



Long term outcomes of survivors of diaphragmatic herniorrhaphy in crossbred cows and buffaloes

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ABSTRACT

Pregnant and lactating bovine animals that survived diaphragmatic herniorrhaphy done under general anesthesia were observed for postoperative complications, fetal survival and recurrence of diaphragmatic hernia during subsequent calving, milk production level in the same and subsequent lactation. Bovines (22 buffaloes and 2 crossbred cows) were divided into group 1 (13 pregnant) and group 2 (11 lactating). All the animals were followed postoperatively for a mean duration of 15.1 ± 2.56 months (till subsequent calving and lactation). In group 1 animals (8 buffaloes and 1 cow), 69.2% calved at full term with healthy calves and produced 94.4% of normal milk yield in subsequent lactation. Four buffaloes had complications like abortion (2), ventral hernia (1) and death (1). Postoperative complications of abortion and death in group 1 animals were not found related to surgery. In group 2, recently parturated animals (8 buffaloes, 1 cow) resumed mean peak milk yield to 37.5% level of the normal in the same lactation. All animals of group 2 came in estrous and conceived. Seven buffaloes and 1 cow calved subsequently and produced mean milk yield of 91.25% that of normal. Three buffaloes developed recurrence of diaphragmatic hernia (2) and ventral incisional hernia (1) in group 2. Majority of the surgical wound related problems (hard swelling, abscessation at postxiphoid or flank skin incision) were managed successfully. Our study revealed that after diaphragmatic herniorrhaphy majority of the surviving pregnant and lactating cows and buffaloes were able to achieve their production and reproduction performance without significant surgery-related complications. Pregnant bovine operated for diaphragmatic hernia are not predisposed to recurrence of diaphragmatic hernia during subsequent calving.

Key words: Buffaloes, Cows, Diaphragmatic hernia, Productive performance, Reproductive performance, Surgery

Diaphragmatic hernia is affecting bovine animals in different stages of production and reproduction. Animals suffering from reticular diaphragmatic hernia are usually presented with variable clinical signs of reduced appetite, abnormal faeces, altered rumino-reticular motility, recurrent or no tympany and low milk yield (Prasad *et al.* 1977, Singh *et al.* 1977, Krishnamurthy *et al.* 1983). However, along with reticulum, herniation of omasum, abomasum, cranial part of rumen, a part of liver and spleen may also occur (Crossfield and Brook 1949, Done and Drew 1972, Singh *et al.* 1977, Prasad *et al.* 1979, Krishnamurthy *et al.* 1983). Diaphragmatic herniorrhaphy done under general anesthesia was successful with 60 to 80% survival (Singh *et al.* 1977, Saini *et al.* 2001a). But this surgical condition has been poorly

discussed in relation to long term surgical outcomes (Gaughan *et al.* 2004, Radostits *et al.* 2007). A high incidence of diaphragmatic hernia was reported in buffaloes in periparturient stage (Singh *et al.* 2006). Thus, animals operated in advanced stages of pregnancy might be at higher risk for recurrence of diaphragmatic hernia. The literature on long term outcomes of surgically treated cases of reticular diaphragmatic hernia is scanty. Therefore, the present investigation was done with the following objectives: To record postoperative complications with long term survival in all animals and to record the milk production level in lactating animals in the same and subsequent lactation; to follow pregnant animals operated in different stages of pregnancy regarding fetal survival, calving, recurrence of diaphragmatic hernia and milk production level in subsequent lactation.

MATERIALS AND METHODS

The present investigation was done on 24 bovine animals (22 buffaloes and 2 crossbred cows) operated for

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diaphragmatic hernia between 2004 and 2008. The present study included those animals which survived at least for 2 weeks following surgery. The animals were divided into group 1 (pregnant animals; 12 buffaloes and 1 cow) and group 2 (lactating animals, 10 buffaloes and 1 cow) based on their physiological status at the time of presentation. Signalment and brief history was recorded. Clinical examination included recording of rectal temperature, respiration and heart rates, rumen motility and dehydration status. A blood sample was collected for hematology. Reticulography was done in right lateral recumbency and diagnosis was made from radiographic or laparo-rumenotomy findings.

