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A study on the prevalence of umbilical hernia in calves in and around Gondar Town, North Gondar, North West Ethiopia

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Abstract

The five years retrospective data from 2008-2012 and cross sectional study from November 2013-April 2014 were conducted in and around Gondar town to determine the prevalence of umbilical hernia in calves and to study the post-operative complications and their management. In a cross sectional study a total of 390 calves of different breed, sex, age and management system were selected by simple random sampling method and physical examination was done by palpation to identify the presence or absence of hernial ring at the umbilicus region. Of these calves only 12 has revealed clinically positive for umbilical hernia with an overall prevalence of 3.1%. Herniorrhaphy was conducted to correct the hernia cases based on the willingness of the owners. Out of 12 calves subjected for radical surgery 2 calves showed post-surgical complication. The risk factors; Age ($\chi^2=4.742$, $p= 0.042$) and management system ($\chi^2=11.891$, $p=0.003$) was found statically significant ($p<0.05$). However Sex ($\chi^2= 0.00$, $p= 1$) and breed ($\chi^2=0.979$, $p=0.522$) did not show statistically significant difference ($p>0.05$) among the risk factors. The five years retrospective data indicated that from a total of 1631 recorded cases, 16 (0.98%) was umbilical hernia, Majority of these were cases recorded during the years 2009/2010 (1.31%). The etiology of umbilical hernias likely has a genetic component; however managerial problems like excess traction on an oversized fetus or cutting the umbilical cord too close to the abdominal wall are other possible causes. Awareness should be created among the society about calf management during and after birth and cases of hernia should be treated seriously and promptly.

Keywords: Calf, Gondar, Herniorrhaphy, Prevalence, Umbilical hernia

Introduction

A hernia is the protrusion of abdominal contents through an opening in the body wall. In calves, the most common form of congenital hernia is the umbilical hernia where portions of the abdominal contents protrude out through the natural opening in the ventral abdomen left by the umbilicus (Smith, 2009) ^[15]. Umbilical hernia commonly present to veterinary clinics, which are normally secondary to failure of the normal closure of the umbilical ring, and which results in the protrusion of abdominal contents into the overlying subcutis. The herniated contents may also become very voluminous so that they cannot be reduced causing incarcerated hernia. Both strangulated and incarcerated hernias are life threatening conditions (Radostits *et al.*, 2007) ^[12]. Radical surgery is the treatment of choice in the vast majority of symptomatic or asymptomatic umbilical hernias and is one of the most common surgical procedures performed (Chavez *et al.*, 2012) ^[2]. Effective Surgical treatment depends on good pre-planning based on an understanding of the encountered lesions (Paul, 2006) ^[11].

The economic impact of umbilical hernia includes the cost of medical, surgical treatment and the loss in calves in breeding animals. It has been generally accepted that umbilical hernia is inherited in a dominant or in a recessive mode. Some studies have found the risk of hernia was higher in some breeds, the incidence being much higher in Holstein cattle than other breeds. However, factors other than genetic may be important, for example many veterinarians have observed that umbilical infection commonly leads to umbilical hernia by slowing of closure of the umbilicus. Further, it is unlikely that the responsible genes are sex linked having greater incidence in females (Radostits *et al.*, 2007) ^[12].

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Infection of the umbilicus or umbilical cord remnants often occurs in a neonatal period as a result of environmental contamination. Common bacteria's isolated from umbilical infections in calves includes *Arcanobacterium pyogenes* and *Escherichia coli* (Gilbert and Fubini, 2004) [4].

The umbilicus is the remnant of the fetal-maternal connection. Prior to birth, the umbilical vein serves as the source of oxygenated blood to the fetus. The paired umbilical arteries are branches of the internal iliac artery and carry waste materials and blood to the placenta (Rings, 1995) [14].

Depending on the size of the hernial ring, omentum, abomasum, intestine, or in combination of these may be inside the hernial sac, longstanding hernias are more likely to develop adhesions between these abdominal structures and peritoneum (Hylton and Trouseaux, 1985) [6]. Umbilical abscesses can result from inflammation of any of the umbilical structures, drainage from the umbilical stalk, although confirming abscess formation, does not identify which of the umbilical structures are involved (Herrmann *et al.*, 2001) [5].

