

Hernias in Farm Animals and its Management technique- A Review

Amare E and Haben F*

School of Veterinary Medicine, Wolaita Sodo University, P. O. Box 138, Wolaita Sodo, Ethiopia

*Corresponding author: Haben Fesseha, School of Veterinary Medicine, Wolaita Sodo University, P. O. Box 138, Wolaita Sodo, Ethiopia. E-mail: tseyon.h@gmail.com

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Abstract

A hernia is an abnormal exit of tissue or an organ, such as the bowel, through the wall of the cavity in which it normally resides. Most hernias are caused either due to congenital or different types of injuries and commonly involves the abdominal content including intestine in most species including cattle, sheep, goat, horse, and donkey. Hernias are classified based on anatomical location, cause, and the organ involved. The symptoms may include pain, discomfort, and swelling. Many types of hernia may happen in sheep, goat, and cattle but the most frequently noted type of hernia was a ventral and umbilical hernia. The hernia can be easily diagnosed by history, inspection, palpation, and radiography. There are several techniques to treat hernia, surgical, or non-surgical depending on the size and the type of hernia. In the case of surgical techniques, there are two types of open and closed surgical operations. Accordingly, in the case of simple and small hernia in size they treat by suturing the edges of the ring by an absorbable suture (Herniorrhaphy), but in case of large hernia must be used mesh to support the muscle in a technique named (Hernioplasty). Irritation due to mesh, post-operative pain and delay the time of healing are among some of the complications observed during the management of hernia. Thus, the hernias should be diagnosed and treated to minimize the risk of the problem and production loss. Besides, horny cattle should not be kept together with other small ruminants and equine. Moreover, animal owners should be advised about the cause, solution to this problem to reduce the loss of their productive farm animals.

Keywords: Cause, Classification; Complication; Diagnosis; Hernia; Treatment

Introduction

A hernia is a bulge of skin contains material of a body cavity passes through a weak spot of the body wall. It is the protrusion of an organ or part through a defect in the wall of the anatomical cavity in which it lies [1]. Anatomically, Hernia consists of three parts that include Hernial Ring, Hernial Sac, and Hernial Content [2]. The hernial sac consists of the tissues that cover the herniated contents. The contents of the hernia are the organs or tissues that have moved to the abnormal location. The nature of the contents can usually be predicted from the site of herniation although mobile structures such as omentum and parts of the intestine can be involved in most sites [3]. Generally, there are two types of causes in hernia, which are predisposing cause and exiting causes. Besides, there are congenital causes like umbilical hernia and inguinal hernias and other traumatic causes such as surgical intervention, certain drugs, and chemicals involved in some hernias. A hernia can be classified into different parts depending on: the anatomical site of herniation (ventral or lateral abdominal hernia, diaphragmatic, inguinal or scrotal, umbilical, perennal, pelvic and femoral hernia), based on the cause of hernia (congenital versus acquired hernia), depending on the type of the herniated tissue as enterocele (containing a portion of the intestine), epiploce or omentocele (of omentum), enteroepiploce (of the intestine and omentum), Gastrocele (of the stomach), vesicocele (of the

bladder), hepatocoele (of the liver), hysterocele (of the uterus) and it may be, external or internal hernia [4].

According to Yasin and his colleagues, the prevalence of retrospective studies of 58 cases of external hernias in ruminants in relation to the species, age, and sex of the animals were presented in Dohuk, Iraq. Hence, eighty-one percent of the hernia cases were in ovine species, 15.6% were in caprine; bovine constituted only 3.4% of the cases. High incidence of hernias was recorded in females; the sex distribution was 72.4% females and 27.6% males. Umbilical hernias constituted 44.8% of all hernias, followed, in reducing the frequency, by ventral (31%), scrotal (13.8%), and inguinal hernias (10.4%) [5]. One of the most important outcomes of herniation is the pathophysiological alteration in the function of the body cavities of hernial contents. Swelling of the herniated body is the classical sign of hernia but in uncompleted hernia, no sign of pain is elicited on palpation and the consistency of swelling depends on the contents [6]. Many studies performed in developing countries showed that the prevalence of different types of hernias in animals is nearly similar. Interestingly, the majority of hernias appeared at the site of natural orifices such as the umbilical and inguinal canal of immature animals, that are associated with their developmental status [7].

In cattle's most common site of a hernia in the abdominal wall which consists of the muscles and ligaments, which act as a

shield and the natural function of it carrying the abdominal contents mainly the intestines. When any weaknesses extend in the abdominal wall, the shield loses its strength and forms a hole which called hernial ring, then part of the viscera of the abdominal cavity passes through the hole and then bulging which is visible on the skin as a hernia [8]. The hernia either occurs when there is a natural weakness in the inguinal canal and femoral or the umbilicus area caused wide in these canals and passing of viscera through it [9]. The primary diagnostic approach is made from the history and by palpation of the hernial region. In addition to physical examination, plain or contrast radiography and trans scrotal ultrasonography can be used in the diagnosis of scrotal hernia in farm animals [6,10]. Furthermore, the diagnosis of the cases can also be confirmed by exploratory puncture of the swelling and demonstration of intestinal contents [11].

