



**VARIOUS SURGICAL PROCEDURES PERFORMED ON DIFFERENT SPECIES OF
ANIMALS: OUTCOMES AND COMPLICATIONS**

MVSc Research Thesis

BY

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VARIOUS SURGICAL PROCEDURES PERFORMED ON DIFFERENT SPECIES OF ANIMALS: OUTCOMES AND COMPLICATIONS

A Thesis submitted to College of Veterinary Medicine and Agriculture of Addis Ababa University in partial fulfillment of the requirements for the degree of Master of **Veterinary Science in Veterinary Surgery**

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STATEMENT OF THE AUTHOR

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LIST OF ABBREVIATIONS

CVMA	College of Veterinary Medicine and Agriculture
IM	Intramuscular
IV	Intravenous
NVI	National Veterinary Institute
OHE	Ovariohysterectomy
SNT	Supernumerary Teat
SPANNA	Society for the Protection of Animal Abroad
VTH	Veterinary Teaching Hospital

ABSTRACT

Surgery is a knowledge, skill and equipment based specialty that mainly employ an incision in order to provide an advanced veterinary care and to improve animals' quality of life as well as increase their life expectancy. In Ethiopia, there is lack of trained personnel, equipments and anesthesia which could potentially be the cause of complications of different surgical cases. There are also no adequate studies conducted to overcome this problem. So this study was conducted with the objectives to gain skill and identify, manage and document complications that could occur during and after surgical procedures in different species. The study was done from September 2018 to June 2019 at Veterinary Teaching Hospital (VTH) of College of Veterinary Medicine and Agriculture (CVMA) of Addis Ababa University (AAU) which is based in Bishoftu town and some cases were performed in the field by the owners' request. During this period, a total of twenty five cases were studied and observations compiled. Almost all domestic animal species and some wild animals such as Marabou Stork and *Oryctolagus cuniculus* were included in this study. The surgical procedures which were performed and compiled are cesarean section, spaying, prolapse (uterine, vaginal and rectal) management, castration, herniorrhaphy, amputation of limb, wing and udder, removal of supernumerary teat and abnormal mass, rasping of sharp molar and abscess draining. During the study in twenty four of the cases a full recovery has been registered whereas one death encountered. Generally, swelling, hypothermia, bleeding, anorexia and loss of body condition were often seen in some of the patients and recorded as a post-operative complication. Use of appropriate aseptic and surgical techniques and also applying good post-operative care can be suggestive in order to minimize post-operative complications.

Key words: *Complications, outcomes, surgical management, veterinary teaching hospital*

1. INTRODUCTION

Ethiopia is believed to have the largest livestock population in Africa (CSA, 2015). This livestock sector has been contributing considerable portion to the economy of the country and still promising to spearhead the economic development of the country. About 50.8 million cattle, 25.9 million sheep and 21.9 million goats are estimated to be in the country (MoA and ILRI, 2013). Cattle play significant contribution in Ethiopian economy as a source of meat, milk, drought power, income, and foreign exchange. Sheep and goats are major sources of income (cash) for the rural poor farmers in most parts of the tropics including Ethiopia. Furthermore, livestock play an important role in providing export commodities such as live animals, hides and skins to earn foreign exchanges (CSA, 2013).

The national animal health service delivery in Ethiopia covers only 40-45% of the country's population (Admasu, 2010). Even though there is low service coverage, there is an increase demand for better veterinary services due to the increasing awareness of the importance of treatment of individual animal by both the rural and urban community (Tiruneh *et al.*, 2014). This low service coverage is attributed to lack of personnel, shortage of drugs and equipments, poor mobility, and highland oriented animal health service delivery (Abebe, 2003).

Surgery, in today's era, in developed countries is moving forward taking advantage of the developments and achievements in human surgery. Cardiovascular operations, tracheal and urethral stenting, advances in surgical oncology, total hip replacement, developments in neurosurgery, and kidney transplantation are among the new modalities. This can be used for animal patients in order to provide them advanced veterinary care and to improve their quality of life as well as increase their life expectancy (Arju *et al.*, 2014).

Surgery is a skill and equipment based specialty that uses sutures, incisions, excision, manipulation, or other invasive procedures as well as local, regional, or general anaesthesia for patient management (Debas, 2006). Surgery lays heavy demand on space, equipment and personnel proficiencies for patient management and could be used as an index of high profile clinical veterinary practice especially in poor resource settings as obtained in many developing countries of Africa and Asia (Eyarefe and Dickson, 2014).

Surgery is one of the means of treatment of different kinds of health problems in different species of animals. However, it has its own risk associated with anesthesia and the surgical procedure conducted in species could be a potential cause for different kinds of surgical complications during and after surgical operation. Lack of trained personnel and equipments are also the potential for surgical complication in Ethiopia. There is shortage of published works in Ethiopia regarding veterinary surgery to serve as reference for future improvement.

Therefore, the objectives of this study were:

- ❖ To gain and improve surgical skills on various surgical techniques and procedures performed on different species.
- ❖ To identify, manage and document complications that could occur during and after surgical procedures in different species.

2. MATERIALS AND METHODS

2. 1. Study Areas and Study Animals

The study was conducted from September 2018 to June 2019 at Veterinary Teaching Hospital (VTH) of the College of Veterinary Medicine and Agriculture (CVMA) of Addis Ababa University (AAU), Bishoftu, Ethiopia. Bishoftu is located in Oromia Regional State lying at a distance of 47.9 kilometers southeast of Addis Ababa, the capital city of Ethiopia. Geographically it is stretched between 8 degrees 43' North – 8 degrees 48' North latitude and 38 degrees 00' East – 38 degrees 48' East longitude (OUPU, 2009).

The equine clinics of Society for the protection of Animals Abroad (SPANNA) and Donkey Sanctuary are found in the College of Veterinary Medicine and Agriculture as components of VTH at Addis Ababa University. Some surgical cases such as rectal prolapse in donkey and ventral hernia in horse were carried out at SPANNA and the Donkey Sanctuary open air clinics. Moreover, some cases were also performed in the field by the owners' request in and around Bishoftu town. The species which were presented for different kinds of surgical interventions included ruminants (9 bovines, 2 ovines and 1 caprine), canine (6 dogs), one feline, equines (2 horses and 1 donkey), 1 swine, Marabou stork and *Oryctolagus cuniculus* (1 rabbit). Weight of the animals were taken by estimation and ranged from 3 to 350 kg. Patients were categorized based on the types of surgical interventions conducted; cesarean section, hernia, castration, rumenotomy, limb amputation, uterine and vaginal prolapse, rectal prolapse, spaying, supernumerary teat removal, udder amputation, irregular/sharp molar correction, abscess drainage and excision of abnormal mass.

2.2. Clinical Parameters Recorded

2.2.1. Signalment

Identification of the animals which were presented for surgical operation was performed by recording of species, age, breed, sex, and health status of each patient.

2.2.2. History

During history taking, different kinds of questions were presented to the owners in order to obtain information regarding the patient conditions like duration of the illness, severity of the problem, history of previous ailment and medication and recorded accordingly. Clinical symptoms such as anorexia, lethargy, depression, weight loss, vomition, enlargement of abdomen, polydipsia, polyuria, dysuria, haematuria, vaginal discharge, any changes on the animal behavior, locomotion disorders, swellings and expressions of pain, and other ailments were recorded.

2.2.3. Physical examination

Parameters which were taken and recorded were respiratory rate (RR), pulse rate (PR), rectal temperature, colour of mucous membrane and hydration status. Abdominal palpation was also conducted depending on the condition of the patient. All the patients were closely inspected for detection of any structural and/or functional disorders of the affected region. The affected parts and/or lesions were manipulated to detect their nature, consistency and tenderness. Exploratory puncture was done whenever indicated to reveal the physical characters or the existence of fluids or contents in the examined lesions.

3. SURGICAL MANAGEMENT

3.1. Surgical Management of Reproductive Disorders

3.1.1. Surgical management of dystocia

Summary

Dystocia is a prolonged and difficult parturition that requires assistance for helping delivery and it could be caused by maternal or fetal causes. Four cases of different species were presented for difficulty of birth in VTH and in field. Three of the cases were ruminants (cow-case 1, sheep-case 2 and goat- case 3) and the other was a cat (case 4). All the cases were in their adult age. Abnormal ranges of parameteres were observed in all cases. Dehydration and pale mucus membrane were observed in case 2, 3 and 4. Deliveries of the first three cases were conducted by cesarean section and the cat by spaying. The operation in case 1 and 3 were done under local anesthesia and case 2 was conducted under local anesthesia and sedation. Surgery in case 4 was performed under general anesthesia. Cesarean section was performed for ruminant through lower flank, left side ventrolateral oblique celiotomy and in the cat through ventralmidline incision. Surgical management of case 3 and 4 were conducted in VTH and while the others were performed in the field. Recovery in ruminants was observed in different time and the cat died three days after the operation time. Early intervention by performing cesarean section can result in the delivery of live lambs, kids, calves or kittens and much healthier dams.

Key words: *Cesarean section, dystocia, spaying*

Literature Review

Calving difficulty, technically called dystocia is defined as prolonged and difficult parturition with assistance frequently being required. The incidence of dystocia in cattle has been widely studied because of its effects on productivity (Youngquist and Threlfall, 2007) and the overall incidence varies with the species and with breeds within the species. Dystocia in small ruminants is considered of low incidence worldwide (<5%) (Brounts *et al.*, 2004; Purohit, 2006). The

incidence is around 5 per cent overall, but reaches almost 100 % in some breeds of dogs and 20 % in some breeds of cats (Linde-Forsberg and Eneroth, 2000). The bovine species is most often affected with dysocia (Noakes *et al.*, 2001). It is apparently higher in dairy than beef cattle. In addition, consideration must always be given to the effect of breed, age and parity in the interpretation of results. The incidence of dystocia appears higher in the larger breeds such as the Holstein, Brown Swiss and Hereford (Mee, 2008).

The usual clinical signs are the onset of labor without delivery of fetus and/or fetal membranes and later regression of parturition signs. The animal may show signs of mild discomfort. The animal may adopt a rocking horse stance and show mild colic pain (Jackson, 1995). Partial anorexia, dullness and depression may be evident. One or both lips of the vulva are pulled in because of torsion of the birth canal. When the cervix is fully dilated it is not palpable as a separate structure and is continuous with the vagina. Incompletely dilated cervix is palpable through per rectum examination (Purohit *et al.*, 2011).

It is convenient to divide the causes of dystocia into those of maternal origin and those of fetal origin for purpose of formulating a clinical management plan for an individual animal (Darvelid *et al.*, 1994; Youngquist and Threlfall, 2007; Bhattacharyya *et al.*, 2015). Maternal Causes: Dystocia, which arises in the mother due to maternal factors, are caused either by constriction of the birth canal or by a deficiency of expulsive forces. The constrictive forms of which the most important are pelvic inadequacies, incomplete dilation of the cervix or ringwomb and uterine torsion (Linde-Forsberg, 2003; Jackson, 2004). The most common fetal-related causes of dystocia are head deviation, forelimb flexion, breech presentation, dog sitting position and fetal malformations (Bhattacharyya *et al.*, 2015).

Fetomaternal disproportion is not only a factor by itself but a relationship between maternal and fetal factors and can be defined as an obstruction of calf expulsion originated by the calf size/birth weight or pelvic dimensions of the dam, that may have several factors in its origin (Mee, 2008). The dimensions of the bony pelvis are too small to allow passage of the fetus. This is most commonly caused by maternal immaturity and often occurs as a result of young being served at too young an age. A small pelvis is a component in dystocia due to fetopelvic disproportion and is exacerbated in cases where the fetus is larger than normal (Jackson, 2004).

Incomplete Cervical Dilatation: Failure of the cervix completely to dilate is a relatively common cause of dystocia in the dairy bovine. It may occur in the heifer, multiparous cows and other species. Improper cervical dilation appears to be more frequent maternal cause of dystocia in cattle (Benesch and Wright, 2001). Formation of scar tissue due to injuries sustained at previous calving in aged animals, improper relaxation during parturition, congenital stenosis of the vagina, vaginal obstruction by fibrous bands, perivaginal abscess or cysts can occlude the genital passage and hinder with the delivery of the fetus (Purohit *et al.*, 2011).

Uterine Torsion: Torsion of uterus usually occurs in a pregnant uterine horn and is defined as the twisting of the uterus on its longitudinal axis (Sane, 1982). Rotation of the uterus on its long axis with twisting of the anterior vagina is a common cause of bovine dystocia, less common in small ruminant and small animals. Uterine torsion is a complication of late first-stage or early second stage labour. It is probably due to instability of the uterus which results from the greater curvature of the organ being dorsal and from the uterus being disposed anteriorly to its subilial suspension by the broad ligaments (Beagley *et al.*, 2010).

Uterine Inertia: The condition where the uterine expulsive forces fail to deliver a fetus is known as uterine inertia. Uterine inertia is classified conventionally into primary and secondary uterine inertia. The most common cause of primary uterine inertia in dairy cows is considered to be hypocalcaemia, with the animal showing signs of milk fever as calving is about to begin. When the uterine musculature becomes exhausted subsequent to failure of delivery of a maldisposed or oversized fetus or due to obstruction in the birth canal, then the condition is known as secondary uterine inertia. The contractions in the uterus then stop or become weak and transient. The animal shows no progress in parturition after the second stage of labor (Purohit *et al.*, 2011). It is produced by lack of tone or failure of the uterine muscles to contract. Primary uterine inertia is failure of uterine muscle to contract normally at parturition which may occur due to failure of the muscle to respond to hormonal stimuli and disease of muscle or lack of failure to release hormones such as estrogen and possibly oxytocins, that initiate uterine contraction in normal muscles (Roberts, 2004).

Hernia of the Gravid Uterus: Occasionally hernia of the gravid uterus occurs through a rupture of the abdominal floor. The accident is one of advanced pregnancy, occurring from the seventh

months onwards in large animals. It is probable that in the majority of cases a severe blow on the abdominal wall is the exciting cause although many observers have stated that it may occur without traumatic influence; the abdominal musculature becoming in some way so weakened that it is unable to support the gravid uterus. The site of the original rupture is the ventral aspect of the abdomen, at the right side in the case of cows. Ventral displacement of the uterus is an uncommon cause of dystocia in cows. It is seen in animals with a ventral hernia or rupture of the prepubic tendon where the pregnant uterus passes downward into the point of the hernia (Benesch and Wright, 2001).

Fetal Oversize: A large number of studies conducted on dairy and beef cows point out that the calf birth weight, especially in 2-year old first calving heifers, significantly affects the difficulty in calving (Purohit *et al.*, 2011). **Fetal Maldispositions:** Although abnormal presentations are thought to be repeatable (Cows that have an abnormally presented fetus once are more likely to do so again), there is little that can be done to reduce the relatively small percentage of calves that experience dystocia due to abnormal presentation. Various diseases of the fetus can result in the altered shape of the fetus and dystocia in cattle (Anderson, 2012).

Twinning: Twin gestation in cattle often culminates in dystocia. Twin dystocia is of three types: both fetuses present simultaneously and become impacted in the maternal pelvis, one fetus only is presented but cannot be born because of defective posture. position or presentation; posture is often most at fault, the lack of extension of limbs or head being due to insufficient uterine space; uterine inertia, defective uterine contractions are caused, either by the excessive fetal load, or by premature birth. When inertia is present, birth of the first or second fetus does not proceed although presentation is normal (Noakes *et al.*, 2001).

Malposition of fetus: Further causes of obstructive dystocia are faulty fetal disposition such as transverse presentation, lateral or ventral deviation of the head or breech posture (especially if the first fetus in a primiparous dam is concerned). Dead fetuses may occasionally cause an obstructive dystocia, especially if the first fetus to be delivered is dead or if massive emphysema formation has already taken place. Furthermore, obstructive dystocia may also be caused by pathological alterations of the soft or bony tissue of the birth canal (pelvic fractures, tumors,

vaginal prolapse, congenital malformations of the uterus, the vagina or the vestibulum) (Johnston *et al.*, 2001).

Dystocia in cattle can be relieved by different obstetric methods, including the caesarean operation and fetotomy. Nowadays, the caesarean operation is one of the most common surgical procedures performed by veterinarians in cattle practice, and is considered as a routine obstetric technique. It has high maternal and fetal survival rates, and often is less exhausting, speedier and safer than fetotomy. There are three main goals: (1) survival of the cow; (2) survival of the calf; and (3) maintenance of fertility. A prompt decision to perform a caesarean operation is important for optimum success. Ideally, it is carried out when a live calf cannot be delivered after 15-20 minutes of manipulation (Benesch and Wright, 2001).

The cow is a good surgical risk, provided that the environment is suitable for aseptic abdominal surgery. The need for urgent intervention is indicated if there is evidence of fetal hypoxia, as shown by hyperactive movements of the fetus and expulsion of the meconium, identifiable in the amniotic fluid. A successful prognosis depends on several factors, such as the skill and speed of the surgeon, duration of dystocia, physical condition of the dam, surgical environment, concurrent disease, and presence of a live calf (Noakes *et al.*, 2001).

Cesarean section in cow is potentially indicated in cases of dystocia when a calf cannot be delivered by fetal rotation and extraction. There are 8 available surgical approaches for the bovine cesarean section: the standing left paralumbar celiotomy, standing right paralumbar celiotomy, recumbent left paralumbar celiotomy, recumbent right paralumbar celiotomy, recumbent ventral midline celiotomy, recumbent ventral paramedian celiotomy, ventrolateral celiotomy, and the standing left oblique celiotomy. Each has its own advantages and disadvantages. Selection of an approach should be based on the type of dystocia, the cow's condition, the environmental conditions, the availability of assistance, and the surgeon's preference (Vermunt, 2008).

Surgical approaches and anesthesia: Cesarean section in small ruminants is usually performed while the animal is in right lateral recumbency under local analgesia, with or without sedation (Brounts *et al.*, 2004). Less frequently, dorsal recumbency under general anesthesia is utilized. Using the lateral approach, a skin incision can be made through the left paralumbar fossa, low

flank or ventrolateral, or lateral oblique (Fubini and Ducharme, 2004). In dorsal recumbency, the incision is made in the ventral midline or paramedian regions. Alternatively, the ewe or doe may be positioned in a 45° angle between the sternal and right lateral side to facilitate exposure of the left flank (Fubini *et al.*, 2002). For paralumbar fossa laparotomy, local infiltration of analgesia using 1% lidocaine and using line block, inverted L block or paravertebral block can be used. Small ruminants are at a higher risk for lidocaine toxicity which may occur at 5mg/ kg of body weight or higher doses (Bhattacharyya *et al.*, 2015).

In cat medical therapy involves administration of the hormone, oxytocin, to stimulate uterine contractions. If calcium levels are low, supplementation of calcium is indicated, because it enhances uterine contractions and increases the effects of oxytocin. If medical therapy fails, surgery to perform a cesarean section (C-section) is indicated. If there are no further plans for breeding the mother or if a uterine rupture is present, ovariohysterectomy (spaying) may be recommended (Wykes and Olson, 2003).

Case 1. Cesarean section in cow

History and clinical examination

The cow was straining for about three hours and it was assisted for delivery with manual traction for a longer time but it could not deliver the calf. The cow was six years old and it was fourth time to be pregnant and there was no such kind of condition during the previous delivery time. The cow was recumbent in left lateral recumbency and it was straining (Figure 1A). There was a discharge from vaginal orifice. There was no any structure of the calf coming from the cow. When it was checked to appreciate the part of the calf and its position, its leg was palpated inside the vagina of the cow and the calf was placed in its normal position (Figure 1B). Since it was straining for a longer time, it had no enough strength to push the calf and there was no adequate pelvic opening to pass the calf. Clinical examination of the body parameters revealed that the temperature, heart and respiratory rates were 39.6°C, 48 beats/minutes and 20 breaths/minutes, respectively.

Anesthesia and preoperative preparation

Penstrip 1ml/20kg was administered intramuscularly before preparation of the surgical area as a prophylaxis. Two linear infiltrations were made on the incision site to desensitize an operative field. Caudal epidural anesthesia was also performed using 2% lidocaine. The position of the cow was changed from left to right lateral recumbency. The surgical site and the surrounding area were washed with water and soap. Then shaved and disinfected with 70% alcohol and stained with iodine (Figure 1C). While the animal was being prepared, calcium borogluconate was administered simultaneously.

Surgical procedure

The incision was placed in front of the stifle and extended cranioventrally in a slightly oblique direction (Figure 1D). Sharp incision was continued through the subcutaneous tissues and compined aponeurosis of the two oblique muscles which form the external sheath of the rectus abdominis muscle. The transverse abdominis muscle and peritoneum were tented and incised in the same direction as the incision. The limb of the calf was manipulated with intact uterus to the incision and the uterus was exteriorized (Figure 1E). Incision of the uterus was made outside the abdomen between the cotyledons without injuring them. The calf was pulled out from the uterus through the incision with assistance (Figure 1F). After removal of the calf, part of the placenta was removed and part of it which was undetached was replaced into the uterus. Checking for another calf in the uterus and also uterine tear were conducted before suturing of the uterus. The uterus was sutured in two rows. The first row was sutured by schmieden's suture pattern and the second by Cushing pattern (Figure 1G). Peritoneum and transverse abdominis muscle were sutured by simple interrupted suture and also the external sheath of the rectus abdominis muscle was sutured in the same pattern (Figure 1H). Procaine penicillin was sprinkled on the muscle layer before suturing the skin. Skin and subcutaneous tissue were sutured by interrupted horizontal mattress suture (Figure 1I).

Postoperative care

Antibiotic (Cyclo, tetracycline) was sprayed on the wound. Penstrip (a combination of Procain Penicillin G and dehydrostreptomycin sulphate) was injected intramuscularly for five days. Suture was removed on fourteenth day from the operation. There was a good progress of healing of the wound.

Postoperative complication

There was swelling on and around the wound (Figure 1J) up to the third day and it was regressed.

Outcome

The wound on the 30th day has completely healed (Figure 1K). The calf was also in a good condition (Figure 1L).



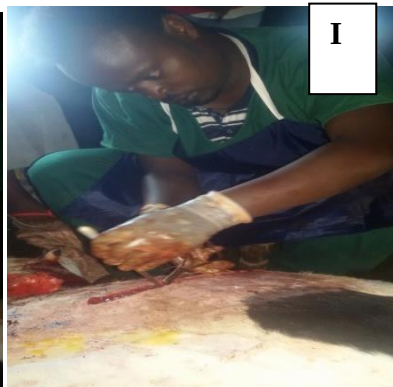




Figure 1: Cesarean section in cow; recumbent cow (A), vaginal examination (B), preparation (C), skin incision (D), uterus exteriorization (E), removing of live fetus (F), suturing of uterus (G), muscle suturing (H) and skin closing (I), swelling (J), recovery on the 30th day (K) and live calf (L)

Case 2. Cesarean section in sheep

History and clinical examination

The abdomen of the sheep was distended. The ewe was also screaming overnight before one day of the operation. The ewe was not eating for two days. During examination from distance, the ewe was restless and showing straining. The abdomen was distended and she could not walk properly (Figure 2A). There was also bloody discharge oozing out from her vaginal orifice and she was screaming. The cause was inadequate pelvic opening; this was confirmed by insertion of the hand through the ewe's vaginal orifice. And also manual traction was performed to remove the fetus but it was unsuccessful attempt. When its parameters were measured, the temperature, respiration rate and heart beat were 38.9⁰C, 28 breaths/minute and 80 beats/minute, respectively. Mucus membrane was pale. When skin pinch taste was conducted dehydration sign was appreciated.

