



Review on The Common Surgical Affections in Sheep and Goats

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ABSTRACT

Numerous surgical affections are common among sheep and goats in different localities all over the world which may cause economic losses and most of these affections are curable. Neglect or late interventions to relieve such disorders lead to massive complications that may be ended by animal culling. The present review aims to illustrate the common surgical disorders in the sheep and goats to facilitate the prevention, control, diagnosis and surgical interventions of such conditions. This review classified the surgical affections systematically and they were stated as surgical affections of the sheep and goats' skin, digestive, urogenital, musculoskeletal, respiratory and nervous systems in addition to surgical affections of sense organs and abdominal wall. Categorizing of such affections gives broad scope for veterinarians and researchers specialized in small ruminant practice to study their incidence and geographic distributions in relation to affections' predisposing risk factors scientifically.

Keywords: abscess, dystocia, Goats, mastitis, Sheep, surgical affections.

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INTRODUCTION

The sheep and goats are important to the economies of several countries all over the world including both rich and poor communities and offer a wide range of products and services such as direct cash income, meat, milk and wool, and risk spreading/management and social functions. Frequently raised in extensive open systems, flocks are extremely susceptible to outbreaks of disease, and quick recognition of ill-health is a high priority for husbandry men and the veterinarians advising them (**Linklater and Smith, 1993**).

Surgical disorders are the major reasons for fatality in small ruminants if the animals are not treated in proper time. However, surgical affections are considered as the main threat to the economic value of small ruminants' business and late or failure of surgical interventions provide no alternatives except culling (**Arju et al., 2014**). Numerous surgical affections have been recorded in sheep and goats resulting in productivity reduction and high economic losses (**Zabady et al., 2004**).

Surgical affections among sheep and goats could be classified into inherited, congenital and acquired conditions (**Samad, 2000**). The inherited and congenital deformities may be lethal, semi-lethal, or compatible with life causing aesthetic defects or having no effect on the animals (**Badawy, 2011 and Gangwar et al., 2014**). Congenital defects of sheep and goats are numerous and can be found in every major body system. Although some have a clearly defined genetic basis, many are the result of environmental factors, such as intrauterine virus infections or toxicities, which interfere with normal fetal development (**Linklater and Smith, 1993**).

Small ruminants are an essential part of livestock, food security and a generational legacy in Kuwait (homeland of the second author), where the number of sheep and goats amounts to approximately 620,000 head of meat consumption in 2016, which is 7,441.10 million tons and wool consumption is 189.30 thousand (**Central Statistical Bureau, Kuwait, 2016**). The importance of these animals despite the absence of a veterinary college in the State of Kuwait and the lack of integrated studies documented on the small

ruminants' field and surgical injuries draw attention to the importance of studying, recording and documenting such affections in the State of Kuwait.

The present review aims to illustrate the common surgical disorders in the sheep and goats to facilitate the prevention, control, diagnosis and surgical interventions of such conditions and the classification of these affections according to the affected system.

Surgical affections of the sheep and goats' integumentary system

Various skin affections have been recorded in sheep and goats, resulting in low production of milk, meat, hide, and wool, as well as high economic losses (Barwell et al., 2015). Some of these affections require surgical interventions which mainly divided into skin wounds and superficial swellings.

1. Skin wound

Different types of skin injure (incised, old septic, lacerated, penetrating and biting wounds) could be reported in sheep and goats. The wound in feet is the common cause of lameness in small ruminants. Similarly, wounds to udder and head are also the most common sites of wounds in goats. Further, continued rainfall for a more extended period as well as hot and humid climate predisposing wounds being infested by maggots as fly population increases in such environment (Patel et al., 2014).