There are several ways to surgical treatment of hernia which depended on the size of the hernial ring at the site, primary repair (Herniorrhaphy) surgical treatment of simple hernia completes with sutures sited in a straight line in the abdomen. Besides, mesh repair (Hernioplasty) surgical repair of large and complex hernia by using networks and may use a laparoscope [12]. Complex abdominal wall and hernia treatment uses a both mixture of primary and mesh techniques [13]. There should be adequate surgical exposure and access to the hernial contents are essential and the tissue may be friable requiring gentle handling. Post-operative care of patient minimizes the load on the surgical repair [14]. Many initial biomaterial devices were useful to repair hernia; however, those devices had a poor mechanical design with lots of complications after surgery [15]. Mesh implantation for hernia repair is one of the common surgical techniques. Later during the 1980s, the tension-free repair technique was introduced in the market by using a synthetic warp-knitted mesh that could repair more difficult and larger hernia defects [16,17].

Many procedures and devices for hernia repair were introduced, but finally, the open mesh technique and laparoscopy technique using textile synthetic mesh have been successful [18]. Each year 20 million meshes are being implanted to repair a hernia in the world and synthetic meshes are involved in 80% of hernia surgeries. The most common textile implants are polypropylene, polyester, polytetrafluoroethylene, and expanded polytetrafluoroethylene [19,20]. In most developing countries including Ethiopia, a hernia is the most neglected health problem and are given lesser attention in different farm animal [10]. There are few complied research articles on different types of hernia, causes, possible treatment, and prevention options. Thus, this review can be used as a guide for field veterinarians and gives an insight into the existing problems of hernia in farm animals and very important for improving livestock health.

Cause and Pathophysiology of Hernia

The causes of a hernia vary depending on each individual. Even though hernia is caused by multiple factors, the mechanical causes including improper heavy weight lifting, hard coughing bouts, sharp blows to the abdomen, and incorrect posture are the common ones [21]. Furthermore, conditions that increase the pressure of the abdominal cavity may also cause hernias or worsen the existing ones [18]. Abdominal wall hernia may occur due to trauma and it is an emergency condition and could

be associated with various solid organs and hollow viscous injuries. Hernias may be congenital or acquired; they may occur as isolated defects or they may be associated with defects of other parts of the body [22].

Congenital: seen upon birth in the early postpartum period. An umbilical hernia occurs due to failure of closure of the umbilical ring at birth; it may have a genetic component and considered to be inherited in sheep and in many cattle breeds, animals with these hernias should not be used for breeding purposes [23]. Congenital inguinal and scrotal hernias are inherited and considered as a genetic autosomal recessive disorder in sheep as in other animal species ([24]. According to a study in Gondar, umbilical hernias in sheep and goats are reported as congenital problems [10].

Increased Intra-Abdominal Pressure During Pregnancy: the loss of abdominal wall strength with age, and under or malnutrition weakens the muscles and tendinous support of the abdominal wall and contributes to cause ventral hernias). Increased intra-abdominal pressure during mounting for the males and pregnancy and the act of parturition in females are the probable causes of the inguinal and scrotal hernias [25,26].

Traumatic: This is caused due to sudden application of a blunt or shearing force to the abdominal wall over an area large enough to prevent penetration of the skin and it weakens the inguinal area especially in group-housed rams [1, 6]. Trauma due to horning from other animals appeared to be the most common cause of abdominal hernias. Ventral hernias are considered to be traumatic due to violent impact with blunt objects like horn thrust separating the abdominal muscles [4, 24, 26]

Infection and Abscess Formation: Interestingly, the majority of hernias appeared at the site of natural orifices such as the umbilical and inguinal canal of immature animals, thus suggesting their developmental status [11, 22]. On the other hand, abdominal hernias were found in adult goats, a matter which supports the hypothesis that abdominal hernias were mostly traumatic [5, 7].

Pathophysiology of Hernias: Alteration in the functions of the body cavities and hernial contents may be important in herniation. These changes in the function may vary in severity from insignificant to lethal and can be due to a space-occupying effect, obstruction of hollow viscous, or strangulation of hernial contents leading to tissue death [25, 27]. Space occupying effects are mostly associated with diaphragmatic hernias when abdominal contents prevent pulmonary expansion but also it occurs within the pericardial sac in the peritoneum which is called a pericardial hernia [28]. Obstruction of the lumen of the bowel by incarceration in hernia can rapidly lead to an accumulation of gas and fluid with fluid and electrolyte disturbance. Semen quality can also be affected by altering the scrotum thermoregulation which mostly associated with a chronic scrotal hernia [23].