Preoperative preparation

Antibiotic (penstrip 1ml/10kg) was administered as a prophylaxis. A combination of ketamine 11mg/kg and xylazine 0.1mg/kg was administered and the ewe was positioned in right lateral recumbency. Lower flank was washed, clipped, shaved (Figure 2B) and rinsed with water and soap. After cleaning, scrubbing with savlon was performed for about five times. The surgical site was infiltrated with lidocaine and stained with tincture of iodine. Surgical drape was also placed on the body of the patient to cover the remaining part of the body. Ringer lactate solution was also secured before the surgical operation (Figure 2B).

Surgical procedure

The surgical procedure that was conducted on the ewe was cesarean section to remove the fetus. Incision was made on the lower flank ventrolaterally (Figure 2C). Skin, muscles and peritoneum were incised in the same direction. Adhesion was observed between peritoneum and rumen and it was separated gently. Part of the gravid uterus containing the fetus was exteriorized and incised and the fetus was pulled out. The fetus was dead and emphysematous and seems not fully matured. The placenta was detached fully and uterus was cleaned after searching for remaining fetus. The incision of the uterus was sutured first by schmieden suture pattern (Figure 2D) and second layer by Cushing (Figure 2E). Muscles were sutured in two layers, peritoneum and transverse abdominis muscle together and the external sheath of the rectus abdominis muscle was sutured by continuous ford interlocking suture pattern (Figure 2F) using 2/0 sized cat gut suture. Skin and subcutaneous tissue were closed in interrupted horizontal mattress suture (Figure 2G) by non absorbable suture.

Postoperative care

Penstrep (1ml/10 kg) was given for five consecutive days. Tramadol 2mg/kg was also provided for three days to relief pain.

Outcome

The wound was healed on the twentieth day (Figure 2H). There was no any complication observed.



Figure 2: Cesarean section in sheep; sheep with distended abdomen (A), preoperative preparation (B), ventrolateral skin incision (C), schmieden suture pattern on uterus (D), suturing uterus by Cushing (E) and suturing muscles by fordinterlocking (D) and recovery on the 20th day (H)

Case 3. Cesarean section in goat

History and clinical examination

A goat was brought to CVMA, VTH clinic which was at her delivery time. The animal delivered two fetuses normally about twelve hours before but she was unable to give birth to the third one. It was the third time of delivery as the owner told us. There was no such kind of a problem during previous deliveries. She was straining until it was brought to the clinic. When the animal was examined in the clinic, there was straining and discharge was coming from the vaginal orifice and also there was placenta hanged from the vagina. There was slight distention of the abdomen and she was unable to stand. Examination through the rectum and palpation on the abdomen was performed to check the remaining fetus and it showed that there was one remaining fetus inside the uterus. Its parameters showed that temperature, heart rate, respiratory rate were 37.6°C, 84 beats/minute and 32 breaths/minute, respectively and its mucous membrane was pale. Dehydration was also observed by skin pinch test.

Preoperative preparation

The animal was restrained in right lateral recumbency. Procain penicillin at dose of 22000IU/kg was administered intramuscularly and fluid (Ringer lactated solution) was secured. The area (left lower flank) was washed, shaved, rinsed and scrubbed with savalon and finally the incision site was stained with tincture of iodine. Since the animal loses her energy due to prolonged time, anesthesia was achieved using sedation with xylazine (0.3mg/kg, IM) and 2% lidocaine by infiltration (Figure 3A).

Surgical procedure

A ventrolateral oblique skin incision was made on the left lower flank (Figure 3B). Muscles and peritoneum were incised in the direction of skin incision. The gravid uterus was exteriorized and handled by the assistance and incised on the place where there were no caruncles (Figure 3C). The fetus was removed gently with caring to prevent uterine fluid flowing to the abdomen. Then the placenta was also detached from the caruncles and removed. After cleaning the edge and the

external part of the uterus, it was closed first by Schmieden suture pattern and then by Cushing using (Figure 3D) 2/0 sized chromic cat gut. The uterus was replaced in to its position. The muscles were sutured by continuous lock stitch suture pattern (Figure 3E) in two layers by using chromic cat gut sized 2/0. Before suturing the skin, procain penicillin was sprinkled on sutured muscles. Finally, the skin and subcutaneous tissue were sutured by interrupted horizontal mattress suture pattern (Figure 3F) silk.

Postoperative care

Antibiotic (cyclo) was sprayed on the skin wound. Procain penicillin at dose of 22000IU/kg was administered intramuscularly for consecutive five days. The animal was observed for hemorrhage and edema on the wound by keeping the goat in the college compound for five days.

Outcome

There was good progress until the 5th day of follow up (Figure 3G) but after that it was impossible to observe the animal because of the distance from where the animal was brought. There was a phone contact with the owner and information was obtained that there was satisfactory progress and healing which was attested by more than one month telephone follow up.





Figure 3: Cesarean section in goat; Infiltration of anesthesia (A), skin incision (B), incising uterus (C), suturing uterus (D), suturing of muscles (E), skin sutured by horizontal mattress suture (F) and recovery on the fifth day (G)

Case 4. Ovariohysterectomy in cat

History and clinical examination

A three years old local bred cat was brought to the VTH with the complaint of difficulty in delivery. The owner told that the cat was straining before three days and delivered two kittens, after that she could not deliver the remaining but she was straining until it was brought to the clinic. The owner requested to assist its delivery and he needed the cat to be sterile then after. The clinical examination revealed distended abdomen (Figure 4A), straining, and other parameters were measured and recorded (temperature 37.7°C , respiration 60 breaths/min, and heart rate 80 beats/min). There was foul smelling when it was brought closer to the professional.

Anesthesia

Xylazine and tramadole in combination were administered intramuscularly as premedication, Ketamine and diazepam used as induction and maintenance.

Positioning and preoperative preparation

The cat was positioned in dorsal recumbency. After administration of premedication, the surgical site and the surrounding area were washed with water and soap and then clipped and shaved. The area was washed again and scrubbed five times by savlon. Prophylaxis was done by using penstrip 1ml/10kg. The incision area was stained by using 2% iodine.

Surgery

Ovariohysterectomy was performed to deliver and to control pregnancy permanently for the future. Prophylactic treatment using penstript was made before the surgical intervention. Skin incision was made on the ventral midline (Figure 4B) caudal to the umbilicus. Ringer lactated solution was also used for fluid therapy. The incision was done through the skin and subcutaneous tissues to expose the linea alba. Linea alba was tented and incised. Both uterine horns were exteriorized from the abdomen and then the left and right ovarian pedicles were clamped (Figure 4C), ligated, and transected sequentially then checked for bleeding. Uterine body just below the uterine bifurcation was ligated by transfixation ligation and transected then checked for bleeding. Uterine stump was replaced into the abdomen after releasing the forceps. Linea alba was sutured by simple interrupted (Figure 4D) and skin with subcutaneous tissue were closed by subcuticular suture patterns (Figure 4E) using vicryl 2/0.

Result and complications

The owner was not willing to bring the animal for postoperative care. When the owner had come on the fourth day and asked about the cat, he reported that the cat was died after three days of the surgical operation. He also told that the cat was awaked from anaesthesia after a long time (3.30hrs). There was also hypothermia at time the surgical operation was carried out (32.4⁰C) and its body temperature was maintained by electric warming device.



Figure 4: Ovariohysterectomy in cat; cat with distended abdomen (A), ventral midline incision (B), clamping pedicles and vessel (C), closing of the linea alba (D) and sutured skin (E)

Discussion

The operation was conducted in four different species and categorized into four cases:

Case 1. Cesarean section was performed on a cow due to difficulty of birth and the signs of difficulty of the delivery were abdominal distension, straining, discharge from the vulva, recumbency after prolonged straining and appearance of the forelimbs through the vulva. All these findings were similar to the published works of Newman and Anderson (2005) and Schultz *et al.* (2008).

The surgical operation in this case report was performed while the animal was in recumbency and ventral oblique celiotomy was performed on the lower left flank. The site was appropriate for the exteriorization of the gravid uterus. There was a satisfactory outcome when the case was

observed starting from the day of the surgical operation up to one month. These results were similar to Parish *et al.* (1995), and Vermunt (2008) who used ventral oblique celiotomy technique, but there was difference in anesthetic technique which was paravertebral nerve block and antibiotics (Oxytetracycline) used before and after the surgical operation.

Case 2. The cause of dystocia in sheep was maternal associated with failure of cervical dilation. This finding was similar to the observation of Taha *et al.* (2005) and Bhattacharyya *et al.* (2015) in the sheep.

Researchers such as Brounts *et al.* (2004), Fubini and Ducharme (2004), and Kumar *et al.* (2013) reported that cesarean section in small ruminants could usually be performed while the animal is in right lateral recumbency under local analgesia, with or without sedation and a skin incision can be made through low flank or ventrolateral, or lateral oblique. This is in agreement with the finding of this case report where the procedure was conducted by sedating the animal and the operation was also made through low flank of ventrolateral incision. The outcome of the surgical operation in this case report showed good prognosis which was similar to the success of the caesarian section operation performed by Hussain and Zaid (2010), Ali (2011), and Kumar *et al.* (2013).

Case 3. The cause of dystocia in the goat in this study was fetal in origin and it was malpresentation of the fetus which was supported by Jackson (1995) who stated fetal malpresentation is the most common cause of ovine and caprine dystocia. A similar cause was also encountered by Ahmed (2012), Pugh and Baird (2012), and Ahmed *et al.* (2017). It has been assumed that mild or severe fetal illness and fetal death might predispose to fetal maldisposition due to maternal illness or abnormal hormone level (Jackson, 1995; Noakes *et al.*, 2009).

The animal tried to stand and feed by itself on the second day of this operation even though the surgical intervention was performed with care. This might be due to weakness caused by prolonged time of straining. However, the success of the present caesarian section agreed with the finding of Brounts (2004) in that the healing took around one month.

There were differences in the time sheep and goat took for recovery and to stand after the surgical operation. The sheep tried to stand from the ground after about an hour of the operation

time and tried to feed at the same time. But on the contrary, the goat tried to stand and feed after two days. The sheep wound has healed completely on the twentieth day, while that of the goat after one month.

Case 4. The clinical signs observed in this case report were abdominal distension and discomfort, straining, foul smelling when approaching the animal, depression and inability to walk which were similar findings with the works of Wykes and Olson (2003), Beccaglia and Luvoni (2006) and Sparkes *et al.* (2006).

If there are no further plans for breeding the mother or if a uterine rupture is present, ovariohysterectomy (spaying) may be recommended (Wykes and Olson, 2003). In this case report also ovariohysterectomy was performed with the consent of the owner. However, death has occurred after three days of the surgical operation. This may be due to prolonged time of straining, lack of post operative care and delaying of the owner to bring the cat to the clinic.

Surgical management was performed in VTH only for case 4 and the others were conducted in the field. The surgical incision performed for a cow showed better outcome in healing and delivered live fetus. This may be due to early management of the case. In case 2 and 3, the fetuses were dead and there was delaying of healing and complication in case 3. Death has occurred after three days of the surgical operation in case 4. The reason could be failure of timely presentation of the case by the owner and consequently fail to manage the case in time.

3.1.2. Ovariohysterectomy in dog

Summary

Canine Ovariohysterectomy, commonly referred to as a spay procedure, is the removal of the ovaries and uterus from the female dog in order to prevent pregnancy and certain types of diseases. The present case study summerises Ovariohysterectomy conducted in two female dogs grouped as **case 1** and **case 2** depending on different conditions:

Case 1: the dog was younger and it was in heat, and the other **case 2** was older and not in heat. Similar preparation, anesthesia and surgical procedure were conducted for both cases. Bleeding postoperative complications during surgical operation was observed **in case 1**. Moreover, there

was also loss of body condition in **case 1**. The complications were anorexia, depression and delayed healing time when compared with **case 2**. For both dogs there was hypothermia which was observed during and after the surgical operation. In **case 2** suture material was removed on the seventh day after complete healing. In **case 1** suture was removed after 15 days indicating an extended healing time. It is generally agreed that spaying operation is better to be conducted during anoestrus period.

Key words: *Estrus, female dogs, ovariohysterectomy*

Literature Review

Canine Ovariohysterectomy, commonly referred to as a spay or neutering procedure, is the removal of the ovaries and uterus from the female dog in order to prevent pregnancy and certain types of diseases. This procedure should only be undertaken if the bitch is in a fit state to withstand general anesthesia. However, the procedure is contraindicated if the bitch presents a generalized condition with hypothermia and dehydration (Ruttema *et al.*, 2001). Elective sterilization of female dogs is one of the most common procedures performed in veterinary practice and spaying pet entails surgical removal of the reproductive organs. In females, these are the ovaries and uterus, and the procedure is called an ovariohysterectomy, or spaying. For routine spaying, the best age for dogs is before puberty. Spayed animals do not go through heat cycles or produce unwanted puppies. Dogs have their first heat at 5 to 12 months of age (Blender, 2012).

The advantages of OHE are decrease in reproductive tract diseases including pyometra and mammary neoplasia in bitches, decrease in pregnancy and parturition related disorders including metritis, mastitis and dystocia, decrease in hormone-associated disorders such as vaginal prolapse in bitches and decrease in undesirable sexual behaviors (Romagnoli, 2008). The disadvantages of OHE are surgical and anaesthetic complications, increased risk of neoplasia of various organ systems, obesity and urinary incontinence in bitches. Furthermore, several surgical techniques of OHE and their benefits and complications have been widely discussed for decades (SPAIN, 2004).

OHE consists of removing the source of hormones that control reproduction and that determine the typical physical and behavioral characteristics distinguishing males and females. In dogs, this is most commonly accomplished by surgically removing the ovaries (spaying) though there are a variety of surgical techniques as well as non-surgical methods of contraception to prevent reproduction without removing the source of gonadal hormones (Kutzler and Wood, 2006).

OHE is generally performed via the linea alba. Per-vaginal hysterectomy can also be performed in the event of uterine prolapse, if the latter cannot be reduced or if has been traumatized to such an extent that it cannot be replaced safely. Specific and nonspecific complications can occur as hemorrhage, adhesences, urinary incontinence, and return to oestrus including repeat surgery. After an Ovarioectomy, bitches tend to put on weight, it is therefore important to inform the owner to reduce the daily ration by 10 % (Djemil, 2010).

The two behaviors affected by spaying of female dogs are “aggressive dominance” toward guardians and indiscriminate eating. In this case, the aggressive behavior increased after spaying. This effect was only noted in female dogs’ ovariohysterectomized before 12 months of age, and that already demonstrated aggression. Bitches ovariohysterectomized after 12 months of age presented no risk of increased aggression and dogs that are in a progestational state for two months following an estrus period and spaying them during that time creates a sudden removal of the source of progestins which tend to have a calming influence on animals. It is proposed that this removal of progesterone may promote irritability or aggression in some individuals (Blender, 2012).

The main indications of OHE include population control, prevention of diseases of the reproductive tract, and elimination of undesirable behaviors associated with hormonal cycling. Elective sterilization of female dogs is important to reduce euthanasia of unwanted dogs (Ruttema *et al.*, 2001). This procedure is indicated for uterine tumours, serious uterine lesions, whether traumatic or infectious in origin. Things that need due attention are treatment of metritis, pyometra, cystic endometrial hyperplasia (CEH), neoplasia, injury, neglected dystocia and congenital abnormalities. OHE is also performed in young dogs up to 2.5 years to decrease the incidence of mammary gland tumors. The relative risk for developing mammary gland tumors

decreases when neutering is performed before first estrus (0.5%), between first and second estrus (8%), and between second estrus and 2.5 years of age (26%)(Kustritz, 2007).

Pre-Surgical care: All surgical patients should receive a preoperative examination by the veterinarian. Dogs that are in their heat cycle may have the surgery postponed until the cycle is over. If the dog is an older animal, the veterinarian may take blood tests and possibly chest x-rays to check for any underlying diseases (Djemil, 2010). Though operation can be done at almost any age and at any phase of reproductive cycle but it is best performed either before puberty or during anoestrus. Some prefer to wait until the animal has passed through one heat period. Six to eight months of age is generally considered best. The surgery may be most hazardous during estrus or pregnancy and in old obese female. Most favorable time to spay a mature bitch is 3 to 4 months after estrus (Concannon and Meyers-Wallen, 1991). Vaccination is always recommended prior to surgery, but preoperative vaccination is acceptable when necessary (Childers *et al.*, 2006).

Food is withheld for at least 8-12 hours before the operation. After proper premedication, the general anaesthesia is achieved by using parenteral or inhalant anaesthetics (Concannon and Meyers-Wallen, 1991). Food should be withheld from all animals for an appropriate period prior to surgery; however, withholding water is neither necessary nor recommended. For pediatric animals (animals between 6 and 16 weeks old), a small meal should be fed 2 to 4 hours before surgery, and food should not be withheld for > 4 hours before surgery (Howe, 2006).

Surgical complication rates associated with ovariohysterectomy in healthy dogs and cats have been reported to range from 6.2% to 20.6% depending on surgeon experience (Pollari *et al.*, 1996; Burrow *et al.*, 2005). Most complications are mild and generally consist of incisional inflammation or gastrointestinal tract upset. Incisional complications are more common in larger animals and animals with longer surgery and times of anesthesia (Burrow *et al.*, 2005).

OHE adversely affects the ability to regulate food intake and thus predisposes these animals to obesity. Inactivity and increased food intake contributes to weight gains up to 38%. When dogs are exercised regularly and their food intake is controlled, there is no significant increase in weight. After OHE; bitches tend to put on weight, it is therefore important to inform the owner to

reduce the daily ration by 10 %. An Elizabethan collar is often given to prevent the dog from licking at the wound (Le Roux, 1983).

History and clinical examination

Case 1: Ovariohysterectomy in six months old dog (in heat)

The owner requested the CVMA, VTH clinic for ovariohysterectomy procedure on his female dog (Figure 5A) to stop breeding permanently. Since he has other dogs in his house, he could not keep other additional dogs in his compound. He informed that the dog was in heat. In addition, he also asked the head of VTH clinic to make spaying as the dog was in heat. The owner identified his dog condition by observing her followed by other male dogs. The dog had moderate body condition. When the dog was examined to determine whether it was in heat or not, there was a clear discharge from its vulval orifice and there was also swelling of vulva. Physical examination was performed on the dog and there was no dehydration. It has normal mucus membrane color. The vital parameters measured for the dog were temperature, heart rate and respiratory rate. The results showed that the bitch's heart and respiratory rates were 120 beats/minute and 28 breaths/minute and the temperature was 39.7⁰C. The surgical procedure was conducted in the owner's house.

Case 2: Ovariohysterectomy in ten months old dog

A female dog (Figure 5B) which was ten months of age was brought to VTH clinic by the owner for spaying. Since the dog was brought from a distance, it was allowed to take rest for about twenty minutes. There was no any abnormal sign observed by the owner before he brought his dog. The dog was not in heat and vaccinated one month and half before. Moderate body condition was observed on the dog. When her mucous membrane color and hydration status were observed they were found to be normal. Different parameters were measured and showed that the heart beat was 120 beats/minute and respiratory rate 28 breaths/minute and the temperature was 39.2⁰C.

The animals in both cases were examined at distance to see their body conditions, swelling on their body, walking pattern and other lesions on their body. However, there were no any abnormalities detected.

Preoperative preparation

The dogs were withheld food overnight and stayed without water for six hours. Premedication was performed with xylazin (1.5mg/kg) and tramadol (2mg/kg) and awaited for about fifteen minutes until the animals became calm and then they were positioned in dorsal recumbency. The area starting from the umbilicus to the pubis was washed with water and soap, shaved (Figure 5C) and washed again and scrubbed with savlon for five times and then painted with tincture of iodine. These activities were performed for both dogs.

Surgical procedure

Just after preparation of the dogs, induction anesthesia was made with ketamine (5mg/kg) and diazepam (0.5mg/kg). The skin was incised along the linea alba (Figure 5D&E), that is, the sheath of the rectus abdominus starting from the umbilicus and ending a few centimeters in front of the pubis. Using a pair of scissors, the subcutaneous connective tissue was bluntly dissected to visualise the linea alba. Using toothed tissue forceps, the linea alba was grasped in the middle and tented up and incised with scalpel and extended with a scissor. Peritoneum was also incised along the skin incision. An index finger was passed to locate the uterine horn (Figure 5F&G) by taking the urinary bladder as land mark. The uterus was withdrawn and followed to the ovary. The ovarian bursa was clamped across by artery forceps. The ovary was grasped between thumb and index finger and withdrawn for ligation. The suspensory ligament of the ovary was ruptured by traction and ovary was withdrawn from the abdomen. Three artery forceps were applied for ligation of ovarian pedicle. Transfixation double ligation was done with chromic catgut size 2-0 to legate ovarian pedicle (Figure 5H&I). The attachment between the ligature and the ovary was then severed. The severed stump was checked carefully for hemorrhage before returning to the abdomen. After removing one ovary, the other ovary was located and removed in a similar manner. The broad ligament was then severed. The body of the uterus was withdrawn from the abdomen. The uterine body including uterine artery were ligated by transfixation double ligation. The uterus was severed just cranial to the ligature. Uterine stump was checked for hemorrhage

and returned into the abdomen. Linea alba and peritoneum together and subcutaneous tissue were sutured separately by simple interrupted and skin by interrupted horizontal mattress suture (Figure 5J&K). Similar surgical operation procedure was performed for both dogs.

Surgical operation for both dogs were conducted on different areas: the younger dog in the field (owner's house) and the other one in VTH surgical operation room at different times.

Postoperative care

The wound was observed for hemorrhage and swelling. Penstript was injected for five days. Plastic material was placed on the dogs' neck as collar to control self inflicting trauma. For younger dog, fluid (Ringer Lactated solution with 40% dextrose) was administered intravenously.

Postoperative complications

Complications were observed in **case 1** which was in heat. The complications were anorexia, depression and delayed healing time when compared with the other one. There was also loss of body condition. For both dogs, there was hypothermia which was observed during and after the surgical operation.

Result

In **case 2** suture material was removed on the seventh day after complete healing. In **case 1** suture was removed after 15 days which was an extended healing time in this case (Figure 5L&M).

