

Pleural effusion and cardiac displacement in a heifer: a case report

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Abstract

A 16-month-old Holstein heifer with a history of anorexia and respiratory distress was referred to the Veterinary Research and Teaching Hospital of Tehran University. Heart and lung sounds were inaudible on the left side but greatly increased on the right side. On electrocardiography (ECG), decreased amplitudes of ECG parameters were observed. Ultrasonography results revealed a pleural effusion with fibrin deposition. After the removal of 30 liters of pleural fluid, the amplitudes of the P, QRS, and T complexes increased markedly, and heart and lung sounds on the left side gradually increased. *Archanobacterium pyogenes* was isolated from bacteriological cultures of the pleural fluid. According to the clinical and paraclinical findings, cardiac displacement due to pleural effusion was diagnosed.

Introduction

Muffling of the heart sounds in cows may occur under a variety of conditions, such as increased thickness or fat on the chest wall or due to pathological condition, including pericarditis, diaphragmatic hernia and displacement of the heart toward the opposite hemithorax. The existence of a space-occupying mass, changes in the pericardial fluid and changes in the pleural space can displace the heart toward the contralateral thoracic wall (McGurik *et al.*, 2002; Peek *et al.*, 2008; Radostis *et al.*, 2007; Divers *et al.*, 2008). This case report describes a heifer with a left-sided pleural effusion that caused cardiac displacement, and changes in the auscultatory and ECG amplitude findings.

Materials and Methods

Case history

A 16-month-old Holstein heifer was referred with a history of anorexia and respiratory distress. Base apex lead electrocardiograms (ECG) were obtained with a Fukuda-501-b-III ECG unit produced by Fukuda company (made in Japan), at a paper speed of 25 mm/sec with a sensitivity of 10 mm = 1 mv. Also, ultrasonography examination was performed with a Sonosite Micromax ultrasound unit (Sonosite, Inc.

USA) and a 1-5 MHz phase array transducer. A complete blood count (CBC) was performed with regards to hematological evaluation. Afterward, thoracocentesis was performed through the seventh intercostal space and a sample of fluid was submitted for bacteriological culture.

Clinical findings and investigation results

Clinical examination showed malaise, fever (40°C), dyspnea, tachycardia (94bpm), and left side jugular vein distension without pulsation. The results of the complete blood count (CBC) indicated a leukocytosis (18000 cell/ μ l) with neutrophilia, hyperproteinemia (8.9 g/dl) and hyperfibrinogenemia (1.6 g/dl). Lung sounds were absent on the left ventral hemithorax, but were audible and increased on the right side of the thorax. Percussion at the left ventral hemithorax revealed dullness and elicited pain. The apex beat of the heart was not audible on the left side but the contralateral heart sounds, were louder than normal. An ECG was recorded and decreased amplitudes of the P, QRS and T complexes were observed. At this stage, a diagnosis of traumatic pericarditis, pleural effusion and diaphragmatic hernia was made. Ultrasonography revealed the presence of anechoic material as well as echogenic particles and irregular echogenic strands floating within the fluid in the left pleural space between the thoracic wall and lung

(Figure 1). Thoracocentesis was performed and 30 L of fibrinopurulent exudative fluid was removed from the left hemithorax. A sample of fluid was taken and *Arcanobacterium pyogenes* was isolated in pure culture. During the removal of pleural fluid, a repeat ECG was performed and at the same time as bilateral cardiac auscultation. At this time, heart sounds on the right side decreased and increased gradually on the left side until they reached normal levels. The left jugular vein distension decreased but did not disappear completely. Following the removal of pleural fluid, the amplitudes of the P, QRS and T complexes gradually increased (Figure 2) and ultimately returned to normal. The heifer was treated with intravenous fluid therapy that consisted of different amounts of normal saline and Ringer's solution with a combination of penicillin (20000 IU) and gentamicin (4.4 mg/kg). The heifer responded satisfactorily to therapy.