Classification of Hernia

Hernias are conventionally classified into different types according to their anatomical site, ventral or lateral abdominal hernia, diaphragmatic, inguinal or scrotal, umbilical, perennal, pelvic, and femoral hernia [28]. Besides, hernias can also be classified as **Reducible Hernia:** In this type can be manually or automatically return the hernial contents into the abdominal cavity. **Irreducible (incarcerated) Hernia:** in this type, the hernial contents cannot be returned into the abdominal cavity. Because of the complication of this type [29].

Umbilical Hernia

Umbilical hernia (omphalocele) result from failure or delayed fusion of lateral folds (rectus abdominus muscle and fascia). It occurs frequently in bovine calves but is rare in lambs and kids. The condition is comparatively more frequent in females than males. It can be congenital or acquired in nature [30]. The acquired umbilical hernia occurs due to resection of the umbilical cord too close to the abdominal wall, excessive straining due to diarrhea and constipation, and infection of umbilical cord preventing the natural closure of umbilical orifice [6, 7].

Umbilicus in calves consists of the urachus, umbilical vein, and umbilical arteries which are known as umbilical remnants. The urachus, umbilical vein and arteries normally regress after birth to become vestigial part of the bladder apex, round ligament of the liver and lateral ligament of the bladder, respectively. Due to improper closure of umbilical opening at birth, a defect may remain in the midventral abdomen to form the congenital hernial ring [6].

The umbilical hernia has been described as heredity in all species of animals, in cattle most of them are small, and so the defected animals should not be used as breeding animals. They most commonly occur in Holstein-Friesian cattle, with heifer calves being at greater risk than bull calves. Congenital hernias outcome from the closure of the peritonea but an inadequate closure of the body wall around the umbilicus causing protrusion of the peritoneum through fascia and skin [10, 31]. Umbilical hernias in calves generally current in veterinary, which are causing due to failure of the normal closure of the umbilical ring, and which results in the projection of abdominal contents into the overlying subcutaneous. Either may happens when cutting the umbilical cord near the body or when animals chewed the umbilical cord or maybe happened due to contaminated handling with the umbilical cord during caesarean section, leading to Omphalitis and weaknesses making them convertible to hernia [9, 32, 33].

Umbilical Masses in Calves May be Divided into Five Categories

uncomplicated umbilical hernias, umbilical hernia with subcutaneous infection or abscess, umbilical hernia with umbilical remnant infection, umbilical abscess or chronic omphalitis and urachus cyst or rupture [4, 21]. The hernias are usually present during the first few days of life and typically enlarge uniformly as the calves grow. Umbilical masses are completely reducible with a palpable circumferential hernial ring. The hernial sac may contain intestine (enterocele), abomasum (most commonly), or omentum. Strangulation of the small intestine, omentum, or abomasum with the hernial sac is possible although rare [30].

A study that was performed in Ethiopia showed that out of the total observed hernial cases, 95.75% and 6.25% were acquired and congenital, respectively. Mechanical trauma contributes to the highest percentage of the total causes of hernia. From hernial cases brought about, 62.5%, 6.3%, and 6.3% were related to abdominal, scrotal, and umbilical types of hernia, respectively. From retrospective data obtained from a total of 10,765 recorded cases, the highest percentage was related to abdominal hernia followed by scrotal and umbilical hernias [10].



Figure 1. The clinical appearance of umbilical hernia in calf

Inguinal Hernia

It occurs when the intestine or abdominal organs descend into the inguinal canal. An inguinal hernia occurs mainly in mature bull and swine but also it can occur in rams and boars. The internal inguinal ring is palpable per-rectum [21]. The normal inguinal ring permits the insertion of one or two fingers. Bulls with internal inguinal ring sufficiently wide to permit insertion of four fingers are predisposed to herniation and the owner should be warned. The majority of inguinal hernia occurs on the left side of the scrotum probably as a result of the rumens weight and the mature bull lying in the sterna position with the left rear leg abducted [23]. Most hernias are indirect (the intestinal components are contained within the tunica vaginalis), but occasionally direct herniation occurs when herniated intestine goes through a vent in the vaginal tunic and is contained within own peritoneal pouch [25, 29].

Inguinal hernias can be either heredity or acquired and they have not been described in the cow or ewe [34]. This is a result due to drooping abdominal viscera through a defect in the inguinal channel when animals are aged or extreme stress. In this type of hernia, part of the bowel may slip through the inner ring to the inguinal canal. It is common in males, as well as we can use X-rays to diagnose [35].



Figure 2. The clinical appearance of inguinal (left) and Scrotal hernia in a dog

Scrotal Hernia

Scrotal occurs when the content descends into the scrotum and it is the extension of the inguinal hernia when viscera reaching to scrotum through the internal and external Ingual canal. The causes of this type of hernia are genetic or acquired, so it is best to hold the castration process Castration of defected animals [24]. In addition to the diagnosis of scrotal hernia in sheep and goats, physical examination, plain or contrast radiography, and trans-scrotal ultrasonography can be used for this purpose [36].

Femoral Hernia

Drooping part of the intestine through the passing region of the femoral vein and artery from the abdomen to the femora, and the fact that the area where gets a hernia. This canal called the

femoral canal. Diagnosis is this hernia by making the animal standing on hind limbs and feel the bulging ventrally to the inguinal ligament and laterally to Pelvic brim [9].

