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College of Veterinary Medicine*



Treatment of Ventral Hernia in Sheep

A Research Project

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Requirements for the Degree of Bachelor in Veterinary
Medicine & Surgery*

By

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَقُلْ يَا رَبِّ زِدْنِي عِلْمًا

صَبْرًا وَتَوْفِيقًا

سورة طه، من الآية / 114

Certificate of Instructor

We certify that **Huda Jassim Muhammed** has completed the fulfillment of her graduation project entitled **Treatment of ventral hernia in Sheep** for the year 2017/2018 under our construction.

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Certificate of supervisor

I certify that **Huda Jasim Muhammed** has completed the fulfillment of her graduation project entitled **Treatment of ventral hernia in sheep** for the year 2017/2018 under my construction.

Lecturer

AHMED KADHIM MUNAHI

March 2018

Dedication

- ♠ *To whom I had the honor to bear his name... my father.*
- ♠ *To the bright face of my life... my Mother.*
- ♠ *To the candles whom illuminate my road... my brothers and sisters.*

Acknowledgment

Thanks to the merit Allah and pray be upon his prophet Mohammad and his progeny.

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HUDA

Summary

The present study was assigned to find the optimal surgical repair for reconstruction of experimentally induced ventral hernia in sheep.

A ventral hernia (5×5) cm had been done in the right flank of (9) ewes and left for a month. After that ewes were randomly divided to (3) treatment groups . the first group animals submitted to polypropylene mesh repair with onlay technique. Whereas the second group the hernia was repaired with polypropylene mesh repair with sublay technique, and in the third group the defect was repaired with tension free sewing technique with catgut.

During clinical monitoring for a month the post operative complications had been presented in the all groups with different levels, the recurrences of hernia were encountered in the first and third groups with infection of wound and fever while there were no life threatening problems faced the second group and presented with seroma and fever. All animals survived from death until the end of the experiment, histologically, the catgut group showed there were a hyperemic blood vessels, fibrous connective and deposition of collagen as well as the suture materials surrounded by inflammation. On the other hand, the sublay group revealed a separate granulomatous foreign body reaction and minimal response of inflammation with reduced process of fibrosis. Whereas, the only group demonstrated reaction of granulomatous foreign body response with process of fibrosis, these results investigated the success of the sublay technique for herniorrhaphy.

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Introduction

Sheep and goats are recurrently presented with different forms of hernias to veterinary clinic. Ventral hernia may occur when the abdominal wall is harshly traumatized and these hernias may be high or low in the flank, along the costal arch or between the last few ribs.

Ventral hernias may be congenital or acquired and they are seen in different species of animals. Many small hernias may appear to resolve spontaneously, but the large ones will require surgical correction.

The debut of the first mesh indicated for hernia repair was in 1958 with the introduction of polyethylene mesh. The use of synthetic meshes was a milestone in hernia repair and led to the development of many other mesh products of various polymer types, densities, and elasticity. There is an increased reliance on the use of mesh in hernia repair either for bridging the defect or for reinforcing the abdominal wall. Meanwhile identifying the right mesh for the right patient can be difficult if not impossible.

Repair of ventral hernia with mesh as opposed to suture has substantially improved long term outcomes and is accepted as the standard of care. However, many studies demonstrate an increased risk for wound complications with mesh placement including infection, seroma, and mesh erosion, the risks of these complications are affected by whether the mesh is placed. For example, mesh exposed to intraabdominal contents potentially increases the risks of adhesions, bowel obstruction and fistula formation.

We thought that repair of ventral hernia in sheep with mesh although it regarded as a routine manner, but there was no consensus on the best technique which used with mesh repair.

So the objectives of the current study were aimed to:

1. Surgical treatment of experimentally induced ventral hernia in sheep by using onlay , sublay mesh repair and tension free sewing with catgut .
2. To find out the best and appropriate technique between onlay versus sublay mesh repair compared with suturing with catgut technique consequently have less complications referring to clinical aspects.

