



## Prevalence of hernia and evaluation of herniorrhaphy in calves

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### ABSTRACT

The present study was conducted on 30 calves affected with umbilical hernia at Veterinary Teaching Hospitals, Bangladesh Agricultural University (BAU), Mymensingh. The calves were divided into 2 groups; group-I (n=15) and group-II (n=15) to study the comparative efficacy of open and close method of herniorrhaphy for the correction of umbilical hernia. Out of these 30 calves, 8 were indigenous and 22 were crossbred and their ages ranged from 3 days to 6 months. Nineteen of the experimental animals were male and 11 were female. The effect of age, sex, breed and season on the occurrence of umbilical hernia in calves was investigated. Calves of 1-3 months age group demonstrated the highest incidence (46.67%) while those of 3-6 months the lowest (23.33%). Umbilical hernia occurred mostly in male calves (63.33%) as compared to their female counterparts (36.67%). The cross bred calves were predominantly (73.33%) affected as compared to the indigenous (26.67%). Umbilical hernia was the most prevalent in the summer (53.33%) and the lowest in the rainy (20%). The recovery rate of umbilical hernia with close herniorrhaphy (93.33%) was better than that with open herniorrhaphy (66.67%). Complication and recurrence rate was significantly higher ( $p < 0.05$ ) in open herniorrhaphy than those of close herniorrhaphy, although average recovery period was higher in close herniorrhaphy. Shorter operation time and excellent healing rate were found in calves treated with closed herniorrhaphy. These findings suggest that the closed herniorrhaphy is better than the commonly-used open method for the correction of reducible umbilical hernia in calves.

**Key words:** prevalence, hernia, herniorrhaphy, open method, closed methods, calves.

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### INTRODUCTION

Congenital disorders in calves have been increasing alarmingly with the increase of crossbred animals. Umbilical hernia, atresia ani and umbilical abscess are among the major congenital disorders causing mortality in calves. A hernia is a protrusion of the contents of a body cavity through a weak spot of the body wall. This may be from accidental or a normal anatomical opening, which does not completely fulfill its physiological function. It is a common defect in calves (Muller et al., 1988). Congenital umbilical hernias are of concern for heritability, although

many umbilical hernias are secondary to umbilical sepsis. Multiple births and shortened gestation lengths are two important risk factors for congenital umbilical hernias in calves (Herrmann et al., 2001). These are probably the result of a polygenic threshold character, passively involving a major gene whose expression is mediated by the breed background. Sire and umbilical infections are associated with risk of an umbilical hernia in calves during the first 2 months of life (Steenholdt and Hernandez, 2004). The frequency of umbilical hernia in the progeny of males ranging from 1-21% is consistent with the hypothesis that enhancer is the carrier of major dominant or co-

dominant gene with partial penetrance for umbilical hernia (Ron et al., 2004). In cattle, large umbilical hernias are seen with an average frequency of 4-15% (Virtala et al., 1996).

There is no data concerning comparison between the open and closed methods of herniorrhaphy in calves. Genetic or environmental factors or their interactions cause congenital defects, and these anomalies are abnormalities of structure or function present at births (Leipold et al., 1983). Umbilical hernia is one of, the major congenital affections in animals particularly in the bovine. It also occurs in foals and pups (Priester et al., 1970). In cattle the condition is comparatively more frequent in Holstein-Friesian breed (Zhigachev, 1983). Congenital defects and disorders of domestic animals cause considerable economic loss to farmers. Improper closure of the umbilicus at birth due to maldevelopment or hypoplasia of the abdominal muscles has been found to be associated with -umbilical hernia in calves (Singh et al., 1989). The acquired umbilical hernia occurs primarily due to manual breaking or resectioning of the cord close to the abdominal wall.

