>4</sup> In cats, reported causes of bacterial endocarditis include *Bartonella* species, *Escherichia coli*, *Streptococcus* species, and *Staphylococcus* species.<sup>5</sup> Although intrathoracic grass awns are not uncommon, an intracardiac grass awn with secondary endocarditis has not been reported in a feline patient. The majority of cardiac foreign body cases reported have been in dogs and include coils or surgical implants; foreign bodies of the myocardium and pericardium such as wood, bullets, and metal have also been described, but none have been associated with endocarditis.<sup>6–11</sup> These cases are usually associated with thoracic and cardiac disease including pneumothorax, pericardial effusion, arrhythmias, pyothorax, respiratory distress, and/or death; however, systemic manifestations from the resultant inflammation, infection, and/or hypercoagulability may also occur such as systemic inflammatory response syndrome (SIRS), sepsis, and/or disseminated intravascular coagulation (DIC).

Reported causes of right heart failure (RHF) in cats include tricuspid valve dysplasia, heartworm disease, arrhythmogenic right ventricular (RV) cardiomyopathy, pulmonic stenosis, restrictive cardiomyopathy, thyrotoxic cardiac disease, and hypertrophic

cardiomyopathy.<sup>12</sup> RHF is diagnosed clinically in cats when there are cavitory effusions (abdominal, pleural, and/or pericardial) in combination with right heart enlargement and central venous distension evident via physical examination (jugular distention), echocardiography or radiography.<sup>1</sup> Definitive diagnosis is made by confirming an elevated central venous pressure in the presence of right heart disease.<sup>12</sup>

Foxtails, which are awns of *Hordeum* species of grasses, are found throughout a majority of the United States. These grass awns are a frequent cause of tissue foreign bodies in dogs and cats, and have been reported in the eye and orbit, cranium, spinal canal, and organs within the peritoneal and thoracic cavities.<sup>13–19</sup> They are most commonly located in the external ear canal, interdigital webs, thoracic cavity, third eyelid, and nasal cavity.<sup>13–19</sup> A sharply pointed tip and retrograde barbs make the grass awn ideal for penetration and unidirectional movement.<sup>16</sup> Like most plant foreign material, grass awns act as a fomite for bacterial inoculation. *Actinomyces*, *Staphylococcus*, and *Streptococcus* species are the most common bacteria isolated from wounds associated with grass awns, although *Pasteurella multocida* and *Nocardia* species are also commonly reported.<sup>14,16,20</sup> This report describes a cat in which aberrant migration of a grass awn and attachment to the tricuspid valve resulted in fibrinous endocarditis and myocarditis with subsequent RHF.

An adult female neutered 3.3 kg domestic shorthair cat of unknown age presented for evaluation of a ventral neck abscess that was treated by surgical drain placement. At the time of original presentation the

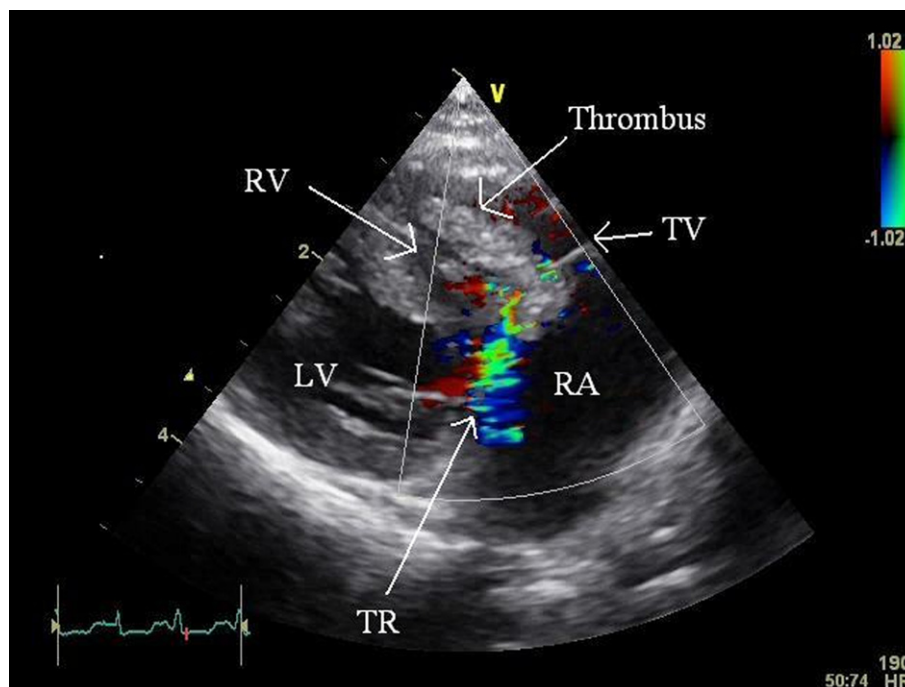
\*Corresponding author. E-mail: [doyle\\_erpdoc@yahoo.com](mailto:doyle_erpdoc@yahoo.com)