Discussion

Elective sterilization of female dogs is one of the most common procedures performed in veterinary practice and spaying pet entails surgical removal of the reproductive organs. These are the ovaries and uterus, and the procedure is called an ovariectomy, or spaying. For routine spaying, the best age for dogs is before puberty (Romagnoli, 2008; Blender, 2012). In this case report the dogs were spayed at the age of tenth and six months old and one was in estrus and the other was not.

The procedure was done in dorsal recumbency with the animals under general anesthesia and consists of a small incision in the abdomen for removal of the ovaries and uterus. This surgical intervention was in line with those of Howe (2006), and Djemil (2010) who reported ovariohysterectomy procedure was performed by general anesthesia but with different anesthetics of valium and morphine at 0.25 mg/kg and 0.1mg/kg, respectively, followed by induction of anaesthesia with propofol at a dose of 5 mg/kg.

A plastic material was placed on the neck of the dogs in order to control self inflicting trauma as it was recommended by White (2012). There was also a satisfactory outcome while the dogs were observed in all visiting days and asking the owners by phone after a long time of surgical procedure. This result agreed with studies by Kyles *et al.* (2012), and Fontbonne *et al.* (2015) who performed ovariohysterectomy in dogs' even though there was some complications in **case 1** of the present study.

There was no complication in **case 2** which was not in heat except hypothermia that was observed during and after the surgical operation. The hypothermia was managed by using electric warmer. During and after surgery, there were complications observed in **case 1** which was in heat. At the beginning of the surgery when incising the skin, there was much bleeding than the other one. When the operation was continued, there was bleeding from unknown origin until the end of the surgical operation. Healing time (full recovery time) that was taken by **case1** was about 25 days and **case 2** only seven days.







Figure 5: Ovariohysterectomy in dog; dog presented for OHE (A and B), shaving the surgical area (C), ventral midline incision (D&E), searching for the uterine horn (F&G), ligating the ovarian pedicle (H&I) and suturing of the skin (J&K) and recovery on 15th (L) and 7th day (M)

3.1.3. Uterine prolapse in a cow

Summary

Prolapse is coming out of one or more of the pelvic structures (bladder, uterus and vagina) from their normal anatomical position through the genital or anal opening. A cow with prolapsed uterus was presented for surgical management. There was anorexia for two days and large sized calf was delivered. Straining was also observed for four hours after delivery and the uterus came out and hanged on the caudal part. This condition was observed for the first time and it was the fourth delivery for the cow. When the patient was observed, there was prolapsed uterus that was contaminated with soil and it was swollen. The cow was recumbent sternally. The temperature, respiration and heart rates were below the normal range. The color of mucous membrane was changed to pale. There was also dehydration. Correction was performed after five hours of the prolapse. Epidural anesthesia, preoperative preparations and supportive treatment were provided simultaneously while the animal was in its lateral recumbency. The fluid therapy helped the cow to stand up by its own and surgical correction was made in its standing position. Follow up was continued for about 15 days and there were no any complications and recurrence. Prolapsed uterus ought to be managed before other complications occurred.

Key words: cow, surgical correction, uterine prolapse

Literature Review

A prolapse is the abnormal repositioning of an organ from its normal anatomical position. Cattle occasionally develop problems with prolapses near the time of calving. Two distinct types of prolapses occur in the reproductive tract of cattle: vaginal or uterine (Noakes *et al.*, 2001a). While both types require medical attention and correction; however, timing of occurrence and prognosis differ. Genital prolapse is a major but not very common reproductive disorder in cattle and buffaloes (Ahmed *et al.*, 2005). It is regarded as an emergency condition and should be managed before excessive edema, mucosal trauma, contamination and fatal hemorrhage lead to a grave prognosis (Miesner and Anderson, 2008). Although a high estrogen level is considered as a prime factor for antepartum vaginal prolapsed, the exact etiology of uterine prolapse is still unclear (Noakes *et al.*, 2001a).

Hypocalcaemia results in myometrial fatigue and delays cervical involution both of which could predispose to uterine prolapse (Murphy and Dobson, 2002; Roberts, 2004). Forced extraction of the fetus has also been incriminated as an etiological factor (Noakes *et al.*, 2001a). Foods containing estrogenic substances such as subterranean clover pasture in Western Australia, soybean meal, mouldy maize and barley may result in a high incidence of vaginal (Murphy and Dobson, 2002) or uterine prolapse in sheep (Noakes *et al.*, 2001a). Although incidence of prolapse as high as 43% has been reported in buffaloes; however, in cattle it is only 1 to 2% (Murphy and Dobson, 2002; Roberts, 2004).

The incidence of vaginal prolapse has been recorded as 1.1% in Hereford cattle (Ahmed *et al.*, 2005) and of uterine prolapse as 0.2% and 0.3% in American beef cattle (Roberts, 2004; Anonymous, 2006) and Scandinavian dairy cattle (Noakes *et al.*, 2001b; Roberts, 2004) respectively. This condition places considerable stress on the animal. Delayed cases may develop fatal septicemia (Bhattacharyya *et al.*, 2007).

Various through transvulvar suturing techniques have been tried to retain the prolapsed mass after proper reduction (Noakes *et al.*, 2001b; Roberts, 2004; Anonymous, 2006; Bhattacharyya *et al.*, 2007), but they are prone to tear the vulva particularly in cases showing subsequent violent straining (Noakes *et al.*, 2001b). The currently most favored technique is Bühner's subcutaneous

perivulvar suture application using vetafil or umbilical tape. However, under field conditions vetafil is very costly and umbilical tape is not readily available in sterile form (Anonymous, 2006). Inadequate information is available in the literature on the prevalence and clinical picture of cows suffering from genital prolapsed (Noakes *et al.*, 2001b).

History and clinical examination

The owner requested to correct the prolapsed uterus after five hours of its occurrence. The cow was anorexic two days before parturition and it delivered very huge calf and its delivery was normal. The cow was straining until four hours of delivery and the uterus came out and hanged on the caudal part. This condition was observed for the first time and it was the fourth delivery for the cow. When the cow was observed, there was prolapsed uterus which was contaminated with soil and swollen (Figure 6A). The cow was recumbent sternally. The temperature of the cow was lowered and reached 33.3⁰C; respiration and heart rates were also slightly below the normal range, 10 breaths/minute and 36 beats/minute, respectively. The color of mucous membrane was changed to pale. The cow was also dehydrated.

Preoperative preparation

Caudal epidural anesthesia was administered by using Lidocaine 2% before cleaning. Since there were weakness, dehydration and abnormal body parameters, supportive treatment was provided by ringer lactated solution and calciumborogluconate while the uterus was being prepared (cleaning and disinfection) (Figure 6B).

Treatment

The prolapsed uterus was cleaned with water and soap. Uterus was soaked in water containing sucrose (Figure 6C) to reduce the edema before reducing prolapsed uterus. The uterus was disinfected with savlon and returned back to its normal position (Figure 6D). Repositioning of the uterus was conducted by inserting hand. Purse string suture pattern was used to control recurrence.

Postoperative care

Purse string suture was applied on the vulva (Figure 6E) and penstrip (1ml/20gk) was administered for five days. Follow up was continued for about 15 days; there was no any complication and recurrence.

Outcome

There was no any complication and recurrence during all visiting days. Follow up was made for about 15 days.

Discussion

Among reproductive disorders, prolapse of reproductive organs occurs as a common gestational accident. The ruminants are predisposed to postpartum uterine prolapse due to the long myometrium contractions, violent straining, low plane of nutrition, hypocalcaemia, relaxed atonic flaccid uterus, lack of exercise and extreme laxity of perineum and vulvar lips (Noakes *et al.*, 2001; Kumbhar *et al.*, 2009; Ahuja *et al.*, 2016). Post partum uterine prolapse is more common than the prepartum prolapse mainly because of abrupt release of increased intra-abdominal pressure, uterine inertia and loss of muscular tonicity (Noakes *et al.*, 2001). In this case the underlying cause was evaluated to be the absolute oversize of the fetus and the low nutritional status of the dam.

A caudal epidural anaesthesia is essential before replacement of a uterine prolapse as it decreases straining and desensitizes the perineum (Hanie, 2006). Similarly in the present case also caudal epidural anaesthesia was used before replacement of the prolapse.

In present case report injectable broad spectrum antibiotic (penstrip) was used for three days in order to prevent secondary bacterial infection and there was no any infection observed for a longer time and the cow conceived after six months of post treatment. This finding agreed with the finding of other studies by Borobia-Belsue (2006), Anonymous (2006), and Bhattacharyya *et al.* (2007).

In this case report purse string suture of the vulva was used for prevention of recurrence of the prolapse. A satisfactory prognosis was observed by conducting proper surgical correction and possible postoperative care.



Figure 6: Surgical management of uterine prolapsed; cow with prolapsed uterus (A), cleaning the prolapsed uterus (B), soaking of uterus (C), replacing the uterus (D) and repositioning of the uterus (E)

3.1.4. Vaginal prolaps in a cow

Summary

The present study reported a case of post delivery vaginal prolapse in a non-pregnant heifer with edematous swelling of the vagina. There were no any abnormalities including no straining observed by the owner. Prolaps occurred two months after the cow's delivery. The condition occurred after the first delivery. Physical examination showed that there was vaginal prolaps and it was swollen. The temperature, pulse and respiratory rates were in normal ranges. The treatment included epidural anaesthesia, cleaning and application of sucrose, prolapsed vagina replacement, and supported therapy by antibiotics. There was no any suture used on the vulva and there was no any complication or recurrence after correction of the prolapsed vagina. Followup was conducted for about ten days.

Key words: Cow, correction management, vaginal prolapse

Literature Review

Genital prolapses are mostly seen in ruminants specially cattle, buffalo, sheep and goat (Patra *et al.*, 2014). It may be defined as coming out of one or more of the pelvic structures (bladder, uterus and vagina) from their normal anatomical position through the genital (vaginal) opening. Among all prolapses, uterine and vaginal prolapses are frequently observed in the reproductive tract of cows (Powell, 2007).

Eversion and prolapse of the vagina is a problem frequently found affecting both cattle and sheep. Most commonly the problem presents itself in mature females during their last trimester of pregnancy. Although vaginal prolapse occurs mainly in pregnant cattle and sheep, the condition is also seen in non pregnant ewes and heifers (Kahn, 2005). In addition, postpartum vaginal prolapse has also been documented (Hosie, 1989).

The hormonal changes that occur during the last trimester of pregnancy, especially the increase of estrogen and the production of relaxin, cause a relaxation of the pelvic ligaments and surrounding soft tissue structures (Wolfe, 2009). The combination of this tissue relaxation with the increased intra-abdominal pressure caused by the pregnant uterus is considered to be the number one predispositioning factor for vaginal prolapse (Kahn, 2005). Other factors capable of increasing this intra-abdominal pressure such as intra-abdominal fat accumulation, rumen distention, large fetuses, more than one fetus and the occasionally hilly terrains also make their contribution to the occurrence of vaginal prolapses (Drost, 2007). A various number of dietary factors such as hypocalcemia and the grazing on pastures with an abundance of clover have also been linked to the disorder (Miesner and Anderson, 2008). In addition to this it is assumed that the occurrence of vaginal prolapse has a genetic foundation in both cattle (Brahman, Brahman crossbreds and Herford) and sheep (Kerry Hill, Romney Marsh) (Kahn, 2005).

Vaginal prolapse mostly happened in cross breed cattle before calving usually in the last trimester of pregnancy. But there was also evidence of postoestral vaginal prolapse in a non-pregnant heifer in Bulgaria (Yotov *et al.*, 2013). A vaginal prolapse begins just cranially of the vestibulovaginal junction as a folding of the vaginal floor. The discomfort caused by this

eversion in addition to the resulting irritation and swelling of the vaginal mucosa is the start of a vicious cycle characterized by increased straining and the formation of a more extensive prolapse. In extreme cases the entire vagina may prolapse with the cervix displaying itself at the most caudal part of the prolapse (Kahn, 2005).

A vaginal prolapse may not directly be considered an emergency but, if not treated, the vagina becomes swollen, edematous and congested and is therefore very susceptible to injury. With the vaginal mucosa compromised, a spontaneous rupture of the vaginal wall is not unheard of (Hosie, 1989). An additional complication that may require urgent attention is the containment of the bladder within the prolapsed vagina. Not only does the bladder potentially hinder repositioning of the prolapse, it is quite likely that a consequential obstruction of the urethra results in the distention of the bladder and in a worst case scenario to a bladder rupture. Other structures such as the intestines and the uterus may also be contained in the vaginal prolapse. A spontaneous rupture of the vaginal wall with herniation of the intestines, bladder or uterus, therefore also belongs on the list of complications to be associated with vaginal prolapse (Veeraiah and Srinivas, 2010).

Incidence of chronic prolapse or eversion of vagina in ruminants is considered to be due to weakness of uterine ligaments and vaginal tissue relaxation particularly in pluripara animals and excessive deposition of perivaginal fat of hereditary predisposition (Noordsy, 1994). Chronic prolapse of vagina is often accompanied by tenismus resulting from cervicitis, vaginitis, abscess of the Bartholin glands and traumatic wounds in the exposed part (Deka *et al.*, 2016).

Deka *et al.* (2016) described therapeutic management of prepartum vaginal prolapse in a jersey crossbred cow. Patra *et al.* (2014) reported that successful surgical management of cervico-vaginal prolapse can be achieved by retention suture or Buhner's suture technique. Vaginal prolapse is an emergency condition and it should be treated immediately before there may occur any trauma or laceration to prevent haemorrhage or bacterial infection. Sometimes the prolapse may cause infertility in subsequent pregnancy. Kuijlaars *et al.* (2012) indicated that the disorder as acute one when it sustain for prolong duration and turned into fibrosis resulting in impossible retention to its normal position. The cure of vaginal prolapse depends on early diagnosis,

immediate replacement of vagina and assurance of further recurrence (Bhattacharyya *et al.*, 2012).

History and physical examination

As the owner mentioned about his cow condition, part of the vagina was exposed outside the perineum and he did not see any straining of the cow. The owner saw the condition in the morning when he was visiting his cows. Prolapse occurred two months after the cow's first delivery. Physical examination showed that there was vaginal prolapse and it was swollen (Figure 7A). The body parameters that were measured showed normal ranges (temperature 38.6⁰C, pulse rate 60 beats/minute and respiration 30 breaths/minute).

Preoperative preparation

The prolapsed vagina and the area around the vulva were washed with water and soap. The exposed vagina was soaked in water containing sugar.

Treatment

On the day of arrival, after clinical examination, the prolapsed vagina and the area around the vulva were washed with water and soap. The exposed vagina was soaked in water containing sugar (Figure 7C) and was given epidural anaesthesia using 5 ml of lignocaine (2%) in between the first and the second coccygeal vertebrae (Figure 7B) and the prolapsed mass was gently massaged back into the pelvic cavity (Figure 7D).

Postoperative care

Oxytetracycline 10% was given for three consecutive days. The cow was positioned in inclined plane standing her cranial part on the lower side to control the prolapsed mass. Follow up was conducted for about ten days. There was no any suture used on the vulva.

Outcome

There was no any complication or recurrence after correction of the prolapsed vagina until the last visiting day (Figure 7E).

Discussion

Vaginal prolapse in cow is a hereditary, chronic, and recurrent disorder. It is one of the reproductive disorders which cause economic loss to dairy farming by hampering the cows and their milk production. It mostly occurs in pluriparous animal than heifers (Noakes *et al.*, 2001). Although vaginal prolapse occurs mainly in pregnant cattle and sheep, the condition is also seen in non pregnant ewes and heifers (Kahn *et al.*, 2005) which were similar to the present case.

Vaginal prolapse is regarded as an emergency condition and should be managed before excessive edema, mucosal trauma, contamination and fatal hemorrhage that lead to a grave prognosis (Miesner and Anderson, 2008). Surgical correction of vaginal prolapse in this study was performed before complications were occurred which is in line with the aforementioned authors.

Application of Bhuner's suture technique is recommended for preventing further recurrence (Wolfe, 2009). But in this case report, there was no use of any suture material placed on the vagina for prevention. The authors' previous experience indicated that only epidural anesthesia was used including the present case and there was no recurrence.





Figure 7: Surgical correction of vaginal prolapse in cow; cow with prolapsed vagina (A), epidural anesthesia (B), soaking the vagina (C), replacing the prolapsed vagina (D) and cow after 10 days of treatment (E)

3.1.5. Castration

Summary

Castration is the most commonly performed surgical procedure in veterinary practice. The most common reason for castration is that the animal is not going to be used for breeding purposes or to prevent behavioral problems. The present case report summarised open castration procedure and postoperative care in three different species of four animals. The age of animals presented for castration ranged from 2.5 to 6 years. The body parameters of all cases were in normal range. Castration was conducted by two techniques: prescrotal castration technique was performed only for case 4 (dog) and scrotal method was made for other cases. Only case 3 (dog) was brought to VTH for the operation and castration for the other cases was performed in the field. There were no any complications observed in all cases during all postoperative procedures. Recoveries of the wounds in all cases were good and their wounds were healed in different times. Possible postoperative care should be followed after performing the operation properly.

Key words: *Open castration, postoperative care, surgical management*

Literature Review

Castration is the most common surgical procedure performed in the horse (Saifzadeh *et al.*, 2008), on commercial swine farms (Dunshea *et al.*, 2001) and dogs (Jana *et al.*, 2007). The

reasons for castration of male animals are different depending of their species. For the horse it is conducted to place them with mares and/or geldings (Saifzadeh *et al.*, 2008). The reason to castrate male pig is to prevent boar taint. Dogs are castrated to prevent diseases of reproductive system such as benign prostatic hyperplasia (Brendler *et al.*, 1983). The most common reasons for castration are to prevent behavioral problems and breeding (Brenda, 2002; Cronin *et al.*, 2003; Schumacher, 2012).

The alternative methods of castration have been shown to reduce the pain induced distress caused by castration in other species such as the rubber ring in lambs and cattle. However, they are not options to pigs due to the anatomy of its testes. Another solution to this issue would be to develop a commercially viable method to alleviate the pain induced distress caused by castration in pigs (Zamaratskaia *et al.*, 2004).

Sterilization in dogs could be performed by surgical and non surgical methods as classified. Surgical sterilization (elective gonadectomy) includes traditional castration, early age gonadectomy and vasectomy (Howe, 2006). Non-surgical sterilization induced by intratesticular injection of chemical substances as calcium chloride and zinc gluconate that cause destruction of testicular cells and subsequent permanent infertility (Abu-Ahmed 2015). Many complications were recorded after both surgical and chemical sterilization as scrotal bruising, hemorrhage, swelling and severe pain (Booth, 2003; Tobias, 2010).

The scrotal technique has been described as an accepted method for pediatric canine castrations (Fossum, 2002). It is becoming widely accepted for adult canine castrations by veterinary surgeons in high-volume spay-neuter clinics which often have limited resources and many animals to sterilize. Procedures that reduce anesthetic time and expedite the surgical procedure by even a few minutes can be of tremendous benefit to these programs (Miller and Zawistowski, 2013).

Three surgical techniques are commonly used for equine castration: 1) open in which the parietal tunic surrounding the testicle is incised and usually retained; 2) closed where the portion of the parietal tunic surrounding the testis and distal spermatic cord is removed, and 3) half closed, where an incision is made through the exposed parietal tunic at the cranial end of the testis or

distal end of the spermatic cord allowing the testis and part of the spermatic vasculature to be prolapsed through the incision prior to removal (Schumacher, 2012).

Potential complications associated with surgical castration include hemorrhage, excessive swelling or edema, infection, poor wound healing, and failure to remove both testicles. It has been suggested that surgically castrated barrows suffer from suppressed immunity and exhibit higher incidences of inflammation, pneumonia and other diseases (Weary and Fraser, 1999; Miller and Zawistowski, 2013).

Castration sites need to heal from the inside out. If the outside skin heals first, serum and blood can accumulate in a pocket and the site will become infected (May and Moll, 2002). To overcome complications that accompany traditional castration techniques researchers have experimented with primary closure of the castration wound to attain first intention healing. Post-operative care after the surgery is extremely important, especially if the skin incision is left open to heal by second intention healing (Vaghela *et al.*, 2016).

Case 1. Castration in a horse

History and physical examination

A six years old local breed horse was presented for castration by the owner. The horse was kept for riding training purpose. It has some aggression behavior. Because of this, castration was decided to be performed in order to minimize its aggression behavior and keep it with female horses. The owner did not see any other abnormality on the horse. When the horse was observed from distance, it had good body condition and activeness was observed. The body parameters such as temperature, pulse and respiratory rates were found to be 38.3⁰C, 32 beats/minute and 12 breaths/minute, respectively. The hydration status and color of mucous membrane were observed and seen to be normal.

Preoperative preparation

The horse was fasted and withheld water overnight. Tetanus antitoxin was administered twelve hours prior to the operation. The scrotum and the surrounding area were washed with water and soap (Figure 8A) and also scrubbed with savlon. The incision sites were stained with tincture of

iodine. Anesthesia was made by administering Xylazine (1.1 mg/kg) followed by ketamine (2.2 mg/kg) intravascularly.

Surgical procedure

Castration was performed through separate incision for each testis, with incisions located parallel to the median raphe. First the lower testis was grasped with thumb and fingers. Skin incision was made through the tunica dartos and scrotal fascia leaving the common vaginal tunic (Figure 8B). Pressure was exerted by the fingers to extrude the testis with the common tunic. Common tunic was incised over the cranial pole of the testis. The incision was continued proximally and hooking the tunic with finger to maintain tension and the testis was released from the common tunic. The testis was grasped (Figure 8C) and stripped off the subcutaneous tissues from the common tunic as far proximally as possible using a sterile gauze sponge. Mesorchium was penetrated digitally to separate the spermatic cord from the ductus deferens, common tunic and external cremaster muscle. The musculofibrous portion of the spermatic cord and the vascular bundle of the spermatic cord were exposed separately (Figure 8D). Both parts were ligated (Figure 8E) with cat gut sized 2/0 and emasculated (Figure 8F) and then removed. The other testis was also removed by the same technique. The wound was left open and allowed to heal by the second intention.

Postoperative care

The wound was cleaned with sterile gauze and savalon (Figure 8G) and also procain penicillin powder was sprinkled inside the open wound. Procain penicillin (22000IU/kg) was administered intramuscularly for five days.

Result

The wound healed within 13 days (Figure 8H) without any complication.



Figure 8: Castration in horse; preparation of the surgical site (A), scrotal incision (B), grasping of testis (C), separating vascular and non vascular parts (D) and ligation of the cord (E), emasculating the cord (F), disinfecting the wound (G) and recovery on the thirteenth day visit (H)

Case 2: castration in a pig

History and physical examination

The owner wanted his pig to be castrated for the reason that his pig has reached four years and six months of age and wanted to replace it by younger one. Since the pig was becoming aged, the owner needed castration of his pig so as to have quality pork and to make the pig docile. Clinical examination of the pig revealed that the temperature, heart and respiratory rates revealed 39⁰C, 64 beats/minute and 12 breaths/minute, respectively.