This congenital defect may be dangerous if not treated in appropriate time. The affected calves may only be salvaged through successful herniorrhaphy. Many factors e.g., suture materials, suture pattern, degree of protrusion; body circumference, ring diameter etc. determine the success of herniorrhaphy (Peacock and Van Winkle, 1976). Suture materials are selected on the basis of their physical and biological properties, condition of the wound and healing characteristics of the tissue to be opposed. Polypropylene is one of the potent secured knotable, flexible synthetic nonabsorbable suture materials frequently used in human practice. There is a lack of information, based on a large number of cases, on which to develop a rationale for the selection of specific surgical and nonsurgical techniques for the management of various types of umbilical hernias. Horizontal mattress and purse string suture patterns with catgut and silk are widely practiced in Bangladesh (Rahman et al., 2001). The modified suture pattern (myomattress) is an overlapping suturing technique that provides adequate support to the suture line (Knecht et al., 1987). If the degree of protrusion, body

circumference and ring diameter of hernial swelling are large, appropriate suture material and pattern is to be needed to close the hernial ring (Wion, 1957). Postoperative complications like stitch abscess, hemorrhage, myiasis, peritonitis, recurrence etc. may be observed (Fretz et al., 1983). Once recurrence occurs, the prognosis is not satisfactory in maximum cases, which ultimately leads to death of the animal.

Several methods for hernial treatment have been described. Ligation of the hernial sac, use of clamps, suturing of the hernial sac and radical operation are normally performed to correct the umbilical hernia, although open herniorrhaphy is the most common method of veterinary treatment (O'Connor, 1980). Despite its common use, open method of herniorrhaphy has many demerits especially bacterial infection that might cause recurrence of hernia. Whether closed herniorrhaphy can minimize these postoperative complications is unclear, although for an irreducible umbilical hernia there is no choice other than open herniorrhaphy. Considering the above facts the present study was initiated with the aims to a) determine the effects of age, sex, breed and season on the occurrence of umbilical hernia in calves, b) to record the information about degree of protrusion, circumference and ring diameter of the umbilical swelling, c) to observe the complications of umbilical hernia after herniorrhaphy and b) to evaluate the postoperative efficacy of closed and open methods of herniorrhaphy used for the treatment of reducible umbilical hernia in bovine calves.

## MATERIALS AND METHODS

### Animals

The present study was carried out on 30 calves affected with umbilical hernia presenting to the Veterinary Teaching Hospital, Bangladesh Agricultural University, Mymensingh, Bangladesh from July 2013 to July 2014. The calves were randomly classified into two groups; group-I (n=15), group-II (n=15), which were treated by open and closed herniorrhaphy, respectively. These animals were apparently healthy other than the herniation. Out of 30 calves affected with umbilical hernia, 8 were indigenous (local) and 22

were crossbred. Nineteen of the experimental animals were male and 11 were female. Ages ranged from 3 days to 6 months and body weights from 20 to 45 kg. History of the cases, size of the hernial rings, type of surgical repair of the hernias, presence of adhesions, postoperative care were recorded and follow-up of the cases, which were achieved by direct contact phone conversation with the owners. Various clinical parameters were recorded prior to operation and at different postoperative periods. The values recorded before operations were considered as control and these values were compared with the experimental values obtained at different postoperative days.

### **Clinical examination of calves**

#### **Diagnosis of hernia**

A preliminary diagnosis was made from the history and by palpation of the umbilical region. Diagnosis of the cases, however, was confirmed by exploratory puncture of the navel swelling and demonstration of intestinal contents. Detection of hernial ring with the index ringer also aided diagnosis.

#### **Reducibility**

The affected animal was placed in dorsal recumbency and the contents were pushed back into the abdomen. In case of reducible hernia, the contents went back to the abdominal cavity and the hernial ring became evident.

#### **Measurement of hernial swelling**

The protrusion of hernial swelling was the length from its neck to the fundus and was measured in cm with a measuring scale. Circumference of the swelling was taken at the level of its body and was measured in cm with a measuring tape. The diameter of the hernial ring was measured after blunt dissection of the abdominal muscle during operation. If the measurement of the ring was found to be below 3 cm, the calf was then subjected to perform closed herniorrhaphy.

#### **Monitoring of clinical parameters**

Respiratory rate, heart rate and rectal temperature were recorded prior to surgery and thereafter 3<sup>th</sup>, 7<sup>th</sup> and 10<sup>th</sup> post-operative day.