<sup>a</sup>Animal Emergency and Treatment Center, 3927 W Belmont Ave, Chicago, IL 60618, USA.

physical examination, hematology (including feline leukemia virus/feline immunodeficiency virus serology), and chemistry were within normal limits. Three days postoperatively the cat presented with anorexia, lethargy, a dry cough and a persistent bloody discharge from the drain site. Pyrexia (105.2F (40.6°C); reference interval (RI), 101–102.5F (38.3–39.16°C)), tachycardia (240 bpm; RI, 140–220 bpm), a grade II/VI systolic heart murmur with point of maximal intensity localized to the left parasternal cardiac apex, a gallop rhythm (a short recording of this can be found on Science Direct at doi:10.1016/j.jfms.2010.08.009), and a persistent firm swelling were noted at the abscess site when the physical examination was performed. Complete blood count (CBC) revealed a mild mature neutrophilia ( $12.66 \times 10^3/\mu\text{l}$ ; RI  $2.5\text{--}12.5 \times 10^3/\mu\text{l}$ ) and a normocytic, normochromic non-regenerative anemia (packed cell volume (PCV) 26%, RI 30–45%). Blood chemistry revealed hypoalbuminemia (1.9 g/dl; RI 2.2–4.0 g/dl) and hyperbilirubinemia (5.5 mg/dl; RI 0–0.9 mg/dl). Thoracic and neck radiographs showed an increased soft tissue opacity and subcutaneous emphysema of the ventral neck, with no evident thoracic abnormalities.

The patient was treated with 140 ml/kg/day intravenous (IV) Normasol-R, IV enrofloxacin (5 mg/kg q24 h) and IV ampicillin (22 mg/kg q8 h). Persistent hypothermia developed (95.9F–99.2F (35.5–37.3°C); RI 101–102.5F (38.3–39.16°C)). Hypotension was noted using a Doppler ultrasonic flow meter (systolic

pressure of 75 mmHg; RI 118–162 mmHg). PCV and total protein decreased to 18% and 4.6 g/dl, respectively, and continued to decline at which point the patient was blood typed (type A) and a unit of packed red blood cells (pRBC, 60 ml) was transfused. Recheck CBC documented a leukocytosis ( $29.6 \times 10^3/\mu\text{l}$ ; RI  $4.2\text{--}15.6 \times 10^3/\mu\text{l}$ ) with a mature neutrophilia ( $26,048/\mu\text{l}$ ; RI 2500–12,500/ $\mu\text{l}$ ), persistence of the non-regenerative anemia, and development of thrombocytopenia ( $40,000 \times 10^3/\mu\text{l}$ ; RI  $170\text{--}600 \times 10^3/\mu\text{l}$ ). Prothrombin time was 16.3 s (RI 7–12.7 s) and partial thromboplastin time was 26.4 s (RI 10–28 s). D-Dimer concentration was elevated (500–1000 ng/ml; RI < 250 ng/ml). Prednisone (1 mg/kg subcutaneous (SC) q12 h) and doxycycline (5 mg/kg orally q12 h) were added due to suspicion of immune-mediated hemolytic anemia. Following the development of acute inspiratory dyspnea, echocardiography revealed pleural effusion, severe right atrial dilatation, as well as a  $1.5 \times 0.6 \times 0.8$  cm vegetative mass attached to the ventricular surface of the valve leaflets (Fig 1). The mass was of mixed echogenicity and extended through the right ventricular outflow tract (RVOT). The vegetation was associated with moderate tricuspid regurgitation as well as turbulent flow through the RVOT. About 80 ml of yellow pleural effusion (transudate, protein <2.0, and low numbers of nucleated cells) was removed via thoracocentesis. No evidence of inflammation or malignancy was identified. Abdominal ultrasound revealed mild mesenteric lymphadenopathy, a moderate amount of ascites



**Fig 1.** Modified right parasternal long-axis echocardiographic image. RV = right ventricle; LV = left ventricle; TV = tricuspid valve; RA = right atrium; TR = tricuspid regurgitation.

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