Preoperative preparation

The animal was restrained and positioned in lateral recumbency. The scrotum was washed with water and soap and disinfected with 70% alcohol (Figure 9A). The incision site was infiltrated with 2% lidocaine.

Surgical procedure

Castration was performed through separate incisions for each testis longitudinally with incision located about 1cm from the median raphe (Figure 9B). First the testis was grasped against the scrotum. Skin incision was made through tunica dartos, scrotal fascia and parital vaginal tunic. The testicle was popped out from the tunic incision (Figure 9C) and the spermatic cord was crushed with forceps. Distal to the forceps, the spermatic cord was ligated with chromic cat gut of 2-0 size in transfixation ligation and excised and the testis was removed. Similarly the other testis was removed.

Postoperative care

The wound was stained by iodine (Figure 9D) just after the surgical operation. Oxytetracycline 20% was administered after the operation. There was no discharge, swelling or any other complication observed during the whole visiting days.

Outcome

There was satisfactory outcome (healing of the wound) when observed after fifteen days (Figure 9E).



Figure 9: Castration in pig; disinfecting the scrotal area (A), incising on the scrotum (B), opening vaginal tunic (C), disinfecting of the wound (D) and recovery on the 15th day (E)

Case 3: Scrotal castration in a dog

History and physical examination

Three years old dog was brought to the clinic by its owner for castration. The owner requested us to castrate his dog in order to reduce its aggression. The animal was kept in door. The dog was vaccinated one month before it was brought to the clinic. The owner did not observe any abnormality in the dog. The dog had good body condition. The body parameters of the dog were: body temperature 38.1⁰C, respiratory rate 28 breaths/minute and pulse rate 80 beats/minute. All

parameters were within the normal range. Color of mucous membrane and hydration status revealed normal.

Preoperative preparation and anesthesia

The patient was withheld over night without feed and water for six hours. The dog was positioned in dorsal recumbency. Anesthesia was made by using xylazine and tramadol as a premedication and ketamine and diazepam as an induction agent. After fifteen minutes of injection of premedication, the surgical site was washed, clipped and shaved (Figure 10A). The area was scrubbed with savlon and also stained with 2% iodine tincture. The dog was transferred to another table for surgical intervention.

Surgical procedure

After the animal was transferred to the operating table, it was draped to only expose the surgical site. Each testis was tensed against the skin of the scrotum and an incision was made parallel to the median raphe, cutting through the skin and dartos muscle was performed (Figure 10B). Incision was also made through the parietal tunic to expose the testicle and epididymis. The testicle was popped out of the tunic incision and, with scissors, the tunic opening was extended to expose the vessels. The cremaster muscle was separated from the vessels (Figure 10C). The parietal tunic and cremaster muscle were ligated using transfixing- encircling ligatures and transected and removed. The vessels were clamped across by artery forceps (Figure 10D) and ligated (Figure 10E) and transected distal to the forceps (Figure 10F). The skin wound was left open for drainage and allowed to heal as open wound.

Postoperative care

Procain penicillin powder was added in to the wound for controlling of postoperative infection. Antibiotic (penstript) and tramadol were injected for three days to prevent infection and pain. Plastic material was used on the neck of the dog as collar to control self inflicted trauma. Follow up was made for six days and it showed good result. There was no swelling or discharge on the wound.

Outcome

On the 18th days of visit, the wound was completely healed without any complication (Figure 10G).



Figure 10: Castration in dog (scrotal); shaving of the surgical area (A), scrotal incision (B), separating the cremaster muscle (C), clamping the vessels (D), ligation of vessels (E), severing of vessels (F) and recovery on 18th day (G)

Case 4: Pre-scrotal castration in a dog

History and clinical examination

The owner wanted his dog to be castrated to make it calm. The dog had a car accident four months ago that led to amputation of the right hind limb (Figure 11A). Other abnormalities were not observed by the owner. The dog had moderate body condition and it was two years and five months of age. Physical examination showed that its temperature, heart rate and respiratory rate were 38.3⁰C, 84 beats/minute and 28 breaths/minute, respectively. The dog's mucus membrane color and hydration status were normal.

Preoperative preparation

The owner was informed to fast the dog from feed for 12 hours and withheld water for six hours before the surgical operation. After taking history and making physical examination, premedication using xylazine (1.5mg/kg) and tramadol (2mg/kg) were undertaken. The animal was positioned in dorsal recumbency after fifteen minutes of premedication. The incision site and the surrounding area were washed, shaved, rinsed and scrubbed five times. The incision site cranial to the scrotum at the level of ventral midline was stained with tincture of iodine.

Surgical procedure

After preoperative preparation, sterile drape was placed to cover the other part of the body. Surgical procedure was performed at the pre-scrotal site. One testis was pushed forward and brought under the skin over the ventral aspect of sheath. An incision was taken over the midline (Figure 11B) and testis was removed by passing between thumb and forefinger. The cord was clamped (Figure 11C) and ligated by transfixation ligation (Figure 11D) using cat gut of 2/0 size and severed to remove the testis. The other testis was then removed by the same incision and skin wound was closed by simple interrupted suture pattern using silk (Figure 11E).

Postoperative care

The wound was observed for hemorrhage and edema formation. Procaine Penicilline at a dose of 22,000IU/kg was given intramuscularly for three days. Elizabethan collar was used to prevent self inflicted trauma. Skin suture was removed at the tenth day of the surgical operation (Figure 11F).

Outcome

On the 25th day visit, the wound was completely healed (Figure 11G) without any complications.

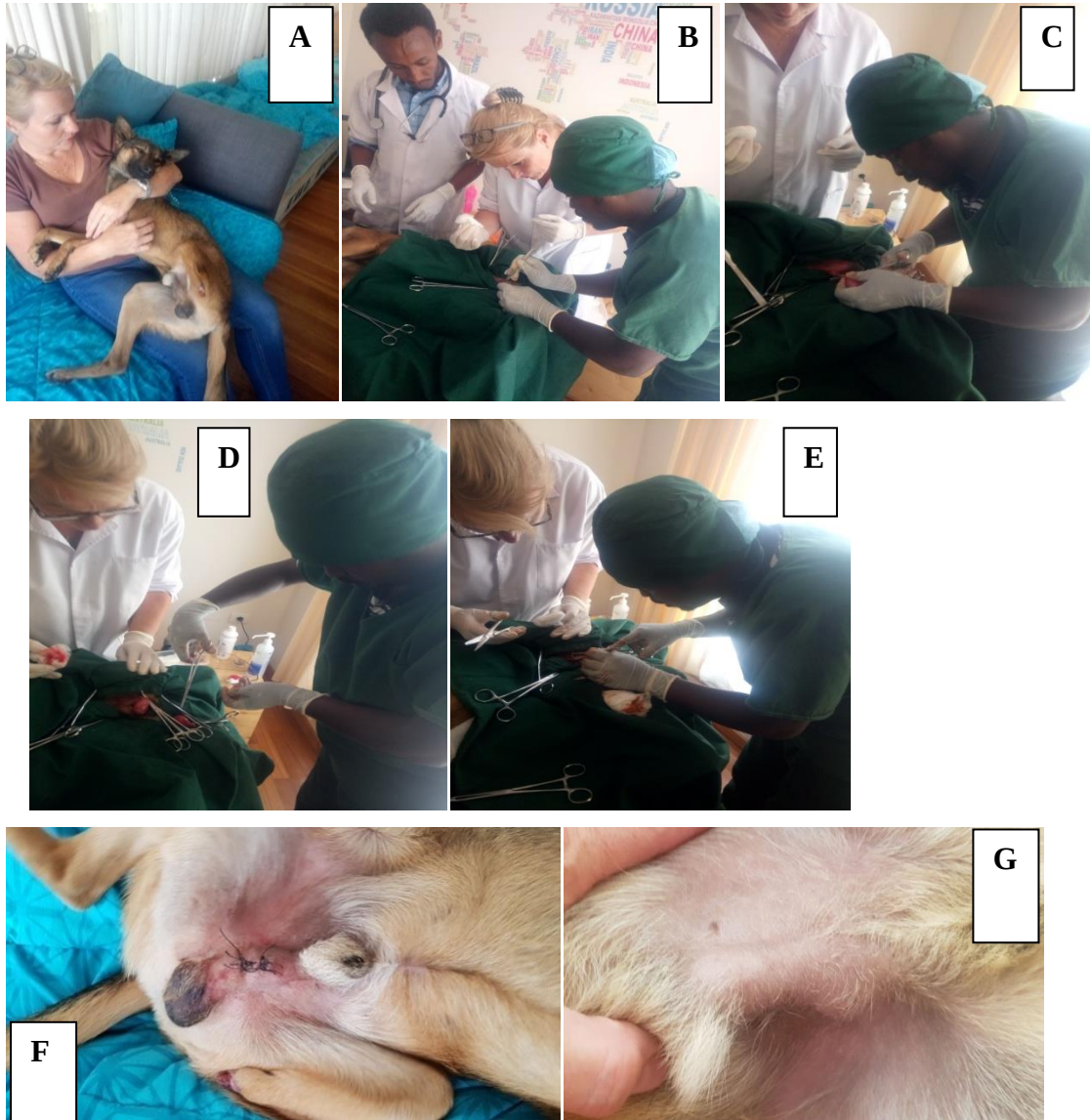


Figure 11: Pre-scrotal castration in dog; amputated dog presented for castration (A), pre-scrotal incision (B), clamping of the cord (C), ligating the cord (D), suturing the skin (E), wound on the tenth day (F) and completely healed on the 25th day visit (G)

Discussion

Case 1. The benefits of castration in stallion are that the horse can then be placed with mares and/or geldings, and is easier to handle (Saifzadeh *et al.*, 2008). Similarly the reasons for castration of a horse in this case report were also to make the horse calm, handle easily and possible to place it with mares.

The animal in the present case report was restrained in dorsolateral position and anesthesia was made by administering Xylazine (1.1 mg/kg) followed by ketamine (2.2 mg/kg) intravascularly; this combination allowed about 12 to 15 min of surgical time which was in agreement with other studies by Schumacher (2004), Moll *et al.* (2010) and Vaghela *et al.* (2016).

The procedure can be performed in a standing sedated horse or under general anaesthesia. Most horses are castrated in the field using either a closed or open castration technique that leaves the scrotal incision(s) open to heal by second intention. Irrespective of the chosen technique, the incidence of castration related complications is generally regarded as low (Kramer, 2006). By the same token, the present case operation was also done in the field and there was no complication during postoperative care.

The wound in the present case report was healed on the thirteenth day of post operation which was not in agreement with the result of Vadalía *et al.* (2012) who observed healing on the seventh day of the post operation. This discrepancy might be observed due to the differences in working environment and sterility of the surgical equipments.

Case 2. Castration of the pig was performed to improve its manageability and improve pork quality because it removes taint. It is preferable to castrate piglets within the first 3 weeks of life (McGlone and Hellman, 2002). In this case report, adult pig that was kept for breeding was castrated and the reasons for castration were to replace with young pig and make it easily manageable.

Local anesthesia in this case report was used by infiltration for the surgical operation. Similarly McGlone *et al.* (1993) also used the same local anesthesia by infiltration for pig castration.

According to Haga and Ranheim (2005) performing castration in pig are not likely to cause complication as long as the technique is not compromised, postoperative care is appropriate and the prognosis is good. There were satisfactory outcomes in the present case report too when

observed after fifteen days in such a way that, there was no discharge, swelling or any other complication observed during the whole visiting days.

Case 3. Surgical castration of dogs is one of the most commonly performed procedures in veterinary practice, and is done as a method of contraception to aid in the pet overpopulation problem as well as to prevent diseases of reproductive system such as benign prostatic hyperplasia, and modify undesirable behaviors such as urine marking, intermale aggression, and mounting of other dogs (Adin, 2011). Castration in the present case was performed to make the dog calm.

The scrotal technique has been described as an accepted method for pediatric canine castrations (Fossum, 2002). It is becoming widely accepted for adult canine castrations by veterinary surgeons in high-volume spay-neuter clinics (Miller and Zawistowski, 2013). Castration in this case report was also performed by scrotal technique which was in line with the findings of the aforementioned authors.

The time of recovery which was taken by the current case was eighteen days. This was not agreed with the study of Adin (2011) who observed shorter recovery time (twelve days) by performing the same surgical technique. This difference might be due to the environment in which the operation was conducted and using of surgical materials that were sterilized in different sterilization techniques.

Case 4. Canine castration is one of the most common procedures performed in veterinary medicine, and the prescrotal surgical approach has traditionally been the most commonly taught method (Fossum, 2002). According to Booth (2003), and Hedlund (2007) a prescrotal technique was simpler to perform, the most common, not time consuming, not requiring a lot of experience and the partietal vaginal tunic had not been opened thereby minimizing risk of peritoneal contamination via the communication between the abdomen. In this case, a prescrotal technique was employed, easily performed and with good outcome which was agreed with the findings of these authors. On the contrary, Okwee-Acai *et al.* (2012) stated that the standard prescrotal surgical castration procedure is tedious, requiring a lot of experience and time consuming.

In the present case, the results of post operative wound healing in this case of prescrotal castration were almost closed, dry, clean and take short time for healing. These results were quite similar with Gizawiny *et al.* (2004) and Okwee -Acai *at al.* (2012).

Complication in this study was not observed in both of the prescrotal and scrotal techniques, but the scrotal approach was faster and took shorter time for healing. Only castration of the pig was conducted under local anesthesia unlike the other cases which were performed under general anesthesia. All the cases were recovered without any complications.

3.2. Surgical Management of Gastrointestine Disorders

3.2.1. Herniorrhaphy

Summary

Hernia is the protrusion of the content of body cavity through a defect in the body wall that could occur in different species of animals. Surgical management of ventral hernias was performed in four different species categorized in four cases. Case 1(ox) and 2(horse) were brought to VTH for examination and treatment and case 3 (sheep) and 4 (rabbit) were observed and treated in the field. Body parameters of the first three cases were in normal ranges. Since the rabbit was very fractious, it was difficult to measure. Hernial rings were palpated externally in all cases. Similar surgical procedure was conducted for all cases. All cases recovered in different times after appropriate postoperative management were performed. Case 3 took longer time for recovery and it was not healed as the other cases. Complications that were observed in rabbit were hypothermia during and after the operation and anorexia after the operation. There was also swelling on the wound area of the horse after the surgical operation that regressed after the third day. Surgical management of hernia should be conducted early after the occurrence of the condition with appropriate postoperative care.

Key words: *surgical management, ventral hernia*

Literature Review

Hernia is the protrusion of the content of body cavity through a defect in the body wall (Slatter, 2009). This may be from accidental or normal anatomical opening which does not completely fulfill its physiological function. The majority of hernia involves the protrusion of the abdominal contents through the part of the abdominal wall, diaphragm, or perineum although hernia can occur elsewhere in the body. The presence of a defect or opening in the wall is the important factor in herniations in respect of whether a protrusion through the opening is present (Knecht and Williams, 2007).

There are three parts of hernia including the ring, the sac and the contents (Al-Sobayil and Ahmed, 2007). The ring is the actual defect in the limiting wall, and it may be as small as a few millimeters or up to several centimeters. Spontaneous attempts at healing may lead to thickening of the edge of the ring through the collagen maturation. As the sac contracts the contents may become strangulated. Hernia caused by trauma is often affected in this way (Slatter, 2009).

The hernial sac consists of the tissues that cover the herniated contents. The contents of 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 (Rings, 2005).

Depending on anatomical site: The anatomical site of herniation is used for classification such as ventral or lateral abdominal hernia, diaphragmatic, inguinal or scrotal, umbilical, perineal, pelvic and femoral hernia (Slatter, 2002).

Abdominal hernia: It is a term used to describe hernia through any part of the abdominal wall other than anatomical orifice. If hernia is ventral to stifle skin fold, it is termed as ventral hernia and the rest; e.g., in the flank region are known as lateral abdominal hernia. Such types of hernias are common in ruminants and are generally acquired in nature. Any trauma such as a kick in camel, horn thrust in cattle or violent contact with blunt object or an abscess in abdominal cavity may lead to tearing of abdominal muscle thereby resulting in herniation of the abdominal contents (Tyagi and Singh, 1993). Abdominal distension due to pregnancy or violent straining during parturition may lead to ventral hernia especially in sheep. An excessively long caudal flank incision for caesarean section in the camel may subsequently cause hernia (Radisic *et al.*, 2010).

Diaphragmatic hernia: It is caused by passage of abdominal viscera into the thoracic cavity through a tear or a congenital defect in diaphragm (Fossum, 2007). Diaphragmatic hernia is very rare in animals. It is seen in dogs more frequently than in other species. Diaphragm is a muscular partition between abdomen and thoracic cavity. Central area of diaphragm is tendinous. The posterior aorta, posterior vena cava 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 diaphragm where it gets torn is close to the posterior vena cava because the vein collapses when the part is subjected to the pressure. The portion close to the esophagus constitutes the 3rd weak

portion (Al-Sobayil and Ahmed, 2007). The abdominal organs in contact with diaphragm are the liver and stomach (Fossum, 2007).

The hernial contents are usually 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 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 diaphragm and represent an enlargement of the esophageal hiatus (Tyagi and Singh, 1993).

Inguinal or scrotal hernia: It occurs when intestine or abdominal organs descend into inguinal canal. If the content descends into the scrotum the term scrotal hernia is used. 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 (Fossum, 2007). The normal inguinal ring permits insertion of one or two finger/s. 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 in 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 (Gilbert and Fubini, 2004). Most hernias are indirect (the intestinal components is 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 (Tyagi and Singh, 1993).

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 (Radisic *et al.*, 2010). 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 (Tyagi and Singh, 1993). Umbilicus in calves consists of 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 mid ventral abdomen to form the congenital hernial ring (Al-Sobayil and Ahmed, 2007).

Umbilical masses in calves may be divided in five categories: uncomplicated umbilical hernias, umbilical hernia with subcutaneous infection or abscess, umbilical hernia with umbilical remnant infection, umbilical abscess or chronic omphalities and urachus cyst or rupture (Jones *et al.*,

1996). 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 (enterocel), abomasum (most commonly) or omentum. Strangulation of small intestine, omentum or abomasum with the hernial sac is possible although rare (Radisic *et al.*, 2010).

A study which 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 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 (Hassen *et al.*, 2017).

Possible changes in hernia: The following changes may occur in case of hernia: These are adhesion, incarceration, torsion, strangulation and hydrocele of the sac (Robbers, 1988). 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 (Fossum, 2007).

An incarcerated hernia is a hernia where hernial contents have become very voluminous so that they cannot be reduced. e.g., an enterocel 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 herniated segment (Venugopalan, 2000). 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 bowel segment and thus favors further accumulation of food material (Al-Sobayil and Ahmed, 2007). Torsion or twisting of hernial contents within the hernial sac interfere with the blood supply to the tissue and may lead into gangrene and toxemia (Smith, 2006).

Strangulation is compression caused by hernial ring causing interference with the blood supply to the hernial contents. When hernia is strangulated soon after the time of its occurrence, it is spoken of as an acute hernia e.g., strangulated inguinal hernia in 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 (Fossum, 2007). Gangrene sets in gradual and the hernial content appears black but also peritoneum loses its shining luster.

Pathogen organism from the gut pass through the intestinal wall and death may occur from toxemia (septicemia) and peritonitis (Al-Sobayil and Ahmed, 2007).

Pathophysiology: Alteration in the functions of the body cavities and of hernial contents may be important in herniation (Hayes, 1974). This 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 (Tyagi and Singh, 1993). 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 pericardial hernia (Slatter, 2002). 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 thermo- regulation which mostly associated with chronic scrotal hernia (Gilbert and Fubini, 2004).

Signs of herniation: There are physical and functional symptoms: Physical symptoms include presence of hernial swelling which is the classic sign of herniation (Roe *et al.*, 2004). 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 (Fossum, 2007).

Inflammation due to trauma or infection can be super-imposed on these signs making palpation difficult (Steenholdt and Hernandez, 2004). The site of a swelling may be some distance from the hernial ring because of the migration of the contents in the subcutaneous space (Slatter, 1993). 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 (Tyagi and Singh, 1993).

Functional symptoms are ordinarily absent in reducible hernia. Colic may be seen in incarcerated hernia. Severe pain, rise of temperature and colic are pronounced in strangulated hernia (Al-Sobayil and Ahmed, 2007). In 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, presence of adhesion or umbilical abscess can prevent reduction. Hernial contents may get strangulated with symptoms of pain and intestinal obstruction (Fossum, 2007).

Strangulation is not common in case of 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 mesentery. The hernia may be contained entirely within inguinal canal without visible scrotal swelling (Venugopalan, 2000). In ventral or lateral abdominal hernia, the hernial swelling is very prominent. Systemic symptoms

are usually absent. The contents of hernia are usually omentum or intestines or both. The hernia may be reducible or irreducible, and strangulation is rare (Venugopalan, 2000).

Diagnosis: It is difficult to generalize about the diagnosis of herniation. Physical and surgical diagnosis is important in most cases. Specific diagnostic features of the various types of hernia are done in different ways (Knecht and Williams, 1987). In 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 (Fossum, 2007).

The hernial swelling is recognized close to or including the scrotum in inguinal or scrotal hernia. The swelling can easily be differentiated from a sarcocele (a hard tumor of testicle), hydrocele, cyst, enlarged lymph node, and cirrhosis cord and so on. A sarcocele is a hard swelling on testicle; hydrocele has characteristics of wave-like filling of fluid which is different from hernial contents. Drawing up of the testicles of the affected side accompanied by symptom of continuous abdominal pain is an almost pathognomonic sign of strangulation of an inguinal hernia. In large animals diagnosis may be confirmed by rectal examination and in small animals it is done by radiography or fluoroscopy (Venugopalan, 2000).

A lateral and a ventrodorsal radiography of the thorax in diaphragmatic hernia may help to confirm the diagnosis. Conditions like hydrothorax, aspiration pneumonia, cardiac diseases, and foreign bodies in the esophagus should be differentiated from diaphragmatic hernia. In case of ventral or lateral abdominal hernia, diagnosis is easy as the hernial ring can be felt in most cases (Fossum, 2007).

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 (Venugopalan, 2000). In developing abscess, there are symptoms of local inflammation and it does not fluctuate under the skin. An abscess has a tendency 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 has no tendency to point and pain or functional symptoms are absent. The presence of hernial ring confirms hernia. Exploratory puncture or radiography may also be done for confirmation (Gadre *et al.*, 1989; Venugopalan, 2000).

General principle and treatment of hernia: Most hernias are best approached by 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 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 hernial ring to achieve proper access (Slatter, 2002).

