Septic Pericarditis and Cardiac Tamponade Caused by Migrating Intrathoracic Grass Awn in an English Setter Dog

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ABSTRACT

The present case report describes a 2-year-old male English Setter dog with pericardial effusion and cardiac tamponade due to septic pericarditis. On transthoracic echocardiography, the pericardium was thickened and pericardial effusion was characterized by hypoechoic material. Moreover, adhesions between the pericardial and epicardial surface were present in the apical region. In close proximity of these adhesions, a linear, spindle-shaped, hyperechoic structure, consistent with grass awn, was visualized. A caudal sternotomic approach allowed to confirm the presence of a grass awn by intraoperative ultrasonography. Pericardiectomy was performed. The recovery was uneventful, and the dog was hospitalized post-operatively for 7 days. Twelve months after the surgery the dog was working to full capacity without evidence of any clinical signs. A migrating grass awn is sometimes a diagnostic challenge for clinicians: this case report describes an uncommon clinical presentation of a migrating grass awn and highlights that ultrasonography can be a useful diagnostic tool for the localization of grass awns in dogs with septic pericarditis.

Keywords: Pericardial effusion; Foreign body; Echocardiography; Pericardiectomy; Canine.

INTRODUCTION

Septic pericarditis is an uncommon condition in dogs, typically associated with trauma, open wounds, foreign body penetration or local infections due to pleural or pulmonary disease (1-6). In several reports, migrating grass awns were recognized during surgery or post-mortem examination, or were suspected despite the fact that the foreign body was not found (1, 5, 7).

Inhaled grass awns commonly cause respiratory disease during spring and summer season, especially in hunting dogs (8-11). Due to its backward pointing barbs and it fusiform shape, the inhaled grass awn tends to migrate through the airways into the lungs and then into the pleural space, pericardium, retroperitoneal cavity, iliopsoas muscles, or out through the thoracic/abdominal wall (9-11, 12-14). Migrating grass awns can cause a severe inflammatory tissue reaction and sepsis.

Various diagnostic techniques, including radiology, contrast radiology, ultrasonography, computed tomography and magnetic resonance imaging, have been used to localize migrating grass awns and for surgical planning (9-11, 13-19). To the best of our knowledge, no study has reported the ultrasonographic visualization of grass awns in dogs with septic pericarditis. The aim of this report is to describe the clinical presentation, ultrasonographic findings, management and outcome for a dog with septic pericarditis and cardiac tamponade caused by migrating intrathoracic grass awn.

CASE REPORT

A 2-year-old male English Setter dog was referred to the Veterinary Teaching Hospital of University of Perugia for echocardiographic evaluation. The presenting clinical signs included a one-week history of lethargy, inappetence, gradual abdominal distension and intermittent pyrexia. The dog had been treated with amoxicillin-clavulanate for 5 days. Owner reported no significant improvement of clinical signs after onset of antimicrobial treatment. Thoracic radiography was performed by the referring veterinarian and radiographic findings included an enlarged and rounded cardiac silhouette. Mild pleural effusion was also observed. On physical examination, the dog showed pale mucous membranes, jugular venous distension, slow capillary refill time, frequent (170 beats per minute) and weak pulses, reduced apex beat impulse, muffled heart sounds and abdominal distension with a ballottable fluid wave.

Transthoracic echocardiography showed a marked homogenous hypoechoic pericardial effusion with tamponade of the right atrium and ventricle (Figure 1). The pericardium was thickened (0.5 cm) and pericardial effusion was characterized by hypoechoic material (Figure 2). Hypoechoic lesions adherent to the pericardium were evident in the apical region (Figure 2). In places the epicardium also was irregular and undulant. In close proximity to the apical region, a linear, spindle-shaped, hyperechoic structure of 2 cm in length was visualized (Figure 3). This structure, suggestive of a grass awn, showed also a linear hyperechoic projection compatible with a barb (Figure 3). Mild hypoechoic pleural effusion was also visualized. Abdominal ultrasound showed a moderate amount of anechoic free abdominal fluid and hepatomegaly with dilated intra-hepatic veins.

Pericardiocentesis was performed, yielding 350 ml of hemorrhagic effusion. Pericardial and abdominal fluid samples were submitted for cytological examination. Pericardial fluid cytology was consistent with a septic exudate, revealing a predominance of degenerate neutrophils with free and intracellular cocci bacteria whereas the abdominal fluid was a modified transudate.