Incisional Hernia

This type happens, when ancient abdominal surgery has debilitated the abdominal wall or may cause infection at the surgical site causes a collapse of the wound closure [37]. Incisional hernias are ventral hernias through an operation scar and are a serious complication of abdominal surgery. Incisional hernias occur in 11 to 23 percent of laparotomies. Incisional hernias enlarge over time and can result in serious complications such as pain, bowel obstruction, incarceration, and strangulation, and enter cutaneous fistula [38]. So septic wounds after the operation, which is the most dangerous predisposing factor and metabolic disorders such as weight gain and kidney deficit, diabetes, lack of protein or vitamin C and the use of some treatments, such as steroids and chemotherapy in addition to the increase in intra-abdominal pressure and Reform manner tensile accompanied by a high percentage [39].

Ventral or Ventrolateral Hernia

A Ventral hernia or Ventro-lateral is defined as a hernia through any part of the abdominal wall other than a natural orifice and the hernia is ventral to the stifle skin fold [4, 26] or a ventral hernia is caused by the migration of viscera especially intestines, through a tear in the abdominal wall that is mostly due to trauma (kicks, horn thrust, violent contact with a blunt object and sudden jump) that resulted in rupture of the prepubic tendon in large animals, particularly cow and mare. A ventral abdominal hernia is commonly found acquired condition in ruminants and horses and common in dog and pig compare to other domestic species [1, 21].

The diagnoses of the hernia made through the contents of the hernia and hernia ring be clear or palpated the viscera under the skin, but the diagnosis of Irreducible hernias defaulted and needed to use the X-ray to reflect the lack of abdominal wall continuity (Sing[40]h et al, 2014). Exploratory laparotomy used to diagnosis the defect, X-ray used to differentiate abdominal wall hernias from fibrino-cystic, abscess, and inflammatory swellings in bovine animals [32, 36, 41].



Figure 3. The clinical appearance of Ventral (left) and Ventrolateral hernia (right) in sheep

Diaphragmatic Hernia

Diaphragmatic hernias are caused by the passage of abdominal viscera into the thoracic cavity through a tear or a congenital defect in the diaphragm. Besides, it could be congenital or acquired. There seem to be few archives of congenital defects in horses. Diaphragmatic hernias are not seen clearly and it must be expected that such natural defects are very rare in the horse. Accidental rupture usually occurs from an abdominal defect, following a blunt wound or penetrating injuries to the abdomen cavity and chest [21]. A diaphragmatic hernia is very rare

in animals. It is seen in dogs more frequently than in other species. The diaphragm is a muscular partition between the abdomen and the thoracic cavity. The central area of the diaphragm is tendinous. The posterior aorta, posterior venacava, and the esophagus pass through it. Herniations are usually noticed close to these structures or at the costal attachments of the diaphragm. The weakest portion of the diaphragm where it gets torn is close to the posterior venacava because the vein collapses when the part is subjected to the pressure. The portion close to the esophagus constitutes the 3rd weak portion. The abdominal organs in contact with diaphragm are the liver and stomach [6, 21].

The hernial contents are usually a portion of omentum, stomach, or liver; very rarely the intestine. The extent of herniation depends on the size and location of the tear. Most diaphragmatic defects are acquired and may be associated with thoracic trauma or a sudden increase in intraabdominal pressure but congenital hernias occur less frequently and are a result of incomplete fusion of pleuroperitoneal folds. Therefore, most congenital defects are in the dorsal tendinous portion of the diaphragm and represent an enlargement of the esophageal hiatus [25, 29]. Frequently the clinical results at presentation include tiredness, respiratory complications, and exercise intolerance [42]. The most signs are tympany, depression, dullness, and scanty feces. The reticulum of all animals with the diaphragmatic hernia was located at the 4th/5th intercostal space by ultrasonography [43, 44]. Laparoscopically can be provided or could be used as a therapeutic technique according to the size and location of the defect. Necropsy or slaughtering animals is also used to diagnose diaphragmatic hernias [45].

Perineal hernia

This type of hernia is different from other types that the contents of the hernia don't cover by peritoneum, and partly due to the weakness of muscle of perineum making it easier to droop some viscera of the abdominal and pelvic cavity. Usually in perineal hernia animal has abdominal swelling and brutal space director and in some cases bilateral in the perineal area is swollen [46]. Contrast studies, either positive or negative, may be helpful and it may have an abdominal shape in a perineal hernia [29].



Figure 5: Show the Perineal hernia

Clinical Signs and Diagnosis of Hernia

The choice of diagnostic modality is often dictated by multiple factors such as cost, availability, safety, and especially in a research setting the detection rate, and reliability. However, the latter remains unclear, as the evidence concerning these factors is limited and sometimes contradictory [26, 31].

