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Trupti T Kherkar
Ph.D Scholar, Department of
Veterinary Surgery and
Radiology, Mumbai Veterinary
College, Mumbai, Maharashtra,
India

Sanjeev S Pitlawar
Associate Professor, Department
of Veterinary Surgery and
Radiology, College of Veterinary
and Animal Sciences, Udgir,
Maharashtra, India

Clinical and surgical insights into diaphragmatic hernia in buffaloes

Trupti T Kherkar and Sanjeev S Pitlawar

Abstract

Diaphragmatic hernia in buffaloes presents a significant health challenge due to its detrimental impact on thoraco-abdominal integrity. This study aims to enhance the understanding of diaphragmatic hernia in buffaloes through an examination of clinical and surgical findings, with the goal of improving diagnostic accuracy and surgical outcomes. The study was conducted on twelve clinical cases of buffaloes with diaphragmatic hernia, presented to TVCC, COVAS, Udgir and Maharashtra. These cases were randomly divided into two groups. Various clinical parameters, including general body condition, appetite, tympany, fecal consistency, regurgitation, respiratory distress, ruminal motility, and pregnancy status, were meticulously examined. Diaphragmatic herniorrhaphy was performed under general anesthesia using ketamine-guaifenesin and isoflurane, with the animal in a supine position via a transabdominal approach. Surgical observations, including the presence of foreign bodies, adhesion of the reticulum, and the status of the diaphragm, were documented. Clinical signs were pivotal for diagnosis. This study underscores the importance of early diagnosis and appropriate surgical intervention in managing diaphragmatic hernia in buffaloes, contributing to improved health management practices for affected animals.

Keywords: Diaphragmatic hernia, buffaloes, rumenotomy, herniorrhaphy, diagnosis

Introduction

Diaphragmatic hernia is one of the commonly occurring thoraco-abdominal disorder in buffaloes. It typically arises from elevated intra-abdominal pressure during pregnancy, sudden falls, strenuous parturition, trauma-induced or congenital diaphragmatic weakening. Due to the indiscriminate feeding behavior of ruminants, foreign bodies may accumulate in the reticulum, leading to irritation of the diaphragm and subsequent rupture. This rupture allows abdominal organs to herniate into the thoracic cavity. Clinical signs are crucial for diagnosis and treatment. Additionally, observations during diaphragmatic herniorrhaphy are vital for the successful management of this disease. Therefore, this study aims to enhance the understanding of diaphragmatic hernia in buffaloes by examining both clinical findings and surgical observations. By doing so, it seeks to improve diagnostic accuracy and surgical outcomes, ultimately contributing to better health management practices for buffaloes suffering from this condition.

Material and Methods

The study was conducted on twelve clinical cases of buffaloes randomly divided into two groups suffering from diaphragmatic hernia presented to TVCC, COVAS, Udgir and Maharashtra during year 2017-2019. Various clinical parameters including general body condition, appetite, tympany, fecal consistency, regurgitation, respiratory distress, ruminal motility, and pregnancy status were meticulously examined. Diaphragmatic hernia was diagnosed through radiography and further confirmed via left flank laparo-rumenotomy, conducted under inverted L-block or paravertebral nerve block with the animal in a standing position. The left flank laparo-rumenotomy was performed 24 hours prior to herniorrhaphy.

Corresponding Author:
Trupti T Kherkar
Ph.D Scholar, Department of
Veterinary Surgery and
Radiology, Mumbai Veterinary
College, Mumbai, Maharashtra,
India

During this procedure, ruminal contents were evacuated, and any foreign bodies present were retrieved.