The hernial ring is best closed by direct suture approximation of local tissue. Knowledge of anatomy of the area is necessary so that suture can be placed in specific anatomical structures that have sufficient holding power to resist disruption (Venugopalan, 2000; Steenholdt and Hernandez, 2004). The mobility of the local tissue can be increased by local dissection or creation of local muscle or fascial flaps such as superficial gluteal or internal obturator muscle flap in perineal herniorrhaphy (Tyagi and Singh, 1993). When large defect makes the approximation of local tissue impossible without tension, prosthetic implants are used. 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 (Slatter, 2002).

Numerous techniques have been described for inserting prosthetic mesh including the use of 1-3 layer 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 interrupted suture of synthetic monofilament non-absorbable material (Slatter, 2009). Despite the many reports of reduced recurrent rate of incision, hernia after mesh repair compared with the use of autologous tissues, early postoperative complications such as pain, seroma formation, and wound infection remain problem (Gilbert and Fubini, 2004). Postoperative care of patients minimize 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 cause of recurrence (Slatter, 2002).

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. An “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 (Fossum, 2007).

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% (Fossum, 2007).

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 (Fossum, 2007).

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 hernial ring. The borders of 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, hernioplasty is performed by covering the gap with facialata or stainless steel wire mesh and suturing it to the borders (Fossum, 2007).

Case 1. Surgical management of hernia in an ox

History and clinical examination

The owner presented a four years old local breed bull to VTH clinic and complained that his bull showed a swelling on the prepuce region and this condition was observed by the owner one day before the animal was brought to the clinic. Also the bull was unable to urinate as usual. The animal had reduced feed and water intake. Physical examination showed that the temperature was 38.5⁰C, heart rate 60 beats/minute, respiration 32 breaths/minute, mucous membrane color and capillary refill time was normal. There was swelling on the prepuce (Figure 12A). There was also abnormal gait on his hind limbs. When the animal was examined while it was on lateral recumbency, hernial ring (Figure 12B) was appreciated just lateral to ventral midline of the abdomen of the bull.

Preoperative preparation

The bull was restrained on its left lateral recumbency and the incision site (lateral to the prepuce on the right side) and its surrounding area were cleaned, shaved and scrubbed with savlon. Finally, the incision site was stained with tincture of iodine.

Treatment

After preparation, the animal was positioned in dorsal recumbency tilting some degree to the left. Anesthesia was administered locally by 2% lidocaine lateral to the incision site on the right side by infiltration (Figure 12C). Skin incision was made on the proposed incision line (Figure 12D) and the prepuce was retracted to the left to expose the hernial ring. The muscle was tented and incised and linea alba that form the hernial ring and the contents of the hernia were exposed. The hernial content was manually reduced and the ring (linea alba) and peritoneum were sutured (Figure 12E) after debridement of the edge of the ring by non absorbable suture in interrupted horizontal mattress suture. The muscle was sutured with cat gut of 2/0 size in simple interrupted pattern. Finally the skin was sutured with none absorbable suture in simple interrupted pattern (Figure 12G and H).

Post-operative care

The wound was observed daily in order to check whether swelling or discharge were developed. Penstrip (1ml/20kg) was administered intramuscularly for five days. Dexamethasone at a dose rate of 30mg was also injected intramuscularly for three days to relief pain. The patient was

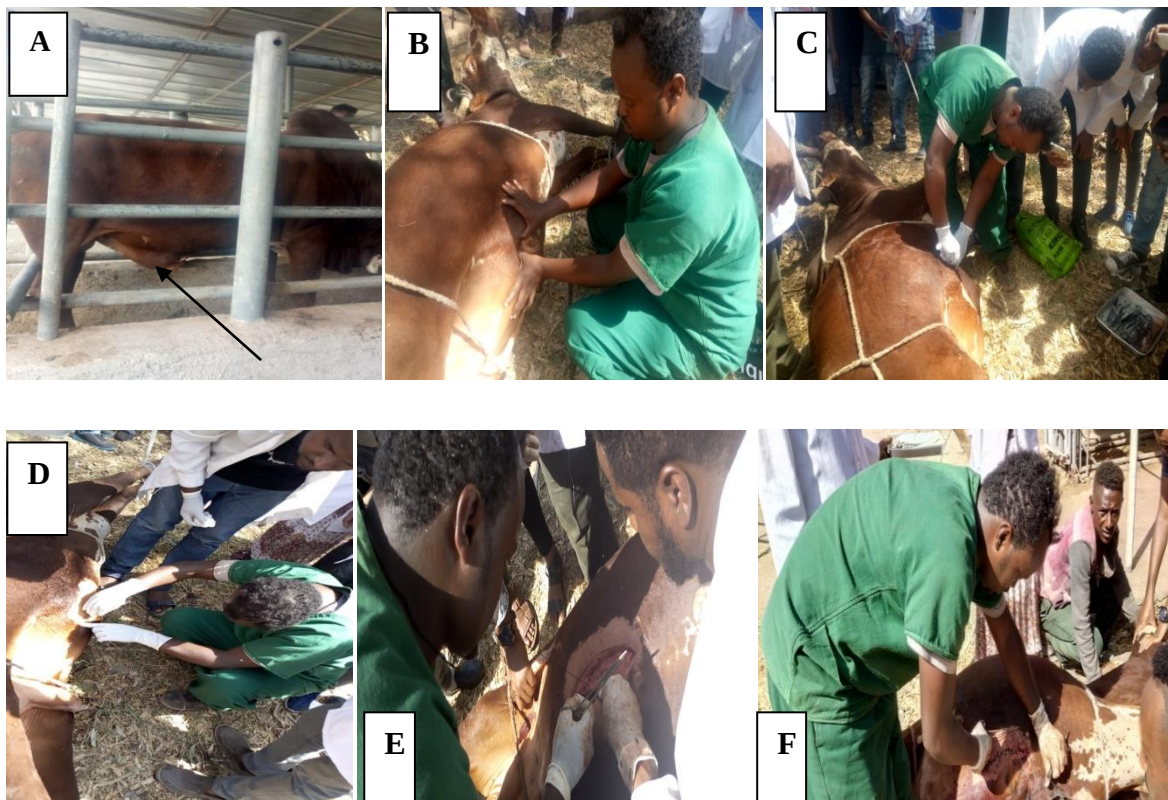
allowed to take only light feed up to 8 days of post surgical operation. After that day, the amount of other feed was reduced by half for about five days.

Postoperative complications

Since the operation took longer time, bloat (Figure 12G) was observed during and at the end of the surgical operation. The animal body condition was reduced until the proper amount of feed started.

Outcome

When the animal was in standing position just after the operation, there was no swelling on the prepuce (Figure 12H) and the patient started urinating freely. There was a good progress and the suture was removed after one month (after complete healing) (Figure 12I and J).



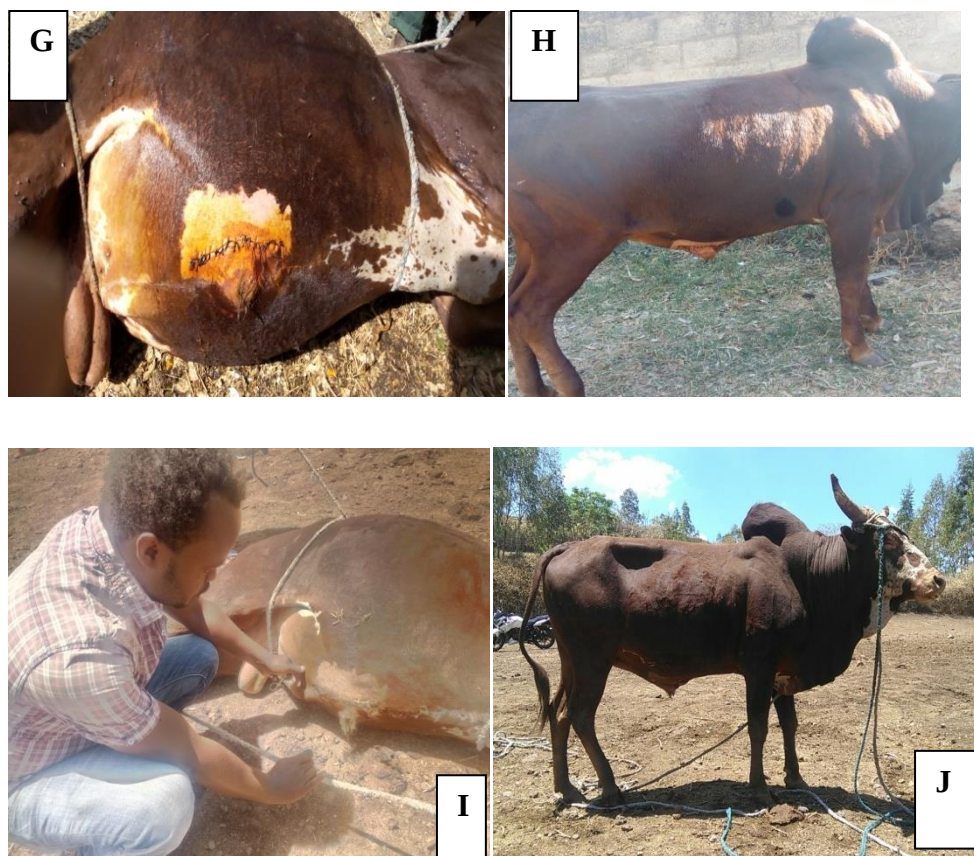


Figure 12: Surgical management of hernia in ox; swelling on the prepuce (A), showing hernial ring (B), infiltration anesthesia (C) incising the skin (D), suturing of the ring (E), skin suturing (F), bloat (G), standing position after the operation (H) Recovery on the 30th day (I) and recovery, on standing position (J)

Case 2. Surgical management of hernia in a horse

History and physical examination

The owner complained that there was swelling on the right caudal ventral part and there was also abnormal walking when the size of swelling was increased. During physical examination, swelling (Figure 13A) was palpated and a ring was appreciated on the right ventral abdomen. Other parameters like heart (30 beats/minute) and respiratory rate (12 breaths/minute) and temperature (38.3⁰C) were normal.

Preoperative preparation

The horse was withheld water and fasted for one day. The horse was under general anesthesia with Xylazine and Ketamine and then restrained on its left lateral recumbency with upper leg stretched upward. The surgical area was washed with water and soap, shaved and then cleaned and disinfected with savlon. Surgical site was stained with tincture of iodine.

Surgical procedure

Infiltration of anesthesia was made on the incision site. Skin incision was made horizontally on the swelling. Subcutaneous tissue was tented and incised along the skin incision and bluntly dissected to identify the ring. The abdominal contents were returned back to the abdomen manually (Figure 13B). Debridement of the edge of the ring was made by sterile scalpel and the ring become ready and properly exposed for suturing (Figure 13C). The muscles with the peritoneum were closed by non absorbable suture in interrupted horizontal mattress pattern (Figure 13D). The skin was closed by non absorbable suture in cross mattress pattern (Figure 13E).

Postoperative care

The wound was observed for swelling and hemorrhage. Procain penicillin was injected for five days.

Postoperative complication

There was swelling on the wound area (Figure 13F) which disappeared after four days of treatment.

Outcome

After 23 days of the surgical operation, the wound has completely healed (Figure 15F) with improvement of other conditions of the horse.



Figure 13: Surgical management of hernia in horse; swelling on the right ventral abdomen (arrow) (A), reducing the content (B), hernial ring (C) closing of muscles (D), sutured skin (E) swelling on the wound area (F) and recovery on the 23rd day (G)

Case 3. Surgical management of hernia in a sheep

History and physical examination

As the owner informed about the patient that, there was a small swelling on the left ventral abdomen (Figure 14A) of the sheep and through time it became enlarged. The sheep gave birth two times while the swelling was there. Different types of treatments were tried by injection. There was no sign of loss of appetite or any other observed signs by the owner until the second delivery. After the second delivery the sheep was unable to walk properly due to the enlargement and weight of the swelling. As the owner indicated there was a horn thrust by ram before the swelling of the affected area. Physical examination showed that body temperature was 38.4⁰C, heart rate 28 beats/minute and respiratory rate 20 breaths/minute. The mucous membrane was changing to pale and there was also dehydration. The sheep had moderate body condition. When the patient was palpated on the swelling area, there was a hernia ring (Figure 14B).

Preoperative preparation

The patient withheld feed for twelve hours and water for six hours. Anesthesia was made by using xylazine (0.5mg/kg) and ketamine (2mg/kg). The animal was restrained in right lateral recumbency. Incision site and the surrounding area were washed, shaved and scrubbed. Ringer lactate solution was secured on the jugular vein.

Surgical operation

An elliptical incision (Figure 14C) was made on the swelling after staining the incision site with tincture of iodine. There was adhesion between peritoneum and intestine and it was detached gently by hand. The content was replaced manually (Figure 14D) and the edge of the ring was trimmed. The ring was sutured by using non absorbable suture in horizontal interrupted suture pattern (Figure 14E). Procaine penicillin powder was sprinkled on the sutured muscle. The skin was closed using horizontal interrupted suture pattern (Figure 14F) with non absorbable suture.

Postoperative care

Procaine penicillin was sprinkled on the wound and penstrip was injected for five days.

Postoperative complications

Abnormal appearance (Figure 14G) was observed after suturing of the skin since it was difficult to remove the whole muscles which were adhered to the ring.

Outcomes

There was a good progress during post surgical visit and follow up to seven days (Figure 14H). After that follow up was continued through cellphone contact and the owner informed that, there were no any problems except the swelling resulted by extramuscles.



Figure 14: Surgical management of hernia in sheep; swelling on the ventral abdomen (A), hernial ring (B), elliptical incision (C), reducing the hernial contents (D), sutured hernial ring (E) and suturing of the skin (F) Abnormal appearance of the wound (arrow) (G) and recovery on the Seventh day(H)

Case 4. Surgical management of hernia in a rabbit

History and physical examination

The owner complained that there was swelling on the lower part of the abdomen of the rabbit. The abnormality was observed by the owner before five days of the surgical operation. The rabbit was one year of age. There was no other sign observed by the owner. While the patient was observed inside the cage, it was very active. There was swelling on the ventral midline of the abdomen (Figure 19) and when it was palpated there was a ring that indicated hernia. Since the rabbit was aggressive to hold for physical examination, sedation was performed for restraining and surgical operation.

Preoperative preparation

Fasting and withholding of water was performed for twelve and six hours, respectively. The rabbit was sedated and restrained in lateral recumbency. Sedation (Figure 15A) was conducted with xylazine at a dose of 5mg/kg via IM. The ventral abdominal area was washed with water and soap and shaved, rinsed with water, disinfected with savlon and stained by tincture of iodine.

Treatment

Induction of anesthesia was done by using a combination of ketamine 35mg/kg and xylazine 5mg/kg intramuscularly. A linear incision was made over the hernial swelling (Figure 15B). The hernial content was reduced manually (Figure 15C). The edge of the hernia ring was debrided and sutured using simple interrupted suture pattern (Figure 15D) with non absorbable suture material. The skin incision was sutured with interrupted horizontal mattress sutures (Figure 15E) with non absorbable suture material.

Postoperative care

The wound was observed for bleeding and swelling. Penistrip at a dose of 1ml/kg was administered for three days consecutively parentally. Anti pain (tramadol 2mg/kg) was also provided for three days for pain management. Multivitamine and 40% dextrose was administered orally for three days.

Post operative complication

When the temperature was measured, it was lowered reaching to 32.5⁰C. There was no good appetite after the surgical operation.

Outcomes

Suture was removed on the 15th day (Figure 15F); there was complete healing on this day its appetite was improved.



Figure 15: Surgical management of hernia in rabbit; Sedating of the patient and swelling on ventral abdomen (A), incising on the ventral midline (B), reducing the content (C), suturing the ring (D), closing of the skin (E) and recovery on 15th day (F)

Discussion

Four ventral herniorrhaphies were conducted in four different species:

Case 1. The cause of ventral hernia in the present case was thought to be horn thrust by other animal. Ventral hernia is commonly seen in the ventral abdominal wall near the midline and size of the hernial opening varies in diameter and the nature of hernial contents depends on the site of the herniation (Krishnamurthy, 1995; Das *et al.*, 2012) which was in line with the current study in such a way that similar location was also noticed and there was large hernial ring through which viscera were protruded.

Herniorrhaphy was performed to treat the patient and satisfactory recovery was observed on the patient body. This finding agreed with other studies by Abdin-Bey and Ramadan (2001), and Sankar *et al.* (2010) who concluded similarly.

Sankar *et al.* (2010) performed herniorrhaphy in a cow by overlapping sutures using no.3 silk in horizontal mattress pattern and observed healing around in one month. In the present case, similar result was observed by using non absorbable suture material to close the hernial ring but different suturing technique was used to close the ring and loss of body condition was observed. This may be due to reducing the amount of feed that was provided to the animal to minimize abdominal pressure on the wound.

Case 2. In young large animals the defect could be congenital or traumatic due to external manipulation during foal or calf delivery (Witte *et al.*, 2008). In this case report, the cause of hernia was not known.

The clinical signs observed in this case were swelling on the ventral abdominal wall, abdominal discomfort and readily palpable hernial ring which were all similar to the clinical signs similar conditions written in literatures by Peroni (2002) and Rijkenhuizen (2005).

Treatment (closure) of the hernial ring with non absorbable suture by interrupted horizontal mattress suture pattern in literature appears to have a good outcome being normal in appearance (Tulleners and Fretz 1983; Elce *et al.*, 2005). A similar cosmetic outcome was obtained in the current study except that, there was an edema on the wound which was observed for about four days before it disappeared. Moreover, it was the only postoperative complication observed on the patient.

Case 3. 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 (Vijayanand *et al.*, 2009). In this case, the cause of hernia was horn thrust by ram and the previous pregnancies might aggravate the condition.

The clinical signs that were observed in this case included presence of hernial swelling, hernial ring and also the absence of pain on palpation. The current result was similar with the findings of Roe *et al.* (2004), and Fossum (2007) in observed clinical episodes mentioned above.

Herniorrhaphy can be done by simply closing the abdominal wall with interrupted horizontal mattress pattern of stitches using absorbable sutures (Pugh, 2002). Similarly the treatment of hernia in this case report was performed by suturing the hernia ring with interrupted horizontal mattress pattern but the suture material in this case was non absorbable suture. The appearance of the wound was not normal which might be due to adhesion of the ring with muscles grown in the direction of the swelling.

Case 4. Signs of ventral abdominal hernia in rabbit included swelling on the affected part, hernia ring when palpated on the swelling and abdominal discomforts (Courtney *et al.*, 2003) which were similarly observed in the present patient.

Anesthesias used in present case were xylazine at a dose of 5mg/kg via IM to sedate the animal and a combination of ketamine 35mg/kg and xylazine 5mg/kg intramuscularly for induction. There were no additional anesthetic agents used as a maintenance. The above anesthetics were used similarly by Cakmak *et al.* (2009).

Treatment of hernia in this case was performed by suturing of the hernial ring with non absorbable suture material in interrupted horizontal mattress suture pattern. During the daily

routine follow-up of the rabbits in this study problems such as serositis, haematoma, and increase in body temperature were not encountered. On the other hand, there was reduction in body temperature after surgical operation and loss of appetite which were in line with the findings of Cihan *et al.* (2006), Cakmak *et al.* (2009), and Kilic *et al.* (2019) in that similar observations were made except that they did not observe loss of appetite.

3.2.2. Rumen impaction (*Rmenotomy*)

Summary

A two years and half month old local breed ox was presented with the history of chronic recurrent tympany for the last two weeks. The bull was kept for ploughing and showed signs of distention of abdomen on the left side and loss of appetite. Scant feces were also observed and gradually its body condition was decreasing. When the animal was presented for examination there were left abdominal distention and scant feces were also observed. The body parameters were not in normal ranges. There was no rumenal motility and when the distention was palpated it was firm. Rumenotomy through left flank approach using local anesthesia was done. Undigestible feed and different foreign materials such as plastic and rope were removed from the rumen. There was loss of appetite up to the third day but it was corrected. By conducting possible postoperative care, there was good progress when the animal was visited for seven consecutive days and weekly until the 50th day of wound healing.

Key words: *Foriegn body, ox, rumen impaction, rumenotomy*

Literature Review

Rumen impaction due to metallic or non-metallic foreign bodies is among the most common cause of gastrointestinal disorders in ruminants (Ismael *et al.*, 2007). The absence of garbage recycling industries especially plastic materials are usually not disposed in a correct manner, and hence they were eaten by grazing animals (Ramaswamy and Sharma, 2011; Desiye and Mersha, 2012). These plastic bags are indigestible and their accumulation in the rumen of grazing animals may lead to adverse effect on health (Ghurashi *et al.*, 2009). Furthermore, plastic bags resist to biodegradation and pollute for decades and centuries and pose great risk to human health and the environment (Ramaswamy and Sharma, 2011). Ruminants are notorious for ingestion of foreign

bodies related to nutritional deficiencies and feeding management of the animals. Foreign bodies are the root causes for various problems in different organs of the animals (Kahn *et al.*, 1999).

The entry and migration of foreign bodies through the body tissues lead to many complications based on nature of the foreign body entrance into the tissues (Calfee and Manning, 2002). Reports from cattle and sheep reared in urban and sub-urban environments indicated that impaction of rumen from the accumulation of foreign bodies such as plastic bags cause interference with the flow of ingesta leading to distention of rumen and absence of defecation (RemiAdewunmi *et al.*, 2004). Adult dairy cattle are most commonly affected because of their more exposure (Radostits *et al.*, 2007).

The bovine fore stomach are affected highly due to ingested foreign bodies which are the subject of attention almost all over the world and also major economic importance due to severe loss of production and production ability and sometimes death of the animal (Ramprabhu *et al.*, 2002). The ingestion and lodgment of foreign bodies are common in the bovine primarily due to indiscriminate feeding habits. In addition, industrialization and mechanization of agriculture have further increased the incidence of foreign bodies in these animals (Semieka, 2010). Ingestion of foreign bodies in cattle is common especially in developing countries where the standard of animal management is unsatisfactory (Misk *et al.*, 1984). Animals with nutritional deficiencies may also ingest various types of foreign bodies deliberately. The indiscriminate feeding habits and mineral deficiency makes them susceptible to inadvertent ingestion of foreign materials. Rumen impaction due to plastics, ropes and leather in the rumen leads to anorexia, decreased production and progressive loss of body condition (Tyagi and Singh, 1993).

Clinical rumen indigestible foreign body impaction is characterized by pale mucous membrane, reduction of milk yield, complete cessation of rumination, impacted rumen, atony, reduced rumen motility, feces become scant and inappetance (Vanitha *et al.*, 2010). The most common symptoms observed in animals with plastic bags were bloat exhibited by the abnormal bulging of the paralumbar fossa on the left side of the abdominal wall (Ramaswamy and Sharma, 2011).

Small ruminants in Ethiopia are kept under an extensive type of management and are likely to be exposed to the ingestion of indigestible garbage from various sources due to a wide spread environmental contamination with plastic bags, absence of policy to protect environment and

frequent occurrence of drought that predispose animals to nutritional deficiency and pica (Abebe and Nuru, 2011).