Clinical Signs of Hernia

There are physical and functional symptoms: Physical symptoms include the presence of hernial swelling which is the classic sign of herniation [26]. The swelling varies in size and shape. In uncomplicated hernia, no pain is elicited on palpation and has doughy consistency if the content is epiploic. The swelling may increase in size while coughing [21]. Inflammation due to trauma or infection can be superimposed on these signs making palpation difficult [14, 47]. The site of swelling may be some distance from the hernial ring because of the migration of the contents in the subcutaneous space. In diaphragmatic hernia, swelling is usually not seen and respiratory signs predominate. Additional signs depend mainly on the nature and status of the contents of hernia [28].

Functional symptoms are ordinarily absent in reducible hernia. Colic may be seen in an incarcerated hernia. Severe pain, a rise of temperature, and colic are pronounced in the strangulated hernia [6]. In the case of umbilical hernia, a discrete spherical swelling is obvious at the umbilicus. The hernial contents are usually omentum or intestine. The circular or oval hernial ring can be palpated without any pain if hernial contents are reducible. However, the presence of adhesion or umbilical abscess can prevent reduction. Hernial contents may get strangulated with symptoms of pain and intestinal obstruction [14, 21]. Strangulation is not common in the case of an inguinal hernia but may occur rapidly. Affected bull shows signs of intestinal obstruction including abdominal pain, and decreases fecal output. The condition must be distinguished from intussusceptions and volvulus of the root of the mesentery. The hernia may be contained entirely within the inguinal canal without visible scrotal swelling [48]. In ventral or lateral abdominal hernia, the hernial swelling is very prominent. Systemic symptoms are usually absent. The contents of the hernia are usually omentum or intestines or both. The hernia may be reducible or irreducible, and strangulation is rare [10].

Diagnosis

It is difficult to generalize about the diagnosis of herniation. Hernias can often be diagnosed based on signs and symptoms. Physical and surgical diagnosis is important in most cases. Specific diagnostic features of the various types of hernia are done in different ways [1, 26]. In the case of umbilical hernia, hernial swelling at the umbilicus is easily observed. The hernia can be usually reduced after putting the animal on its back and the hernial ring can be felt [3, 49]. In inguinal or scrotal hernia, the hernial swelling is recognized close to or including the scrotum. The swelling can be easily differentiated from a saccule (a hard tumor of the testicle), hydrocele, cyst, enlarged lymph node, and cirrhosis cord, and so on. A saccule is a hard swelling on the testicle; Hydrocele is an accumulation of serous fluid in the scrotum that occurs when fluid collects in the thin sheath surrounding a testicle and it is different from hernial content. Drawing up of the testicles of the affected side accompanied by symptoms of continuous abdominal pain is an almost pathognomonic sign of strangulation of an inguinal hernia [18, 21].

Medical imaging such as endoscopy, Radiography, or fluoroscopy is used to confirm the diagnosis or rule out other possible causes. In diaphragmatic hernia, lateral and ventrodorsal radiography of the thorax may help to confirm the diagnosis. Con-

dition like a hydrothorax, aspiration pneumonia, cardiac diseases, and foreign bodies in the esophagus should differentiate from a diaphragmatic hernia. In the case of a ventral or lateral abdominal hernia diagnosis is easy as the hernial ring can be felt in most cases [10, 43, 50]. Hernias have several deleterious effects, such as lowering the productivity and reproductively of the affected animals abdominal, inguinal and perineal hernias could entrap a fetus or fetuses in their hernial sacs leading to dystocia [31, 40]. Clinical signs of acute abdominal conditions, radiological indications of strangulation of the hollow viscera, and disturbances of the intestinal canalization. For this reason, a differential diagnosis is made with epiploic strangulation, or, in the case of small hernias, with Richter's hernia (parietal strangulation) [10]. In traumatic hernia further evaluation by conventional radiology, CT-scan, arteriogram, bowel contrast studies, or color duplex sonography may be necessary especially in the case of handlebar injuries ultrasound may be helpful [6, 36]. These help to differentiate hernia from hematoma, spermatic cord hematoma, iliac or femoral artery disruptions or thrombosis, and testicular dislocation/torsion/tumor or scrotal enlargement [21, 27].

Radiographic Examination

We utilized contrast radiography in confirming our diagnosis and assessing post-operative follow-up. We strongly advise this approach, particularly in conjunction with scrotal and inguinal hernias. In this situation, post-operative recurrence of hernia may be anticipated. Therefore, contrast radiography could give an immediate differential diagnosis. A survey of the available literature showed that contrast radiography has been used for the diagnosis of diaphragmatic hernias in buffaloes and cattle and sheep [5, 6, 36].

Differential Diagnosis

A hernia should be differentiated from abscess, tumor, hematoma, and cyst. Abscess, tumor, and cyst develop slowly whereas hernia is of sudden occurrence [26, 31]. In developing an abscess, there are symptoms of local inflammation and it does not fluctuate under the skin and tends to point. In hematoma, the collection of blood may feel like free fluid or may give a slight crepitating sound on palpation. A cyst fluctuates uniformly and does not tend to point and pain or functional symptoms are absent. The presence of the hernial ring confirms hernia. Exploratory puncture or radiography may also be done for confirmation [27, 48].