2, Cutaneous Myiasis (Maggot wound)

Myiasis is a common and widespread clinical problem that is closely interlinked with severe economic losses of livestock due to neglected cutaneous infection. Myiasis (blowfly strike) is much common in sheep than in goat, which may occur around the head following fights, in wounds in soiled areas around the tail, breech and penis, or on the feet of animals with foot rot/scald. Myiasis flies include *Lucilia sericata* (green bottle), *Protophormia terraenovae* (blue bottle) and *Wohlfahrtia magnifica* (flesh fly) (Matthews, 2016). The female fly lays eggs on new wounds followed by the hatching of larvae that creep, feed, and live in the tissue. Wounds, ulcers, sores, broken horns, injured eyes, and disrupted skins are the most prevalent predisposing factors of myiasis in domestic animals (Supta et al., 2019).

3. Superficial swellings

Superficial swellings are common in sheep and goats with a global distribution. They represent one of the most frequent reasons for surgical interference in these animals (Hakim et al., 2018 and Sadan, 2019). Case history, physical examination, and exploratory puncture are routinely performed to diagnose superficial swellings in sheep and goats. Ultrasonography could be used as a unique, non-invasive imaging technique for diagnosis and

differential diagnosis of various superficial swellings in these animals, particularly when physical examinations are inaccurate and inconclusive (Hashefi, 2009 and Sadan, 2019).

4.Abscesses

Abscesses in sheep and goats were found at different parts of the body; parotid region, submandibular region, umbilicus, chest wall, gluteal region, testes, and eyelids (Misk et al., 2008 and Sadan, 2019). Abscessation may occasionally arise as a result of penetrating wounds. A variety of bacteria, including *Streptococcus* spp., *Staphylococcus* spp., *Trueperella* (*Arcanobacterium*, *Actinomyces*) *pyogenes* and *Moraxella* spp., have been isolated. These present as an individual problem in individual animals. An injection abscess may arise at the site of vaccination or other injection because of faulty septic injection techniques. *Actinobacillosis lignieresii*, which is usually present in the mouth of ruminants, is occasionally isolated from abscesses around the face and neck of goats. Because of the risk of spreading caseous lymphadenitis, abscesses should be handled carefully and not lanced in situations that could lead to the spread of the disease (Matthews, 2016).

5.Caseous lymphadenitis

Caseous lymphadenitis (CLA) is one of the most common forms of abscessation in the small ruminant. The etiology is *Corynebacterium pseudotuberculosis*, a gram-positive, rod-shaped bacterium. The major secreted toxin is phospholipase D (PLD), which is responsible for causing the abscesses. Contamination of open wounds is the main cause of infection; inhalation is also possible; the tonsils can be infected after ingestion of the organism and kids can be infected by bacteria in milk. Flies can spread the disease. Following discharge from an abscess, the organism survives in the environment for many months (Pugh and Baird, 2012).

Enlarged and abscessed peripheral lymph nodes, particularly of the head and neck (parotid, mandibular and prescapular nodes), but occasionally other sites such as popliteal nodes, depending on where the organism gained entry to the body. The generalized (visceral) form of the disease causes abscessation of almost any organ and internal lymph nodes following haematogenous spread but is less common in goats than sheep. Goats with internal abscesses do not always have enlarged peripheral nodes. Although goats with external abscesses often show no other clinical signs of disease, goats with internal abscesses may become progressively emaciated and involvement of the thoracic lymph nodes can lead to respiratory symptoms (Matthews, 2016).

6.Cysts and Wattle cysts (Tassel cysts - Branchial cleft cysts)

The most common cysts recorded in sheep and goats are Wattle (tassel) cysts, thyroid cysts and interdigital cysts (Sadan, 2019). Wattle cysts are an inherited fault resulting in swelling at the base of one or both wattles, varying from pea-size to several centimeters in diameter (Abu-Seida, 2014). They occasionally occur in all breeds of goat that have wattles, although they are more prevalent in particular family lines. They are usually present at birth but may enlarge with time and become more noticeable (Sadan, 2019). Surgical removal may be requested if the cyst is unsightly, particularly in show goats. Aspiration is pointless as they will soon refill and there is a risk of abscessation. Wattle cysts are the result of a failure of the branchial clefts to fuse during embryonic development. *Dermal inclusion cysts* can sometimes be mistaken for wattle cysts (Matthews, 2016).

