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*Original article*

# Comparative evaluation of different techniques for herniorrhaphy in calves

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## Abstract

Umbilical hernia is one of the most common problems in young calves. This problem occurs in dairy sector as well as in the local farmers. Present study was conducted to compare outcomes of four different techniques of herniorrhaphy. Twenty four young calves (n=24) were divided in 4 groups (A, B, C, and D) which underwent four different surgical techniques. Group A underwent vicryl plus suture material and pants-over-west technique, Group B underwent mesh application with Dexon suture material by using simple interrupted suture pattern, Group C underwent closed method with Nylon No. 3 suture material by using vertical mattress suture pattern and Group D underwent clamp application method with Silk No. 2 suture material by using simple interrupted suture pattern. The result showed that mesh application method was comparatively better with respect to feed intake, body weight gain and healing time. There was no reoccurrence with non-significant hematological changes ( $p \leq 0.05$ ). It is concluded that mesh application method is safer than other three techniques and there are no systemic effects of this surgical intervention on calves' health.

**Key Words:** calves, mesh application, suture material, umbilical hernia

## Introduction

After birth, the umbilical structures could be infected and abscess formation of sub cutaneous tissues may develop. Umbilical infection develops via ascending route of infection from environment. After umbilical infection, symptoms such as pain during palpation, irreducible swelling and sinus discharge at umbilical region could be seen. If infection does not dissolve

through use of medication and drainage, surgical intervention becomes necessary. Surgery is performed to resolve the problem of umbilical hernia by removal of umbilical remnants. Umbilical hernia is a congenital defect that develops as a result of improper closure of abdominal muscles, umbilicus cutting near to abdominal wall, or asepsis of umbilicus. Risk factors include short length of gestation period as well as multiple births. For its closure, open method, clamp method and

sac ligation method are used. Recurrence rate has been reported higher in open method as compared to closed method (Marciniak et al. 2004). Hernia is the most common problem related to umbilicus. All breeds are susceptible to congenital disorders with inflammation at umbilical region (Hermann et al. 2001). Incidence rate of umbilical hernia is different and ranges from 6 to 14% among all hernias present in adults. Generally, the surgery of umbilical hernia is a common procedure. There are multiple mesh repair and suture techniques used in umbilical herniorrhaphy (Amaya et al. 2015). Various post-surgical problems occur in surgery of umbilical hernia (Kool et al. 2014). Umbilical hernia can be corrected by various surgical procedures. Circumferential bandage is one of the simple and an effective procedure to push back the hernial contents in abdominal cavity and closure of hernia ring. This technique is quite easy and can be applied in field cases. Its results can be compared to herniorrhaphy technique (Steenholdt and Hernandez 2004). Open method herniorrhaphy is most commonly used but it has some demerits. Economic cost regarding surgical and medical treatments decreases the inbreeding value of an animal. During surgery, there are various risks of stress with respect to anesthesia, tissue insult and immunological subjects. In some studies it has been suggested that hernia could be corrected by use of simple bandage around the abdomen. There are various advantages of open method as compared to different other techniques (Alibhai et al. 2009). It has been recorded that in large size hernias, closure is more difficult because of wound dehiscence, recurrence rate, and late or improper healing. Lack of proper healing was attributed to ischemia resulted from over-excision of soft tissues. In 1960s, prosthetic mesh was used first to repair ventral hernia. Different scientists described advantages of polypropylene mesh for treatment of anterior wall hernias. The successful repair of hernia depends on good elasticity of suture material and collagen accumulation which results in proper healing. Polypropylene mesh is inexpensive and strong with good tissue incorporation (Wilhelm et al. 2009). In most cases, location of hernia has been reported below or above the umbilicus through weak lineal alba. Females are reported as more prone to umbilical hernia. Different techniques are introduced to reduce recurrence rate. Mesh repair is more widely used and well accepted method for hernia repair (Anjum et al. 2014). According to European Hernia Society, the protrusion of abdominal contents in a pouch, either above or below 3 cm from the umbilicus is considered an umbilical hernia. From last decades, Prosthetic repair is one of the most popular hernia repair methods. Mesh repair is more accurate and precise with respect to proper repair, lower recur-

rence rate and less treatment and post-operative complications (Ergul et al. 2012). After surgical repair, complications can be diagnosed by ultrasonography which is an effective tool to identify abscess, incarcerated intestine and infected vessels (Crane et al. 2011).