Complication and Changes of Hernia

The following possible changes may occur in the case of hernia: These are adhesion, incarceration, torsion, strangulation, and hydrocele of the sac [24]. An adhesion may take place between the sac and a content making reduction difficult or impossible. Hydrocele of the sac is caused by exudation from hernial contents. A constrict hernial ring favors such exudation [21, 23]. An incarcerated hernia is a hernia where hernial contents have become very voluminous so that they cannot be reduced. e.g., an enterocele may become incarcerated either due to more and more intestinal segments entering into the hernial sac or as a result of the accumulation of food material within the lumen of the herniated segment [2, 25]. The accumulating food materials become hard masses as the water gets absorbed from them and these hard masses make reduction of

hernia very difficult. They may also cause partial or complete obstruction of the bowel segment and thus favors further accumulation of food material [6]. Torsion or twisting of hernial contents within the hernial sac interferes with the blood supply to the tissue and may lead to gangrene and toxemia [51].

Strangulation is compression caused by hernial ring causing interference with the blood supply to the hernial contents. When a hernia is strangulated soon after the time of its occurrence, it is spoken of as an acute hernia e.g., strangulated inguinal hernia in a race-horse. In strangulated hernia, the constriction at the hernial ring interferes with blood supply to the hernial content and venous drainage causing congestion and edema. Blood and mucus escape into the lumen and blood-stained effusions take place from the peritoneal surface [21]. Gangrene sets in gradual and the hernial content appears black but also peritoneum loses its shining luster. Pathogen organisms from the gut pass through the intestinal wall and death may occur from toxemia (septicemia) and peritonitis [6]. In the case of a long-standing hernia, there may be massive adhesions contributing to the difficulties in dissection. Diminished fibrin degradation is a common pathway for the formation of adhesions. Besides, high friction, inflammatory reaction, and ischemic tissue have been found to cause adhesions and have significant effects on the surgical treatment as well as the prognosis of the condition [52].

Extensive dissection to free the sac from the cord or the adjacent tissue, especially in patients with large sliding inguinal hernias, may be demanding and there is an increased risk for complications. The significance of aggravating factors such as complex injuries related to the hernia (size, degree of sliding, multiplicity, etc.), patient characteristics (age, activity, respiratory disease, dysuria, obesity, constipation) or special surgical circumstances (technical difficulties, infection risk) have been demonstrated [4, 5]. Also, it causes hemorrhage, peritonitis, and strangulation. However, some complicated cases present with poor prognosis. Like adhesions, intestinal incarceration and diffuse fibrinopurulent peritonitis are associated with a ventral abdominal hernia in some cases and can be fatal even with proper patient stabilization [53]. In laparoscopic ventral hernia repair, adhesions are a common occurrence due to trauma of surgery or by the reaction of mesh or fixation devices. All techniques or devices create adhesions in the site of the hernia. This risk is preventing by the use of films or meshes made of polyvinyl difluoride, Polypropylene, polyester coated by another material, like titanium, polydioxanone, cellulose, hyaluronic acid, or collagen [5, 11].

Factor Affecting the Recurrence and Complication of Hernia

Patient-related factors: Postoperative complications and concurrent infection may increase the relative risk for re-operation after hernia repair [54]. Coexisting infections, late admission, emergency repair, older age, high abdominal pressure, previous surgery in the lower abdomen, anatomical characteristics of the hernia, and hereditary factor are considered as a precipitating factor for recurrence of hernia [6, 36].

Operative technique and type of anesthesia as a risk for recurrence: The surgical technique used and anesthetic protocol has a significant effect on the outcome after hernia repair. Direct recurrence after herniorrhaphy can be caused by insufficient medial mesh fixation and overlap over the pubic tubercle

[55].

Duration of hernia: It may be a possible factor for a detrimental outcome. The cumulative probability of the irreducibility of inguinal hernia increases from 6.5% at 12 months to 30% at 10 years [56]. The cumulative probability of strangulation for inguinal hernia was 2.8% after 3 months, rising to 4.5% after 2 years. In the case of femoral hernia, the risk was 22% in the third month and 45% at 21 months. Then, the short duration of the hernia may be considered a detrimental factor [57].

Infection as a risk for recurrence: Infection, which increases the risk for reoperation, maybe more frequent than previously reported. Bailey reported a wound infection rate of 3% in the hospital, which increased to 9% in the case of community surveillance. Wound complications were recorded in 7% of cases in the hospital and 28% by community surveillance [58].