A diagnosis of septic pericardial effusion with cardiac tamponade possibly due to the migration of a grass awn was made and a sternotomy to remove the pericardium and grass awn was recommended.

After premedication with midazolam (0.2 mg/kg IV; Midazolam, Hameln pharmaceuticals gmbh, Hameln, Germany) and sufentanil (0.2 μg/kg IV; Disufen, Angenerico Spa, Roma, Italy), 5 min of preoxygenation (flow-by; 5 L/min) was given via face-mask. General anaesthesia was induced with lidocaine (1.5 mg/kg IV; Lidocaina 2%, Esteve Spa, Milano, Italy) and propofol IV to effect (Propovet, Ecuphar srl, Milano, Italy) (20) and after tracheal intubation the dog was connected to a rebreathing circuit and maintained with isoflurane (1,8-2,5%; Isoflo, Ecuphar srl, Milano, Italy) in 100% oxygen. Sufentanil (0.5-1 mcg/kg/h CRI) and lactated Ringer solution (10 mL/kg/h CRI) were infused during the entire anaesthetic procedure (21). Lungs were ventilated in a volume-controlled mode with a Tidal Volume of 12 mL/kg, an inspiratory-to-expiratory time ratio of 1:2, a fraction of inspired oxygen of 1, positive end expiration pressure of 3 cm H_2O, and a peak airway pressure of 16 cm H_2O; respiratory rate was regulated to maintain the end-tidal carbon dioxide at 35-40 mmHg (22). The dog received preoperative carprofen (4mg/kg IV; Rimadyl, Zoetis, Roma, Italy) (23) and postoperative bupivacaine 0,25% (1 mg/kg every 8 hours for 24 hours; Bupisen, Torinomedica, Torino, Italy) through an intrathoracic drain and methadone (0,2-0,3 mg/kg IM every 6-8 hours; Semfortan, Dechra Srl, Torino, Italy). Prophylactic cephazoline (30 mg/kg IV; Cefazolina Teva, Teva srl, Milano, Italy) was administered preoperatively.

After routine surgical preparation and a standard midline approach, the mediastinum appeared reactive and inflamed. A large part of this reactive and altered mediastinum had adhesions with the ventral portion of the parietal pleura obstructing the access to the pericardium. The mediastinum was carefully removed by a Ligasure device (Ligasure, Covidien Italia spa, Milano, Italy) to allow the inspection of the whole thorax and the pericardium.

The pericardial sac was thickened and reactive. Intraoperative ultrasonography was performed using a 5- to 8 MHz microconvex probe encased in a sterile protective cover and positioned directly on the pericardium to help the surgeon in finding and removing the grass awn (identified by preoperative transthoracic echocardiography).

Although phrenic nerve visualization was initially arduous because of the thickened and reactive pericardial sac, a carefully search for the course of the nerve allowed to the surgeon to perform safely sub-phrenic pericardiectomy by means of a Ligasure device. To complete the removal of the pericardium, it was necessary to perform a partial lung lobectomy completed by surgical stapler (ENDO GIA, Medtronic

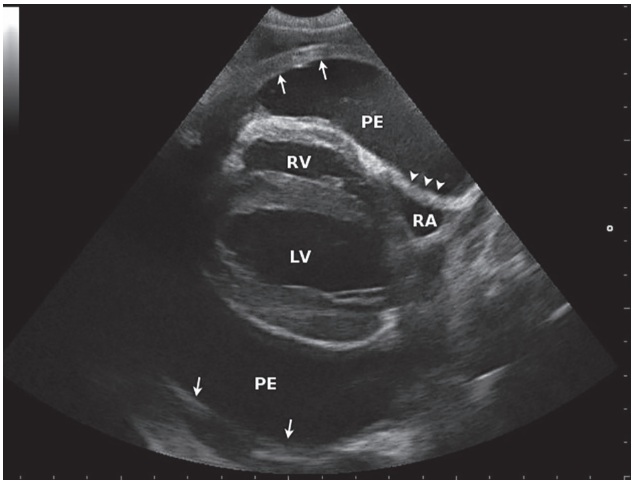

Figure 1: A right parasternal long-axis echocardiographic view showing large volume homogenous hypoechoic pericardial effusion (PE). Arrows indicate the thickened pericardium and arrowheads demonstrate right atrium (RA) tamponade. RV: right ventricle; LV: left ventricle.