### **Techniques of herniorrhaphy**

#### ***Preparation of the patient***

Keeping the calf off-feed prior to surgery is very important especially when dealing with a large hernia. Typically, hay is restricted for 36 hours, grain for 24 hours and water for 12 hours. On very large hernias, the hay can even be restricted for 48 hours. With this off feed protocol, even very large hernias can be surgically repaired. Preoperative antibiotic (PPG) and NSAID (Flunixin) are mandatory. The animal was placed on the operation table in dorsal recumbency and was restrained physically by the assistants. The operation site was clipped, shaved and draped using sterile surgical towel. The site was finally painted with tincture of iodine.

#### ***Anaesthesia***

Diazepam (Sedil 2%; Square Pharmaceuticals, Bangladesh) at a dose rate of 0.4 mg/kg was administered intramuscularly. Later, 7 ml of 2% lignocaine hydrochloride (Jasodaine® Jason Pharmaceuticals Ltd., Dhaka, Bangladesh) was infiltrated in an inverted 'V' shaped manner from cranial to caudal aspect of hernial ring (Klein and Firth, 1988).

#### ***Surgical treatment***

Surgical treatments of hernia were performed by open and closed techniques. In calves, because of the rate of adhesions and infection of internal structures, the open technique was performed otherwise closed technique was applied (Sutradhar et al., 2009).

#### ***Suture materials***

Chromic catgut (Surgigut®, Huaiyin Medical Instruments Co. Ltd., China) no. 2 were used. The skin edges were closed by horizontal mattress suture with nylon thread in a simple interrupted suture pattern.

### Postoperative management

This consisted of a course of antibiotic for 5 days. The skin stitches were removed within 10 - 12 days after operation in open herniorrhaphy and after 2-3 weeks in case of close herniorrhaphy. The animals were kept under supervision for a month to observe any complication if there was any. Each animal was treated postoperatively with penicillin-streptomycin at a dose rate of 30,000 IU/kg for the penicillin and 10 mg/kg streptomycin for 5 days.

### Statistical analysis

All values of hernial distribution related to age, sex, outcome of herniorrhaphy with or without complication and recurrence were reported as a percentage for each group. Fisher's exact test was used for comparisons between groups. Differences between groups were considered as significant whether  $p < 0.05$ . Data analysis was performed using SPSS 11.5 software (SPSS, USA).

## RESULTS AND DISCUSSION

### Effects of age and sex

Among 30 affected calves, 63.33% were male and 36.67% were female. The effect of age and sex on the occurrence of umbilical hernia in calves is presented in Table 1. In male animals, the highest incidence (26.67%) of the disease occurred in calves of 1-3 months old while the lowest incidence (16.67%) was observed in calves of 3-6 months.

Table 1  
Effects of age and sex on the occurrence of umbilical hernia in calves.

Age	Occurrence of umbilical hernia		
	Male	Female	Total
< 1 month (n=9)	20%	10%	30%
1-3 month (n=14)	26.67%	20%	46.67%
3-6 month (n=7)	16.67%	6.67%	23.33%
Total (n=30)	63.33%	36.67%	100%
P & Level of significance	0.64 NS		

The highest incidence (20 %) of the disease in the female was also recorded in 1-3 months age group which is similar to the male calves. The lowest incidence (6.67%), however, was observed in calves 3-6 months of age. Considering different age groups, the highest incidence (46.67%) was found in 1-3 months age group while the lowest incidence (23.33%) was observed in 3-6 months age group.

The prevalence of an open hernial ring in the first week of life can vary between 18-24% depending on the farm sampled (Herrmann *et al.*, 2001). The results of the present study indicate that congenital umbilical hernias in calves appear just after birth. The genetic influence on the incidence of congenital umbilical hernia has been suggested in previous studies (Herrmann *et al.*, 2001). In addition to heredity, the etiology of an umbilical hernia may be an umbilical infection or abscess (Gadre, 1989).

