The Indian Journal of Veterinary Sciences & Biotechnology ***(2018) Volume 13, Issue 4, 78-83***
ISSN (Print) : 2394-0247 : ISSN (Print and online) : 2395-1176, abbreviated as IJVSBT
10.21887/ijvsbt.v13i4.11565

Submitted : 28-01-2018 ***Accepted : 10-03-2018*** ***Published : 08-04-2018***

Diagnosis of Diaphragmatic Hernia in Buffaloes : A Review

Madan Pal[1] and Rishi Tayal[2]

[1]Veterinary Surgeon, Animal Husbandry and Dairying Department, Haryana

[2]Professor, Department of Veterinary Surgery and Radiology,

Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar-125004, Haryana (India)

Corresponding Author: drmadanlega@gmail.com

Abstract

Diaphragmatic hernia is a common thoraco-abdominal disorder in adult-milch buffaloes. This disorder with its high morbidity and mortality has emerged as a major surgical condition affecting the productivity of farm animals. Increased intra-abdominal pressure due to normal heavy weight of viscera, tympany of varying degrees, advanced pregnancy and efforts at calving plays major role in inducing reticular diaphragmatic hernia in buffaloes. Signs of tympany, brisket oedema, anorexia, chronic cough, abduction of limbs, intermittent constipation or diarrhoea with small quantity of loose or scanty pasty faeces are usually present in most of the animals affected with diaphragmatic hernia. The condition is difficult to diagnose only on the basis of clinical signs and symptoms. However, imaging technique like ultrasonography can be of high diagnostic value in detecting the condition.

Key words: Buffalo, diaphragmatic hernia, ultrasonography

Introduction

Diseases of the digestive tract in ruminants constitute a major part of clinical problems. Sometimes these diseases remain undiagnosed and results into major cause of economic loss to farmers. It often becomes difficult to differentiate whether the condition requires medicinal or surgical treatment or both. Diaphragmatic hernia (DH), traumatic reticuloperitonitis, vagal indigestion, omasal impaction, abomasal impaction and reticular abscesses are more commonly encountered abdominal disorders (Singh *et al.,* 1993). In such disorders, there is accumulation of ingesta in the fore-stomach or abomasum resulting in reduced appetite, dehydration, recurrent tympany, drop in milk yield, brisket oedema, chronic cough, constipation, abduction of limbs, eventually weakness and recumbency (Behl *et al.,* 1996; Krishnamurthy *et al.,* 1980).

A tentative diagnosis of reticular diaphragmatic hernia can be made on the basis of clinical signs and auscultation findings (Radostits *et al*., 2007). It can be diagnosed by plain (Misk and Semieka, 2001) and contrast reticulography (Nigam *et al.,* 1980; Krishnamurthy *et al.,* 1983 a; Saini *et al.,* 2001).

Ultrasonography provides a practical and straight forward method for examination of reticulum in

healthy cows (Braun, 2009). Recently, ultrasonography has been reported as a non-invasive imaging modality to diagnose reticular diaphragmatic hernia in bovine based on the visibility of reticular wall and its motility at the fourth and fifth intercostal spaces (ICS) from the right side (Saini *et al*., 2007; Athar *et al.,* 2010).

Materials and Methods

The diagnosis of diaphragmatic hernia is based on clinical signs, ultrasonographic and radiographic findings.

Clinical signs

Gastrointestinal disturbances especially those affecting reticulum as traumatic reticuloperitonitis, diaphragmatic hernia and reticular abscess were represented as major problems commonly affecting ruminants (Braun *et al*., 1994). The general signs of indigestion including anorexia, ruminal tympany, scanty faeces, reduced milk production and atonized rumen were considered shared signs between different gastrointestinal disturbances especially those of reticulo-rumen origin like traumatic reticuloperitonitis, peri-reticular abscess and diaphragmatic hernia (Braun *et al.,* 1998). Krishnamurthy *et al.* (1983 b) performed an analysis of 140 clinical cases (1 bullock, 8 buffalo heifers and 131 she-buffaloes) of diaphragmatic hernia and observed signs of tympany, brisket oedema, chronic cough, abduction of limbs, intermittent constipation or diarrhoea with small quantity of loose or scanty pasty faeces in most of the animals. Appetite was much reduced and depraved with or without change in rumination. Bisla *et al*. (2003) observed progressive weakness, reduced production, partial to complete anorexia, recurrent tympany, scanty and pasty faeces in 45 buffaloes with diaphragmatic hernia.