Review of Literatures

Hernia is the protrusion of an abdominal organ or part of a viscus through a defect in the abdominal wall happening at any location other than groin, its types are umbilical hernia, spigelian hernia, incisional hernia, epigastric hernia and paraumbilical hernia (Hershman et al., 2001).

Small ruminants are immensely presented with various forms of hernias to veterinary hospitals, ventral hernias can occur when the abdomen is heavily traumatized and these affections may be low or high in the flank region, in parallel to costal arch or among the last ribs (Sankar et al., 2010). Among all types of hernias; the umbilical hernia had a maximal occurrence of post-operative complications after treatment (Al-sobayil and Ahmed 2007). The recurrence of umbilical hernia is customarily relevant to both the pre-operative lesions and the size of hernia, the literature focused on the prosthetic materials to treat hernias wider than three centimeters to prevent recurrence (Venclauskas et al., 2008).

Hernias generated after surgical intervention in the abdominal region had a risk of recurrence and considerably is a problem (Kuhry et al., 2008). Repairing of these types of hernias must have mesh application when ever probable to decrease iteration rates when compared with suture technique (Ellis, 2005). The advantages of using mesh repair are fast recovery as well as low of both morbidity and mortality (Sains et al., 2006).

Surgical intervention was the treatment in almost cases of hernias, the surgical repair was either herniorraphy or hernioplasty, generally the surgical correction in the treatment of hernias were classified into three groups:

1. Tension correction with suture alone, this method which is specified for small and reducible hernias (Kharia et al., 2001).
2. Tension free correction, in this case required mesh application which occlude the defect and tissues the grew into the prosthesis (Rosch et al., 2003).
3. The laparoscopic technique, this type of correction of hernia should achieved under general anesthesia and enter the abdominal cavity by laparoscopic probes to insert the mesh (McKinlay and Park 2004).

The decision about which technique should be performed was not well appointed, and the choice relied on the imitation, context and familiarity besides the type and size of hernia.

Correction of ventral hernia with mesh rather than suturing had essentially improved with long term results and was acceptable as optimum of care (Nguyen 2014).

However, many literatures declared that an increment of risks of complications with mesh application such as; infections, seroma and erosion of mesh (Berger 2014). The threatening of the mentioned complications was where the prosthesis was located? Mesh faced intraabdominal viscera actually augmented the fistula formation, risks of adhesions and intestinal obstruction (Snyder 2011).

The common two surgical techniques which most repeatedly used in case of treatment of ventral hernia were the onlay and sublay application of mesh, anyway; it remained inexplicit about any technique was optimal (Timmermans et al., 2014). A literature supposed that the sublay surgical technique had most efficiency than the onlay technique with decreased recurrence and low complications (Petro et al., 2015).

Materials and Methods

1- The experimental animals:

Nine adult healthy female sheep with age (5 ± 1) years and weighed (35 ± 5) kg, these animals were preconditioned in the animal teaching station / college of veterinary medicine / university of Al-Qadisiyah, where kept in a controllable environment for observation and adaptation throughout the period of study which started from December 2017 to January 2018. The ewes had ear tags numbers according to the data base of the teaching station, all the animals were housed in (4×10) meters pens for entire experiment, the accommodation period included dewormed the animals with ivermectin in a dose of (0.2) mg/kg bw at least 15 days before the surgical operations as well as vaccinated against the common endemic diseases.

The ewes were kept off feed for (48) hours prior to operations, the right flank was clipped and shaved and the skin was prepared aseptically for the surgery (fig.1), the ewes restrained in left lateral recumbency with assistance of xylazine in a dose of (0.1) mg/kg bw and local analgesia was achieved with a linear infiltration of lidocaine Hcl 2%. A venous catheter was placed in the cephalic vein for the continuous infusion of saline solution during the surgery and subsequent drug administration.