In the present study, diaphragmatic herniorrhaphy was done 24 h after rumenotomy as per Saini *et al.* (2007). Preoperatively, animals were administered inj prednesolone acetate 100 to 200 mg, IM. For general anesthesia, animals were premedicated with midazolam, induced with 5% thiopentone (1.5 to 2g, IV) and maintained with halothane (Kaur and Singh 2004, Saini *et al.* 2007). Animals were shifted from lateral to dorsal recumbency and standard post xiphoid surgical technique for diaphragmatic herniorrhaphy was used (Singh *et al.* 1980b). Normal saline (0.9%) solution (40 ml/kg) was administered intravenously for 2–3 days, along with inj. ampicillin and cloxacillin (10 mg/kg, IM, BID, for 7 days), inj gentamicin (2 mg/kg, IM, BID for 3 days), meloxicam (0.2 mg/kg, IM, OD for 3 days), bolus yeasac (2 PO for 15 days) and powder Liv 52 (50 g PO for 15 days), postoperatively.

All the survived animals were followed to record survival and complications related to wound healing or recurrence of diaphragmatic hernia. Resumption of milk production, onset of estrus, conception and subsequent parturition was recorded in lactating or recently parturated animals. The pregnant animals were followed postoperatively till parturition to record any complication related to pregnancy or survival of the fetus and level of milk production in the subsequent lactation.

RESULTS AND DISCUSSION

Out of total 24 bovine animals, 17 (9 in group 1 and 8 in group 2) survived with minor complications which were managed successfully. However, the remaining 7 animals had long-term complications such as recurrence of diaphragmatic hernia (n=2), ventral incisional hernia (n=2), abortion (n=2) which lead to culling and death (n=1).

In the present study, the affected animals had a mean age of 5.98 ± 0.37 years. The higher incidence of diaphragmatic hernia in adult recently calved and advanced pregnant cows and buffaloes have been reported (Prasad *et al.* 1977, Krishnamurthy *et al.* 1983, Singh *et al.* 1980a, Steiner *et al.* 1992, Saini *et al.* 2007). Majority of the animals had normal rectal temperature, respiration and heart rates. Major clinical signs observed were partial (75%) or total anorexia (25%), mild to moderate dehydration, recurrent tympany in all the

animals, passing of scanty black constipated faeces (66.7%; n, 16) and mean loss of milk yield by 91%. Survived animals had a chronic illness with a mean duration of 3.82 ± 0.78 weeks (range 1–20 week). Earlier workers had also described similar clinical features of diaphragmatic hernia in cows and buffaloes (Krishnamurthy *et al.* 1983, Saini *et al.* 2001a, 2001b, Mohindroo *et al.* 2007, Athar *et al.* 2010).

In the present study, survived animals had normal mean hemoglobin 11.67 ± 0.50 g/dL, mild leukocytosis ($10025 \pm 730 / \mu\text{l}$) with neutrophilia ($50.17 \pm 3.35\%$). Early cases of diaphragmatic hernia with normal hemoglobin content had better chances of survival postoperatively (Saini *et al.* 2001a). Neutrophilia was also reported in majority of the buffaloes suffering from diaphragmatic hernia irrespective of presence of metallic foreign bodies in the reticulum (Singh *et al.* 1977).

The survived cows and buffaloes were followed for a mean duration of 15.1 ± 2.56 months (range 1.5 to 48 months). In 14 animals (13 buffaloes and one cow), hard inflammatory swelling was recorded at post-xiphoid skin incision. Out of which, in 6 buffaloes, swelling resolved spontaneously. In remaining 7 buffaloes and 1 cow abscess formation at suture site and partial wound dehiscence was observed. Majority of the abscessed wounds were managed successfully. Two buffaloes in which ventral incisional hernia occurred had abscess formation at that site. Cited literature revealed scanty studies on the long term follow up of diaphragmatic hernia. A few retrospective studies on this condition were found in cows (Saini *et al.* 2001b) and buffaloes (Prasad *et al.* 1977, Saini *et al.* 2001a). In the present study a high incidence of inflammatory swelling and abscessation was observed which might be associated with unhygienic conditions prevalent at owner's farm house and use of silk for suturing muscles and skin. However, study conducted by Saini *et al.* (2001a) reported a very low incidence of complicated wound healing (8.8%) in buffaloes operated for diaphragmatic hernia. Silk elicits an intense tissue inflammatory reaction and has significant capillarity. Prolonged complete absorption may occur at a period of greater than 2 years (Smeak 1998). As it is cost effective suture material and has high tensile strength, it is widely practiced in bovine surgery. But capillarity is the greatest disadvantage of silk which might be the cause for the inflammatory swelling and abscess formation.