Rumenotomy is a routine procedure for the removal of foreign bodies such as baling twine, nylon ropes or plastic bags that are obstructing the reticulo-omasal orifice. Carbohydrate engorgement is frequently occurring in the rumen which can also be corrected by rumenotomy (Fubini and Ducharme, 2004).

History and physical examination

The bull was kept for ploughing and showed signs of distention of abdomen on the left side and loss of appetite. The age of the animal was two years and half month. Scant feces were also observed and gradually its body condition was decreasing. The condition started to occur about a couple of weeks before. The animal has been treated for about five days by penstrip and diclofenac and also by digestion powder for abdominal distention. When the animal was observed for examination there was left abdominal distention and scant feces were also observed. While vital parameters were taken, there was reduction in temperature (36°C), the heart sound was not properly heard, respiration was also slightly decreased (20 breaths/minute), and the mucous membrane was pale. The bull was slightly depressed. There was no rumenal motility and when the distention was palpated it was firm.

Preoperative preparation

The animal was kept without feed and water for twelve hours. It was provided lactated ringer solution and 40% dextrose before the surgical operation and until the end of the operation. The left paralumbar fossa was washed with water and shaved (Figure 16A) with blade, rinsed and scrubbed using savlon. Anesthesia was administered by using 2% lidocaine locally by infiltration.

Surgical procedure

Rumenotomy was decided to be conducted in order to treat the patient. The patient was draped on the left side except the surgical site. The surgical site was stained with tincture of iodine. Skin incision was made at the midpoint of tuber coxae and ventral to the transverse process of lumbar

vertebrae (Figure 16B). Other muscle layers and peritoneum were incised in the direction of skin incision. The rumen was exteriorized and fixed with the skin (Figure 16C) and incised. While the content was removed, undigestible feed and different foreign materials such as plastic bag, sack thread and rope were obtained (Figure 16D). The edge of the rumen was cleaned and sutured with 2/0 chromic cat gut firstly by Schmieden's suturing (Figure 16E) and finally by Cushing suture pattern (Figure 16F). The suture used for fixing the rumen was removed and the rumen was inserted. After changing the pair of gloves, transverse abdominis muscle with peritoneum and the two oblique muscles together were closed by continuous lock stitch pattern in two layers using 2/0 chromic cat gut. The skin was sutured in interrupted horizontal mattress suture by using silk suture (Figure 16G).

Postoperative care

Pentrip (1ml/20kg) was administered parentally for five days. Antibiotic was sprayed on the wound (Figure 16H). Only light feed was provided for about six days and the amount of feed was reduced.

Outcome

There was good progress when the animal was visited until the 50th day (Figure 16I) of wound healing.

Discussion

The prominent clinical signs observed in the present study were pale mucous membrane, absence of rumination and reduced ruminal motility. Depression was observed in the affected animal. Rectal examination revealed pellet mucous coated dung. The clinical signs noticed in the current study were reported by Hailat *et al.* (1996), Igbokwe *et al.* (2003) and Reddy *et al.* (2004). Reduced body temperature and distention of left side abdomen were also observed in the present case.

Rumenotomy is the only effective method of treatment for plastic foreign bodies but an early diagnosis is essential for favorable outcome (Mulat *et al.*, 2015). Similarly rumenotomy was conducted in this case report also in order to remove indigestible foreign materials.

Non-penetrating foreign bodies such as plastic bags, rope and sack thread were observed in this case report. The present findings are supported with the report of Igbokwe *et al.* (2003) and Roman and Hiwot (2010) as they have also noticed plastic bags, rope and sack thread. In their study they have also found leather materials. This similar finding might be due to the environment polluted by the same types of waste materials.

The outcome of rumenotomy was good in the current case report. When the patient was observed for about twenty days, there was a satisfactory progress observed on the animal associated with wound healing, motility, rumen distention and feeding. There was also a phone contact with the owner time and again in order to get information about the patient. Hence, good progress in the condition of the animal was obtained. This finding was similar with the findings of Ismail *et al.* (2007) and Sileshi *et al.* (2013). Sileshi *et al.* (2013) revealed that the outcome of rumenotomy was significantly associated with the quantities of foreign bodies.





Figure 16: Rumenotomy; shaving of the surgical area (A), upper flank incision (B), rumen fixing with skin (C), pulling of plastic material (D), schmieden's suture pattern (E), suturing by Cushing technique (F), skin suturing (G), spraying of antibiotic (H) and wound healing on the 50th day (I)

3.2.3. Donkey rectal prolapse

Summary

Rectal prolapse is a protrusion of one or more layers of the rectum through the anus. A 1.5 years old donkey was presented at VTH, Bishoftu, Ethiopia with a history of an elongated cylindrical reddish mass protruding through the anal orifice for three days before admission date. The jenny was suffering from straining during defecation for more than a week. Clinical examinations revealed prolapsed rectal wall soiled with faeces and slightly increased body parameters. The animal was operated under caudal epidural anesthesia using lignocaine hydrochloride 2%. The rectal tissue was gently pushed back into the rectum manually. Purse string suture was placed at

the edge of the anus to prevent reoccurrence of the prolapse. Procaine penicillin (22000IU/kg) was administered for three days. Careful digital removal of faeces from rectum was also performed. There was no recurrence or other abnormality as the owner explained through phone contact until the 10th day. Rectal prolapse ought to be managed before necrosis and other complications occur.

Key words: *Correction management; donkey, rectal prolapse,*

Literature Review

Rectal prolapse is a protrusion of one or more layers of the rectum through the anus. It is subdivided into either complete or incomplete rectal prolapse depending on whether it involves all layers of the rectum or just the rectal mucosa (Anderson and Miesner, 2008). It is the most common surgical affection involving the rectum of cattle. The condition may be a result of prolonged tenesmus or increased intraabdominal pressure due to bloat, trauma, colitis, proctitis, diarrhea, act of parturition, dystocia, intestinal parasitism, and tail docking. Other causes of straining include intestinal neoplasia, foreign bodies, perineal hernia, constipation, congenital defects, lower urinary tract and prostatic diseases (Thomas *et al.*, 2003; Kumar *et al.*, 2004; Marjani *et al.*, 2009).

Prolapse of bowel or mucosa through the anus of the animal has been categorized into four types. In a type I rectal prolapse, only the rectal mucosa and submucosa project through the anus. A type II lesion represents a complete prolapse of the full thickness of all or part of the rectal ampulla. Type I and II prolapses are the most common. In a type III prolapse, a variable amount of small colon intussuscepts into the rectum in addition to a type II prolapse. In a type IV prolapse, the peritoneal rectum and a variable length of the small colon form intussusceptions through the anus (Turner, 1987; O'Conner, 2005).

Cause of rectal prolapse in donkey is quite common in some regions and can be due to a variety of reasons including chronic diarrhoea associated with infection or parasitism, foreign bodies or feed impaction due to poor teeth, dehydration, or following parturition many of which cause increased straining (tenesmus) (Colahan *et al.* 1999). Other non-gastrointestinal causes can

include overloading (the animal strains in the hindquarters to move the load) and prolonged recumbency from other illnesses. A study of 177 donkeys in Ethiopia by Getachew *et al.* (2012) showed over 83% of the cases were associated with the presence of *Gasterophilus nasalis*.

Treatment of rectal prolapse involves washing of the prolapse gently and removing as much necrotic tissue as possible. Applying table sugar will help decrease any oedema and allow for easier replacement back into the rectum (Myers and Rothenberger, 1991). The rectal tissue should be gently pushed back into the rectum manually, avoiding excessive pressure which could tear the delicate rectal mucosa; lubrication could be used to aid the process. If the animal continues to strain and the rectum keeps re-prolapsing, we have to consider sedation, if this has not already been given, or even a caudal epidural anesthesia should be given (Michou and Leece, 2012) if the animal appears to be in a lot of pain. Ensure that a caudal epidural anesthesia has been administered before suturing the anus. Many rectal prolapses can be resolved through manual correction and do not require suturing. If this is not possible then a suture can be placed. If the prolapse has been replaced and held in place with sutures, ensure that the sutures are removed after 48 hours (72 hours at most) (Colahan *et al.* 1999). Leaving in sutures will ultimately lead to the death of the animal which is far worse than the original prolapse (Colahan *et al.*, 1999)

A novel treatment in the field, when suturing is not possible or not required, is to use a bandage pack to keep the prolapse inside after manual replacement. Moreover, careful monitoring of the animal is required and analgesia and anti-inflammatory drugs administered. The owner needs to be advised to provide a soft diet to reduce straining until the symptoms have resolved (O'Conner, 2005).

History and clinical examination

A 1.5 years old local breed donkey was brought to The Donkey Sanctuary clinic. The owner brought his jenny with the complaint of an elongated cylindrical reddish mass protruding through the anal orifice for three days before admission date. He also said that his jenny was suffering from straining during defecation for more than a week. While the animal was examined, there was prolapsed rectum that was hanged in the anal orifice (Figure 44A). When some parameters were measured, the following results were observed: temperature 39⁰C, respiratory rate

21 breaths/minute, heart beat 48 beats/minute and also pinkish visible mucous membrane and moderate body condition were observed.

Preparation

The donkey was restrained in standing position. Dorsal coccygeal area was cleaned, shaved, and disinfected for low epidural anesthetic injection. The prolapsed rectum was also cleaned and disinfected.

Treatment

After administration of epidural anesthesia, the tail was kept upward for easy manipulation of the rectum. The rectum was washed with water and soap (Figure 44B) and table salt was also applied in order to reduce the edematous rectum. Necrotized tissues were removed from the prolapsed rectum. Tetracycline ointment was applied (Figure 44C) on the exposed rectal tissue for purpose of lubrication. The rectal tissue was gently pushed back into the rectum manually (Figure 44D). Purse string suture (Figure 44E) was placed at the edge of the anus to prevent reoccurrence of the prolapse.

Postoperative care

Procaine penicillin (22000IU/kg) was administered for three days. Careful digital removal of faeces from rectum was also performed. These were done by nearby clinic to the owner.

Outcome

There was no recurrence or other abnormality as the owner informed by phone contact until the 10th day.

Discussion

Rectal prolapse has been reported to commonly occur in young animals in association with prolonged tenesmus or increased intraabdominal pressure or straining caused by foreign bodies, perineal hernia, constipation, congenital defects, lower urinary tract and prostatic diseases (Kumar *et al.*, 2004; Marjani *et al.*, 2009). The case at hand was caused by violent straining due to constipation probably related to less water supplement.

Low epidural anesthesia was administered using 2% lidocaine in the current case in order to desensitize perineal area for easy manipulation and control of straining. Surgical correction was done easily and there was no straining then after. This finding was in agreement with the finding of Singh and Jain (2013) who used the same anesthesia in similar technique.

The usual procedure for correction of rectal prolapse, its reposition and application of a purse string suture were applied in this case report. The animal recovered uneventfully as there was absence of anal stricture after few days. This finding agreed with the findings of Michou and Leece (2012), and Getachew *et al.* (2012). The patient was kept on easily digestible green fodder. Careful digital removal of faeces from rectum was also performed.



Figure 17: Surgical management of prolapsed rectum; Examination of prolapsed rectum (A), cleaning of the prolapsed rectum (B), applying ointment (C), replacing the rectum (D) and purse string suturing (E)

3.3. Surgical Management of Musculoskeletal Abnormalities

Summary

This case study summarizes the surgical management of right wing amputation in Marabou Stork and hind limb amputation in a local breed dog in veterinary teaching hospital, Bishoftu, Ethiopia. The reasons for the amputation of wing and limb were severe injury on the affected parts. Both cases were brought to the clinic and managed in different times. The injury in the dog was observed on the right hind limb. The Stork's injury (fracture) was on the right wing. Due to severity of the injury on the hind limb of a dog, amputation of the limb on the stifle joint was decided to be conducted under general anesthesia. In Marabou Stork, amputation just ventral to the elbow joint was conducted using obstetrical saw. Sedation and local anesthesia was used for amputation of the wing. There were no any complications encountered during and after the surgical operation in both cases. Early surgical management of fracture is essential for proper healing.

Key words: *Fracture of wing, hind limb injury, surgical management*

Literature Review

Limb amputation secondary to primary boney tumors, severe trauma or catastrophic injury is considered a viable option in small animal veterinary practice where successful treatment or salvage of the limb is precluded (Stone, 2009). Reports in production animals, however remain uncommon. This is due in part to the often-poor prognosis associated with such lesions or with

the potentially high cost of the procedure and affected animals is often either slaughtered or euthanized (Pal *et al.*, 2011). Wing amputation procedures are indicated as the last surgical option when infectious disease, neoplastic disease, severe radial nerve paralysis, or when chronic malunion fractures compromise the systemic health of the patient (Stone, 2009).

Limb amputations in contrast are uncommon in farm animal practices and very few were reported. It is due to animal size, animal intended use, and value of animal, temperament and high cost for the primary repair. These animals will either be slaughtered or euthanized. Fracture repairs are recommended based on the prognosis of the affected limb and other factors, however when options are limited, amputation should be recommended as an alternative to euthanasia (Desrochers *et al.*, 2014).

Wing amputation procedures are indicated as the last surgical option when infectious disease, neoplastic disease, severe radial nerve paralysis, or when chronic malunion fractures compromise the systemic health of the patient (Azmanis *et al.*, 20013). As wing salvage is paramount for optimal quality of life, indications for complete wing amputation are limited and case reports are scarce. Indications for full wing amputations include severe proximal humeral and/or humeral air sac infectious or neoplastic disease, invasive neoplastic disease at the elbow joint, severe radial nerve paralysis, and chronic proximal humeral malunion fractures (Nakano and Une, 2016).

Limb amputation is the gold standard for local management of primary bone tumors (Dernell *et al.*, 2001). Osteoarthritis, neurologic disease, obesity, and large breed have been cited as relative contraindications for amputation (Straw and Withrow, 1996). However, osteoarthritis, weight, and size are rarely problematic because osteoarthritis often occurs in large-breed dogs of middle to older age with preexisting osteoarthritis, and most animals have minimal difficulties after amputation (Kirpensteijn *et al.*, 1999).

Amputations of limbs in small animal practices are common especially in dogs with cases of osteosarcoma or severe trauma to the limbs (Stone, 2009). Limb amputation is indicated based on the irreversible nature of the injury or poor prognosis resulting in a non-functional limb. Reported indications for limb amputation in veterinary species include catastrophic injury to associated soft tissue structures such as muscles, tendons, ligaments and nerves, chronic or

gangrenous infection, osteomyelitis, loss of blood supply and open comminuted long bone fractures (Pal *et al.*, 2011).

Dogs with neurologic disease or severe clinical osteoarthritis are exceptions, and palliative management or limb-sparing techniques should be considered in these cases. Thoracic limb amputation should include the scapula, for both tumor control and cosmetic reasons, particularly for dogs with proximal humeral osteoarthritis (Dernell *et al.*, 2001). In the pelvic limb, coxofemoral disarticulation should be performed for dogs with osteoarthritis distal to the proximal femur whereas dogs with proximal femoral osteoarthritis should be treated with either en-bloc acetabulectomy or subtotal hemipelvectomy to achieve adequate tumor control and minimize the risk of local recurrence. Despite the fact that limb amputation is a commonly performed procedure in veterinary medicine, quantitative data regarding outcomes are lacking (Weigel and Slatter, 2001).

Case 1. Hind limb amputation in a dog

History

The dog was injured when it was trying to pass through corrugated iron fence one day before it came to the clinic. Bandage was applied on the wound for protection and control bleeding by the owner.

Clinical findings

The right hind leg was injured; the muscle and ligament proximal to tarsal joint, about five cm of muscle and ligament were removed and some of the caudal part of tarsal bone was exposed (Figure 18A). The parameters that were measured were temperature (39.8⁰C), heart beat (120 beats/minute) and respiratory rate (29 breaths/ minute). Mucous membrane was slightly changed to pale color.

Preoperative preparation and anesthesia

The patient was held over night without feed and withheld water for six hours. The dog was positioned in lateral recumbency. Anesthesia was made by using xylazine and tramadol as a

premedication and ketamine and diazepam as an induction agent. The wound area was washed, clipped and shaved. The area was scrubbed with savlon and also stained with 2% iodine tincture.

Surgery

After the patient was prepared, it was transferred to another table for surgical intervention. The patient was draped out of the surgical area. Incision was made distal to stifle joint (Figure 18B) in order to make flap and after incising of the skin and muscles, amputation was made on the stifle joint (Figure 18C). The muscles were apposed each other by simple interrupted suture (Figure 18D) and after adding procaine penicillin on the sutured muscle layer and the skin was sutured by horizontal mattress suture (Figure 18E). Finally iodine was applied on the wound.

Postoperative care

The wound was bandaged after suturing. Antibiotic (penstrpt) was used for five days and the wound was observed for any complication. Suture was removed on the 20th day.

Outcome

The wound has completely healed (Figure 18F) when seen on the 35th day visit.

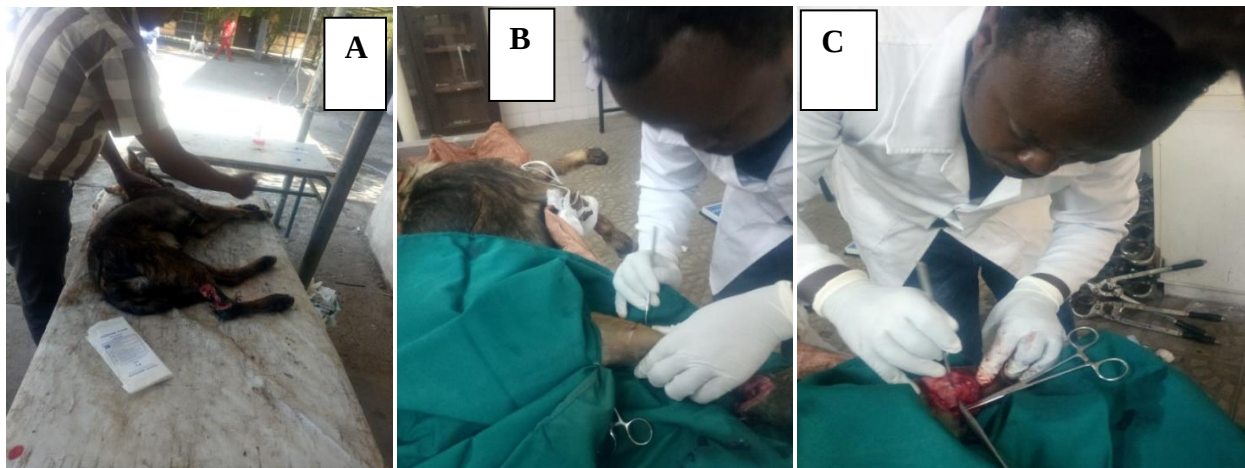




Figure 18: Hind limb amputation in dog; severely injured limb (A), incising the skin (B), disarticulating the stifle joint (C), closing of muscles (D), skin suturing (E) and recovery on the 35th day (F)

Case 2. Wing amputation (Marabou stork)

History and physical examination

The animal (Marabou Stork) was kept in Bishoftu Agricultural Research Institute. One day before the surgical operation, the guard got the patient with the bone of right wing broken and the wing was dropped. The animal's head and beak were covered by a cloth for restraining purpose and local anesthesia was made by using 2% lidocaine by infiltration technique to make examination properly. When the animal was examined, the right wing was drooped (Figure 19A) and there was bone (radius) fracture near to elbow joint and part of the fractured bone was also exposed to the outside. For further examination and treatment, the animal was taken to CVMA, VTH clinic.

Anesthesia and surgical procedure

The patient was restrained by covering its head with a cloth and the upper and lower beaks were tied together. Anesthesia was made by administration of the combination of ketamine (40mg/kg) and xylazine (10mg/kg) intramuscularly. Feathers around the area were plucked. The surgical area was washed with water and soap and also it was disinfected with savlon. Debridement was made in order to remove necrotized tissue. Incision was made along the unexposed portion of the

fractured bone to visualize and easy manipulation of the fractured bones (Figure 19B). Fractured bones, damaged nerve and necrotized tissues were observed which were difficult for easy anatomical reduction. When internally observing the condition, ulna was also fractured completely ventral to the elbow joint. Fractured bones and necrotized tissues were removed and cleaned with savlon. Amputation just ventral to the elbow joint was conducted using obstetrical saw (Figure 19C). The muscles around the stump of the bones were closed by simple interrupted suture pattern using non absorbable suture (Figure 19D).

Postoperative care

Procain penicillin (22,000IU/kg) and tramadol 2mg/kg were administered parenterally for three days. Bandage soaked by iodine which was changed every day was applied on the wound for three days. The patient was kept in a separate cage to prevent from injury that could be caused from other animals for one week and returned back to the owner.

Outcome

The wound was completely healed (Figure 19E) after one week.

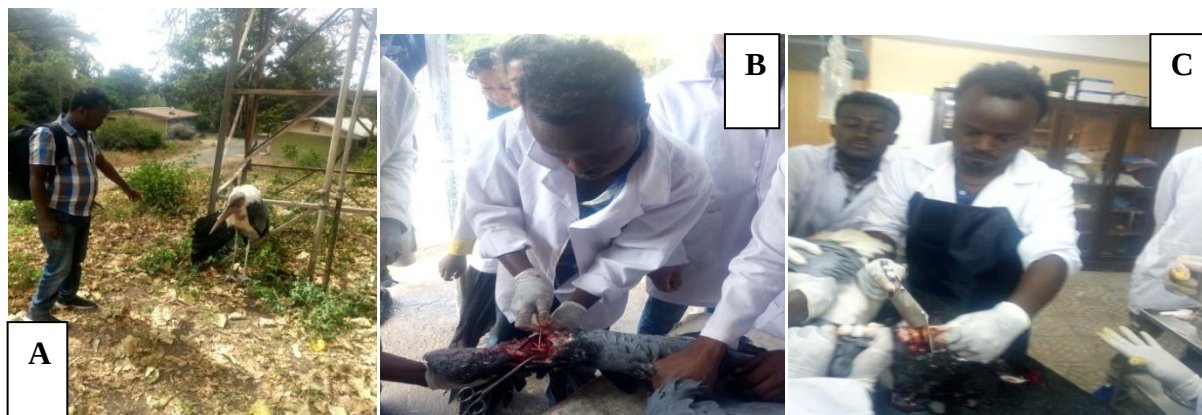




Figure 19: Wing amputation in stork; patient with dropped wing (A), incising on the affected part (B), amputation by obstetrical saw (C), closing of the wound (D) and healing after one week (E)

Discussion

Case 1. Amputations of limbs in small animal practices are common especially in dogs with cases of osteosarcoma or severe trauma to the limbs (Stone, 2009). For the rear leg amputation, there are two techniques that are commonly used. The first is a “high femur” amputation that results in a short, well padded stump at the level of the rump/thigh. The muscles of the mid-thigh are cut and the femur (thigh bone) is cut close to the hip. When the tissues are sewn together, this provides good padding for the pelvis when the pet is lying down and offers a cosmetic appearance by maintaining symmetry of the rump area (Bone and Aberman, 1988). The second technique is often used when the disease of the rearleg is in the thigh area; the leg is removed by “coxofemoral (hip) disarticulation”. This means that the leg is removed at the hip joint; only the pelvis and the surrounding muscles remain. This amputation technique is very successful as well, with slightly less padding over the amputation site and a less symmetrical appearance (Weigel, 2003).