In our study, almost all calves > 1 month old showed a history of umbilical infection early in life. Very similar results were reported in another study, in which sire and umbilical infection were closely associated with umbilical hernia (Steenholdt *et al.*, 2004). Umbilical infection may result in weakening of the adjacent abdominal wall and cause an acquired umbilical hernia. Presently, the incidence of hernia was highest at 1-3 months of the umbilical infection. Nearly identical results were reported in another study, in which umbilical hernia occurred most often at an average age of 6.7 weeks after birth (Virtala *et al.*, 1996).

The overall incidence of congenital umbilical hernia was 1.8%. A significant influence on incidence was exerted by the sex of the calf, the occurrence of multiple births (Herrmann *et al.*, 2001). Calves, between 1 and 3 months were most frequently affected with umbilical hernia. This observation is agreeable to earlier reports (Field, 1988, Gadre *et al.*, 1989, Rahman *et al.*, 2001). Chuang *et al.* (2000) reported that the disease is more prevalent in calves of below 1 month. In Bangladesh diagnosis of the affection may be delayed because animals are reared in backward system and owners are either ignore or have less interest for their management.

Gender had an effect on the incidence of umbilical hernia in this study. Males showed a higher incidence than females (19 vs. 11, respectively). Similar findings have been reported previously (Herrmann *et al.*, 2001). The results of an open herniorrhaphy were more complicated in the male calves because of the proximity of the penis to the umbilicus, which made it harder to maintain the postoperative bandage than in female calves. Contamination by urine may also contribute a postoperative complication. Umbilical hernia occurred predominantly in male calves (63.33%) as compared to their female counterparts (36.67%). This finding is agreeable with those of Das and Hashim (1996) and Rahman et al. (2001) but contradictory to Brem et al. (1985) and Singh et al. (1989) who indicated females to be more susceptible to umbilical hernia than males. Higher prevalence in males may be due to large swelling at umbilical region for preputial sheath. During development of such large preputial sheath, the ventral abdominal wall may not be properly developed and leads to the formation of hernial ring before birth (Rahman et al., 2001). Navel infection in the male is also more frequent due to continuous moistening by urine.

### Effects of breed

The effect of breed on the occurrence of umbilical hernia in calves is shown in Table 2. Out of 30 affected calves, 8 were indigenous and 22 were cross bred and the incidence was 26.67% and 73.33% respectively. Among the indigenous calves 16.67% were male and 10% female while these values in the cross-breds were 46.67% and 26.67% respectively. The hernia has been reported to be hereditary in origin and occur due to one or more pair of autosomal recessive genes more predominantly found in Cross bred animals (Angus and Young, 1972; Hayes, 1974; Baird, 1993). The higher incidence in cross bred calves may be due to preference of owners to inseminate their cows with these breeds. Pure Holstein cattle and the offspring of Holstein X indigenous cross are more likely to suffer from this congenital defect than the indigenous breed (Hayes, 1974; Kohli, 1999).

Table 2

Effects of breed on the occurrence of umbilical hernia in calves.

Breed	Occurrence of umbilical hernia		
	Male	Female	Total
Indigenous (n=8)	16.67%	10%	26.67%
Cross (n=22)	46.67%	26.67%	73.33%
P & Level of significance	0.752 NS		

### Effects of season

The disease was found to occur throughout the year (Table 3). Incidence of umbilical hernia was higher (53.33%) in the summer (February-May) whereas; the lower incidence (20%) was recorded in the rainy season (June- September). This observation was agreeable with earlier reports (Dehoux, 1992, Samad et al., 2002). Various indigenous grasses amply grow in the summer season and the cattle widely graze or are fed these fodder. Feeding of these grasses might explain the increased nutrition level, resulting increased conception rate. As a result, the calving rate is increased at the end of winter. This might contribute to the increased incidence of umbilical hernia in the summer season.

Table 3

Effects of season on the occurrence of umbilical hernia in calves.

Season	Occurrence of umbilical hernia		
	Male	Female	Total
Winter (October-January)	16.67%	10%	26.67%
Summer (February-May)	33.33%	20%	53.33%
Rainy (June - September)	10%	10%	20%
P & Level of significance	0.347 NS		

The highest incidence (53.33%) of umbilical hernia was in the summer season while the lowest incidence (20%) was found in the rainy season. The incidence of the disease in the winter season was 26.67%.