2- Surgical operation for induction hernia

Experimental induction of ventral hernia have been done for all nine ewes at the right flank by made a straight incision about (10) cm long firstly through the skin (fig.2) then demoted down subcutaneously, bleeding was arrested assiduously, exposure the dorsal surface of the abdominal muscles by reflection of the skin edges laterally, the muscles were separated bluntly and with size (5×5) cm of portion of the abdominal muscles was severed and discarded (fig.3) to create a hernia, eventually the two edges of skin were sutured together by silk number (1) in a routine manner and all animals were left a month post surgery.

Animals were randomly divided into three treatment groups (3 ewes in each one) in the first group (onlay group) which subjected to application of polypropylene mesh (polymesh® turkey) by the onlay repair technique, the second group (sublay group) submitted for polypropylene mesh application by sublay repair technique (fig.4), and the third group (catgut group) in which the hernia were repaired with tension free catgut (Gut suture® China)

sewing technique. The experimentally induced ventral hernias were treated as following:

Group one (Onlay group):

After standard aseptic preparation desensitization of site of hernia, a skin incision had been done directly over the bulging of hernia from cranial to caudal poles, gently inspection and dissection to the tissues to liberate the adhesions and reach to hernia ring, hernia sac was clearly reduced to the abdominal cavity, polypropylene mesh with adequate size was placed on the external abdominal oblique muscle for full the gap and fixed with stitches, hemostasis was secured and incision was closed routinely.

Group Two (Sublay group):

The objectives of the preperitoneal or sublay mesh repair had two steps: mesh location deep to the versus abdominis and mesh extension well post the hernia defect. After the hernia sac was dissected and delineated, the defect was exposed and the sublay plane was originated between the internal transversus abdominis sheath and the transversus abdominal muscle for the placement of the mesh. The internal transversus abdominis sheath along with the peritoneum was closed with (0) catgut. A polypropylene mesh fit to the size was located in the already created plane behind the transversus. The mesh was stitched with few interrupted (0) catgut suture. Subcutaneous tissues and skin were closed with standard manner.

Group three (catgut group):

After usual determination and exposure of the defect, continuous suturing with cross horizontal mattress by catgut (1) was achieved to close it. The skin incision was reapposed in a routine way.

Food was prohibited (12) hours after surgery, then slowly reintroduced until reach on full ration by 10 days, broad spectrum antibiotic penicillin (20000) IU and streptomycin (10) mg/kg bw were prescribed IM for at least 4 days, skin incision was checked daily and suture was removed after (14) days and the ewes returned to the paddock.

Macroscopic and microscopic evaluations of hernias repair were achieved on all ewes at one month post-surgical operations.



Fig.1: Aseptical preparation of the skin before surgery.