Surgical parameters, including observations from rumenotomy such as the nature of foreign bodies, adhesion of the reticulum, and the status of the diaphragm (whether intact or ruptured), were documented. Additionally, the peridiaphragmatic structures were assessed by palpation to detect any pathological lesions. Buffaloes were fasted for 24 hours and water was withheld for 12 hours. Diaphragmatic herniorrhaphy was performed under general anaesthesia using ketamine-guaifenesin and isoflurane anesthesia, with the animal placed in a supine position via transabdominal approach. The right cranial quadrant of the abdomen was aseptically prepared. A crescent-shaped incision of 25-30 cm in length, caudal to the xiphoid cartilage, was made. Upon accessing the thoracic cavity, manual exploration of the diaphragm and reticulum was conducted to evaluate the extent of herniation and adhesions. Adhesions were removed manually by gentle manipulation. The herniated organ was then carefully retracted back into the abdominal cavity. Closure of the hernial rent was achieved using absorbable suture material. Various observations related to diaphragmatic herniorrhaphy, such as the herniated organ and its location, size of the hernia, duration of surgery, and details regarding suturing materials and techniques employed for herniorrhaphy, were recorded.

Post-operatively, the buffaloes received a seven-day course of antibiotics, analgesics, and B-complex supplementation to promote healing and prevent infection. Additionally, intravenous fluid therapy consisting of Inj. Ringer's Lactate and Inj. Dextrose was administered to address electrolyte imbalances and ensure proper hydration.

Results and Discussion

Diaphragmatic hernia has a wide range of clinical signs depending on the extent of herniation, size of the hernial ring and the type of herniated viscera (Kelmer *et al.*, 2008, Attia 2016) [13, 5]. Anorexia, inappetance, recurrent tympany, scanty defaecation, reduced milk production, suspended rumination are considered as general clinical signs in buffaloes suffering from diaphragmatic hernia or any other digestive disturbances (Abdelaal *et al.*, 2009 and Misk, 2015) [1, 16].

The mean age of animals suffering from diaphragmatic hernia ranged from 4 to 9 years, with weights spanning from 313 to 442 kg. At the time of presentation, 66.66% of the animals were in a healthy body condition, while the remaining 33.33% exhibited a weak body condition. The weakened body condition in these 33.33% of animals is hypothesized to result from gastrointestinal disturbances associated with diaphragmatic hernia.

In Group I, about 66.66% (four buffaloes) exhibited anorexia, whereas 33.33% (three buffaloes) in Group II were anorexic. Additionally, reduced appetite was observed in 16.66% (two buffaloes) of Group I and 33.33% (three buffaloes) of Group II. These findings are consistent with previous studies by Ramprabhu *et al.* (2003) [22], Singh *et al.* (2006) [28] and Athar *et al.* (2010) [4], who reported clinical signs of partial anorexia, suspended rumination, recurrent tympany, and scanty feces in buffaloes suffering from diaphragmatic hernia. Recurrent tympany was observed in four buffaloes (66.66%) in Group I and in all six buffaloes (100%) in Group II. Additionally, two buffaloes (33.33%) in Group I did not exhibit tympany. Athar *et al.* (2010) [4] reported that 63% of animals showed recurrent tympany, while three animals did not. The higher incidence of recurrent tympany in Group II

suggests a direct correlation between the severity of diaphragmatic hernia and the occurrence of tympany. Previous studies by Mally and Jayadevappa (1974) [15] and Athar *et al.* (2010) [4] identified reticular adhesions as a primary cause of ruminal tympany. The herniation of the reticulum into the thoracic cavity can lead to stagnation and persistence of feed in reticulum, resulting in the proliferation of gas-producing bacteria and subsequent recurrent bloat (Fig. 1). This mechanism was also documented by Radostits *et al.* (2007) [21] and Sawale *et al.* (2015) [26].

Respiratory distress was observed in three buffaloes (50%) in Group I and in four buffaloes (66.66%) in Group II. These findings are consistent with those reported by Deshpande *et al.* (1981) [9] in cases of diaphragmatic hernia. The prevalence of respiratory distress in buffaloes with diaphragmatic hernia can be attributed to the space-occupying effect of the herniated organs within the thoracic cavity, which compromises lung function. Deshpande *et al.* (1981) [9] also observed similar clinical signs, suggesting that the displacement of abdominal organs leads to significant pulmonary dysfunction. The presence of abdominal organs in the thoracic cavity reduces the available space for lung expansion, resulting in compromised respiratory efficiency.