## Materials and Methods

### Animals selection

The research was carried out in the Department of Veterinary Surgery and Pet Sciences Lahore during a period of 2019-2020 along with the collaboration of private and public institutes. Bovine calves (n=24) were selected including males and females and their age was ranging from 0 to 6 months. All calves having umbilical hernia were presented at various cattle farms, various Veterinary hospitals in Lahore and Kasur Districts. Cattle farms included both commercial and small holder's farms rearing exotic and local cattle breeds. Veterinary hospitals were including private clinics, government hospitals and university teaching hospitals in both districts. Animals presented at clinics or in the farms had umbilical hernia with a ring of abdominal muscles and contained abdominal contents such as intestines, omentum and fat tissues.

All the procedures were conducted according to the rules and regulations approved by the Ethical Review Committee (ERCULA), and Department of Veterinary Surgery and Pet Sciences, University of Veterinary and Animal Sciences, Lahore-Pakistan.

### Study design

The current study was conducted on twenty four cow calves, divided into four groups naming Group A, B, C and D. There were six animals in each group. Efficacy of different open and closed surgical methods for the repairing of umbilical hernia was compared. Cow calves affected with umbilical hernia were available at cattle farms and presented to various veterinary hospitals in Lahore and Kasur districts. Data about each calf with respect to case history, age, sex, breed, vital signs, body weight, size of hernia ring, size of hernia content/swelling, presence of adhesions and reducibility was collected. Furthermore, information related to birth and after birth management, nutritional management and housing conditions were also recorded.

### Surgical site preparation

Surgical site was prepared by clipping, shaving hair and scrubbing on required part of skin. Scrubbing was done using disinfectant surgical scrub pyodine iodine solution (Pyodine surgical scrub®). After scrubbing,

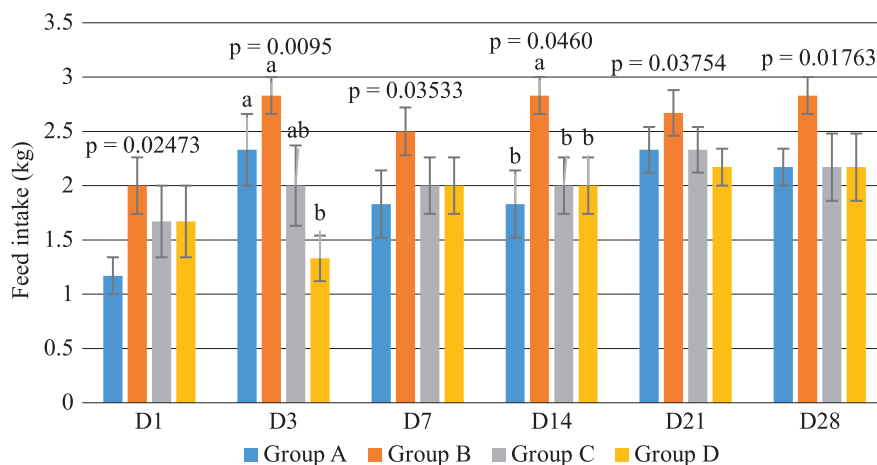


Fig. 1. Comparison of feed intake (kg) in Group A, Group B, Group C, and Group D of calves.

surgical site was covered with four surgical drapes to decrease the chance of contamination and the drapes were fixed using towel clamps. (Udegbumam et al. 2015).

### Positioning

The calves were positioned in dorsal recumbency for surgical intervention (Bellavance et al. 2010).

### Anesthesia to patients

Before starting surgery, diazepam was given intramuscularly to calves. Animal were anesthetized by Diazepam (Inj. Diazepam (Valium) 5mg/ml, Martin Down Pharmaceutical, Pakistan) at a dose rate of 0.4 mg/kg intramuscularly. Desensitization was done by 7 ml of 2% lignocaine (Lignosym, Symans Pharmaceutical, Pakistan) with local infiltration (Doijode 2019).