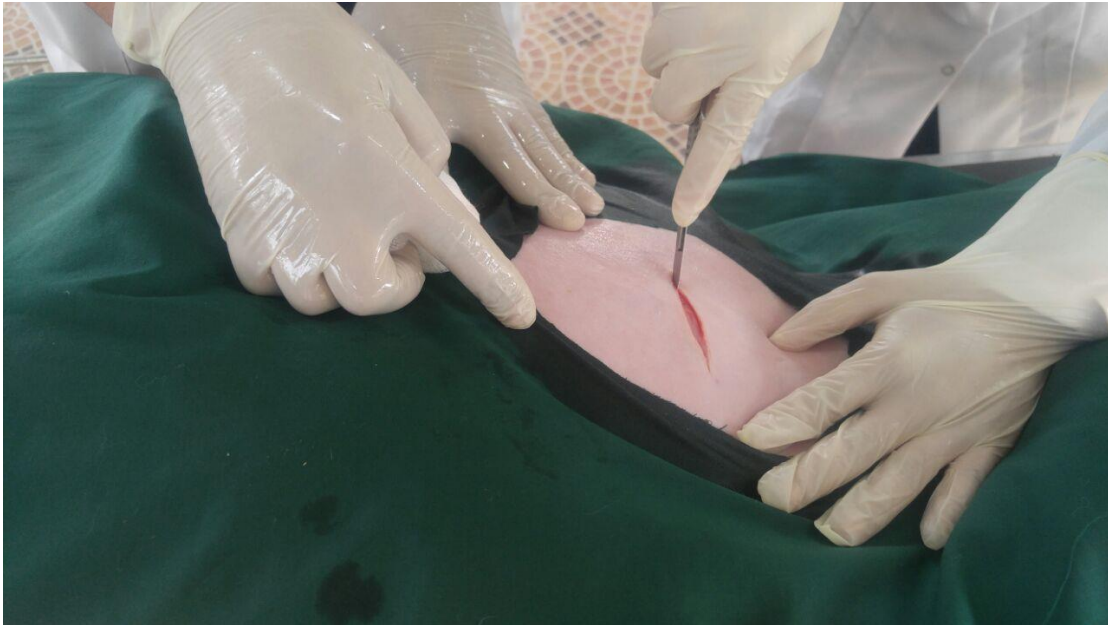


Fig.2: Straight incision about (10) cm long firstly through the skin.

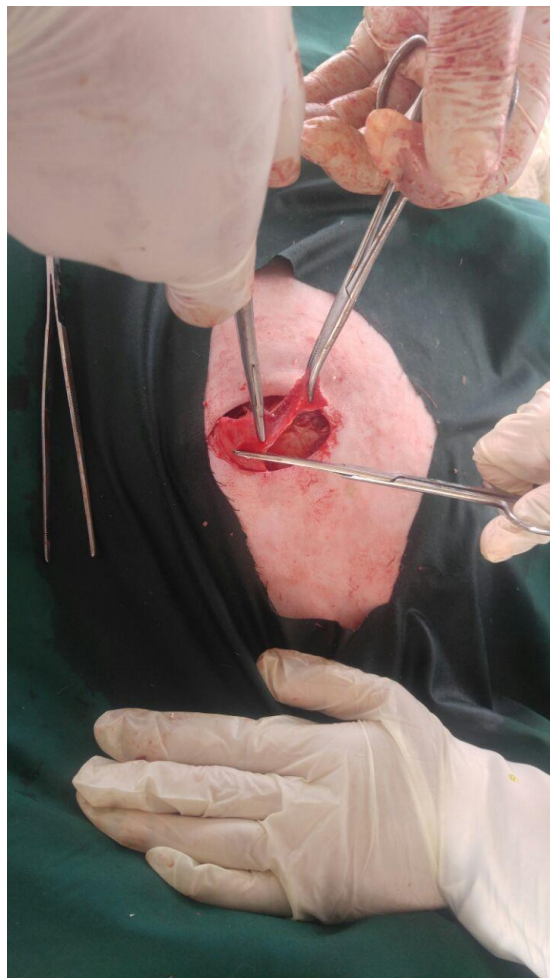


Fig.3: size (5×5) cm of portion of the abdominal muscles was severed.



Fig.4: sublay application of mesh at the site of hernial ring.

Results

All nine ewes recovered from surgical repair without clear complications, they had a good appetite and defecated normally during 24 hours postsurgery. Body temperature, respiration and heart rates were in normal values through out the experiment.

The post –surgical complications had been mild and easily managed generated in group two with seroma one week post repair, it responded to the standard treatment. Whereas group one and three showed a wound infection and fever also it respond to the routine treatment of wound, the infection didn't interfere with stability of mesh and/or absorbable suture technique.

No recurrence of hernia was noticed in sublay group mesh repair in present study while in the onlay and catgut groups occurred with one animal in both, other complications faced the operations in all animals as shown in (table1). All animals survived from death until the end of the experiment, these results indicate the success of the group two technique with fair consequences in the other two groups.