General Principle and Treatment Options of Hernia

There are different techniques for repairing the hernia. The first one is herniorrhaphy which is a primary repairing method and a surgical repair of simple hernia done by suturing the site of the abdomen. Hernioplasty (repair by mesh) is another surgical repair method that is used to treat large and complex hernia by using networks and maybe using a laparoscope [12]. The third one is the combination of primary and mesh techniques are used to gather in compounding cases. Other types of complex repairs can include the use of tissue extension, transfer, and even transplantation. Surgical time, duration of hospitalization, and postoperative complications may be reduced by using this technique of primary repair and avoiding mesh implantation [13]. Most hernias are best approached by an incision over the sac or ring. In acute, traumatic abdominal hernias, a midline laparotomy approach may be preferred if the surgeon requires access to abdominal viscera to evaluate the concurrent injury. Adequate surgical exposure and access to the hernial contents are essential, and the tissue may be friable requiring gentle handling. It may be necessary to enlarge the hernial ring to achieve proper access [4, 28]. The hernial ring is best closed by direct suture approximation of local tissue. Knowledge of the anatomy of the area is necessary so that suture can be placed in specific anatomical structures that have sufficient holding power to resist disruption [47, 48]. The mobility of the local tissue can be increased by local dissection or creation of local muscle of facial flaps such as superficial gluteal or internal obturator muscle flap in perennital herniorrhaphy [27, 28]. Generally, the non-absorbable sutures should be used if the hernia was at least 8 months old or else having a large hernial opening (>4 fingers). Absorbable sutures can be used in cases where the size of the hernial ring is no more than 4 fingers or if the hernia is less than 8 months old [6].

Using Mesh: Mesh is used to treat a complex abdominal hernia with extensive tension produced along the incision of the abdominal muscle. The mesh is sited beneath the muscle. although, use of non-absorbable synthetic mesh material to achieve a tension-free closure of these abdominal wall defects is the most widely used reconstruction technique. Nylon mesh may be used for the repair of large abdominal hernias with adequate strength in adult bovines as an economic alternative to the costly meshes [8].

The surgical adhesives that using for mesh fixation in hernia repair must be less traumatic to induce less tissue damage and less postoperative pain. So, gel-like film shields the mesh to delay the adhesion between mesh and sorrowing tissue (Nevler

et al, 2014). Besides, collagen isolated from bovine fetal was set up to effectually support component repairs process including rapid revascularization and extracellular matrix remodeling [59, 60].

Types of Mesh

There two types of meshes. The synthetic one is prepared from nylon whereas the biologic mesh is prepared from the skin or porcine (pig), bovine (cow). They are more resistant to infection and they stimulate the growth of tissue [8]. Moreover, warp-knitted mesh for hernia repair should have properties such as structural stability, easily cut, flexible, and easy to mold for the feasibility of hernia operation [61, 62].

Types of Synthetic Mesh and its Composition

Two types of textile implants are currently used for hernia repair, standard or synthetic, and composite implants. Composite mesh shortens the repair duration and complications. These implants may be partially absorbable or completely non-absorbable materials [15, 62].

Synthetic Mesh

Mainly there are four types of materials used in standard or synthetic implants such as polypropylene, polyester, and polyvinylidene fluoride [63]. These textile-manufactured meshes are chemically inert and are low degradable materials. Synthetic implants differ by mesh design, fiber density, and type of polymer, and therefore they behave different after hernia implantation [64]. Polypropylene polymer-based synthetic mesh is the most dominant mesh for hernia repair. It is hydrophobic, strong, flexible, resistant to infections, more compliant, and has reduced inflammatory response [65]. Polypropylene is very resistant to tissue enzymes, biological degradation porosity, and good mechanical properties. The use of polypropylene mesh is common for all hernia repairs. In addition to this, lightweight polypropylene mesh is suggested for reduced inflammatory response, better compliance, and for overcoming the animals' discomforts [66].

The biocompatibility of polypropylene mesh, its ability to provide good resistance to tensile forces applied by the muscular structures, and the pressure by abdominal viscera are well described in the literature. It also represents an excellent tool to support granulation tissue, and later, tendon-like tissue. Besides, the mesh has a good adhesive capacity with surrounding tissues [67-69]. The margin of safety provided by this material for treating hernias can compensate for the higher costs compared with traditional surgery because it can reduce the incidence of recurrence, as reported in other animal species viz. Horses and dogs [13, 70].

Numerous techniques have been described for inserting prosthetic mesh including the use of 1 -3 layers of mesh at various levels between the layers of the abdominal wall. The mesh extends 1.5-3 cm beyond the margin of the defect and is anchored to a strong supporting structure with an interrupted suture of synthetic monofilament non-absorbable material [27, 28]. For instance, prosthetic implants are used to repair a large defect and this helps to make the approximation of local tissue without tension. The most commonly used synthetic material is a monofilament plastic mesh made of polypropylene or polyethylene which is well tolerated in wounds, does not disintegrate with age, and can stretch in two directions to distribute the load more evenly [4, 11, 28].