7.Hematomas

Hematomas were diagnosed in sheep and goats with a history of exposure to trauma. They generally appeared as circumscribed, soft, small-to-large-sized swellings mainly on the head and sometimes on lateral, dorsal and ventral aspects of chest and abdomen of sheep and goats, which occurred due to fighting among the animals. Auricular hematomas occurred mainly due to trauma and appeared as ovoid or round, tender, fluctuating swellings on pressure (Tsioli *et al.*, 2013). The swelling was either in the inner or outer surface of the ear flap and was fluctuant and fluid-filled, like a water balloon. Exploratory puncture and aspiration revealed pure blood in recent hematomas and serosanguineous fluid in older hematomas (Sadan, 2019).

8.Skin Tumours

The major skin tumors among small ruminants are papilloma, squamous cell carcinomas and malignant melanomas which occur most commonly in white dairy or Angora goats with non-pigmented skin (Foster, 2011 and Matthews, 2016).

8.1.Cutaneous papilloma (warts)

A virus of the papovavirus group causes papillomatosis in sheep, but a viral cause has not been confirmed in goats. Three types of papilloma have been described in the goat: Mammary, Cutaneous and Genital. Cutaneous papilloma occurs mainly on the head, neck and thoracic limb and is flat, circumscribed with a crusty surface and ring-wormlike in appearance. Generally, a spontaneous resolution occurs in a few months. Occasionally, surgical removal or the use of autogenous vaccines is indicated. Tumors of the udder of white goats often persist without the regression normally associated with viral papilloma. However, some totally or partially regress during the non-

lactation period only to recur the following year during lactation. Animals with persistent lesions may develop squamous cell carcinomas in subsequent years (Matthews, 2016).

8.2.Squamous cell carcinomas

Squamous cell carcinomas occur particularly peri-anally, around the vulva and udder and on the eyelid and nictitating membrane in areas of non-pigmented skin in response to stimulation by ultraviolet irradiation. In the early stages, the tumors appear as thickened areas of skin, enlarging rapidly and becoming ulcerated and often coalescing to form large masses. Tumors of the udder can eventually erode through the wall of the teat, leading to mastitis and may metastasize to the supra-mammary lymph node (Matthews, 2016).

8.3.Malignant melanoma

Malignant melanomas commonly occur on the head and ears, and occasionally on the vulva or peri-anally, arising as small firm nodules from black pigmented areas and enlarging rapidly to form a black mass. Rapid spread via the lymphatic system may occur to involve the regional lymph nodes. Some melanomas may be unpigmented and resemble squamous cell carcinomas (Matthews, 2016).

9.Tail affections

Injury of the tail seems to be more common in sheep than goats. The tail tip is usually the affected part of the tail in sheep and the myiasis was also recorded in cases suffered from tail necrosis and gangrene due to traumatization (accident) (Salib and Farghali, 2016).

10.Horn affections

Uneven growth of the horns is frequently seen in both sexes of male sheep and goats due to ecological, management, or genetic reasons. Horns of sheep have a triangular section, but horns of goats have an oval section (Dyce *et al.*, 2010) that make sheep are more liable to cause compressions or wounds from overgrown horns than goats. Overgrown horns induce injury to other animals during the fighting and create some traumatic affections to the animal itself. The overgrown horns may cause traumatic injuries to head, neck and eye leading to poor animal welfare. Disbudding of the newly born animal and dehorning in adult one may minimize the risk of traumatic injuries in the farm (El-hawari *et al.*, 2015).