In the present study, group 1 animals (13) were pregnant for 2–6 months. A detailed follow up of pregnant animals is shown in Table 1. All 9 survivors of group 1 (8 buffaloes and 1 cow) calved at full term. These animals produced 94.4% of normal milk yield in the subsequent lactation. No adverse effects of prednesolone acetate (100 to 200 mg, IM) and thiopental sodium (1.5 to 2g, IV) were observed in pregnant (2–6 month of gestation) animals of the present study, as most of the surviving bovines (69.2%) completed their gestation uneventfully and delivered healthy calves. Similar findings were reported by Prasad *et al.* (1977) where all pregnant buffaloes recovered uneventfully and became

Table 1. Detailed follow up of pregnant bovines operated for diaphragmatic hernia

Animal no.	Species and age	Pregnancy status before surgery	Calving and calf health	Peak Milk yield (%)	Pregnancy related complications
1.	Cow, 9 years	4 month	Full term calving with healthy calf	100%	Nil
2.	Buffalo, 10 years	3 ½ month	Full term calving with healthy calf	100%	Nil
3.	Buffalo, 3 ½ years	5 month	Full term calving with healthy calf	100%	Nil
4.	Buffalo, 3 ½ years	6 month	Not recorded	Not recorded	Abortion at 9 month (3 month after surgery)
5.	Buffalo, 5 years	4 ½ month	Full term calving with healthy calf	100%	Nil
6.	Buffalo, 9 years	5 month	Full term calving with healthy calf	100%	Nil
7.	Buffalo, 3½ years	2 month	Calving at full term with healthy calf	50%	First lactation and poor health
8.	Buffalo, 8 years	4 month	Full term calving with healthy calf	100%	Nil
9.	Buffalo, 4 years	5 month	Full term calving with healthy calf	100%	Nil
10.	Buffalo, 5 years	3.5 month	Not recorded	Not recorded	Ventral incisional hernia after 1½ month of surgery (culling from herd)
11.	Buffalo, 6 years	5 ½ month	Not recorded	Not recorded	Uterine torsion 4 month after surgery, dead fetus delivered. Death of buffalo after 3 days of calving
12.	Buffalo, 6 years	5 month	Full term calving with healthy calf	100%	Nil
13.	Buffalo, 7 years	5 month	Not recorded	Not recorded	Abortion after 1½ month of surgery (culling from herd)

productive members of the herd.

Four buffaloes, in the animals of group 1, had long-term complications; abortion (n=2) at 6.5 month of pregnancy (1½ month after surgery) and at 9 month of pregnancy (3 month of surgery), ventral incisional hernia (1) at post-xiphoid region 1½ month after surgery, and death (1) after 4 month of surgery. The buffalo that died due to toxemia following uterine torsion, was in the second trimester of pregnancy at the time of surgery. A buffalo that developed incisional hernia at post-xiphoid skin incision, previously had abscessation at that site. All these long-term complications in animals of group I could not be correlated to anesthesia or surgery. Steiner *et al.* (1992) surgically treated a 7-month pregnant cow suffering from diaphragmatic hernia but the cow aborted on day 4 of surgery. However, a year later the cow gave birth to a healthy calf.

Out of 11 animals in group 2, eight buffaloes and one cow started producing milk within 2 weeks after surgery and the mean peak milk yield resumed was 37.5% level of the normal in the same lactation (Fig. 1). Animal owners were advised to milk the animals twice daily irrespective of milk yield. Early stages of lactation and improvement in health condition would be important factors for the resumption of milk production level in the same and subsequent lactation. Prasad *et al.* (1977) and Saini *et al.* (2007) also observed improvement in the level of milk production in diaphragmatic hernia corrected animals after surgery.