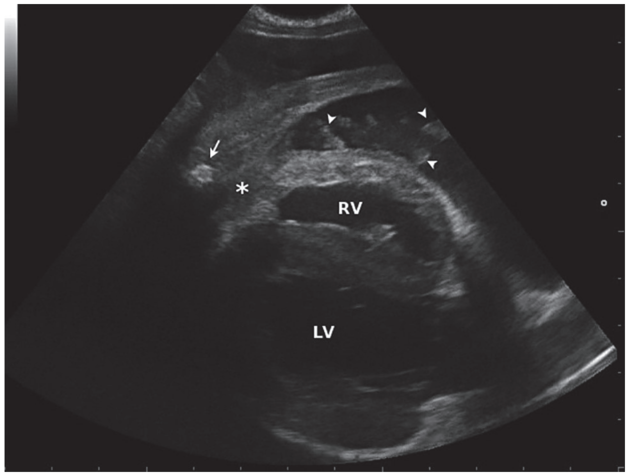

Figure 2: A modified right parasternal long-axis echocardiographic view optimized to see the adhesions between the pericardial and epicardial surface in the apical area (*). A hyperechoic structure (arrow) was evident in the same area. Arrowheads indicate hypoechoic material in the pericardial effusion. RV: right ventricle; LV: left ventricle.

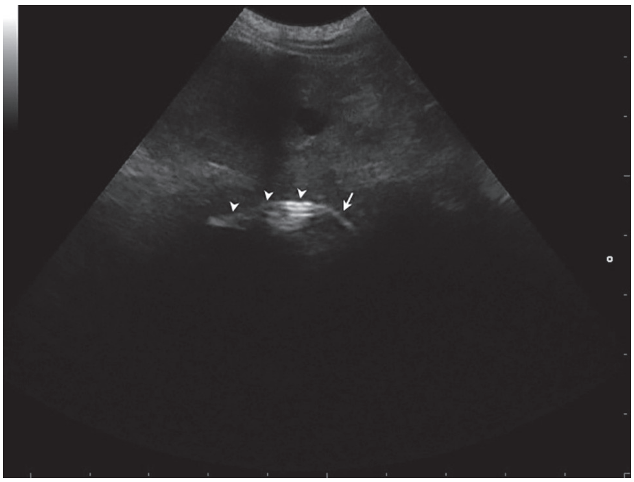

Figure 3: The same echocardiographic view as in Figure 2 optimized to visualize the hyperechoic structure in long axis. A spindle-shaped hyperechoic foreign body (2 cm in length), consistent with a grass awn, was visualized (arrowheads). A linear hyperechoic projection compatible with a barb was also evident (arrow).

Figure 4: Photograph of the grass awn after the removal from the pericardium. The caliper allows to measure the length of the awn.

Italia, Milano, Italy) of the right intermedius lobe which was atelectatic in its apical portion and adhered to the pericardial by the fibrous reaction. The grass awn was retrieved from the excised pericardial tissue, confirming the ultrasonographic diagnosis (Figure 4). The remaining portion of the abnormal caudal mediastinum was also removed by Ligasure dissection. The thoracic cavity was then irrigated with 4 liters preheated sterile saline solution to remove any debris and also to warm the patient. A thoracic drainage tube was inserted through the 7th left intercostal space. The sternotomic access was closed with single suture across the ribs connecting the dissected sternebrae with metallic wire cerclages in the form of a figure eight; the remaining layers were closed according to standard procedure. The chest drainage was removed 72 hours after the surgery, and after seven days of hospitalization, the dog was discharged.

The excised pericardium was submitted for histopathology and bacteriological culture. Pericardial histopathology revealed extensive chronic active inflammation with presence of neutrophils, macrophages, lymphocytes and plasma cells. Pericardial culture grew *Moraxella catarrhalis* which was sensitive to marbofloxacin. Follow-up at 12 months after the surgery revealed that the dog was working to full capacity without evidence of any clinical signs.

DISCUSSION

Pericardial effusion often presents with signs of cardiac tamponade depending on the volume and the rate of fluid accumulation. If tamponade develops quickly, collapse due to acute reduction in cardiac output may occur. Chronic cardiac tamponade is associated with signs of right-sided congestive heart failure, including pleural effusion, abdominal distension and ascites (24). Pericardial effusion in dogs is usually associated with heart-base tumor or idiopathic pericarditis. Less commonly, it is secondary to congestive heart failure, septic, parasitic or fungal pericarditis (25-88). The case described in this report presented with clinical signs compatible with progressive pericardial effusion and right-sided congestive heart failure, and, interestingly, the septic pericardial exudate was associated with the presence of a migrating pericardial grass awn.