Surgical affections of the sheep and goats' digestive system

1.Oral cavity

The oral lesion in sheep could accompany many systemic diseases including foot and mouth, bluetongue, orf, ulceration dermatosis and sheep pox. Other oral lesions limited to the oral cavity such as

abnormalities of the teeth and their supporting soft tissue. Malocclusion, bacterial infections and tumors. Congenital dental anomalies and tongue affections are considered the most common oral cavity lesions that affect production. They are the main reason for culling otherwise healthy breeding ewes before the end of their natural reproductive life leading to an increase in flock replacement costs (Matthews, 2016).

2. Tooth affections

Enamel hypoplasia is widely considered a good indicator of systemic stress during the period of tooth crown formation. It has been used in numerous studies to retrospectively assess the occurrence of stress episodes during dental development in primates (Goodman and Rose, 1990). More recently, the study of enamel hypoplasia as a stress marker has been extended to mammals with high-crowned cheek teeth, such as American bison (Niven *et al.* 2004). However, studying enamel hypoplasia in the cheek teeth of these species poses problems not encountered in species with low-crowned cheek teeth (Kierdorf *et al.* 2006). As has been shown for the cheek teeth of cattle, the presence of coronal cementum can hamper or even prevent the recording of hypoplastic defects in enamel by external inspection (Kierdorf *et al.* 2006).

3. Tongue

The tongue is a movable musculo-membranous organ. It has an attached root, body and free apex, capable of both vigorous and precise movements as in prehension, lapping, grooming and manipulation of the food within the mouth on the one hand and speech articulation on the other (Dyce *et al.*, 2010). Ulcerations on the tongue are commonly encountered in dental practice. Solitary ulcers of the tongue are often caused by sharp edges of a broken tooth or ill-fitting dentures. Other less commonly known causes include traumatic ulcerative granuloma with stromal eosinophilia, atypical histiocytic granuloma, infections like tuberculosis, late stage of syphilis or fungal infections like histoplasmosis (Gopalkrishnan *et al.*, 1996).

4. Reticulum

Traumatic reticuloperitonitis (TRP) resulting from perforation of the reticular wall by a sharp foreign material causes a fatal digestive system disease. It may result in local or diffuse peritonitis and foreign bodies may also penetrate the thoracic cavity and the adjacent abdominal anatomic structures, including the liver and spleen. Although TRP is reportedly common in cattle, its occurrence has rarely been documented in small ruminants (Radostits *et al.* 2007).

5. Rumen

Laparotomy in goat is an invasive surgical procedure into the abdominal cavity that allows visual

examination of abdominal organs and documentation and correction of specific pathologic abnormalities observed (Ames, 2007). Laparotomy is indicated for exploration of abdominal and pelvic cavities and other surgical procedures involving abdominal and pelvic organs; other specific indications cesarean section, embryo transfer to produce transgenic goats, ovariectomy, rumenotomy, abomasotomy, ventral abdominal herniorrhaphy, intestinal resection, anastomosis, and cystotomy (Matthews, 2016). While in small ruminants too when they develop pica, influenced by boredom or extended periods of confinement, nutritional or mineral imbalance, unfamiliar items used to be intake as food like plastic bags, cloth, leather, twine and rope (Pugh and Baird, 2012).

In sheep, rumenotomy was performed by using one method of the rumen; the first skin fixation technique reflected good results (modified ruminal ring techniques) as well as modified Wingard's technique. These techniques were used for foreign bodies syndrome in sheep (Abdel-Hady *et al.*, 2015)

6. Anus and rectum

6.1. Atresia ani

The deformities of external genital organs are of extraordinary warning because of their repercussion on generations. These defects are observed in different parts of the body, especially the last part of the digestive tract like atresia ani. This congenital anomaly has been reported in all domestic animals. It is one of the quite frequently found defects of the intestine among sheep because of the recessive gene. (Suthar *et al.*, 2010). Atresia ani with rectovaginal fistula: The treatment was performed by anal reconstruction. A circular skin incision was made at the site corresponding to the anus and flap of skin was removed.