Clinical there were no intraoperative difficulties faced. Besides that clinical followup presented with six post surgical complication among all the animals. The recurrence of hernia took place in two ewes related to the first and third groups during the second week post operative. In group one and three; one ewe in each group had fever (41.2) degree at the second day it resolved in three days with specific treatment as well as antibiotics and the animals resumed their normal activity.

Histologically, the catgut group showed there were a hyperemic blood vessels, fibrous connective and deposition of collagen as well as the suture materials surrounded by inflammation (Fig.5,6). On the other hand, the sublay group revealed a separate granulomatous foreign body reaction and minimal response of inflammation with reduced process of fibrosis (Fig.7). whereas, the only group demonstrated reaction of granulomatous foreign body response with process of fibrosis (Fig.8)

Table1: shows the complications after repair of hernia

Group	Number of animals	Complications	Response to treatment
1	3	1-*Recurrence 1- wound infection 1-fever	- + +
2	3	1-Seroma	+ +
3	3	1-Recurrence 2- fever	- +

+ respond to treatment

- Don't respond to treatment

*number of complicated case.

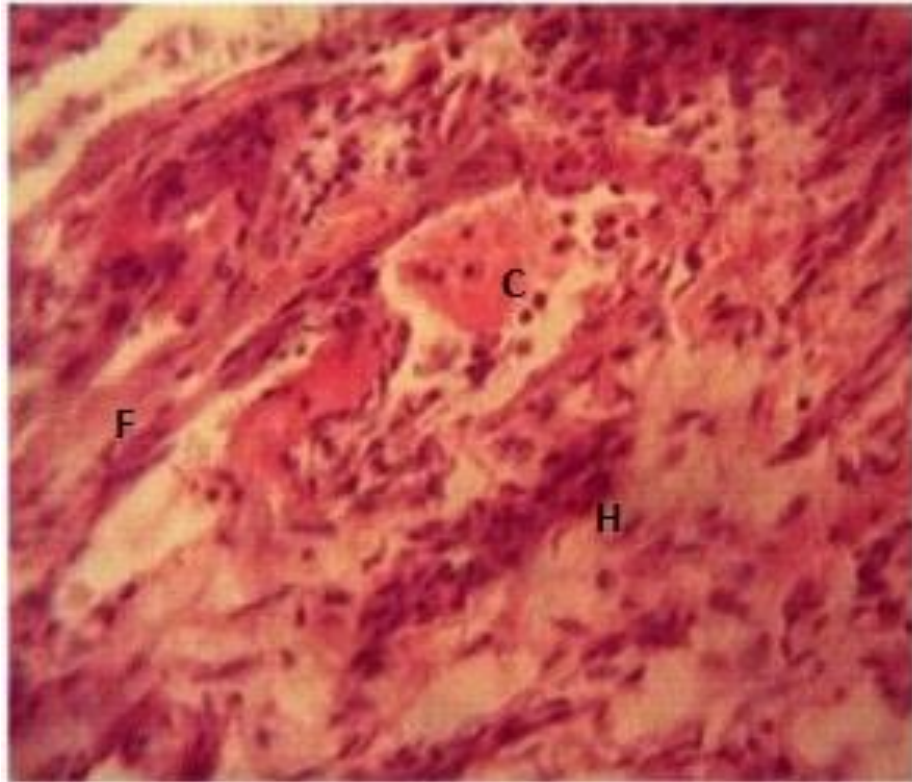


Fig.4:
Catgut group shows a hyperemic blood vessels (H), collagen deposition (C) and fibrous connective tissue (F). H&E.