Athar *et al*. (2010) recorded clinical findings in cases of diaphragmatic hernia in bovines. Duration of illness ranged from 6 days to 4 weeks. 15 (55.55%) animals were dull and depressed at time of presentation and had a dry muzzle while others appeared alert. Fourteen animals (51.8%) were recently parturated, 6 (22.2%) were in advanced stage of pregnancy while rest were in different stages of lactation. Nineteen animals (70.4%) were passing hard black faeces, 7 animals (25.9%) had reduced faecal output while 1 animal was passing loose faeces. Recurrent tympany was observed in majority of the animals (63%) while 3 animals had persistent tympany and 5 did not show any tympany. Two animals had a single episode of tympany. Regurgitation was observed in 2 cases. Rumen was hyper motile but with reduced strength of ruminal contractions in 17 (62.9%) animals while in 3 animals rumen was hypomotile. No rumen motility could be appreciated in 4 animals while in 3 animals rumen motility was normal.

Recently, Pal (2017) observed the clinical sign and symptoms in fifty nine cases of diaphragmatic hernia affected buffaloes reported at TVCC, LUVAS, Hisar. Physical condition was poor to moderate in all the cases. The animals suffering from diaphragmatic hernia had mean age of 5.33 ± 2.0 ranging from 3.5-11 years. Diseased animals showed anorexia (58%) and inappetance (42%). The duration of illness ranged from within week to more than 2 months. Long duration of illness was responsible for poor physical status of animals. The study was conducted on 35 pregnant (59%) and 24 non-pregnant (41%) buffaloes. Seven animals (34%) were reported in early gestation, 16 (26%) in mid gestation and 12 (20%) animals were in late stage of gestation. Three animals were recently parturated.

Rumen motility was variable but majority of the cases showed normal to increased ruminal motility. In 32 percent of the animals decreased ruminal motility was observed, where in 4 percent of animals ruminal motility was nil. The records regarding tympany were available for 59 animals. Recurrent (73%) and persistent (15%) tympany was observed in majority of the animals (88%). Five animals (9%) did not show any sign of tympany. While in 2 animals (3%) single episode of tympany was observed. Faeces were black hard in 42 (71%), loose in 5 (9%) and normal in 3 (10%) subjects. Defecation was absent in 6 (10%) animals. Mean rectal temperature of animals was within normal

range. Fifteen animals (25.4%) had history of fever. Abnormal respiratory sound in form of cough was present in 28 animals (47.5%). Seven animals had history of brisket oedema. A sharp decrease in milk production was noted in 61 % animals (Pal, 2017).

Ultrasonographic diagnosis

The reticulum is well detected when the transducer is applied parallel to the ribs at the level of right elbow. Both B and real time B+M modes can be used to assess the reticulum. The reticulum is first located and observed for three minutes without moving the transducer. The reticular motility pattern is observed in real time B+M mode ultrasonography. The motility of the reticulum is first observed in the abdominal cavity at the 6th or 7th intercostal spaces and then moving transducer ventrally towards the midline. Thereafter, the reticulum is located in the thoracic cavity by placing the transducer at the 4th and 5th intercostal spaces at the level of elbow or moving transducer ventrally toward the midline. Then the reticular motility in the abdominal cavity could be compared with that of the thoracic cavity.

Different types of the reticular motility pattern (complete, incomplete, continuous wave like and no reticular motility) have been observed at the 4th intercostals space in cases of diaphragmatic hernia. Recently, it has been proved that presence of the reticulum with or without its motility at the 4th intercostals space is suggestive of diaphragmatic hernia in buffaloes (Pal, 2017). Recently, it has been also proved that the presence of reticulum and its motility at the 5th intercostal space is not suggestive of diaphragmatic hernia in buffaloes (Pal, 2017). In these cases, possibly due to extreme pressure on diaphragm (due to severe tympany) the reticulum could be observed at the 5th intercostal space.

Ultrasonographically, the normal reticulum of buffaloes has a smooth contour and appears as a half moon or crescent shaped structure. The different layers (mucosa, sub-mucosa and tunica serosa) and honey comb-like structure of the mucosa of the reticular wall usually cannot be often seen. Ultrasonographically, magnets and foreign bodies are difficult to visualize because of the gaseous content of the reticulum.