Developing a consistent approach to evaluation of a calf with an umbilical mass can help ensure accurate diagnosis. A palpation of the mass in the standing calf is the first and often only steps necessary for evaluation. Simple hernias in calves are reducible which usually non-inflammatory. Therefore, the swelling associated with a hernia should be cool, non-painful and lack evidence of drainage. Reduction should allow palpation of a distinct hernial ring in the body wall. Large hernias may be difficult to reduce in the standing calf. If there is any doubt about the reducibility, the calf should be cast in lateral or dorsal recumbency and palpation repeated (Awad *et al.*, 2008) [1].

The swelling represents an active infection; the swelling will be non-reducible and will often have the characteristic signs of inflammation. Signs of inflammation may be less evident if the infection is chronic with a thick fibrin capsule or has drained well recently to leave a fibrotic cord, however, the swelling will still be non-reducible. It is important to recognize that umbilical hernias and infections commonly coexist in calves (Mawera and Muguti, 1994) [10].

Ethiopia has largest population, with estimated 49.3million cattle, 46.9million sheep and goats, 7.55 million equines and 2.3 million camels in Africa. However, the contribution from these huge resources to national income is disproportionately small, owing to several factors such as drought or malnutrition, management problems, poor genetic performance and prevalence of livestock diseases (Gilbert and Fubini, 2004) [4]. In Ethiopia despite many efforts tried to study the prevalence of infectious and other parasitic diseases in calves in the country, hernia has been given lesser attention to treat as a separate health problem. This holds true in and around Gondar except some efforts done to assess and record traumatic hernia problems in University of Gondar veterinary clinic and Gondar town veterinary clinic case book. Therefore, the objectives of this study were to study the prevalence of umbilical hernia, post-operative complications and their managements in calves.

Materials and methods

Study area

The study was conducted in and around Gondar town, at Amhara regional state of Ethiopia. Gondar town is located 740Km Northwest part of Addis Ababa. The elevation of the area is about at latitude of 12 04'North, longitude of 27 02' east and the altitude range between 1800-2500 m.a.s.l. The

climate of the region is somewhat warm with mean annual temperature of 20.5 c (17.2-23.9 c) and mean annual rainfall of about 1000mm (600-1400mm). The region receives a bimodal rain fall, the average annual precipitation rate being 1000 that comes from the long and short rainy seasons. The short rainy season occur during March, April, and May, while the long one extends from June through September. The production system observed around the areas is cereal based agricultural activities and livestock farming activities.

Study population, sample size determination and sampling methods

The study was conducted on calves younger than 12 months old in the stated area from November 2013 –April 2014 with respect to their age, sex, and breed and management system. Simple random sampling were used to select the study animal in each farm and sampling also occur in calves that comes to Gondar university veterinary clinic with their dam and for other health problem. Since there was no similar work done in the area the required sample size for this study is calculated by the formula of

$$n = \frac{1.96^2 * p_{exp} (1 - p_{exp})}{d^2} * 100$$

Described by Thresfield + (2005)

Where: n=required sample size

P_{exp}=expected prevalence

d=desired absolute precision

Taking the expected prevalence as 50% because of the prevalence of the problem in this particular district is not known.

Therefore, the required sample size will be, $n = \frac{1.96^2 * 50 / 100 (1 - 50 / 100)}{0.05^2} * 100 = 384$ However to increase the level of accuracy of determining the prevalence the study sample size has been increased to 390.

Study design

Cross sectional study

Cross sectional study was conducted on calves of different breed, sex, and age and management system to determine the prevalence of umbilical hernia and to study the post-operative complications and their management.

Retrospective study

A retrospective data on the prevalence of umbilical hernia for the last five years was collected from the recorded case books available in University of Gondar and Gondar town veterinary clinic to compare it with cross sectional study.

Study methodology

Calves that came to Gondar University veterinary clinic and in different farms were diagnosed by close physical inspection for the presence of swelling like hernia, abscess, tumor, edema, cyst and hematoma in the umbilicus region. Up on palpation the presence of hernial ring at the base of the swollen part confirms the occurrence of umbilical hernia in which it is a characteristic feature of the real umbilical hernia in calves. Apart from this an exploratory puncture using sterile needle was conducted in few cases to aspirate and characterize the content of the swollen part on the body of animals.

For the retrospective study presence of umbilical hernia in calves from the last five years recorded clinic case book was counted and percent was calculated to determine the previous occurrence.

Data management and Analysis

All the data collected during the study period was checked, coded and entered in to Microsoft Excel spreadsheet and analyzed using SPSS software version 16. The prevalence of umbilical hernia was calculated as the number of positive samples divided by the total number of samples examined. Pearson’s chi- square (χ^2) was used to evaluate the association of different variables with the prevalence of umbilical hernia. P-value<0.05 (at 5% level of significance) was considered as statically significant.