## Physical measurements of umbilical hernia in calves

### Swelling measurement and ring diameter

The body circumferences of the umbilical swelling are presented in Table 4. Mean body circumference of the umbilical swelling in the group-I calf was 17.72 cm in contrast to group-II calves where this value was 13.99 cm. These values were statistically significant ( $p < 0.05$ ). The diameters of the hernial ring are presented in Table 4.4. The diameter of hernial ring was 4.74 cm in group-I calf while that in the Group-II calves was 2.41 cm. These values were statistically significant ( $p < 0.05$ ).

Table 4  
Physical measurements of umbilical hernia in calves.

Group	Swelling measurement (cm)	Ring diameter (cm)
Group-I (n=15)	17.72 ±0.63	4.74 ±0.26
Group-II (n=15)	13.99±0.33	2.41±0.08
Level of significance	P<0.05	P<0.05

± = Standard error

The degree of protrusion, body circumference and ring diameter of umbilical swelling were significantly higher in group-I calves than those of

Table 5  
Comparison between open and closed method of herniorrhaphy.

Techniques	Recovery without complication (%)	Recovery with complication (%)	Recurrence (%)	Average recovery period (day)
Open herniorrhaphy (group- I)	66.67±.15	26.67±.22	6.67±.13	11.47±0.34
Closed herniorrhaphy (group-II)	93.33±.07	6.67±.22	0.00±.01	23.01±0.63
Level of significance	NS			

Other complications included abscess, inflammatory swelling, accumulation of serous fluid, secondary bacterial infection, which were higher in group- I than in group-II. Healing rate with minimum complications was better in group-

group-II calves. The increased degree of protrusion, body circumference and ring diameter of umbilical swelling in group-I calves are not available in literature. However, this may be due to ignorance of farmers who tend to bring their patients to the hospital at the advanced stage of the disease. Fretz et al., (1983) found that most patients affected with umbilical hernia were less than 6 months old. The diameter of hernial ring in the present study ranged from 2 to 8 cm. This finding is also agreeable with the previous reports (Muller et al., 1988, Chaung et al., 2000).

### Evaluation of both open and closed methods of herniorrhaphy

Umbilical hernia was corrected by both open and closed methods of herniorrhaphy in calf. Horizontal mattress sutures were used to close the hernial ring in open herniorrhaphy after exposing the skin. Vertical mattress sutures were used in closed methods of herniorrhaphy in calf.

Out of 30 clinical cases, 15 were treated by the open method of herniorrhaphy (group-I) and 15 were treated by the closed method (group-II). Recurrence rate of hernia in group-I animals was 6.67%. Hernia recurred in one calves treated with open herniorrhaphy within 2 weeks with swelling and muscular weakness at the site of operation. In group I, complication occurred in four calves one week later with swelling, myiasis and stitch abscess at the site of operation.

II than in group-I with minimum complications, although swelling was totally absent after the open method of surgery. In most cases treated with closed methods of herniorrhaphy, healing was completed within 3 weeks of surgery. The healing

was smoother and shorter in duration among young female calves than in older of male calves. Delayed healing was common in male calves in both treatment groups.

On admission in the hospital, the hernia affected calves were apparently bright and active. Had a good appetite, normal heart and respiratory rate and rectal temperature. Similar observations have been reported elsewhere (Freeman et al., 1988; Kumar, 2001). In the present study, heart and respiratory rates underwent slight increase at different days after herniorrhaphy. Similar results have been reported earlier (Yeasmin, 1992). Slight increase of rectal temperature was recorded up to the 3rd day of operation. This parameter then returned to normal level well before healing. Postoperative elevation of rectal temperature may be associated with surgical trauma and thereafter due to acute inflammation (Saini et al., 1992, Mattra, 2004). Hernia size varies depending on the extent of the umbilical defect and the amount of abdominal contents contained within it. Umbilical hernias are the most common birth defects in calves, especially in Holstein-Friesians (Steenholdt and Hernandez, 2004). The etiology of umbilical hernias likely has a genetic component (Masakazu, 2005); however, excess traction on an oversized fetus or cutting the umbilical cord too close to the abdominal wall are other possible causes. Many umbilical hernias are secondary to umbilical sepsis (Steenholdt and Hernandez, 2004). They may occur as isolated defects or may be associated with defects of other parts of the body (Dennis and Leipold, 1968).