Mohindroo *et al.* (2007) diagnosed diaphragmatic hernia in twenty buffaloes using ultrasonography and observed the reticular motility in abdomen and thorax. It was concluded that presence of reticular motility could be an important criteria for diagnosis of reticular diaphragmatic hernia in buffaloes. Saini *et al*. (2007) reported use of ultrasonography, radiography and surgery in successful recovery from diaphragmatic hernia in a cow. The reticulum was seen within the abdominal cavity as a smooth crescent shaped structure with biphasic contraction when scanned at the right 6th and 7th intercostal spaces at level of elbow. The reticular motility at the level of the 4th and 5th intercostal spaces into the thorax was suggestive of diaphragmatic hernia. Athar *et al.* (2010) diagnosed diaphragmatic hernia in 27 animals (26 buffaloes and 1 cow) at the level of 4th and 5th intercostal spaces. It was revealed that ultrasonography was more accurate than radiography in diagnosis of diaphragmatic hernia with less discomfort to patient. In another study Kumar and Saini (2011) suggested that ultrasonographic visibility of reticular wall at the 5th intercostal space should be interpreted as normal in cows (irrespective of pregnancy) and in advanced pregnant buffaloes and doubtful for reticular diaphragmatic hernia in non-pregnant buffaloes.

Abouelnasr *et al.* (2012) observed utility of B+M mode display for detection and evaluation of reticular motility in thoracic cavity which was mandatory for diagnosis of diaphragmatic hernia in buffaloes. Incomplete biphasic reticular contraction was detected at the level of 5th intercostal space in 3 buffaloes. A gliding reticular motility was viewed at the level of 4th intercostal space from right side in 1 buffalo. No motility could be identified in the thoracic cavity from both right and left side in other 2 buffaloes. Ultrasonographically, normal reticulum appeared as a half-moon-shaped structure with a smooth or even contour. The different layers of reticular wall and honeycomb like structure of mucosa of the reticulum usually could not be imaged using ultrasonography. Aref and Abdel-Hakiem

(2013) revealed that diaphragmatic hernia could be diagnosed ultrasonographically by placing the transducer at the 3rd-4th intercostal spaces of left and right sides of thorax and revealed that presence of half moon shape reticulum at this position was suggestive of diaphragmatic hernia.

Singh *et al*. (2013) performed B+M mode ultrasonography for evaluating reticular health in 6 cows and 24 buffaloes and revealed that B+M mode display was helpful in diagnosing and documenting normal reticular motility as well as various conditions with reticular involvement like reticular diaphragmatic hernia, reticulo-phrenic adhesions and reticular atony. In another study, it was proved that ultrasonographic diagnosis of diaphragmatic hernia was doubtful when it was depending on reticular location and manner of contraction. But it was more reliable to detect relation of the reticulum with adjacent thoracic organs and observing its motility inside the thoracic cavity (Abdelaal *et al.,* 2014).

Radiological diagnosis

The radiological examination for the diaphragmatic hernia can be performed using Siemens Large Animal X-ray machine having maximum mA of 600 and KVP of 150. The radiological examination is performed in left lateral recumbency with forward stretched forelimbs in cases of diaphragmatic hernia. Exposure factors in the range of 150-160 mAs and 85-90 KVP at a film focal distance of 90–100 cm are required for diagnosis of diaphragmatic hernia in buffaloes. The images of radiographs are processed in the computer radiography system. The following findings are recorded upon the radiological examination in cases of diaphragmatic hernia i.e. nature of foreign body (metallic or non-metallic), location of foreign body (reticular, diaphragmatic and pericardial position, status of diaphragmatic line (intact or discontinued) and circumscribed swelling of soft tissue density (reticulum) within the thorax or cranial to diaphragm.

Krishnamurthy *et al.* (1983 a) employed radiographic examination of reticulophrenic areas for diagnosis of multiple hernia rings in diaphragm of she buffaloes and suggested contrast radiography using barium sulphate following the evacuation of hernia sacs filled with impacted ingesta during rumenotomy to demarcate the different pouches as well as to know the sizes and extent of herniation. Krishnamurthy (1993) opined that either plain or contrast radiography is required for confirmation of diaphragmatic hernia in buffaloes. In buffaloes, right lateral recumbency advocated because in most cases herniation occurs through the right hemi diaphragm.