The rectal pouch was bluntly dissected and retracted. The blind stump of the rectum was incised and sutured all around with the skin by using interrupted mattress silk sutures. A linear skin incision of 7–8 cm extended horizontally, midway between the anus and vagina was performed. The perineal tissue was separated by blunt dissection, then rectal and vaginal walls were separated. The rectal and vaginal wall defects were sutured separately with chromic catgut no.1/0 by Cushing suture pattern. The perineal tissue and skin were closed in a conventional manner. (Bademkiran *et al.*, 2009). Rectovaginal fistula or anus vaginalis is an inherited lethal abnormality in which there is an abnormal passage between rectum and vagina; also, feces are passed through the vagina due to the imperforate anus (Ali *et al.*, 2020a)

6.2.Rectal prolapse

Formed the basis for a large-scale study that found short-docked lambs had a higher incidence of rectal prolapses than medium- or long-docked lambs (**Abdel-Hady et al., 2015**). Establishing a policy to improve the welfare of exhibited lambs as related to rectal prolapse requires an understanding of causal factors. It is important to note that the previous studies that evaluated the effect of dock length on rectal prolapse indicated that sex, feeding regimens, environmental conditions, and body condition also affected the incidence of rectal prolapse (**Matthews, 2016**).

Surgical affections of the sheep and goats' urogenital system

1.Urethral affections

Congenital anomalies of the urinary system are widespread in small ruminants, especially in ram and buck; though, a wide variety of abnormalities may be encountered. Hypospadias is found in association with hermaphroditism in goats; other defects are uncommon (**Ames, 2007**). The urethral process is commonly amputated therapeutically and sometimes prophylactically in male small ruminants (**Abdel-Hady et al., 2015**).

2.Urethral dilatation (Urethral diverticulum)

The dilated part of the urethra below the induced fistula was resected or obliterated. In hypospadias, the urethra's bared mucous membrane was covered by suturing the skin edges after their dissection from the underlying tissues. The displaced urethral orifice was widened (**Misk et al., 2008**).

3.Penile affections

Persistence penile prolapse means the prolapse of the penis from prepuce all the time or inability of the animal to retract the prolapsed penis into the prepuce (**Misk et al., 2013**). Penile urethral dilatation is a painless, fluctuating and glistening cystic like pouch covered externally with healthy skin. It varied in size from a small bean-like swelling to a large mandarin like the size. It extended in front of the scrotum to variable distance on the ventral aspect of the penis (**Senna et al., 2003**). Buried or concealed penis is a congenital abnormality in which the penis is hidden below the surface of prepubic skin (**Ali et al., 2020b**).

4.Testicular affections

The castration of male goats is a routine practice in many countries aimed at reducing management problems with aggressive and sexual behaviour, as well as improving meat quality (**Matthews, 2016**). The main techniques used to castrate goats include surgical or nonsurgical/ischemic (elastrator, burdizzo or emasculatome) methods (**Ames, 2007**). Castration has been shown to elicit inflammatory reactions, physiological stress,

suppression of immune function, pain-associated behavior, and a reduction in performance (**Abdel-Hady et al., 2015**).

An inguinal hernia causing distension of the scrotum may be confused with enlarged testicles. *Orchitis*, or inflammation of the testes, may be unilateral or bilateral, acute or chronic. In the acute condition, the testes will be swollen and painful and the buck will be pyretic, lethargic and unwilling to move. In chronic orchitis, fibrous adhesions may limit movement within the scrotum and the testicles become atrophied and fibrous. Ultrasonographic examination of the scrotum using a 5 MHz linear scanner will aid differentiation between orchitis and epididymitis. *Neoplasia* is an uncommon cause of infertility in bucks, but seminomas, adenomas and carcinomas have been reported and should be detectable by ultrasonography. *Hematoma*, or intratesticular hemorrhage, may cause enlargement of a testis. As the hematoma organizes, its ultrasonographic appearance became more echogenic, eventually appearing hyperechoic relative to the surrounding testicle. Fibrin tags and adhesions may also form in the affected area (**Ali et al., 2019a**).

