

Ultrasonography and radiographic diagnosis of reticular diaphragmatic hernia in a bull

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Abstract

A 7yr old bull with history of anorexia, voiding of dung in pellety nature for a period of 3 days with no symptoms of recurrent bloat was primarily diagnosed as Diaphragmatic hernia by right lateral recumbent radiograph and on ultrasonography in standing position.

Key words: Bull, cTnI, Diaphragmatic hernia, TRP, Ultrasonography

Diaphragmatic hernia is described as protrusion of abdominal organs into the thoracic cavity through opening in the diaphragm at the musculotendinous junction. It is observed mostly in adult dairy animals that are either in their late gestation or have recently calved (Smith, 2002).

Case History and Clinical Observations

A 7-year-old bull was referred to Large Animal Outpatient unit of Veterinary clinical complex, VCRI, Orathanadu with the history of anorexia and pellety dung voiding for 3 three days. On clinical examination it had a normal rectal temperature of 99.7⁰F and the conjunctival mucous membrane was pale pink moist and rumen was impacted with absence of rumen motility. Pellety dung was found in the rectum on per rectal examination. On auscultation muffled heart sounds with a heart rate of 54/min, suggested the involvement of adjacent structure over the heart. Blood samples were analyzed which revealed normal haemogram with leukocytosis and altered biochemical values (Table.1). The Cardiac troponin I (cTnI) in serum was measured by the i-STAT machine as per the manufacturer protocol. It showed slight elevation of cTnI (0.09 ng/ml). Electrocardiography was performed on animals in a standing position employing base apex lead system placement approach (Rezakhani *et al.*, 2004). ECG values were as follows P_{amp} - 0.15mV, P_{duration} - 0.08s, PR_{interval} - 0.2s, R_{amp} - 0.6 mV, QRS_{duration} - 0.08s, QT_{interval} - 0.36s, ST_{interval} - 0.36 sec, T_{amp} - 0.1mV, T_{duration} - 0.08s). The short QRS complex and T waves indicated compression of cardiac chambers by herniated reticular tissue and low perfusion and low conductivity. Our ECG findings were simulating to the findings of

Tharwat (2011) with small QRS complexes and short short T waves in case of pericarditis condition.

Ultrasonography was done with (EsoateMylab one) 2.5. to 5 MHz curvilinear transducer. Ultrasound examination of the heart and reticulum was done following (Braun *et al.*, 1993) at the left side between 4th to 5th intercostal space of thoracic cavity and using the 6th to 8th intercostals window in the abdominal cavity. The observation was deviation of the heart axis and compression of cardiac chambers in thoracic cavity and in abdominal cavity reticular wall appeared as straight line without motility. These findings were in agreement with findings of Venkatesan *et al.* (2020) who reported diaphragmatic hernia in crossbred Jersey cow, wherein ultrasonographic description showed compressed cardiac chambers with reduced intensity of pumping; the reticular wall was seen in the thoracic cavity and it appeared as a straight line. Heart was not visualized even on right side between 3rd to 4th intercostal space. Ultrasonography of heart and lower abdomen revealed, neither pericardial effusion nor peritoneal effusion respectively.

Radiographic examination was done by keeping the animal in standing position; but it did not reveal clear contour of heart, reticulum, and diaphragm; thus, another attempt was made as per previous report (Athar *et al.*, 2009) where in the animal was casted on right lateral recumbency and radiography was done at 90-100 kVp, 50-60 mAs and a focus film distance of 90-100 cm using an 800 mAs using Siemens X-ray machine. On X ray Diaphragmatic border was not clear and reticular structure was observed with sand particles masking the silhouette of heart in the thoracic region (3rd to 6th rib) which tentatively confirmed the protrusion of diaphragm as diaphragmatic hernia. This was in agreement with