Echocardiography is a valuable tool for diagnosis of pericardial effusion and cardiac tamponade since it is fast, reliable and noninvasive. Recently, transthoracic, transesophageal and intraoperative ultrasonography has been used to localize and to guide the removal of grass awns that had migrated into the lungs, pleural space or iliopsoas muscles, improving the success of the surgical approach (10, 11, 14). In our report, transthoracic echocardiography was a useful diagnostic tool allowing to demonstrate pericardial effusion and cardiac tamponade secondary to migrating intrathoracic grass awn. The pericardium was thickened and pericardial effusion was characterized by hypoechoic material. The latter echocardiographic feature could be suggestive of the presence of fibrin within pericardial effusion. Moreover, the echocardiographic findings of a distorted pericardium with regional variation in excursion due to adhesions between the pericardial and epicardial surface were confirmed during the surgery. Finally, a linear, spindle-shaped, hyperechoic foreign body consistent with grass awn was visualized in close proximity of the adhesions. The typical ultrasonographic appearance of grass awns, noted a spindle shaped hyperechoic structures, has been reported for various sites, but their appearance in the pericardial region, associated with septic pericarditis, has not yet been described (8-11, 13, 14). As previously reported, the ultrasonographic identification of the grass awn in our dog was enhanced by surrounding tissue characterized by an inflammatory response (10, 11, 13, 14).

It is important to emphasize that the ultrasonographic visualization of grass awns might be difficult, especially when located within the pericardial sac or on the pleural surface of the pericardium, because of the presence of scattered hypoechoic elements (fibrin, tissue remnants, cellular debris). We found it useful to scan lesions in multiple planes to distinguish foreign bodies from air or debris present in the diseased region.

Literature on the management of septic pericarditis is scarce and generally requires pericardiocentesis, antimicrobial administration and can necessitate pericardiectomy in dogs requiring repeated pericardiocentesis (1-6). Pericardiectomy appears necessary to prevent restrictive pericarditis and it is associated with a better prognosis (1-3, 29). Subtotal pericardectomy, as described in this case report, involved removal of the pericardium ventral to the phrenic nerves: this procedure can be performed through a median sternotomy in order to allow concurrent visualization of both phrenic nerves (30). The execution of a pericardiectomy by means of a Ligasure device is an alternative surgical technique in place of the traditional scissor dissection and normally preferred in those cases in which the pericardium is thickened, reactive and markedly vascularized, in order to guarantee a quicker removal and optimal hemostasis.

The Ligasure device was developed as a large vessel-sealing device and operates at high current and low voltage. One advantage of the Ligasure device is that the unit is able to sense the impedance of the tissues and when impedance is high enough and protein coagulation is complete, the seal cycle terminates. Once the tissue has been sealed, a cutting blade can be advanced between the two sealed areas (31). Although bipolar electrosurgery sealing devices have widespread applications in minimally invasive surgery, surgeons should be aware of the risk of iatrogenic tissue damage from thermal burn. Whenever the device is discharged, the surgeon should elevate the device away from surrounding tissues. This may be more challenging when working near cardiac structures due to motion. Thus, the surgeon should concentrate on synchronizing the discharge of the device with the motion of the heart. Moreover, bipolar electrosurgery sealing device should be applied with extra care near the heart, as thermal damage can lead to ventricular fibrillation and cardiac arrest. The use of harmonic devices or dissecting scissors can decrease the risk of thermal burn. Harmonic technology may be advantageous over electrosurgery, as lateral thermal damage is reduced and visualization improved by reducing smoke formation (30).

To the best of our knowledge, this is the first report describing ultrasonographic findings of a migrating pericardial grass awn in a dog with septic pericarditis and cardiac tamponade. Migrating grass awns can present a diagnostic challenge for clinicians and ultrasonography, as described in our clinical case, can be a useful diagnostic tool for the localization of grass awns in dogs with septic pericarditis. Migrating grass awn should always be considered in the presence of septic pericarditis, especially when ultrasonographic findings such as thickening of the pericardium, pericardial effusion characterized by hypo- or hyperechoic content and adhesions between the pericardial and epicardial surface, are observed.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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