In Group I, two buffaloes (33.33%) exhibited semisolid feces, three (50%) had scanty feces, and one (16.66%) had normal feces. In Group II, fecal characteristics were as follows: hard scanty feces in one buffalo (16.66%), scanty feces in one (16.66%), semisolid feces in two (33.33%), solid feces in one (16.66%), and diarrhea in one (16.66%). These findings are consistent with those of Athar *et al.* (2010) [4], who reported that 70.4% of animals passed hard black feces, 25.9% had reduced fecal output, and one animal had loose feces. Similarly, Abdelaal *et al.* (2014) [2] observed scanty soft feces in four animals (40%), scanty hard feces in five (50%), and loose feces in one (10%).

Regurgitation was observed in 16.66% of the animals in both Group I and Group II. However, 83.33% of the animals did not show regurgitation. The clinical signs of tympany and food regurgitation from the mouth are consistent with the findings of Athar *et al.* (2010) [4]. These symptoms may be attributed to an impaired eructation process and rumination complications associated with reticular hernia (Abdelaal *et al.*, 2014) [2].

Ruminal hypomotility was observed in 33.33% of cases in Group I and 50% in Group II. Conversely, hypermotility was observed in 66.66% of animals in Group I and 33.33% in Group II. One case from Group II showed normal ruminal motility. According to Abdeal *et al.* (2014), ruminal hypomotility in cases of diaphragmatic hernia (DH) is often indicative of indigestion. Conversely, a hypermotile rumen may suggest vagal indigestion that has developed as a secondary condition to DH. Also, the entrapment of the reticulum in the thoracic cavity leads to distortion of the oesophageal groove and reticulo-omasal opening, resulting in ruminal hypermotility and frothy rumen content, as stated by Priyanka and Bisla (2019) [20]. Andrews *et al.*, (2004) [3] and Attia, (2016) [5] reported hypermotility of rumen which might be due to involvement of the vagus nerve.

Two (33.33%) animals from Group I and four (66.66%) animals from Group II were non-pregnant. Dhablania *et al.* (1971) [10], Prasad *et al.* (1979) [18], noted that the incidence in lactating buffaloes was appreciable. Athar *et al.* (2010) [4] observed diaphragmatic hernia in 51.8% of recently parturient animals, 22.2% of advanced pregnant animals, and 25.92% of animals in various stages of lactation. Found that

diaphragmatic hernia was most commonly seen in dairy cattle that had recently calved or were in advanced pregnancy. Priyanka and Bisla (2019) ^[20] stated that the incidence is common during pregnancy as the uterus extends into the abdominal cavity, causing pressure on the visceral organs and ultimately on the diaphragm. In the present study, 50% of animals in both Group I and Group II were pregnant.

Left flank laparo-rumenotomy was performed 24 hours prior to diaphragmatic herniorrhaphy. Observations during rumenotomy provided valuable information regarding the nature and extent of the hernia, aided in the removal of metallic foreign bodies from the reticulum, helped locate the site of herniation, and allowed emptying of forestomach contents to prevent regurgitation during herniorrhaphy.

Non-potential foreign bodies were found in five animals, potential foreign bodies in three animals (Figure 2), and no foreign bodies in four animals out of twelve. Three animals from Group I and one from Group II showed no foreign bodies, yet herniation was observed.

In Group I, three buffaloes had reticulophrenic adhesions, two had adhesions between the diaphragm and cranioventral aspect of the reticulum, and one had adhesions with the lung lobe margin. Five buffaloes had moderate adhesions, and one had severe adhesions. In Group II, four animals had reticulophrenic moderate adhesions, and two had adhesions with the lung lobe margins. Reticular adhesion in all animals of both groups indicated that traumatic reticulitis or reticuloperitonitis predisposes them to diaphragmatic hernia. Hutchins *et al.* (1957) ^[12], Prasad *et al.* (1982) ^[19] and Saini *et al.* (2001) ^[24] stated that mortality in cows suffering from diaphragmatic hernia is high, mostly due to tough or fibrous adhesions of the herniated reticulum to the diaphragm, lungs, or pericardium. Manual breaking of adhesions can cause rupture of the pleura, leading to severe respiratory distress or death (Saini *et al.*, 2007) ^[23]. Treatment is rarely successful except where adhesions are not firm or extensive, as stated by Hall (1963) ^[11], Trout *et al.* (1967) ^[31] and Singh *et al.* (1977) ^[27]. However, in this study, complications such as respiratory distress or death were not observed.