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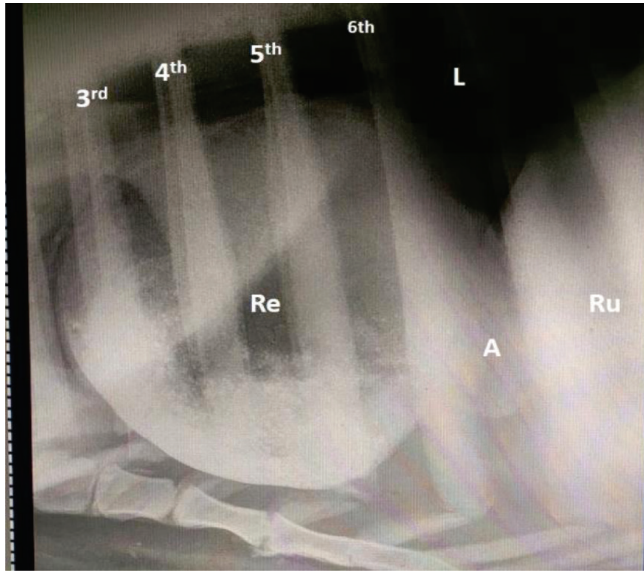


Fig. 1. Radiography on right lateral recumbency of animal shows indistinct diaphragmatic line and reticular structure with the sand particles at 3rd to 6th ICS masking cardiac silhouette (Re - Reticulum, A - Adhesion, Ru- Rumen, L- Lung)

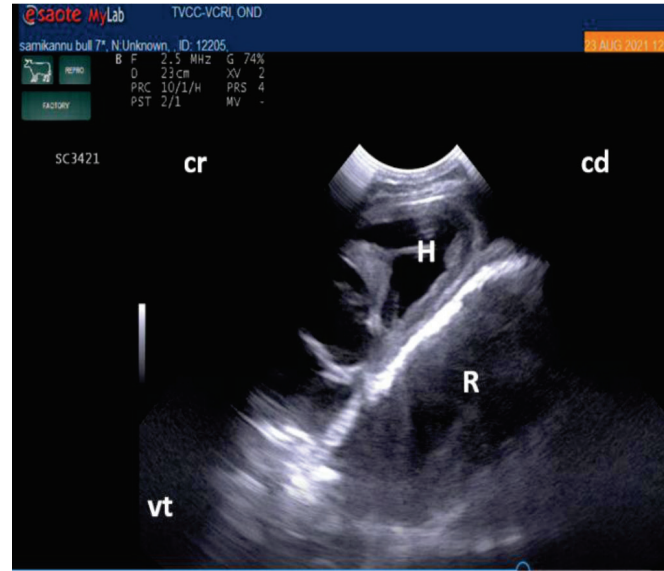


Fig. 2. Ultrasonography heart at 4th ICS space showing compressed cardiac chambers with reticular wall (cr-Cranial, cd - caudal, H- Heart, R- Reticulum and vt-ventral)

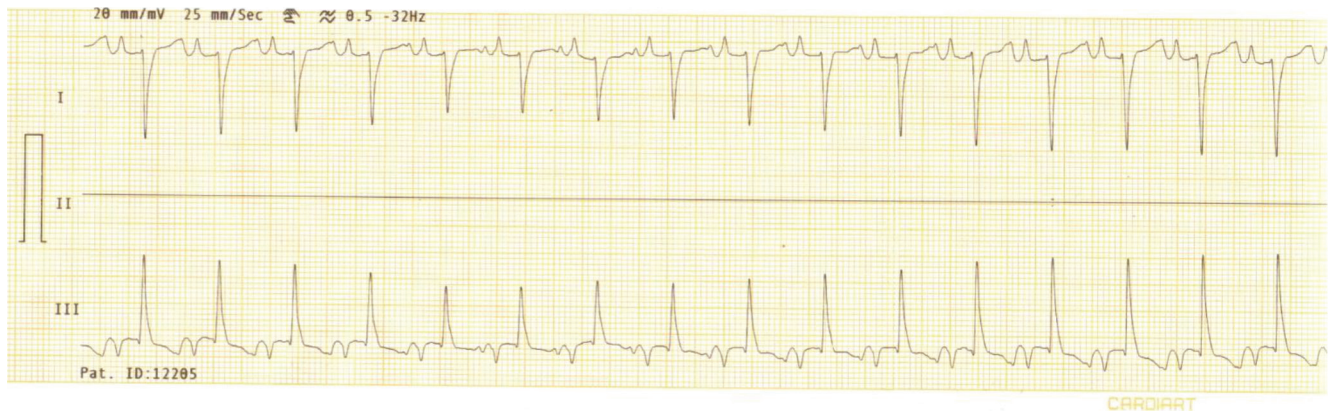


Fig. 3. Electrocardiography (20mm/mV) showing decreased amplitude of QRS complexes and T waves is evident of compressed cardiac chambers due to herniated reticulum.