Open method of herniorrhaphy is always indicated for older calves when adhesion or abscess is commonly associated with umbilical hernia (Horney and Wallace, 1984). Herniorrhaphy can be done by simply closing the abdominal wall with a horizontal mattress pattern of stitches using absorbable or non-absorbable sutures (Pugh, 2002). In the current study, the size of the hernial rings was > 1 cm in each case. Herniorrhaphy was carried out using horizontally interrupted stitches with chromic catgut and sometimes nylon or sterilized silk for open method, and double layer of nylon thread for the closed method of herniorrhaphy. If the hernial ring is more than one finger in size or persists for more than 2 to 3

weeks, then surgical intervention is indicated (Pugh, 2002).

Treatment by closed herniorrhaphy appeared to be a more satisfactory (80%) regimen for reducible umbilical hernia in calves, although a better result was found in the early fixing of hernial rings, consistent with other observations (Masakazu, 2005). Ready contact with the floor and licking by the cows may increase the risk of susceptibility of infection in open herniorrhaphy. The sutures in closed methods of surgery help to promote adhesion by cicatrization between the surface in contact and consequent closure of the hernial orifice. In this study we found splendid closure of the hernial ring after close method of herniorrhaphy.

Although general anesthesia is commonly used in cattle, there are some risks with its use. Local or regional anesthesia is safe and effective and is still the most desirable procedure in many situations (Edmondson, 2008). The present study indicates that local infiltration anaesthesia with or without tranquilization may be quite sufficient for performing the surgical repair. Diazepam (0.4 mg/kg) was used intravenously as a tranquilizer in this study, which was cheap in comparison with xylazine and also produced satisfactory results. Infiltration local anaesthesia with 2% lidocaine was also satisfactory for anaesthesia of the umbilical region. Positioning on dorsal recumbency of the animal on a surgical table was found to be important to facilitate reduction of the hernial contents and herniorrhaphy. This recumbency was also suitable for closed herniorrhaphy or during suturing.

In this study, both the absorbable (catgut) and non-absorbable (silk/nylon) suture materials were used to correct the umbilical hernia. Absorbable sutures were used for comparatively young calves, whereas silk was used with older calves to increase protection. The effects of suture materials and type of hernias were not considered in our study because they have no effect on the outcome of surgical treatment (Al-Sobayil and Ahmed, 2007). Better healing and less complication were found in calves treated with the closed method of herniorrhaphy. The results of this study suggest that closed herniorrhaphy may be a suitable and

satisfactory choice of surgical treatment for the reducible umbilical hernia in bovine calves provided the hernial ring is narrow (usually below 3 cm in diameter).

### **Post operative complications and their management**

Out of 30 operated calves, only 33.34% recovered with minimum complications and (6.67%) cases recurred. The affected stitches were removed and dressed regularly. The recurred cases were again taken under operation. All these animals recovered without any further complication.

### **CONCLUSIONS**

Umbilical hernia occurred mostly in calves of 1-3 months age group. The prevalence of umbilical hernia is more common in male calves than that in female calves. The higher incidence of umbilical hernia is encountered in the cross bred calves in contrast to indigenous calves. This disorder is more prevalent in the summer season. No bull having suffered from umbilical hernia should be used for breeding purpose, as these might transmit the autosomal recessive gene responsible for congenital defects. Better healing and less complication were found in calves treated with the closed method of herniorrhaphy. The results of this study suggest that closed herniorrhaphy may be a suitable and satisfactory choice of surgical treatment for the reducible umbilical hernia in bovine calves provided the hernial ring is narrow (usually below 3 cm in diameter).

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