Plain radiographs revealed a demarcated diaphragmatic line and presence of metallic foreign bodies in a sac-like structure located cranial to diaphragm whereas contrast radiography showed passage of contrast agent into herniated reticulum located cranial to diaphragm in cases of diaphragmatic hernia in bovine. (Saini *et al.,* 2007). Chaudhari *et al.* (2009) studied radiographs of 338 clinical cases of cattle and buffalo for recording incidence of various affections in bovine. All animals subjected to lateral plain radiography of reticulo-thoracic region. Out of these, only 27.81% cases were interpreted as a foreign body syndrome, of which 21.59% were potential and 6.21% were non-potential foreign bodies. Presence of foreign body in the thoracic region was shown in 4.44% of cases. The incidence of diaphragmatic hernia was recorded in 6.50% of animals. Athar *et al.* (2010) conducted a study on 101 animals suffering from thoraco-abdominal disorders. Out of which, 27 animals (26 buffaloes and 1 cow) were diagnosed with diaphragmatic hernia based on clinical signs, radiography, ultrasonography and left flank laparorumenotomy. A sac-like structure cranial to the diaphragm was observed in 18 cases (66.67%). In the rest of 9 animals (33.33%), diaphragmatic hernia could not be diagnosed on the basis of radiography although a break in continuity of diaphragm was observed on the radiographs. Aref and Abdel-Hakiem (2013) reported radiological findings in cases of diaphragmatic hernia and observed circumscribed swelling of soft tissue density (reticulum) within thorax and overlying the caudal border of heart with discontinuation of diaphragm. Pal (2017), recently, studied 26 cases of diaphragmatic hernia using radiography and compared with ultrasonographic and surgical findings. On the basis of radiological findings, only 11 cases (42.3%) were diagnosed for reticular diaphragmatic hernia. In 15 (57.7%) cases,

radiography failed to diagnose reticular hernia and these cases were suspected for diaphragmatic hernia, traumatic pericarditis, hydrothorax and adhesions

Conclusions

Ultrasonography is more accurate and less stressful than radiography in diagnosis of diaphragmatic hernia in buffaloes. Ultrasonography is also less hazardous than radiography to animal as well to personnel involved in the examination. Ultrasonography is a valuable tool for diagnosis of diaphragmatic hernia in buffaloes. Because in pregnant and tympanic animals, casting of animals in left lateral recumbency during radiography is not safe and may cause harm to foetus or animal itself. In such situations, ultrasonography becomes an alternative technique to radiography to diagnose diaphragmatic hernia in buffaloes in standing position.

Conflict of Interest: All authors declare no conflict of interest.

References:

Abdelaal, A., Gouda, S., Ismail, A. and Gomma, M. (2014). Reticular diaphragmatic hernia in Egyptian buffaloes: Clinical, Haemato-biochemical and ultrasonographic findings.

Abouelnasr, K.S., Mosbah, E., Karrouf, G.I. and Zaghloul, A.E. (2012). Comparative ultrasonographic findings of traumatic reticulitis, perireticular abscess and diaphragmatic hernia in buffalo (Bubalus Bubalis*). J. Amim. Sci*. **12:** 590-595.*Pak. Vet. J.* 1-4.

Aref, N.M. and Abdel-Hakiem, M.A.H. (2013). Clinical and diagnostic methods for evaluation of sharp foreign body syndrome in buffaloes. *Vet. World*. **6(9):** 586-591.

Athar, H., Mohindroo, J., Singh, K., Kumar, A. and Raghunath, M. (2010). Comparison of radiography and ultrasonography for diagnosis of diaphragmatic hernia in bovines. *Vet. Med. Int.* Article ID 939870, DOI:10.4061/2010/939870.

Behl, S.M., Singh, J. and Krishnamurthy, D. (1996). Functional disorders of the stomach (Vagus indigestion) in bovine. A review. *Indian J. Vet. Surg*. **17:** 71-80.

Bisla, R.S., Singh, J., Tayal. R., Singh, S. and Krishnamurthy, D. (2003). Assessment of oxidative stress in diaphragmatic hernia affected buffaloes subjected to trans-abdominal diaphragmatic herniorrhaphy. *Indian J. Vet. Surg.***24(2):** 92-94.