Discussion

Inflammation of pleura almost always results in the accumulation of fluid in the pleural space (McLennan *et al.*, 1995; Pringle, 1998; Radostis *et al.*, 2007). In cattle, pleural effusions are most commonly unilateral on the right side because the pleural sacs are separated and do not communicate; however, both sides may be affected in some conditions (Radostis *et al.*, 2007). Primary pleuritis is usually due to a perforation of the pleural space and subsequent infection, but it can occur in cattle with traumatic reticuloperitonitis. Secondary pleuritis refers to that which develops from infectious lung diseases. Muffling of the heart sounds may suggest an increase in tissue and tissue interfaces between the heart and the stethoscope. This can be due to a shift in the heart due to displacement by a mass, changes in the pericardium, such as increased fluid and or fibrous tissue, or changes in the pleural space (Radostis *et al.*, 2007). Jugular venous distention without pulsation can occur with compression of cranial vena cava from a cranial thoracic or middle mass or from occlusion of the jugular vein with a thrombus (McGurik *et al.*, 2002). *Arcanobacterium pyogenes* is present in the environment and in the gastrointestinal tract. It is also a common isolate from abscesses in the body and the primary cause or a secondary invader in a wide variety of pyogenic infection in ruminants.

Decreased amplitudes of ECG complexes have been previously reported in cases where there was a large accumulation of fluid in traumatic pericarditis (Cebra *et al.*, 1998; Reef *et al.*, 2002). Chronic effusion can lead to fibrin formation, which may be seen as linear, irregular echogenic strands floating within the fluid (Braun *et al.*, 1997; Nyland *et al.*, 2002; Scott, 2008; Radostis *et al.*, 2007; Reef *et al.*, 2002). In the present case, the pressure of the fluid, fibrin deposition

and thoracic abscesses in the left side of the thorax resulted in cardiac displacement towards the contralateral thoracic wall. Compression of the left atria diminished the return of blood to the heart and resulted in unilateral jugular venous distention. The decreased amplitudes of the ECG complexes following pleural drainage markedly increased. Therefore, it can be concluded that ECG can be used as a diagnostic tool to identify pleural effusion. In this heifer, the primary cause of pleural effusion and fibrin deposition was not determined but according to the clinical situation and the prevalence of pleuritis, we suspect that perforation of the pleural space that resulted in pleuritis was associated with an infection with *Arcanobacterium pyogenes*. Pleural effusion is recognized as anechoic or echogenic material within the pleural space, between the thoracic wall or diaphragm and lung.

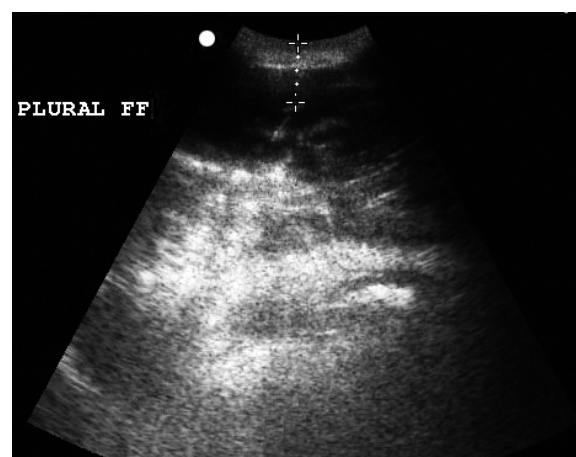


Figure 1: Heifer, standing intercostals image of the left thorax represents anechoic material within the pleural space between the thoracic wall and lung, as well as echogenic material and fibrous strands within the fluid.



Figure 2: Base apex lead electrocardiogram of the heifer, showing the markedly increased amplitude of the P, QRS and T complexes (lower strip) after the removal of 30 L of pleural fluid. Paper speed 25 mm/sec; calibration 1 cm/mv.

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