5.Scrotal hernia

Many small umbilical hernias may appear to resolve spontaneously, but large or strangulated umbilical hernias will require surgical correction. The inguinal hernia is relatively common in bulls, rams and boars. The scrotal hernia is merely an extension of an inguinal hernia. A congenital inguinal hernia is rare in bulls, but it may result in evisceration at castration. Acquired inguinal hernias occur in mature bulls and rams (**Matthews, 2016**).

6.Vaginal prolapse

Vaginal prolapse is a problem affecting females of several animal species (**Couri et al., 2012**). Cervical-vaginal prolapse appears as a smooth pink to red mass at the rear end of the ewe. In the fresh stage, the incomplete CVP may temporarily appear when the ewe is lying down due to increase the intraabdominal pressure but disappear when the ewe stands. On the other hand, complete CVP does not disappear when the ewe is standing and known as complete CVP. The CVP mass varies in its size from a tennis ball to a melon (**Fisher, 2016**). Irritability and discomfort due to the displacement of the vagina with/without the cervix progressively lead to increased straining and increases the size of the extensive prolapse (**Kahn, 2005**). The size of the CVP is also increased and become more swollen due to both oedema and the urine retention inside the occluded urinary bladder (**Matthews, 2016**). Complications as consequences of the CVP include difficult urination, hardening of the CVP wall,

occasionally rupture of the vaginal wall through which specific organs such as intestine, urinary bladder and/or uterus may eviscerate. All these complications are life-threatening and may result in the death of the animal. Maternal dystocia is a common sequela if the ewe survives until lambing without treatment (Fisher, 2016).

7. Caesarean section (dystocia)

Appropriate surgical preparation for aseptic surgery is indicated. After the opening of the abdominal wall, the gravid horn must be exteriorized using fetal extremities. Care must be exercised to prevent uterine wall rupture and spillage of contaminated fetal fluid into the abdominal cavity in cases of a dead fetus or delayed dystocia. It is advisable to pack the exteriorized uterus using sterile and moist towels in those situations. A long incision is made in the greater curvature of the uterus in an area devoid of cotyledons. In most cases, one incision in the uterine horn is used to deliver multiple fetuses (Matthews, 2016).

8. Udder and teat affections

Mastitis reflects the inflammation of the mammary gland, which may occur due to any bacterial infection secondary to teat injury or poor management, as reported by (Marogna *et al.*, 2010). Radical mastectomy (unilateral or bilateral) is a salvage procedure and indicated in cases of chronic suppurative mastitis, gangrenous mastitis and neoplastic or hyperplastic conditions of the udder (Abdel-Hady *et al.*, 2015). Unilateral or bilateral mastectomy are recommended as a pain-relieving procedure for extensive lesions involving udder and in cases of chronic mastitis, gangrenous lesions or neoplasia (Farghali, 2001 and Cable *et al.*, 2004). Chronic mastitis develops from an untreated case of acute mastitis, which manifested as C formation of an abscess within the mammary parenchyma (Scott, 2007).

Surgical affections of the sheep and goats' musculoskeletal system

Congenital anomalies of the distal part of the limbs are common in small ruminants (Senna *et al.*, 2003 and Matthews, 2016). An autosomal recessive gene causes contracted flexor tendons and arthrogryposis and it is the most prevalent abnormality in the newborn ruminants (Senna and Abu-Seida, 2004 and Abdel-Hady *et al.*, 2015).

1. Fractures

Fracture of bones is a feature of accidental surgical affection where ribs are more vulnerable. For both anatomical and mechanical reasons, the condylar process is easy to fracture and is a common site of mandibular fractures. It accounts for 26–57% of all

mandibular fractures (Abdel-Hady *et al.*, 2015). Anatomically, the site can be classified as the intracapsular condylar head, neck, and sub condylar fracture (Haug and Assael, 2001). Limb fractures in ruminants can account for up to 10% of the caseload at ruminants' referral centres (Matthews, 2016). Challenges encountered in ruminant fracture fixation include both economic constraints as well as increased forces placed upon the repairs (Nuss K. Plates, pins, and interlocking nails, 2014). Success rates of up to 90% have been reported in ruminants when internal repair methods are used including plating and lag screw techniques (Auer *et al.*, 1993).