Result

Cross sectional study

Out of a total 390 calves examined 12 were positive for umbilical hernia with an overall prevalence of 3.1 %. The relationship between breeds and umbilical hernia is provided in Table 1. The maximum prevalence was recorded in cross breeds (3.6%) while minimum prevalence was observed in local breeds (1.7%). There was no statically significant difference in the prevalence of umbilical hernia in cross and local breeds ($p>0.05$).

Table 1: Prevalence of umbilical hernia on basis of breed

Breed	No of calves examined	Hernia encountered	Prevalence (%)	X ² -value	P-value
Cross	275	10	3.6	0.979	0.522
Local	115	2	1.7		
Total	390	12	3.1		

The prevalence rate of umbilical hernia between different age group (≤ 5 months old) and ($>5-12$ months old) was also investigated. The highest prevalence was recorded in calves

below 5 months old (4.3%) than those from above 5 months old (0%) and there was statically significant difference between the study age groups in the prevalence rate ($p<0.05$).

Table 2: Prevalence of umbilical hernia on the basis of age group

Age group	No of calves examined	Hernia encountered	Prevalence (%)	X ² -value	P-value
≤ 5 months	282	12	4.3	4.742	0.042
$>5-12$ months	108	0	0		
Total	390	12	3.1		

In this study the prevalence of umbilical hernia in different management system also investigated. The prevalence was higher in calves at extensive management system (8.2%) than those from intensive (1.8%) and semi intensive (0%)

management systems. These difference in the prevalence of umbilical hernia in these three management systems is statically significant ($p<0.05$).

Table 3: Prevalence of umbilical hernia in different management system

Management system	No of calves examined	Hernia encountered	Prevalence (%)	X ² -value	P-value
Intensive	226	4	1.8	11.891	0.003
Extensive	98	8	8.2		
Semi-intensive	66	0	0		
Total	390	12	3.1		

The prevalence of umbilical hernia in female and male calves was equal; the values were 3.1%. This was not statically significant ($p>0.05$).

Table 4: Prevalence of umbilical hernia on the basis of sex

Sex	No of calves examined	Hernia encountered	Prevalence (%)	X ² -value	P-value
Male	129	4	3.1	0.00	1.00
Female	261	8	3.1		
Total	390	12	3.1		



Fig 1: Umbilical hernia in a calf-cases



Fig 2: Hernial ring after contents reduction



Fig 3: Closure of hernial ring by interrupted overlapping mattress sutures



Fig 4: Hernia site after surgical intervention and dressing

4.2. Retrospective study

From a total of 1631 calves examined 0.98% (16 of 1631) of

Table 5: Prevalence of umbilical hernia in calves during the last five years

Year of Record	No of calves examined	Hernia encountered	Prevalence (%)
2008/2009	332	2	0.6
2009/2010	304	4 were positive for umbilical hernia (Table 5)	1.31
2010/2011	351	3	1.2
2011/212	238	2	0.84
2012/2013	406	5	1.23

Post-operative complications and their management

In a cross sectional study out of 12 calves subjected for radical umbilical hernia surgery 2 calves showed post-surgical complications. One calf had little abscess around the incision after eight days of post operation and the wound was cleaned daily and dressed with povidone iodine. Another calf developed seroma on the fourth day post-surgery and 1 % povidone-iodine was used frequently for wound lavage and the calf became normal.

Discussion

The umbilicus in newborn calves consists of the urachus (a tube that attaches the fetal bladder to the placental sac) and the remnants of the umbilical vessels that transport blood between the fetus and its mother. Normally, just after birth these structures shrink until only tiny remnants remain within the abdomen (belly). If the area in the body wall through which these structures passed remains open, abdominal contents can protrude through the defect resulting in an umbilical hernia (Dennis *et al.*, 1997) [3]. The etiology of umbilical hernia likely has a genetic component (Herrmann *et al.*, 2001) [5]; 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. This may occur as isolated defects or may be associated with defects of other parts of the body (Steenhold *et al.*, 2004) [16].

The result of the present study indicated that there was a problem of umbilical hernia in calves in the study area. Which appear at the overall prevalence of 3.1% (12 of 390). Most of these cases were encountered in calves less than five months old with a prevalence of 4.3% but no hernia observed in calves above six months old (0%). This finding is in agreement with Jettennavar *et al.*, (2010) [7] that states a study conducted 18 commercial dairy farms in New York, 15% of heifer calves had umbilical hernias during the first 3 months of age.