Composite Mesh

Synthetic polymers such as polyester and polypropylene are coated to form a composite mesh so that individual concerned risk of such polymers can be avoided [71]. All composite meshes are mainly divided into two sections; permanent layers and temporary layers. In the temporary (absorbable) type of composite mesh, a barrier coating is applied before its application for hernia repair. The temporary layer of composite meshes reduces the risk of complications related to synthetic meshes in direct contact with the abdominal viscera. Such a degradable coating provides the barrier between synthetic mesh and intraperitoneal contents. These meshes cannot easily be cut or modified to a particular shape after once they are manufactured. Parietex is an example of such composite meshes. It is composed of a collagen barrier on one side and a warp-knitted structure of polyester on the other side in order to facilitate proper tissue ingrowth and comfort in use. These composites mesh have excellent properties in vivo with reduced shrinkage, good integration, and quick fibrous tissues ingrowth [61, 72]. Permanent composite meshes with polypropylene are also available in the form of heavy and light-weight composite meshes. In this case, double-sided textile polymers such as polypropylene, on the other side are used to improve the tissue ingrowth and post-implantation mesh properties. Dual composite mesh composed of polypropylene has been used as a durable material in ventral hernia repair. Permanent composite or barrier-coated meshes removed the complications observed in synthetic mesh material [73]. The selection of mesh under a specific situation of the implantation is very important to understand. For example, polypropylene is suitable for low infection but more flexible, whereas PTFE has reduced adhesion properties but a greater chance of infection [61, 62, 74].

Postoperative Care

Postoperative care of patients minimizes the load on the surgical repair. Any cause of increased intraabdominal pressure such as vomiting or excessive barking can predispose to failure of the repair. Other causes of recurrence are infection, extreme tension, and inadequate nutrition of the exposed tissue. Technical failures such as the use of incorrect suture materials or inappropriate tissue layers are important causes of recurrence [5, 28].

Reduction and retention by the bundles: In this case, the hernia is reduced by local manipulation and bandages applied around the abdomen to prevent its return. Elastoplasts bandages are better to avoid interference with breathing. The bandages are retained for two to three weeks. This method of treatment is effective in some cases of umbilical hernia [6, 21]. By application of blisters or injection of irritant solutions: Injection of irritant solutions close to hernia ring after reducing the hernia causes inflammatory swelling which is sometimes sufficient to prevent recurrence of small hernia and to facilitate closure of hernia orifice. The solutions commonly employed for this purpose are sodium chloride 5-15% and zinc chloride 5-10% [21, 23].

By ligature or hernia clamp: A set of through and through mattress sutures may be applied at the base of hernia sac after reducing the hernia to facilitate sloughing of the sac and simultaneously closure of the hernia ring. This method is also not effective in some cases [27, 28].

By radical operation: In this case, the hernia sac is incised and the hernia contents are returned through the hernia ring. The

hernia sac is ligatured at its neck, amputated, and its stamp is pushed through the hernial ring. The borders of the hernia ring are then freshened and sutured together. Closed suturing of hernia ring is called herniorrhaphy. If the hernia ring is very large, suturing its edge is not possible. In such cases, hernio-plasty is performed by covering the gap with fascia lata or stainless steel wire mesh and suturing it to the borders [21].

Surgical Technique and Anesthetic Procedure

Food was withheld for 24 hours and water for 12 hours before surgery. The appropriate surgical site should be clipped free of hair, and the skin was prepared for aseptic surgical operation. Field block anesthesia by making walls of infiltration of 2% lidocaine hydrochloride enclosing the hernial borders was used for umbilical, small ventral hernias, and, inguinal and scrotal hernias of immature animals. For large ventral hernias, in addition to the local anesthesia, the animal may be subjected to operations under intravenous or intramuscular injection general anesthesia (for non-ruminant) whereas in ruminants they are sedated with a different type of anesthesia [6, 11, 26].

The general techniques of repair in the most common type of hernia are:-

- 1) Two elliptical incisions are made through the skin on each side of the sac and are joined at each end; the hernia ring is adequately exposed.
- 2) The patch of skin between the incisions is bluntly dissected from the sac and discarded.
- 3) The edges of the skin are reflected from the sac by blunt dissection.
- 4) The sac is carefully dissected from the underlying tissue. Care should be taken to avoid severing the sac and exposing the peritoneal cavity.
- 5) The hernia is reduced by pushing the sac into its normal cavity.
- 6) The hernia ring is closed by overlapping sutures using chromic catgut with umbilical tape in case of a large ring. The edge of the ring along with fascia is fixed to the body wall with a simple continuous suture using chromic catgut.
- 7) The skin edge is suturing by interrupted sutures using non-absorbable suture material [27, 28].

Conclusion and Recommendation

A hernia is a common surgical problem in different farm animals that affects the productivity of the animals. Thus, the hernias should be diagnosed and treated to minimize the risk of the problem and production loss. Accordingly, up to date knowledge of the different types of hernias is more important for the proper repair of hernias. In conclusion, careful handling of unusual contents of hernias, proper surgical technique as well as suitable mesh-type help to reduce the recurrence rate and avoid damage to some of these structures. In addition, horny cattle should not be kept together with other small ruminants and equine. Moreover, animal owners should be advised about the cause, solution to this problem to reduce the loss of their productive farm animals.

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