### Surgical techniques

Group A (n=6) was dealt with open method by using vicryl suture material. Group B (n=6) was dealt with hernioplasty by using Dexon suture material. Group C (n=6) was dealt with closed method by using nylon suture material and group D (n=6) was dealt with closed method by using silk suture material.

In group A (n=6), first of all, hernia contents were pushed back into abdomen by placing the animal in dorsal recumbency. Incision was made on the loop of lose skin at position of cranial to umbilicus. After that, a long incision directly over the hernial sac was made. Incision was increased with surgical scissor to open and access inside hernia sac. Displaced organ were put to their original anatomical location and the hernia sac was removed. Suturing was done to close sac with vicryl plus and suturing pattern was Pants-Over Vest. After that, closure of subcutaneous layer was done by using horizontal suturing patterns. The skin was

closed with silk no. 2 by using simple interrupted suturing pattern. In group B (n=6), prolene mesh was stitched with Dexon suturing material no. 2 by using vertical mattress suturing pattern. Sutures were attached on both sides of the muscle openings through which the hernia contents were protruded. In group C (n=6), sutures were applied in the skin with vertical mattress by using Nylon no.3 as a suture material. In group D (n=6), sutures were applied on the skin caudally with silk no. 2 suture material by using simple interrupted suture pattern.

### Statistical analysis

Results were analyzed using repeated measure ANOVA. A probability level of <0.05 was considered as statistically significant. Statistical analysis was done by SPSS version 20.00.

## Results

### Physical parameters recording feed intake of individual calves

The feed offered to calves was 70% of total feed intake (kg) to prevent disruption of suture line or wound dehiscence.

In feed intake observation, overall decrease was recorded in all groups. Statistical analysis of results showed that there was a significant ( $p \leq 0.05$ ) difference in all groups. Decrease in feed intakes continued up to 3 days in all groups then it returned to normal. Group B has lower variation in decreasing feed intake during the observation.

### Weight gain

In weight gain observation, initial decrease was seen in all groups. Statistical analysis of results showed

Table 1. Comparative mean±standard deviation of feed intake (kg) values in Group A, Group B, Group C, and Group D of calves.

Time period	Feed Intake (kg) in groups				p value
	A	B	C	D	
Day3	2.33±.81	2.83±.40	2.00±.89	1.33±.51	<0.05
Day7	1.83±.75	2.50±.54	2.00±.63	2.00±.63	
Day14	1.83±.75	2.83±.40	2.00±.63	2.00±.63	
Day21	2.33±.51	2.67±.51	2.33±.51	2.17±.40	
Day28	2.17±.40	2.83±.40	2.17±.75	2.17±.75	

Table 2. Comparative mean±standard deviation of the weight gain values in Group A, Group B, Group C, and Group D of calves by ANOVA test.

Time period	Weight gain (g)				p-Value
	A	B	C	D	
Day 0	49±9.69	50.33±8.77	41.17±3.97	41±4.94	<0.05
Day 7	49.33±9.85	52.17±8.97	42.83±5.49	41.83±4.79	
Day 14	50±9.42	54±9.03	43.33±6.12	42.33±4.84	
Day 21	50.67±9.68	57.33±9.83	44±5.51	42.67±4.80	
Day 28	51.17±9.32	59±9.81	44.83±5.45	43±4.94	

that there was a significant ( $p \leq 0.05$ ) difference in all groups. Decrease in weight gain continued up to 3 days in all groups. Then it returned to normal. Group B had lower variation in decreasing weight gain during the observation.

### Recurrence of umbilical hernia

The reoccurrence rate was observed in all groups except Group B. Group B was free from any reoccurrence.

### Healing time

The duration of healing in Group A, B, C and D animals was observed. The statistical analysis of all groups using repeated measure ANOVA had shown a significant difference ( $p \leq 0.05$ ). It was observed that group A is significantly different from all other groups. Group B showed a significant difference with Group A, C and D.