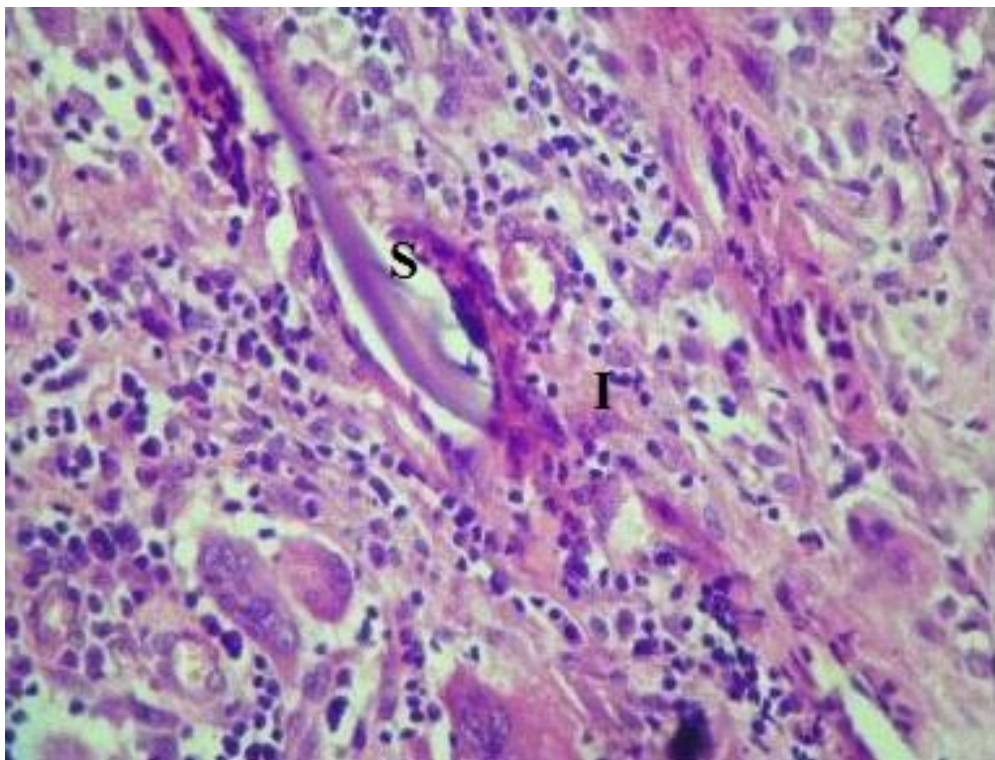


Fig.5: Catgut group displays absorbable suture material (S) surrounded by inflammation (I). H&E