Amputation of the left hind leg of the local breed dog in this case report at the stifle joint and subsequently saving the particular animal was very much essential as because large portion of ligament and muscle were removed that could not cover the bone ventral to the stifle joint. Similarly Kumar (1999) subjected the dog to general anesthesia (combination of ketamine and diazepam) to perform amputation. And then the amputation was performed successfully.

Postoperative care of the animal in literatures include administration of antibiotics intramuscularly with amoxicillin and cloxacillin (Intamox, Intas Pharmaceuticals Limited) at a dose of 10mg/kg b.wt./day for 5 days (Hogy *et al.*, 2013). But in this case report postoperative care was performed by using penstrip (combination of penicillin and streptomycin) and tramadol for five days. In all cases the outcome was successful though the types of antibiotics used differed.

Csae 2. Avian bones are thin and brittle and tend to break into fragments upon a variety of natural events like midair collisions, fights with other birds (Houston, 1993) or anthropogenic experiences like gunshot wounds, collisions with automobiles or fences, encounters with traps, attacks by dogs or cats, etc. (Fix and Barrows, 1990). In this case report the exact cause of fracture was not known but it seemed collision with car or fences.

Anesthesia in the present case was administered by using a combination of ketamine (40mg/kg) and xylazine (10mg/kg) intramuscularly and the operation was conducted while the patient was not completely induced. This result was partially in agreement with the finding of Nanjappa *et al.* (2013) who performed amputation of humerus on Black Kite bird by the same surgical procedure except the amputation site was midshaft of the femur.

Procaine penicillin (22,000IU/kg) and tramadol 2mg/kg were administered postoperatively along with antiseptic wound dressing for 5 days. The skin sutures were removed on the 10th day postoperatively. The bird recovered completely without any complications and became completely normal by the 15th day. When we compare this finding with the study of Nanjappa *et al.*, (2013), different types of antibiotics and anti pain were used including the time of treatment. But in this case better result was observed within shorter time unlike the finding by Nanjappa *et al.* (2013).

Case 3. Removal of abnormal growth

Summary

Skin and subcutaneous tumours are the most frequent kinds of such a disease known to affect dogs accounting for one third of all cases in this species. This case study summerises the surgical management of tumor in local breed dog that was presented in veterinary teaching hospital,

Bishoftu, Ethiopia. There was a small swelling and it became bigger after a year. Clinical examination revealed that, there was a mass hanged on the caudal part of the left hind limb and other parameters that were measured were normal. The mass was removed surgically from the dog hind limb by making an elliptical incision around the mass. Skin was closed by non absorbable suture in interrupted horizontal mattress suture pattern. Plastic material that can be used as collar was placed on the neck of the dog to prevent self inflicting trauma. Since the plastic was removed by the second day, there was scar which become narrower and healed after 45 days. Appropriate collar should be used until complete healing of the wound.

Key words: *Abnormal mass, dog, surgical removal*

Literature Review

Skin and subcutaneous tumours are the most frequent kinds of such a disease known to affect dogs accounting for one third of all cases in this species (Finnie & Bostock, 1999; Rothwell *et al.*, 2002). The incidence of cutaneous tumours in dogs is estimated to be 450 cases every year per 100,000 dogs (Bostock, 2004). The etiology of canine skin and subcutaneous tumours is unknown. Most authors connected higher incidence rates with exposure of different unfavorable environmental factors (Guzman *et al.*, 2003; Bostock, 2004). The age of the dogs with diagnosed skin tumours is commonly reported to range widely between 4 months and 16 years although the average age is approximately 9 years (Finnie & Bostock, 1999; Brodey, 2009).

Goldschmidt *et al.* (1998) between 1985 and 1990 on the other hand collected a total of 65,000 surgical pathology specimens from dogs and 13,250 from cats. The prevalence rates of skin tumors and tumor-like lesions were 45% in dogs and 24% in cats (Goldschmidt *et al.*, 1998). Brodey (2009) reported that the skin tumor rates from necropsies and biopsies were different. He collected 3492 skin tumors from 9178 biopsies which were 38.1% of all biopsies, and 74 skin tumors from 1120 necropsies in dogs which were 6.6 % of all necropsies.

A general classification of the skin tumors was performed by McClelland as early as 1940. The general division of skin tumors differs in the literature (Goldschmidt *et al.*, 1998, Bomhard, 2001). Bomhard (2001) divided them into tumors of the head, neck, limbs, chest, back, abdomen,

perianal, tail, and some tumors without data regarding locations. The extremities are defined as limbs (arms and legs) (Bostock, 2004).

Generally, about 1% of dogs and 0.5% of cats had one or more primary tumors, and the prevalence for malignant tumors in dogs was similar to that in cats. However, the prevalence of benign tumors in dogs was over 10 times the prevalence in cats (MacVean *et al.*, 2010). The incidence rate of benign and malignant neoplasms in dogs and cats were reported to be about 1077 cases per 100,000 dogs/year and 188 cases per 100,000 cats/year. Dogs have about six times as many neoplasms as cats. In dogs, 67.6 % of such neoplasms were found in the skin and connective tissue, in cats 44.8 % were found in these sites (Goldschmidt *et al.*, 1998; Scott *et al.*, 2001).

Skin tumors are divided into mesenchymal, epithelial and melanocytic tumors as in the WHO classification, and some authors in their statistics use the term "tumor-like lesion" as a separate term (Goldschmidt and Shofer, 2009). Generally, neoplasms are composed of one tissue type only, but there are exceptions such as teratoma and mixed neoplasms which consist of multiple tissues (Cullen *et al.*, 2002). Mesenchymal tumors are more common and make up about 55 % of tumors in dogs and 46% of tumors in cats (Willemse, 1991; Goldschmidt and Shofer, 2009). Epithelial tumors are less common than mesenchymal tumors in dogs (35 %) and cats (43 %). Melanocytic tumors are relatively more common in dogs (4 %) than in cats (1 %) and tumor-like lesions are somewhat higher in dogs (11 %) than in cats (9 %) (Goldschmidt and Shofer, 2009). In another study, follicular tumors and tumor-like lesions together represent 10.4 % and 8.1 % of all skin tumors in dogs and cats, respectively (Abramo *et al.*, 1999).

Hepatoid gland tumors were primarily neoplasms in males rather than females, with almost 89% and 11%, respectively, as was found by Frese (2001), Goldschmidt and Shofer (2009) and Bomhard (2001). This predilection has also been reported in most other publications (Scott *et al.*, 2001; Goldschmidt and Hendrick, 2002). Histiocytomas were also slightly more frequent in males (52-69 %) than in females (31-48 %), similar to melanomas, which were more frequent in males (about 50-61 %) than in females (39-50%) (Frese, 2001; Bomhard, 2001; Goldschmidt and Shofer, 2009). In contrast, leiomyomas and leiomyosarcomas were more common in females (76 %) than males (24 %) (Bomhard, 2001). Lipomas were also more common in females (68 %)

than in males (32 %) (Bomhard, 2001; Goldschmidt and Shofer, 2009), and Fibromas also had a predilection for female animals (Scott *et al.*, 2001). Some tumors vary from author to author; basal cell tumors, for example, are more common in males according to Frese (2001) and Bomhard (2001), in contrast to Goldschmidt and Shofer (2009). Most other skin tumors show no clear sex predilection in the literature (Goldschmidt and Shofer, 1992; Bomhard, 2001).

Some skin tumors have been described as being more common in some breeds, the more common example being malignant histiocytosis, which was first described in a Miniature schnauzer dog (Scott *et al.*, 2001), then was frequently reported in Bernese mountain dogs and has also been reported in various dog and cat breeds (Court *et al.*, 1993, Goldschmidt and Hendrick, 2002). Nodular dermatofibrosis of the German shepherd dog is a rare breed-specific syndrome (Goldschmidt *et al.*, 1998). Another example is the mast cell tumor, which was found more commonly in Boxer, Pug and Boston than in other breeds (Scott *et al.*, 2001; Goldschmidt and Shofer, 2009). Furthermore, subungual squamous cell carcinoma showed breed disposition in Giant schnauzer and Gordon setter and many other breeds (Goldschmidt and Hendrick, 2002; Goldschmidt and Shofer, 2009).

Generally, it is known that cancer essentially represents an illness of the higher age, however, it is yet to be discussed whether the frequency of the malignome continues to increase up to the highest age-groups or whether it sinks again after a highpoint in a certain age-group (Frese, 2001). Individually, there are some tumors which are found in young animals more commonly than in old animals. The more common examples are canine cutaneous histiocytoma and papilloma, the majority of which occur in young dogs, but dogs of any age can be affected (Goldschmidt and Hendrick, 2002; Goldschmidt and Shofer, 2009). Regarding tumor-like lesions, there are also two examples, dermoid cyst and the follicular cyst, which are both more frequently found in young animals than in adults (Bomhard, 2001).

The treatment of tumor can be performed by surgery. The first surgery provides the best chance for a cure in an animal with a tumor. Therefore, it must be planned carefully to ensure that either the mass is excised completely or the remaining tumor cells can be treated with adjunctive therapy. Surgical planning depends on knowledge of tumor type, clinical stage, and expected biologic behavior. If these are not known, then surgery should be planned to encompass all

possible eventualities including intraoperative cytology or frozen-section histopathology (Gilson and Stone, 1990).

There are four levels of aggressiveness (doses) for surgical resection: radical, wide, marginal, and debulking. Incompletely excised benign and malignant tumors will recur. Recurrent tumors are often more locally invasive due to altered vascularity and local immune responses, and the destruction of normal tissue planes makes subsequent surgeries more difficult and extensive (Gilson and Stone, 1990; Withrow, 2001).

History and clinical examination

A four years old local breed female dog was brought to CVMA, veterinary teaching hospital with a mass hanged on the proximal caudal part of left hind leg, laterally (Figure 20A). The owner complained that there was a small swelling and it became bigger after a year. Clinical examination revealed that, there was a mass hanged on the caudal part of the left hind limb. The body parameters showed that: Body temperature 38.3⁰C, respiratory rate 28 breaths/minute and pulse rate 80 beats/ minute. All parameters were in the normal ranges. Mucous membrane color and hydration status were also normal.

Preoperative preparation

The dog was fasted over night and withheld water for six hours before the operation. The patient was premedicated with xylazine and tramadol intramuscularly and waited for fifteen minutes until the dog was calmed. The dog positioned and restrained in right lateral recumbency. The surgical site and the surrounding area were washed with water and soap, clipped and shaved and then disinfected with savlon. The surgical site was painted with tincture of iodine. After preparation, the animal was transferred to another table for surgical operation.

Surgical treatment

After transferring of the patient, draping was made by the surgeon. An elliptical incision was made vertically around the mass (Figure 20B). Blunt dissection was made (Figure 20C) and the exposed vessels were ligated by using absorbable suture material (cat gut sized 2/0) and excised (Figure 20D). The mass was removed bluntly without injuring the muscle. Procaine penicillin

powder was sprinkled on the wound and the skin was closed by silk in interrupted horizontal mattress suture pattern (Figure 20E).

Postoperative care

The wound was stained with iodine tincture. Plastic material that can be used as collar was placed on the neck of the dog to prevent self inflicting trauma. Penstript was injected for three consecutive days intramuscularly.

Postoperative complication and result

The plastic material which was placed on the dog's neck was removed and then the dog removed the suture from its wound. There was scar that became narrower and healed after 45 days (Figure 20F).

Discussion

Skin tumours are the most frequent kinds of such a disease known to affect dogs accounting for one third of all cases in this species (Rotthwell *et al.*, 2002). The etiology of canine skin and subcutaneous tumours is unknown (Bostock, 2004). As it was known from the history of this case, there was a small swelling on the affected part that became larger after a year and half month. There was no any injury observed on the affected area.

According to Shofer (2009), out of all 430 canine cutaneous tumours 223 were malignant while 207 were benign. However, based on the findings of Scott *et al.* (2001) malignant cutaneous neoplasms accounted for 46.6% vs 53.4% for benign. In this case report, it was tried to conduct cytology in pathology laboratory for confirmation purposes but it was difficult to observe anything in the slide. The mass was taken to national laboratory (Sebeta) but they could not accept it because of the sample size. Due to the above reason it was not possible to confirm and categorize the mass.

The mass was removed surgically by following possible aseptic condition. The operation was conducted under general anesthesia (premedicated with xylazine and tramadol, induction by

ketamine and xylazine intramuscularly). Cat gut (2/0) was used to ligate blood vessels encountered on the affected part and skin was sutured by using non absorbable suture.

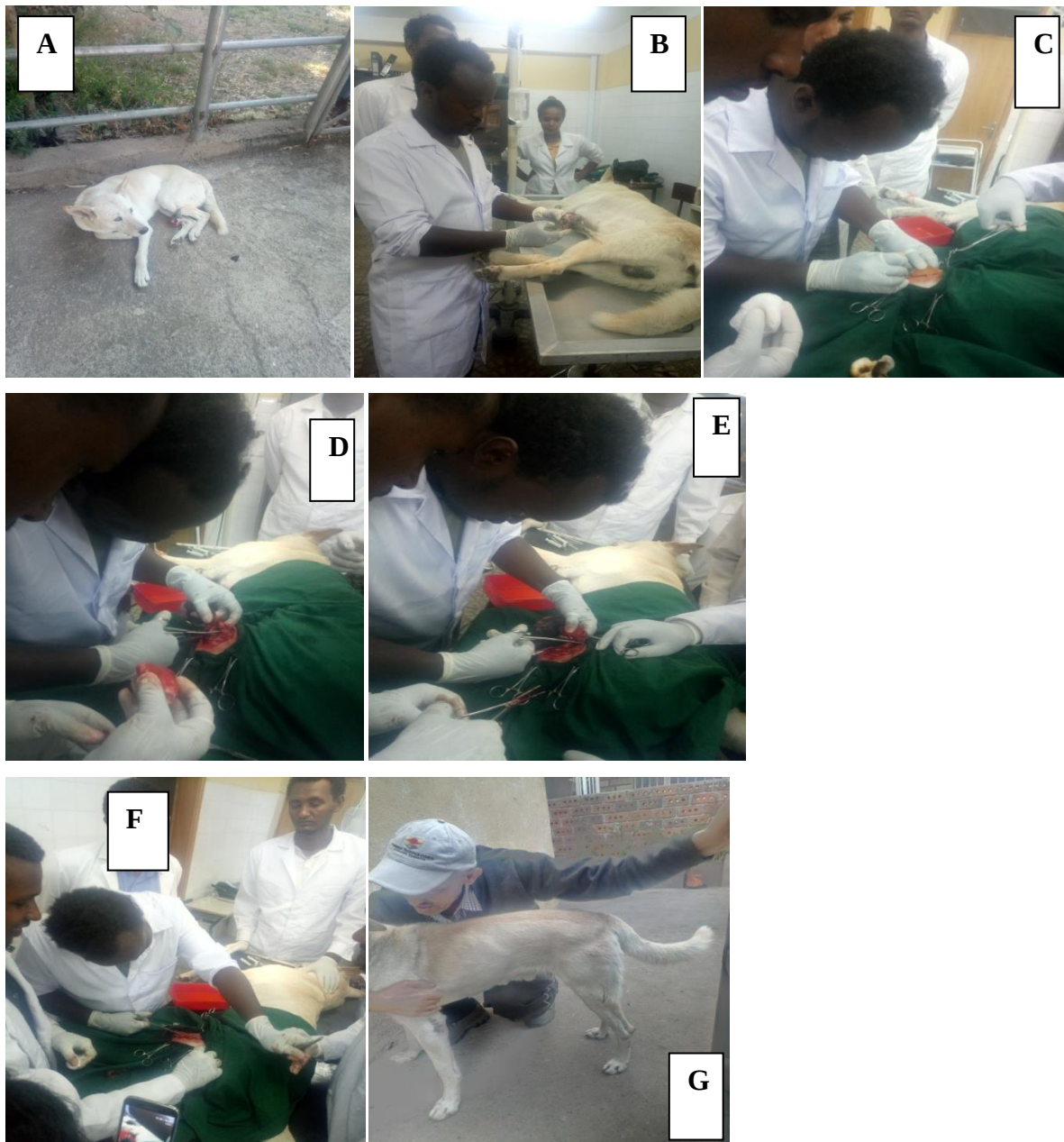


Figure 20: Excesion of abnormal mass; dog with abnormal mass on the left hind limb (A), an elliptical incision (B), blent dissecting of the mass (C), excising the mass (D) and skin suturing (E)

3.4. Surgical Management of Mammary Gland Disorders

3.4.1. Supernumerary teat removal

Summary

Supernumerary teats (hyperthelia) are an undesired and heritable trait in dairy cattle. This case study summarises the surgical management of supernumerary teat in three weeks age calf that was performed in the owner's house. The calf was delivered with the fifth extra teat (supernumerary teat). There were no any other abnormal signs that were observed by the owner of the animal. Body parameters that were measured revealed normal. Extra teat was removed by sedating the animal and using local anesthesia. The edge of the skin was closed with two bites of simple interrupted suture pattern and painted with tincture of iodine. Antibiotic was injected intramuscularly for three days. The suture was removed on the tenth day and the wound was completely healed on this day without any complication. It is better to remove extra teat when the animal is in its younger age.

Key words: *Calf, supernumerary teat, surgical management*

Literature Review

Supernumerary teats (hyperthelia, SNT) are an undesired and heritable trait in dairy cattle; particularly if supernumerary mammary glands are also present (hypermastia). This is due to aesthetic reasons, possible disturbances of machine milking, and because supernumerary mammary glands may act as a reserve for bacteria threatening udder health (Boodstein, 1972).

SNT has been observed in various mammalian species. In humans (Urbani and Betti, 1996), sheep, guinea pigs (Goertzen and Ibsen, 1951), and mice (Howard and Gusterson, 2000), a simple dominant/ recessive inheritance has been found. In these species, special families, pedigrees, or lines and their crosses have been investigated. In cattle, larger samples that are more likely to exhibit greater variability have been analyzed. Literature reports show a frequency range for SNT in cattle of 15 to 69% (Stavikova *et al.*, 1982; Sieber, 1986). Clear differences between breeds were observable. For example, a frequency of 15% was found in German

Holstein (Brka *et al.*, 2000a) and 69% in German Simmental (Sommer *et al.*, 1961). These differences suggest that SNT is heritable. Several contradictory proposals have been made for the mode of inheritance in cattle (Brka *et al.*, 2000a).

From a maximum-likelihood analysis of 27 half-sib families with known phenotype of the sire, simple recessive or dominant inheritance was excluded (Brka *et al.*, 2000b). From the results of this study, it was concluded that the inheritance in cattle either involves a more complex penetrance pattern or is oligo- or polygenic. Published estimates for the heritability of SNT were between 0.09 and 0.63 (recently reviewed by Brka *et al.*, 2000a). With the exception of Sieber (1986), who analyzed a dataset of 26,823 German Simmental cows, only comparatively small datasets (200 to 1500 animals) were available. Threshold models are most appropriate for the genetic analysis of binary traits (Gianola, 1982), but this method has been used only once in the analysis of a small SNT dataset of 818 Holstein animals (Brka *et al.*, 2000a).

Supernumerary teats are extremely common in certain lines of cattle, especially Guernseys. Usually one to four extra teats are observed although more can occur. Generally, the supernumerary teats are located caudal to the rear quarter teats or between the rear and forequarter teats. These “extra” teats require removal, least functional glands evolve that would likely become infected because they cannot be milked effectively. Such infections provide a chronic source of mastitis organisms for other quarters in the herd (Groeneveld, 1990).

Supernumerary teats that are joined to one of the four major teats have been called webbed or “Siamese” teats. These may appear as distinctly separate teats or only as small raised areas on the wall of one of the major teats. These teats frequently have a separate gland of their own although they may communicate with the teat or gland cistern of the major teat. In either case, these joined teats require special treatment and careful differentiation from simple supernumerary teats (Stavikova *et al.*, 1982)

A desirably shaped udder with four, well-spaced teats does a great deal for the general appearance of a dairy cow. It may also improve its value as a milk cow in the dairy herd. Heifers are occasionally born with one or more extra teats. These extra teats can be unsightly, may pose a problem as a site for an udder infection, and may interfere with the function of the milking machine. Extra teats should be removed as soon as they can be positively identified. It is best to

remove extra teats when a heifer calf is two to six weeks old. The young calf does not have a great deal of blood circulation in the skin area around the rudimentary teats; therefore, very little bleeding can be expected (Urbani and Betti, 1996).

History and physical examination

The owner complains that his calf was delivered with fifth extra teat (supernumerary teat) three weeks ago. There were no any other abnormal signs that were observed by the owner of the animal. When the calf was examined, there was supernumerary teat that was grown between the right side of normal teats (Figure 21A). There were no other abnormal signs when the temperature (38.9⁰C), heart (80 beats/minute) and respiratory (40 breaths/minute) parameters were measured.

Preoperative preparation

The calf was positioned and restrained in dorsal recumbency. The surgical site and the surrounding area was washed with water and soap (Figure 21B) and shaved. The area then scrubbed with savlon stained with iodine tincture.

Surgical procedure

The patient was sedated with xylazin in 0.2mg/kg intramuscularly and lidocaine was injected as local anesthesia by infiltration. Hemostatic forceps was used to pinch (Figure 21C) and “extra” teat was stretched and held firmly with one hand and then it was excised at the junction between the skin (Figure 21D) and teat with sterile scalpel blade fixed on disinfected scalpel handle. The edge of the skin was closed with two bites of simple interrupted suture pattern (Figure 21E) and painted with tincture of iodine.

Postoperative care

Iodine was applied on the sutured wound (Figure 21F). Antibiotic (penstip 1ml/10kg) was injected intramuscularly for three days.

Outcome

The suture was removed on the tenth day. The wound was completely healed on the 10th day without any complication (Figure 21G).

Discussion

There was a history of supernumerary teat on the dam in this case report and this abnormality was also observed on the calf and this might be due to hereditary effect as mentioned by Brka *et al.* (2000b).

The supernumerary teat in the present case was observed between the rear and forequarter teats on the right side. Similar observation was obtained by Groeneveld (1990) who observed extra teat located caudal to the rear quarter teats or between the rear and forequarter teats in a calf of one week age.