However, internal fixation is infrequently used due to the high cost of orthopaedic implants relative to the owner-perceived value of the animal, and regulatory concerns over metal implants. According to the type of fracture, external coaptation using casts after closed reduction is commonly used as an inexpensive means of fracture stabilization in ruminant patients due to the ease of application in a field setting. However, casting can only be used to immobilize fractures distal to the radius/ ulna or the tibia unless combined with a Thomas splint. Successful treatment with casting alone or with a Thomas splint-cast combination reportedly ranges from 54% to 57% in cattle (Matthews, 2016).

2. Bursitis

The clinical signs of subcutaneous bursitis in all forms were highly diagnostic and exploratory puncture was highly confirmative. Surgery appeared to be the ideal treatment for cases of presternal and olecranon bursitis by complete surgical excision of the swelling. In contrast, medical treatment of precarpal bursitis by evacuation of the contents and several injections of anti-inflammatory drugs were more practical. In conclusion, we can state that three forms of subcutaneous bursitis were diagnosed in buffaloes and cattle namely, olecranon, presternal, and precarbal. Subcutaneous bursitis can be corrected medically and surgically with encouraging results. (Misk, 2008).

3. Foot affections

Foot diseases are major causes of lameness in small ruminants and responsible for great economic losses. The prevalence of foot lesions was nearly similar in sheep and goats and ranged between 5.77% and 33.85% in different farms in previous studies. Footrot was the most common disease, but with significantly higher prevalence, especially malignant foot rot, in sheep than in goats. *Dichelobacter nodosus* and *Fusobacterium necrophorum* were isolated from cases of footrot. White line disease, sole ulcers, foot abscess and hoof overgrowth, were frequently recorded in sheep and goats (Aguiar *et al.*, 2011).

Surgical affections of the sheep and goats' abdominal wall

Hernia

It forms as an extension of an inguinal hernia when the abdominal organs protrude through an enlarged inguinal ring into the scrotum (AL-Sobayil and Ahmed, 2007). Unilateral scrotal hernia in male lambs of the Merino, Hampshire, Suffolk and the Arabic Naomi breeds was described (Senna *et al.*, 2003 and AL-Sobayil and Ahmed, 2007). The scrotal hernia is usually caused by trauma such as a horn injury in group-housed males. In addition to physical examination, plain or contrast radiography and trans-scrotal ultrasonography can be used to diagnose scrotal hernia in sheep and goats (Abdin-Bey and Ramadan, 2001). Two elliptical incisions were made on either side of the swelling and the adhesions between the parietal peritoneum and skin were dissected using both blunt and sharp dissection. The hernial ring was exposed and freshened before its suturing by interrupted horizontal mattress pattern using silk sutures. The excessive skin was removed before the suturing of the wound edges using silk sutures (Jettennavar *et al.*, 2010).

Surgical affections of the sheep and goats' nervous system and sense organs

Diagnosis of neurological diseases can be one of the most frustrating aspects of small ruminant practice. Many diseases can present with similar signs, and diagnostics are limited. But because some neurological diseases have herd implications, or are zoonotic, the practitioner must try to find a list of most likely diagnoses, so that treatment and/or preventative measures can be taken. The most common diseases involving the brain that in adult goats are polioencephalomalacia (PEM) and listeriosis. PEM can be seen in any age animal and is associated with disruption of normal diet or eating habits. Listeriosis affects goats more often than cattle and sheep and is most commonly seen in winter and early spring. Circling is frequently seen in affected animals. Sheep and goats are very susceptible to tetanus. Rabies in sheep and goats can present with a variety of clinical signs. Sometimes the dumb form occurs. Other times animals are more aggressive. Other diseases such as bacterial meningitis, brain abscesses, otitis, toxicosis, and injuries in other livestock species can occur in sheep and goats (Navarre, 2007).