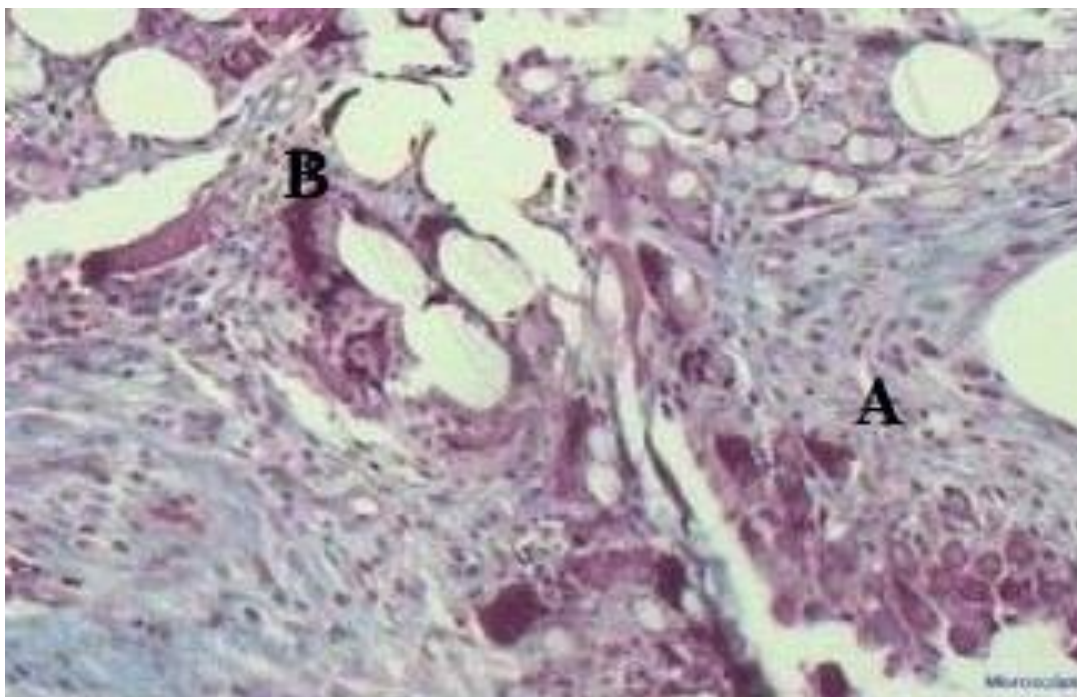


Fig
.6:
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ation illuminates disconnected granulomatous foreign body reaction and minimal inflammatory response (A) with reduced fibrosis (B). H&E.

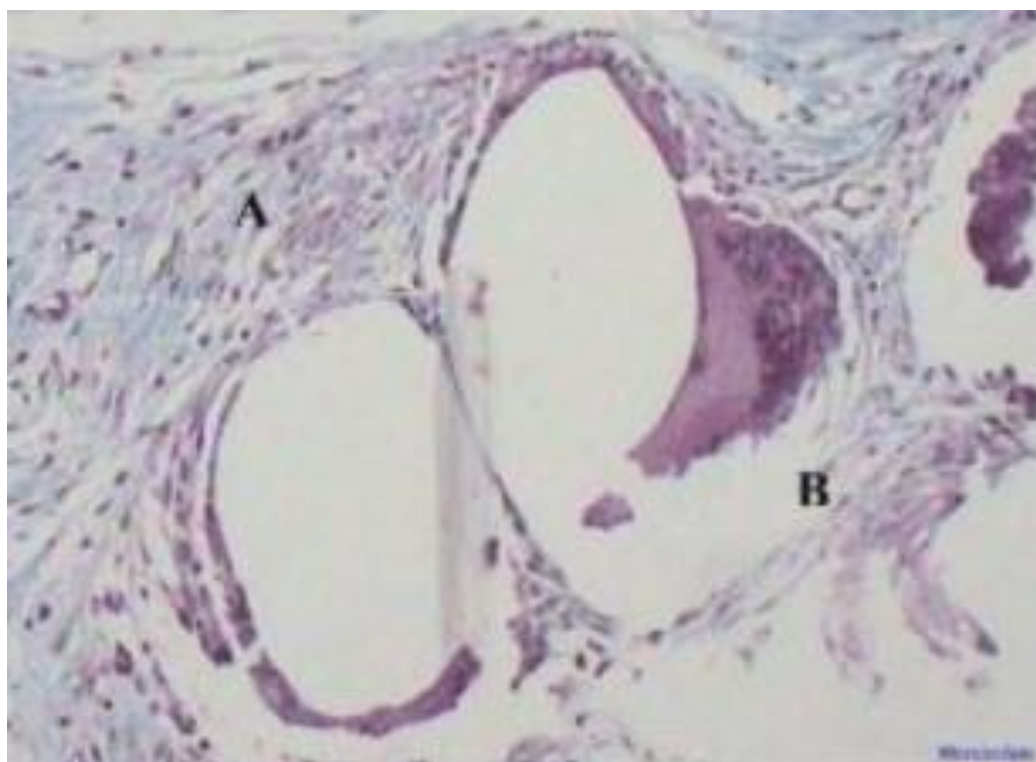


Fig.
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body reaction and inflammatory response (A) with process of fibrosis. H&E.

Discussion

The present study explicated the scientific and dependable methods for treatment of ventral hernia in sheep. The latter demonstrated hernias with great incidence especially among ewes (Yasin 2017). In the same way (Al-sobayil and Ahmed 2007) elucidated that the hernias were more commonly presented in sheep rather than goats with augmentation of occurrence of ventral hernias. Many studies emphasized this fact, that ovine had the high percentage of event of ventral hernias when compared with the other farm animals (Misk et al., 2008, Tanko 2015).