These lactating animals (group 2) came in estrus after a

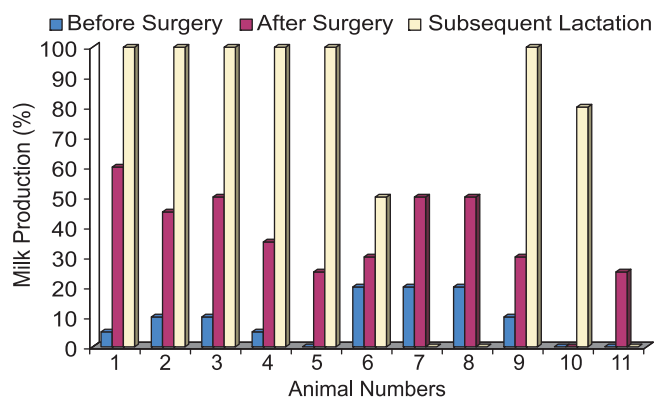


Fig. 1. Level of milk production in lactating animals before and after surgery (Animal numbers 7, 8 and 11 were culled before the start of subsequent lactation).

mean period of 4.77 ± 0.68 months of surgery and conceived after 1 or 2 inseminations. Evidence of onset of estrus, in the present study, also indicated improvement in health and endocrine status of the animals after surgery. Majority of the animals (7 buffaloes; 1 cow) in group 2 conceived and delivered healthy calves without any complications. Three buffaloes developed long term complications. Two buffaloes from this group had recurrence of diaphragmatic hernia after 7 and 9 months of surgery. History revealed no known trauma in these animals. One buffalo developed incisional hernia at the post-xiphoid region after 5 months of surgery (Table 2). Earlier this animal also had abscessation and swelling at the

Table 2. Detailed follow up of lactating bovine operated for diaphragmatic hernia

Animal no.	Species and age	Duration of calving	Estrus and conception	Calving and calf health	Complications, if any
1.	Cow, 5 years	6 week	Estrus after 3 month of surgery and conceived	Calving at full term with healthy calf	Nil
2.	Buffalo, 4 years	8 week	Came in estrus after 3¼ month of surgery but not conceived. On next estrus at 4 month conception occurred	Calving at full term with healthy calf	Nil
3.	Buffalo, 6 years	2 weeks	Estrus after 9 M of surgery and conceived	Calving at full term with healthy calf	Nil
4.	Buffalo, 6 years	2 weeks	Estrus after 3 month of surgery and conceived	Calving at full term with healthy calf	Nil
5.	Buffalo, 8 years	3 weeks	Came in estrus after 3½ month of surgery but not mated. On next estrus at 4 ¼ month, conception occurred.	Calving at full term with healthy calf	Nil
6.	Buffalo, 5 years	6 week	Estrus after 12 month of surgery and conceived	Calving at full term with healthy calf	Poor health condition
7.	Buffalo, 6 years	8 week	Estrus after 5½ month of surgery	Not recorded	Recurrence of diaphragmatic hernia after 7 month of surgery (culled)
8.	Buffalo, 7 years	2 weeks	Came in estrus twice, mated but not conceived	Not recorded	Recurrence of diaphragmatic hernia 9 month of surgery (culled)
9.	Buffalo, 7 years	18 weeks	Estrus after 9 month of surgery and conceived	Calving at full term with healthy calf	Nil
10.	Buffalo, 7 years	52 week	First estrus observed at 4 month of surgery but not mated. On next estrus it was mated and conceived	Calving at full term with healthy calf	Poor health condition and diarrhea
11.	Buffalo, 5 years	4 week	Came in estrus after 4½ month but not mated	Not recorded	Ventral hernia after 5 month of surgery (culled)

affected site. In group, 7 buffaloes and 1 cow survived disease free, gave birth to 8 healthy calves at full term and produced milk yield 91.25% that of normal. Earlier reports also described recurrence of diaphragmatic hernia and its successful surgical management using autologous skin graft (Kumar *et al.* 1979). But, in the present study, owner of the animal did not agree for the surgery again.

From the present study, it was concluded that after diaphragmatic herniorrhaphy majority of the pregnant and lactating buffaloes and cows could achieve their production and reproduction performance without any significant surgery-related complications. Pregnant bovines operated for diaphragmatic hernia are not predisposed to recurrence of diaphragmatic hernia during subsequent calving.

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