1. Ear affections

Ear disease, whether acute or chronic, can be quite disabling and painful, causing not only clinical signs related directly to the ears but often lethargy, anorexia and neurological disturbances. External ear comprises ear pinna and ear canal. External ear in animals is more prolonged and deeper than in humans,

which makes infection or wax to build up easily and hard to remove (Duarte and Hamdan, 2004). Many external ear affections want surgical intervention. Otitis externa has a multifactorial etiology and bacteria play an important role in optic disease. A wound on the ear pinna, gangrene, hematoma and otitis (Tyagi and Singh, 2006).

2. Eye affections

Faulty differentiation of tissue during ocular development can produce a dermoid characterized by a mass of normal skin in an abnormal location. The anomaly occasionally develops along the eyelid margin and within the palpebral conjunctiva at the lateral canthus, although the temporal perilimbal conjunctiva and cornea are more typical locations (Radostits *et al.*, 2007). Infectious Ovine keratoconjunctivitis (IOK) has the common name pink eye. Keratoconjunctivitis is inflammation of the covering mucosa of the eye, including orbit and the inner surface of the eyelids. When the inflammation extends to layers below the conjunctiva the diseases called keratoconjunctivitis (Radostits *et al.*, 2007).

Lacerations of the eyelids should be repaired promptly to prevent lid deformities infections and exposure-induced damage to the cornea. Conjunctivitis in individual animals can occur as a result of irritation by dusty hay (particularly if fed from overhead racks), dust, wind, bright sunlight or localized trauma or foreign objects in the conjunctivae, or as a result of an allergy. Infectious keratoconjunctivitis ('pink eye' or contagious ophthalmia) is an acute contagious disease characterized by inflammation of the conjunctiva and cornea in one or both eyes (Matthews, 2016).

3. Tumors of the eyelids

Reported tumors of the eyelids in small ruminants include squamous cell carcinoma, fibroma, fibrosarcoma, melanoma and lymphoma. Tumors of the third eyelid are occasionally observed and include squamous cell carcinoma, adenocarcinoma and lymphoma. Excision is generally curative (Matthews, 2016).

Surgical affections of the sheep and goats' respiratory system

Nasal cavity

Enzootic nasal adenocarcinoma (ENA) is an economically significant highly contagious neoplasm of sheep and goats, associated with the oncogenic retroviruses; enzootic nasal tumor virus (ENTV) 1 and 2, respectively. The clinical symptoms developed during the neoplasm evolution included constant seromucous nasal discharge and signs of upper respiratory obstruction as nostrils flaring, dyspnoea and mouth breathing. These signs are frequently reported in

previous articles (Wang *et al.*, 2016; Ozmen and Serpin, 2016; Sid *et al.*, 2018 and Santana de Cecco *et al.*, 2019). Exophthalmia, skull deformations, facial asymmetry as well as emaciation, were reported in our cases, which considered as concurrent findings with other studies (Wang *et al.*, 2016, Ozmen and Serpin, 2016, Sid *et al.*, 2018 and Santana de Cecco *et al.*, 2019). Successful surgical interventions were applied, resulted in satisfactory. On the other side, endoscopic resection of ENA showed a successful result as a less invasive method comparing with traditional surgical procedures (Ali *et al.*, 2019b).

CONCLUSIONS

Numerous surgical affections are common among sheep and goats at different localities which may cause economic losses and most of these affections are curable. Categorizing of such affections gives wide scope for veterinarians and researchers specialized in small ruminant practice to manage and control these conditions and study in a scientific manner their incidence and geographic distributions in relation to affections' predisposing risk factors.

Conflict of interest

The authors declare that any financial or personal factors have not influenced this work.

Author's contribution

All authors contributed equally and approved the final manuscript.

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