Ventral hernia is regarded as a traumatic defect (Roberts 1991) resulted from blunt objects which lead to separation of abdominal muscles (Nelson 1988). Additionally, elevation of intraabdominal pressure with pregnancy, poor nutrition and loss of abdominal wall power in proceeding of age; all these factors can attenuate the muscles and tendons and eventually cause hernia (Hosie 2000). The flank region in ruminants composed of inadequate thick muscles covering, but has a short fleshy part with thorough aponeurosis (Dyce et al., 2002).

In the present study we used in group three (catgut group) a catgut suture materials to close the hernia ring and this agree with (Baxter 2004) who stated that the absorbable suture materials have no effects on surgical results with different tension suture techniques. Furthermore, in accordant with (Weaver et al., 2005) who stated that umbilical hernias with (7-10) cm in width were contracted by using a horizontal mattress pattern and absorbable suture materials, though this showed complications represented with abscess and recurrence.

In accordance with (Whitfield-Cargile et al., 2011) who declared that hernioplasty by using prosthesis is the optimal choice for treatment hernias to prevent probability of reherniation which may occur in some cases with a huge hernia ring. The optimal mesh repair should stimulate growth of tissue from overlaying fascia with no adhesions (Bernard et al., 2007), and this compatible with using of polypropylene mesh in the sublay group. However, good prognosis has been obtained from sublay group with no recorded any complications along the period of study, while (Elce et al., 2005) found that a tension free mesh application has a fair to good prognosis but with complications as infection, seroma, sinus and fistula, this variances from our findings may arise from difference of

experimental model as well as the technique of using mesh within hernia ring. The most common type of using mesh for repair of large ventral hernia is the polypropylene mesh (Fina et al., 2009).

This type of mesh has many beneficial characteristics such as pliability, strength, elasticity, cheap when compared with polytetrafluoroethylene mesh and well tolerated by tissues (Sorour 2014).

Sublay group showed that this technique was the best one among other techniques due to less noticeable complications as well as no adhesion was recorded and this may due to presence of the mesh between interior transversus abdominis sheath and the latter muscle itself, this technique avoid direct attachment of the mesh with the viscera of abdominal cavity, similarly (Giusto et al., 2006) found that interposition of omentum between the mesh and viscera is considered as a safe, cheap and not correlated with major complications. The sublay mesh repair is regarded to be a foreign body, during the inflammatory reaction following application of mesh; phagocytic cells can't digest and degrade the foreign materials leading to a granulomatous inflammatory reaction with recruitment of macrophages and lymphocytes and lose their motility and accumulate at the site of injury. It can predicted that the inflammatory cellular reaction is the major cause of shrinkage shown in the mesh equal to scar tissue formation in normal wound healing, the additional shrinkage noticed with the coated polypropylene mesh may be because of presence of further degradable coating, the coating may stimulate an excessive inflammatory response and therefore, a larger degree of shrinkage.

Our data collected from the experiment study showed that the operative time in the onlay technique was much longer than sublay group, besides that the incidence of seroma formation is highest following onlay procedures. Furthermore, onlay technique is correlated with a higher rate of wound infection that remained one of the most common complications of this procedure (Saeed et al., 2014). Besides that (Hameed et al., 2009) compared the recurrence ratio in onlay against sublay repair and found higher incidence in case of onlay technique.

Conclusions and Recommendations

1- Conclusions:

- The present study presents the success of using sublay technique as an optimal surgical repair of ventral hernias in sheep.
- Mesh repair is technically easy for application.
- The complications that encountered in sublay group were relatively minor and simply managed.

2- Recommendations:

- Apply the present study on the other species of animals like calves.
- Longer monitoring of the cases to explore the late complications.
- Herniorrhaphy of pregnant ewes suffered from hernia.

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