Status of diaphragm was recorded along with extent of herniation in all the twelve animals. The diaphragm was found ruptured in all animals of both groups during rumenotomy. Small reticular herniation (one-fourth of the reticulum) was observed in two buffaloes and half reticulum herniation in four buffaloes of group I. In group II, six buffaloes showed small reticular herniation (one-fourth of the reticulum). Diaphragmatic adhesions were moderate in all animals of groups I and II, except for one animal in group I.

Assessment of peridiaphragmatic structures was carried out by palpation, with only the heart being appreciable due to its beats. No pathological findings were observed.

During diaphragmatic herniorrhaphy, observations and positioning-related complications were studied. The procedure was performed in the supine position for both groups. For the transabdominal approach, the anesthetized buffalo was placed in dorsal recumbency. Carroll and Hartsfield (1996) ^[8] and Taylor (1991) ^[30] recommended supplemental oxygen for anesthetized cattle in lateral or dorsal recumbency due to cranial shifting of the rumen and intestines, which decreases lung capacity. This position also compresses the posterior vena cava and abdominal aorta, leading to respiratory depression. The use of intermittent positive pressure ventilation effectively prevented these issues in this study.

The reticulum was the only herniated organ in all animals, with the hernial ring predominantly located at the right side of the diaphragm. Previous studies by Abdelaal *et al.* (2014) ^[2] and Saini *et al.* (2007) ^[23] corroborate this finding. In buffaloes, herniation typically occurs through the right ventro-medial part of the diaphragm, which ruptures from the musculo-tendinous junction (Saini *et al.*, 2000) ^[25]. Deshpande *et al.* (1981) ^[9] observed that the hernial ring is usually located at the junction of the musculotendinous portion of the diaphragm, ventral to the foramen venae cavae, and slightly lateral to the median plane. Generally, the hernial ring is fibrosed, thick, round to oval in shape, and varies in dimensions. Braun *et al.* (2018) ^[7] stated that the reticulum is the most commonly herniated organ through a diaphragmatic tear in Bovidae; however, other abdominal organs such as the forestomach, abomasum, liver, omasum, spleen, and small intestines may also occasionally be herniated.

The mean duration of surgery was 44.33 ± 1.43 minutes for Group I and 43.83 ± 1.38 minutes for Group II. Bellavance *et al.* (2010) ^[6] reported a duration of 2.5 hours.

Suturing material and technique for herniorrhaphy used was recorded. Polydioxanone loop No. 1 was used in both groups, proving suitable for hernial repair. The continuous lock stitch technique with looped suture material was found to be more satisfactory compared to other techniques suggested by previous studies (Vig, 1972; Singh, 1974; Bellavance *et al.*, 2010) ^[6]. Whereas, Talekar *et al.* (2018) suggested using a continuous lock stitch pattern with fishnet non-absorbable suture material for diaphragmatic herniorrhaphy. Bellavance *et al.* (2010) ^[6] recommended a simple continuous suture with PDS II 2-0 and also suggested that a prosthetic patch might be used for large congenital or traumatic defects.



Fig 1: Froathy rumen content



Fig 2: Potential and non-potential foreign bodies retrieved from a buffalo

Conclusion

Diaphragmatic Hernia (DH) is a common issue in buffaloes. Clinical signs are crucial for diagnosis. Performing a laparo-rumenotomy prior to diaphragmatic herniorrhaphy is beneficial for the surgical management of diaphragmatic hernia. Using polydioxanone looped suture material for herniorrhaphy yielded satisfactory results

Conflict of Interest

Not available

Financial Support

Not available

Reference

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