### Discussion

A total of 10% of hernias consist of umbilical hernias. Different clinical studies and trials show their experiences with some clinical cases by using surgical procedures. There is a little information about comparison of various techniques of umbilical herniorrhaphy. In beginning of twentieth century, the overlapping technique was very famous with respect to effectiveness and repairing of incisional hernia. It was not considered

more effective in epigastric and umbilical hernia repair as compared to incisional hernia. Because of higher recurrence rate associated in this technique, surgeons started to explore different other techniques. There are many techniques are being used but there is need to use prosthetic material and tension-free suture repair for umbilical herniorrhaphy. There are varieties of techniques with respect to their advantages as well as harmful outcomes. Overlapping technique which is also known as pants-over-vest technique was used in umbilical hernia repair. Recurrence problem was observed by using pants-over-vest technique in incisional and epigastric hernias (Muschaweck 2003). There was a need of best technique for the repairing of hernia. The use of the vicryl plus suture material was found comparatively better than pants-over-vest technique as vicryl had time of two weeks to be absorbed which is enough time for wound healing. Recurrence in some cases was associated with early absorption of suture material. As there was also recurrence of hernia in 13 cases out of 34 calves (Singh et al. 2014). Umbilical hernia was diagnosed by clinical history, signs, palpation, by needle impression and auscultation. Risk factors were body weight, sex, age, and hernia ring size and suture material. Suture pattern errors and infections were linked with recurrence rate of umbilical hernia (Jaman et al. 2018). Diagnosis of umbilical hernia was confirmed by ultrasonography and palpating the umbilical region with fingers. Protruded hernia contents, hernia ring and adhesions were confirmed through palpation. In current study, prosthetic material was used

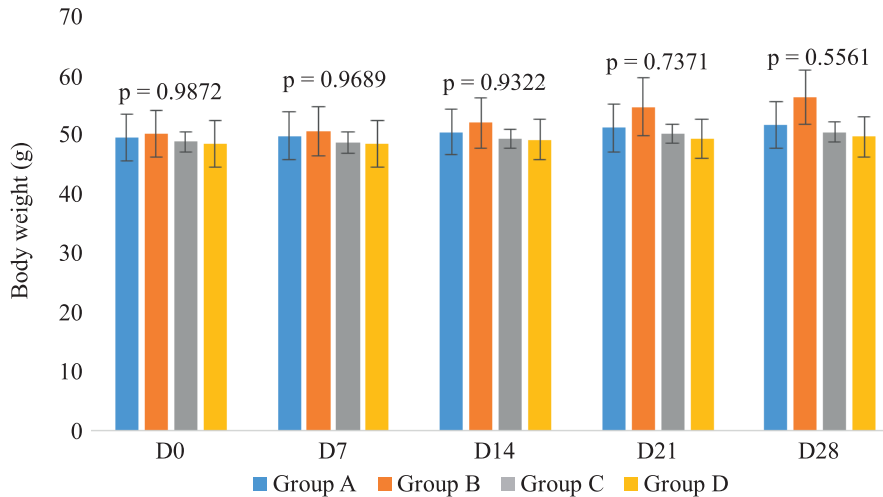


Fig. 2. Comparison of body weight gain (g) in Group A, Group B, Group C and Group D of calves.