In one study almost all calves greater than one month old showed history of umbilical cord infection early in life (Mazakazu, 2005) [9]. In a very similar report, umbilical infection was closely associated with umbilical hernia. The distribution of this hernia in calves by age and sex were accounts a value of 40% and 20.84% at a minimum age less than 2 and 4 week, and 20% and 8.34% at a maximum age greater than 8 weeks for female and male respectively which is in accordance with the findings of this study.

Breed difference in the occurrence of umbilical hernia was evident and the highest prevalence has observed in cross breeds (3.6%) than local breeds (1.7%). This finding was in agreement with Rings, (1995) [14], Steenhood and Hernandez, (2004) [16] who states that umbilical hernias are the most common birth defects in calves especially in Holstein Frisian breeds. The prevalence of hernia in the first week of life varies from 18-24% depending up on the farm sampled.

During this investigation there was equal occurrence of hernia on both sexes which was 3.1%. So sex has no effect on the prevalence of umbilical hernia. But this finding completely disagree with that of Mazakazu, (2005) [9] who observed that gender had effect on occurrence of umbilical hernia and female showed a higher incidence than male.

The result of this study, with respect to management system showed that prevalence of umbilical hernia was higher in calves at extensive management system (8.2%) followed by intensive (1.8%) and semi intensive (0%). This difference may be due to ignorance of farmers giving proper bedding to

calves after birth and contamination of umbilicus by different pathogenic organism. The risk factors; Age and management system was found statically significant ($p < 0.05$). However Sex and breed did not show statistically significant difference ($P > 0.05$) among the risk factors

As result obtained from retrospective study conducted in Veterinary clinics in and around Gondar town (Table 5), from a total of 1631 recorded calf cases, 16 cases were umbilical hernia (0.98%). Majority of these were cases recorded during the years 2009/2010 rather than other years. This variation might be most probably due to improper record management of cases on the clinic case book especially when there were huge numbers of animals treated per day or it may be due to lack of surgical instruments and trained personnel to handle the case at district veterinary clinics.

In the present study post-operative care was aimed to prevent surgical infection by correcting dehydration, acid-base and electrolyte disturbances and giving antibiotics after surgery. Intravenous fluids like Ringer's lactate and 5% dextrose in normal saline were also used to correct electrolyte loss and dehydration, as suggested by Kohli *et al.*, (1984)^[8].

With respect to post-surgical complications, one calf showed abscess and another calf developed seroma around the incision site, this may be due to improper handling of owners their calves after surgery and contamination of surgical wound by pathogenic organism from the surrounding environment, this is in accordance with Rebhun, (1995)^[13] who opined that the various conditions originating from contamination of surgical wound are localized abscess, seroma formation, wound dehiscence, peritonitis which have to be managed accordingly.

Conclusion and recommendations

The umbilicus in newborn calves consists of the urachus (a tube that attaches the fetal bladder to the placental sac) and the remnants of the umbilical vessels that transport blood between the fetus and its mother. Normally, just after birth these structures shrink until only tiny remnants remain within the abdomen (belly). Unlike to this umbilical hernia formed due to failure of the normal closure of the umbilical ring, and which results in the protrusion of abdominal contents into the overlying subcutis which varies in size depending on the extent of the umbilical defect and the amount of abdominal contents contained within. It causing in alteration of body function vary in severity from insignificant to lethal. In the present study calves of difference breed, sex, age and management system were examined and umbilical hernia case were encountered with an overall prevalence of 3.1%. Majority of the cause that could increase the likelihood of this happening were managerial problems like cutting off the umbilicus close to the body wall, excessive traction being applied to an oversized fetus during delivery and straining of the calf due to constipation or diarrhea.

From the above observations so far made the following recommendations are forwarded.

- Multiple dipping of the navels after birth with 70% iodine before it dries and calves should be well-bedded with material that keeps it both clean and dry.
- Awareness should be created among the farmers about calf management during and after birth and timely reference of umbilical hernia cases to hospitals for herniorrhaphy.
- Wide dissemination of information about neonatal care *i.e.* Ligation of naval cord, cutting excess length, cauterization and abdominal bandage must be taken.

- Short term training should be given to field veterinarians on surgical management of Umbilical hernia which has to be organized by University teaching hospitals.
- The effect of hernia and other surgical cases in animals should be further studied to know the magnitude of the problem.

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