Braun, U. (2009). Ultrasonography of gastrointestinal tract in cattle. *Vet. Clin. Food Anim.* **25:** 567-590.

Braun, U., Fluckiger, M. and Gotz, M. (1994). Comparison of ultrasonographic and radiographic findings in cows with traumatic reticulo-peritonitis. *Vet. Rec*. **135:** 470-478.

Braun, U., Iselin, U., Lischer, C. and Fluri, E. (1998). Ultrasonographic findings in five cows before and after treatment of reticular abscesses. *Vet Rec*. **142:** 184-89.

Chaudhari, K.S., Thorat, M.G., Yadav, G.U., Mulani, J.B., Suryawanshi, A.A. and Ingale, S.S. (2009). Role of radiological examination in diagnosis of foreign body in bovines. *Vet. World*. 2 **(9):** 339.

Krishnamurthy, D. (1993). In: Ruminant Surgery. 1st edn. CBS Publishers, New Delhi, India**. pp.** 231-232.

Krishnamurthy, D., Nigam, J.M., Peshin, P.K., Sharma, D.N., Chawla, S.K. and Singh, S. (1983a). Diagnosis and repair of multiple hernia rings in diaphragm of she-buffaloes. *Indian Vet. J*. **60:** 480-484.

Krishnamurthy, D., Nigam, J.M., Deshpande, K.S., Peshin, P.K., Singh, S.C. and Sharma, D.N. (1983b). Bovine diaphragmatic hernia-An analysis of 140 clinical cases. *Indian Vet. J*. **60:** 1011-1016.

Krishnamurthy, D., Deshpande, K.S., Nigam, J.M., Peshin, P.K. and Singh, S.C. (1980). Repair of diaphragmatic hernia in bovines. Transthoracic approach. *Indian J. Vet. Surg.***1:** 7-11.

Kumar, A. and Saini, N.S. (2011). Reliability of ultrasonography at the fifth intercostal space in the diagnosis of reticular diaphragmatic hernia. *Vet. Rec*. **169:** 391.

Misk, N.A. and Semieka, M.A. (2001). The radiographic appearance of reticular diaphragmatic herniation and traumatic pericarditis in buffaloes and cattle. *Vet. Radiol. Ultrasound*. **42(5):** 426-430.

Mohindroo, J., Kumar, M., Kumar, A. and Singh, S.S. (2007). Ultrasonographic diagnosis of reticular diaphragmatic hernias in buffaloes. *Vet. Rec.***161(22):** 757-758.

Nigam, J.M., Singh, A.P. and Mirakhur, K.K. (1980). Radiographic diagnosis of bovine thoracic disorders. *Mod. Vet. Pract.* **6(12):** 1021–1025.

Pal, M. (2017). Comparative evaluation of ultrasonographic, radiological and surgical findings in cases of diaphragmatic hernia, reticular abscess and traumatic reticuloperitonitis in buffaloes. Ph.D. Thesis, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar.

Radostits, O.M., Gay, C.C., Hinchcliff, K.W. and Constable, P D. (2007). In: Veterinary Medicine. A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs and Goats. 10th eds. Saunders Elsevier, Philadelphia. **pp.** 189-382.

Saini, N.S., Kumar, A., Mahajan, S.K. and Sood, A.C. (2007). The use of ultrasonography, radiography, and surgery in the successful recovery from diaphragmatic hernia in a cow. *Canadian Vet. J.* **48(7):** 757-759

Saini, N.S., Sobti, V.K., Mirakhur, K.K., Singh, S.S., Singh, K.I., Bansal, P.S., Simran, P.S. and Bhatia, R. (2001) Survivors of diaphragmatic hernia in buffaloes (*Bubalus bubalis*). *Indian J. Anim. Sci*. **71:** 839-40.

Singh, J., Singh, A.P. and Patil, D.B.(1993). In: *Ruminant Surgery*. CBS Publishers and Distributors, New Delhi, India. **pp.** 175-82.

Singh, S., Mohindroo, J., Kumar, A. and Sangwan, V. (2013). B+M mode ultrasonography in evaluating reticular health in cows and buffaloes.*Indian J. Vet. Res*. **22(2):** 52-58.

❑