Hakim Ahar *et al.* (2009) who reported three animals out of twenty-seven affected with diaphragmatic hernia showed sac-like structure without any metallic densities cranial to the diaphragm on radiography examination, but in contrast the report of Venkatesan *et al.* (2020) also reflects inconclusive diagnostic confirmation even after casting the animal in right lateral recumbency for radiography.

Treatment and Discussion

Diaphragmatic hernia observed most commonly in dairy animals (Cows and buffaloes) that are in late

pregnancy or recently calved. The current case of a bull discussed would have been an acquired one due to traumatic injury incidence. Reticular adhesions were the major cause of tympany and also this recurrent tympany was more pronounced in diaphragmatic hernia (Saini *et al.*, 2007; Mally and Jayadevappa, 1974). In this present case animal didn't show any recurrent tympany as per the owner report and also on animal physical observation. Cardiac troponin I (cTnI) immunoassay showed an elevated level of troponin I (0.09 ng/ml), which indicated myocardial damage in the heart as a compensatory mechanism due to compression by the

Table 1. Haemato-biochemical parameters of a bull affected with diaphragmatic hernia

| Parameters | Observed values | Reference values |
|-----------------------|-----------------|------------------|
| Hb (g/ dl) | 10.2 | 8.5-12.2 |
| PCV (%) | 33 | 22-33 |
| RBC (mill./cumm) | 4.6 | 5.1-7.6 |
| WBC /cumm | 16,950 ↑ | 4900-12000 |
| Neutrophills (%) | 31 | 15-45 |
| Lymphocytes (%) | 62 | 45-75 |
| Monocytes (%) | 4 | 2-7 |
| Eosinophills (%) | 3 | 2-20 |
| Platelets /cumm | 3,60,000 | 2,00000-6,50,000 |
| Glucose (mg/dl) | 64 | 45-75 |
| Cholestrol (mg/dl) | 78 | 65-220 |
| BUN (mg/ dl) | 76 ↑ | 6-27 |
| Creatinine (mg/ dl) | 3.7 ↑ | 1-2 |
| Total protein (g/ dl) | 6.55 | 5.7-8.1 |
| Albumin (g/dl) | 2.37 | 2.1-3.6 |
| AST (IU/ L) | 250 ↑ | 78-32 |
| ALP (IU/ L) | 140 | 0-200 |
| CK (IU/ L) | 604 ↑ | 35-280 |
| Calcium (mg / dl) | 9.98 | 9.7-12.4 |
| Phosphorus (mg / dl) | 9.6 ↑ | 5.6-6.5 |
| Magnesium (mg / dl) | 2.47 | 1.8-2.3 |
| cTnI (ng/ml) | 0.09 ↑ | 0.02 |

herniated reticulum in thoracic cavity; this elevation of cTnI was 45 times higher than a normal healthy cow as per the report of Venkatesan *et al.* (2020a), who reported that cTnI in healthy cow was only 0.0204±0.011 ng/ml.

The hemato-biochemical findings of this case revealed leukocytosis, elevated BUN, creatinine, AST, CK and Phosphorus levels (Table 1). BUN elevation is an indication of oldest prognostic biomarker of heart failure and also dehydration status (Xue *et al.*, 2014). These changes generally observed in cattle with chronic inflammatory conditions as in traumatic reticuloperitonitis (Abdelaal 2014) and traumatic pericarditis (Venkatesan *et al.* (2020a). Elevation of creatinine, CK, AST in biochemical parameters indicates that there is involvement of muscle damage. Hyperphosphatemia noticed is in association with azotaemia.

In this present case, results of radiographic imaging of thoracic cavity suggested tentatively diaphragmatic hernia but ultrasonography ultimately confirmed diaphragmatic hernia via compressed cardiac

chambers, appearance of reticulum as a straight line and reduced reticular motility.

Further this case was referred for surgical correction and further management.

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