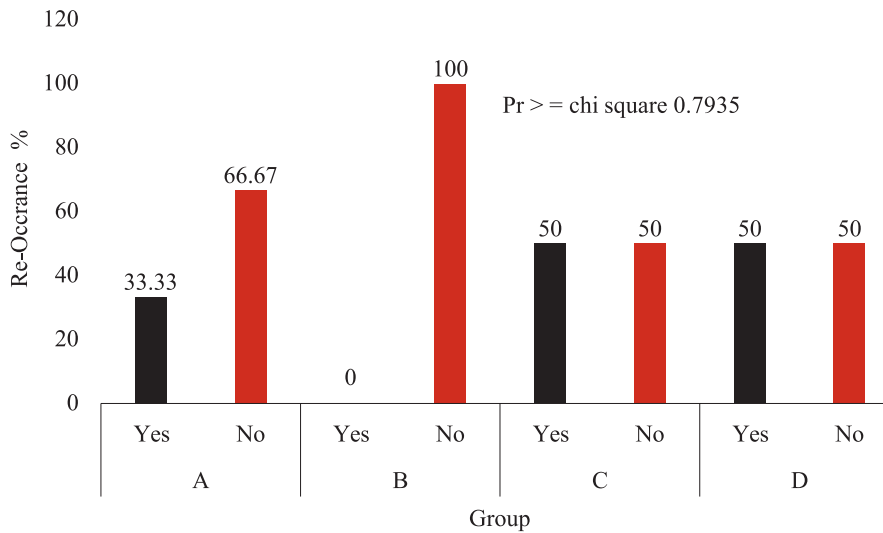


Fig. 3. Comparative mean ± standard deviation of reoccurrence values rate in Group A, Group B, Group C and Group D of calves by ANOVA test.

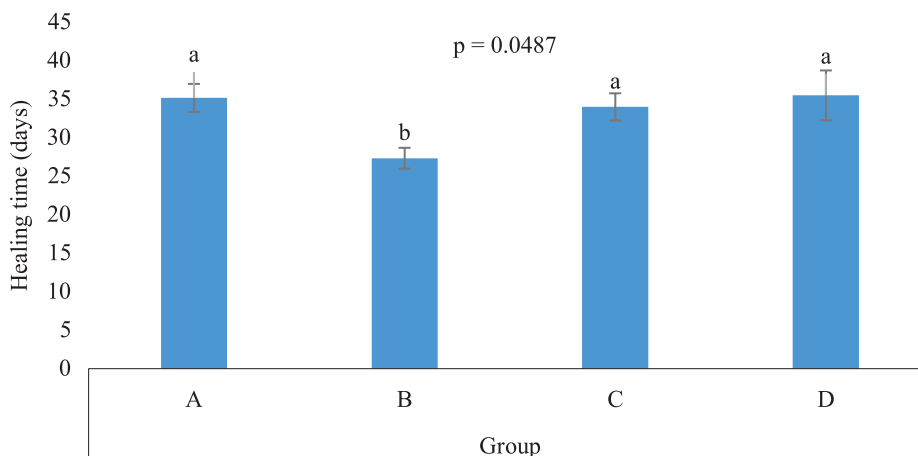


Fig. 4. Comparative analysis of healing time in Group A, Group B, Group C, and Group D of calves.

to reduce the recurrence rate in umbilical hernia repair. Comparison of outcomes of opening surgical method and laparoscopic surgery was done. Out of 76 patients, 20 were treated with open method by applying mesh,

24 with primary suture repair and 43 by laparoscopic repair. Higher surgery duration, higher complications rate and long duration of recovery were linked with open method of hernia repair. However, length of hos-

pital stay and recurrence rate was lower in open method as compared to other methods (Gonzalez et al. 2003). Prolene mesh with Dexon suture material by adopting simple interrupted suture pattern was used. Mesh hernioplasty showed best results as compared to Dexon suturing technique. Mesh was used at the site of hernial ring by pushing back the hernia contents inside the cavity. Dexon suture material had long lasting tensile strength i.e. more than one month. In another study, 40 new born crossbred calves were included in which 17 were females and 23 males. All were randomly divided into two groups. One group was treated by open method and other was just only by the belly bandage with the ring size of 2 to 5 cm. The long term success rate with 61.50% and 84.60% was seen in total 26 calves and 13 in each group, respectively. Belly bandage is considered economical and can be applied as 1<sup>st</sup> line of hernia management in new-born calves with 5cm ring size (Fazili et al. 2013). Application of clamps is considered one of the most known treatments of umbilical hernia. There was no significant morbidity by using clamp method (Riley et al. 1996). Riley et al. (1996) discussed about clamp application and close herniorrhaphy are economical but not the permanent remedy for hernia repair because recurrence rate is higher in these methods. Recurrence is associated with large hernia ring size and in animals of age more than 3 months. Recurrence is higher in 3 month old calves because they fed on solids that increase abdominal pressure. Recurrence leads to lower feed intake, less weight gain ratio and delayed healing.

## Conclusion

The present study confirms that mesh repair herniorrhaphy is most safe and successful technique in the repair of soft tissue as compared to other 3 conventional suturing techniques with respect to comfort, recurrence rate and healing time.

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