Supernumerary teat on the calf was surgically removed in early stage of the calf under sedation by using xylazine at a dose of 0.2mg/kg intramuscularly and using local infiltration anesthesia and there was no any bleeding complication and good recovery which was similar finding with the study of Brka *et al.* (2000a) who conducted surgical removal of supernumerary teat in a four weeks calf. However, the anesthesia which was used by the above author was a combination of xylazine and ketamine intravenously. There are no adequate articles regarding supernumerary teat problems and surgical management.





Figure 21: Supernumerary teat removal; calf with extra teat (A), cleaning the surgical area (B), pinching extra teat (C), excision of the teat (D), suturing the wound (E), staining the wound by iodine (F) and wound on the tenth day (G)

3.4.2. Udder amputation

Summary

Gangrenous mastitis is relatively uncommon but often is fatal mastitis of sheep, goats and cattle. Affected cows always lose the quarter of the mammary gland. This case study summarised the surgical management of gangrenous mastitis in exotic breed of adult cow that was performed in the owner's house. At the beginning of this condition, there was injury at the end of the right caudal teat and the udder became swollen. The cow was treated for five days for the udder and teat abnormality. The udder becomes black on the right caudal quarter. When the cow was examined, there was a blue- blackish discoloration on the affected part and it had slight hard consistency and felt cold when it was palpated. Milk sample was taken to NVI before the above

changes were observed to confirm the cause of mastitis and it showed that its cause was *Escherichia coli* bacteria. All measured parameters were in normal range. The operation was performed on standing position. The affected part was removed by using epidural and local infiltration anesthesia. Bleeding and loosening of suture were the complications observed during and after the surgical operation. Healing of the wound took more than two months.

Key words: *Cow, gangrenous mastitis, surgical management*

Literature Review

Animal care, hygiene, and management are important factors in the dairy cow diseases of great economic importance. Mastitis is one of the most common problems reported throughout the world accounting to its major impact on both economy and animal welfare as it affects the production status of an animal. During latency of the infection, the causative organisms persist in the udder and environment as well and the resulting disease leads to irreversible injury to the udder by afflicting alveolar epithelium through setting up inflammation. Affected cows always lose the quarter of the mammary gland that is involved and sometimes the animal dies too (Phiri *et al.*, 2010). The hidden organisms in the udder may flare up to produce clinical mastitis (Radostits *et al.*, 2000). Bovine mastitis is divided into 4 categories: peracute, acute, sub-acute and subclinical based on the severity and rapidity of its occurrence. Diagnosing subclinical mastitis as the earliest as possible by somatic cell count and bacterial load count is a prerequisite in limiting the development of clinical mastitis (Fraser *et al.*, 1998).

Gangrenous mastitis is relatively uncommon but often fatal mastitis of sheep, goats, and cattle. Affected cows always lose the quarter of the mammary gland that is involved and sometimes the patient dies, too. Because most of the cases are caused by gram-positive organisms, procaine penicillin containing intramammary infusions are used (Phiri *et al.*, 2010). Gangrenous mastitis, a per-acute form of mastitis is associated by alpha-toxin induced necrosis of the udder (Smith and Sherman, 2009) and is characterized by severe acute inflammation along with signs of heat and redness. The lesions are histopathologically characterized as progressive swelling, vascular degeneration, and focal erosion and ulceration occur throughout the ductal system (Carlton and McGavin, 1995).

Proteus species: is less common pathogens that can cause mastitis. As opportunist organisms, they usually invade the mammary gland when defense mechanisms are compromised or when they are inadvertently delivered into the gland at the time of intramammary treatment. Such organisms are also sporadic in occurrence and usually affect only one cow or a few cows in a herd (Phiri *et al.*, 2010). Mastitis mainly caused by *Staphylococcus aureus* and *Escherichia coli* may progress to gangrenous one. But the lacking of early diagnosis and farmers' awareness, the approximately curable *Staphylococcus aureus* and *Clostridium perfringens* were also isolated from gangrenous mastitis (Ribeiro *et al.*, 2007).

The treatment of gangrenous mastitis is very difficult and only possible by amputation of the gangrenous quarter (s) only to save the life of an animal despite of doubtful prognosis. Physical examination of the udder is characterized by discolored (blue- blackish or blue-greenish) and cold udder and surgical removal of the dead and dying tissue is considered as an immediate management option (Ribeiro *et al.*, 2007).

Gangrenous mastitis being the deadliest form of mastitis to be treated (Bloway, 1993) could lead to gangrene induced toxemia and loss of animal life in severe cases (Ribeiro *et al.*, 2007). Drying-off the affected animal is advocated in cases of mastitis not amenable to medical treatment to allow sloughing of the affected quarters or surgically as implicated. Partial mastectomy is considered as a safe and effective surgical procedure for udder disease in elite cattle and complete mastectomy following conservative therapy in exceptional circumstances provided the animal is sound and healthy as reported by some authors who compared different methods of mastectomies. Teat amputation and physiological udder amputation (tying off blood vessels supplying the udder) have also been suggested to treat gangrenous mastitis (Dehghani and Baniadam, 1996; Cable *et al.*, 2004; Allen *et al.*, 2008).

Ruminants with severe but localized diseases of the udder do well after radical mastectomy (Cable *et al.*, 2004). Large surgical defects after mastectomy are common, but they heal by second intention. Seroma formation is the most common complication after mastectomy and continues to be an important problem during the early postoperative period. Mastectomy is a procedure of choice in gangrenous mastitis in ruminants (Frank 2002; Ribeiro *et al.*, 2007).

History and clinical finding

The cow under question was examined and kept under medical care for mastitis. Since there was no response of different kinds of treatments, milk sample was collected and submitted to the National Veterinary Institute (NVI) to know the exact cause of mastitis. While the sample was being processed, the owner informed that the affected quarter was changed to blue- blackish color. At the beginning of this condition, there was injury at the end of the right caudal teat and the udder becomes swollen. The cow was treated for five days for the udder and teat abnormality by oxytetracycline 10% solution. The udder became black on the right caudal quarter. When the cow's udder was examined again, there was a blackish discoloration on the affected part (Figure 22A) and it had slight hard consistency and felt cold when it was palpated. The body parameters such as temperature was found to be 38.1⁰C, respiration rate 32 breaths/minute and pulse rate was 56 beats/minute. All measured parameters were in normal ranges. The cause of the condition was *Escherichia coli* as confirmed in NVI bacteriology laboratory.

Preoperative preparation

Penstrip (1ml/20kg) was administered as a prophylaxis and treatment. The right side of the udder was washed, shaved and disinfected with savlon. Caudal epidural anesthesia was administered using 2% lidocaine.

Surgery

Local infiltration anesthesia was also used to desensitize the operation area. The operation was performed on standing position. The affected part was first removed by gentle traction (Figure 22B) and debridement was done by using scissors. Bleeding was controlled by using artery forceps and ligation with chromic cat gut sized 2/0. The wound was disinfected with iodine 2% and the skin was sutured by simple interrupted technique with non absorbable suture material (Figure 22C).

Complication and postoperative care

Bleeding was the main complication which was observed during the surgical procedure. Due to friction between the medial aspect of the right hind limb and wound, suture materials were removed (Figure 22D) on the second day. The open wound was not sutured again. It was managed as it was opened regularly by washing and disinfecting for about ten days. Penstrip

was also administered intramuscularly for seven days. Boiled water with salt and iodine were used for cleaning and disinfecting for about fifteen days. Follow up was continued for about two months.

Outcomes

The wound was healed as shown in Figure 22E on the 60th day of visit.

Discussion

Bovine gangrenous mastitis is an acute or per-acute condition involving one or more quarters of the cow's udder (Allen *et al.*, 2008). In this case report blackish discoloration of the right caudal quarter of the udder was observed. It was felt cold when it was palpated. Similar observations were made by Ribeiro *et al.* (2007) in that the affected udder was characterized by discoloration (blue- blackish or blue-greenish) and cold upon palpation (Ribeiro *et al.*, 2007). *Staphylococcus aureus*, *Clostridium perfringens*, and *Escherichia coli* have predominated in causing gangrenous mastitis in ruminants (Green and Bradley 2004; Atyabi *et al.* 2006). The finding of *E. coli* in this study was supported by these authors. On the other hand *Staphylococcus aureus*, and *Clostridium perfringens* were not isolated in this case report. This difference might be due to the study duration and number of cases handled.

Caudal or low epidural analgesia was used for amputation of the udder in the current case. The present result was supported by Turner and McIlwraith (2013) in that cranial or high epidural, alternatively high dose of caudal or low epidural analgesia could be used for udder amputation.

There was difficulty in healing of the wound in this case since the suture was located on the right caudal area. Friction between the medial aspect of the right caudal hind limb and the wound made the suture difficult to retain on the wound. Wound care was performed for more than one month and the case was observed for about two months. Frank (2002) and Ribeiro *et al.* (2007) indicated large surgical defects after mastectomy are common, but they heal by second intention. Seroma formation is the most common complication after mastectomy and continues to be an important problem during the early postoperative period. Mastectomy is a procedure of choice in gangrenous mastitis in ruminants.



Figure 22: Udder amputation ; blackish discoloration of udder (A), removing the affected part (B), simple interrupted suture (C), wound with removed suture (D) and wound on the 60th day (E)

3.5. Surgical Management of Teeth Disorders

3.5.1. Rasping of sharp molar

Summary

Affections of irregular and sharp molar teeth are the most common clinical condition. Last molars are more predisposed in cattle and buffaloes. This case study summarised the surgical management of sharp molar teeth in local breed cow that was presented to veterinary teaching hospital, Bishoftu, Ethiopia. The history of the cow showed that it usually throw cud materials on

the ground with tooth grinding sound. The condition began two days before. When physical examination was performed, the parameters were in normal ranges. The cow's body condition was poor. There was bulging of cheek when observed laterally. Color of mucous membrane was pale and there was dehydration upon skin fold examination. The mouth was cleaned thoroughly and then the sharp edge of the teeth was rasped. When the cow was observed on the 5th day, the abnormality observed previously was resolved.

Key words: *Cow, rasping, sharp molar teeth*

Literature Review

Affections of irregular and sharp molar teeth are the most common clinical condition. Last molars are more predisposed in cattle and buffaloes. Usually, clinical manifestation of overgrown molar teeth occurs as quidding, bulging of the cheeks due to impaction of the food material and salivation, animals usually throw cud materials on the ground and also irregular molar can hamper mastication and cause simple indigestion (Tyagi and Singh, 2013).

The process of removing potentially harmful sharp points and edges from the cheek teeth is called rasping or 'floating'. This is undertaken on a regular basis depending on the age of the animal and the health of the mouth. Before rasping the teeth a thorough examination of the mouth should first be performed. This can only be done properly by using a device called a speculum or 'gag' to safely keep the mouth open (Huber, 2004). This allows the practitioner to look and feel inside the mouth to check not only for sharp points but also for other problems such as broken or missing teeth. Only once the mouth has been examined will the teeth be rasped. There are many different types of dental rasps available and the practitioner will have a range of instruments to allow work to be performed on teeth in various parts of the mouth. Floating of the teeth can also be undertaken using motorized equipment. Motorized equipment in the right hands can be a very effective tool for both routine floating and the specific management of dental irregularities (Erjavec and Crossley, 2010).

History and physical examination

Eight years local bread cow was brought to CVMA, veterinary clinic and the owner complained that the cow usually throw cud on the ground with tooth grinding sound. The condition began two days before. When physical examination was performed the parameter showed that temperature, respiratory rate and heart rate were 38⁰C, 24 breaths/minute and 68 beats/minute, respectively. The cow's body condition was poor. There was bulging of cheek when observed laterally (Figure 23A). The mouth was cleaned thoroughly and observation inside the oral cavity revealed that there was a sharp upper molar edge.

Preoperative preparation

The cow was restrained in standing position inside the crush. The mouth was cleaned thoroughly with water and accumulated food and saliva were removed and then rinsed with hydrogen peroxide.

Treatment

After cleaning and inspection, a mouth gag of proper size was inserted. A tooth rasp was introduced after withdrawing and holding the tongue in the opposite direction and then the sharp edge of the teeth was rasped (Figure 23B).

Result

There was no any abnormality observed when the cow was observed on the 5th day.

Discussion

Clinical manifestations observed in this case were bulging of the cheeks and salivation and there were history of throwing of cud materials and inappetance. Similar manifestations were observed by Tyagi and Singh (2013).

Huber (2004) recommended the removal of potentially harmful sharp points and edges from the cheek teeth by rasping and this process should be conducted first by applying appropriate mouth gag and performing a thorough examination of the mouth. Similarly in this case also, a mouth gag was used in order to observe the condition and manipulate easily. After a thorough examination of the mouth, rasping of the sharpened teeth was performed with the help of a senior

veterinarian from the donkey sanctuary project. It is imperative to point out scanty literature information is available pertaining to surgical correction of bovine sharp or irregular molar teeth.



Figure 23: Surgical management of teeth abnormality; bulging of cheek (A) and rasping of sharp molar (B)

3.6. Wound Management

3.6.1. Abscess draining

Summary

Abscess is the collections of pus in confined tissue spaces usually caused by bacterial infection. A subcutaneous abscess is a collection of pus and infected material within the tissues beneath the skin. This case study summarised the surgical management of abscess in local breed cow that was presented to veterinary teaching hospital, Bishoftu, Ethiopia. There was a small swelling on the upper part of right hind limb before one month and then gradually it became bigger on the affected part. Clinical examination revealed swelling on the right side caudally just bellow the point of tuber coxae. The symptoms and signs of subcutaneous abscesses were pain, heat, swelling, tenderness, and redness. Aspiration of fluid was also conducted by using sterile needle in order to observe and confirm whether the fluid is pus or not. The body parameters were in normal ranges. The sample was collected and submitted to NVI laboratory revealed bacteria other than the suspected pus forming bacteria which were grown on the media. Surgical drainage of the abscess was the selected treatment with antibiotic injection. Drainage and disinfection of the wound was conducted continuously for three days and antibiotic was also given on these

days. When the animal was visited on the 15th day there was no any swelling, discharge and wound on the affected part.

Key words: *Abscess, cow, surgical management*

Literature Review

Abscess is the collections of pus in confined tissue spaces usually caused by bacterial infection and the most common cause is *Staphylococcus aureus* bacteria (Blood *et al.*, 2007). Organisms may enter the tissue by direct penetrating trauma with a contaminated object, dissemination via lymphatic or hematogenous routes from a distant site. Abscesses may begin in an area of injury or in compromised tissue where leukocytes accumulate. Progressive dissection by pus or necrosis of surrounding cells expands the abscess (Blood *et al.*, 2000).

Abscesses usually are soft to firm swellings that gradually enlarge over days to weeks. Although abscesses most commonly develop on the head and limbs, they may occur anywhere on the body. They usually are not painful, frequently immovable, minimally inflamed, contain caseous exudate, and are typically walled off by a thick capsule. Abscesses may be confined to the subcutaneous space, or they may extend to underlying dermis and bone (Hassan *et al.*, 2019).

The purulent exudate ‘pus’ remains surrounded by a limiting membrane called the pyogenic membrane (Tyagi and Singh, 2012). During pus formation, there occurs by a breach of surface of the skin or mucous membrane leading to the entrance of pyogenic microorganisms. Usually solitary pus containing external outgrowths are common in cattle and buffaloes (Sahoo and Ganguly, 2015). Abscesses may also develop in internal body organs such as the lungs or liver if the organisms enter the bloodstream. Various factors which predispose for abscess formation may be impaired host defense mechanisms, presence of foreign bodies, obstruction to normal drainage (eg, in the urinary, biliary, or respiratory tracts), tissue ischemia or necrosis and hematoma (Kofler *et al.*, 2004).

A subcutaneous abscess is a collection of pus and infected material within the tissues beneath the skin (Hassan *et al.*, 2019). Most subcutaneous abscesses result from traumatic skin penetration with resulting infection, for example facial subcutaneous abscesses are common in cattle eating roughage containing foxtailgrass (*Hordeum jubatum*), several animals in a herd may be affected

at one time, and the awns of these plants migrate into the cheek mucosa, causing subcutaneous abscesses. Highly vascularized connective tissue may then surround the necrotic tissue, leukocytes, and debris to wall off the abscess and limit further spread (Radostitis *et al.*, 2007). The *Corynebacterium*, *Staphylococcus*, *Streptococcus*, *Pasteurella* spp., *Escherichia coli*, and other gram-negative rods. *Peptostreptococcus anaerobius* and *Eubacterium tortuosum* were isolated in external and internal abscesses in cattle (Sinha, 2006).

The symptoms and signs of cutaneous and subcutaneous abscesses are pain, heat, swelling, tenderness, and redness (Stephen and Edward, 2010). Diagnosis of cutaneous and subcutaneous abscesses is by physical examination and that of deep abscesses often require imaging/ultrasonographic examination (Radostitis *et al.*, 2007). The abscesses contain purulent material, are well encapsulated, and must be surgically drained and treated as an open wound. Medical therapy with parenteral antimicrobials and iodine is ineffective (Hassan *et al.*, 2019).

History and clinical examination

There was a small swelling on the upper part of right hind limb before one month and then gradually it became bigger on the affected part. Clinical examination revealed swelling on the right side caudally just below the point of tuber coxae (Figure 24A). The symptoms and signs of subcutaneous abscesses were pain, heat, swelling, tenderness, and redness. Aspiration of fluid was also conducted by using sterile needle in order to observe and confirm whether the fluid was pus or not. It was differentiated from other mass or swelling conditions like tumor, hematoma and hernia by palpation and aspiration of the fluid. The body temperature was 38.4⁰C, respiratory rate 32 breaths/minute and pulse rate 60 beats/minute. Color of mucous membrane and hydration status revealed normal.

Sample collection

With a sterile 18 gauge needle a small amount of fluid (pus) was aspirated from the swollen area and it was immediately transferred on microscope slide and smear was prepared.

While the animal was restrained in crush, the sample was taken to NVI in cold chain having suspected common bacteria such as *Staphylococcus*, *Streptococcus*, and *Escherichia coli* that are occurring in subcutaneous abscesses for laboratory confirmation.

Laboratory Diagnosis and Result

The prepared smear was stained with Gram staining procedure. And a drop of immersion oil was added on the slide and observed under 100X objective. Unclear field of the slide was observed.

The sample taken to NVI was cultured on Tryptose Soy Agar (TSA) and on Gram staining the bacteria were Gram negative. Since the result of Gram staining was Gram negative, the colony was subcultured on MacConkey agar to confirm whether *Escherichia coli* bacteria were present in the sample or not by excluding Gram positive bacteria (*Staphylococcus* and *Streptococcus*). Even though bacteria are grown on the media, they have no features of *Escherichia coli* bacteria. Bacteria other than the suspected pus forming were grown on the media.

Preoperative preparation

The site was prepared by clipping, shaving of hairs (Figure 24B) and disinfected with savlom as antiseptic solution.

Treatment

Surgical drainage of the abscess was the selected treatment of choice with antibiotic injection. First the animal was restrained in the crush. A stab skin incision was made on the dependent part of the swelling in order to allow proper drainage of the content. All the contents were evacuated with pressure on the swelling to facilitate the flow of fluid from the cavity (Figure 24C). Since the animal was aggressive to perform the remaining procedure, the patient was casted on the ground by using rope. Disinfection inside the cavity was performed with iodine (Figure 24D).

Postoperative care

Drainage and disinfection of the wound was conducted continuously for three days and antibiotic (Perstrip 1ml/20kg) was also given on these days.

Outcome

There was a good progress when the animal was visited on the 15th day .There was no any swelling, discharge and wound on the affected part (Figure 24E).

Discussion

A subcutaneous abscess is a collection of pus and infected material within the tissues beneath the skin (Hassan *et al.*, 2019). In the present case report also abscess was found subcutaneously on the right side caudally just bellow the point of tuber coxae. The symptoms and signs of subcutaneous abscesses were pain, heat, swelling, tenderness, and redness in the present case and these findings were in agreement with that of Stephen and Edward (2010), and Hassan *et al.* (2019) who encountered similar signs.

In literatures, commonly found subcutaneous abscess bacteria from cattle are *Staphylococcus*, *Streptococcus*, and *Escherichia coli* followed by other bacteria like *Corynebacterium*, *Pasteurella* spp. and *Eubacterium tortuosum* (Sinha, 2006; Mosa *et al.*, 2010; Hassan *et al.*, 2019). The present study revealed the commonly pus forming bacteria such as *Staphylococcus*, *Streptococcus*, and *Escherichia coli* which were suspected. However, from the sample collected and submitted to NVI laboratory, the result showed that bacteria other than the suspected bacteria were grown.

Treatment was conducted by surgical drainage, disinfection with iodine and parentral antibiotic administration; the progress was satisfactory and there was complete healing. This finding was in agreement with other studies by Radostitis (2007), Thorat *et al.* (2008), and Hassan *et al.* (2019) who employed similar surgical technique and came up with the same outcome.

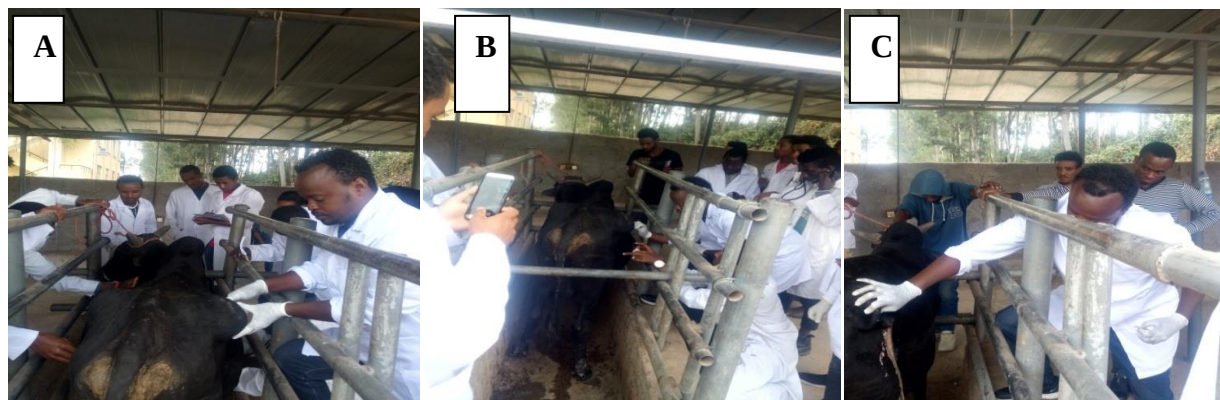




Figure 24: Abscess draining; examination of the swelling (A), shaving of the incision site (B), draining of pus (C), disinfecting inside the cavity (D) and recovery on the 15th day (E)

4. CONCLUSION AND RECOMMENDATIONS

The present study stressed on the surgical cases, management, post-operative complications and their managements involved in different species of animals presented to VTH, CVMA and in the field. A total of twenty five surgical cases were studied and observations compiled in bovine, ovine, caprine, canine, feline, equine, swine, Marabou Stork and *Oryctolagus cuniculus* species of animals. Different types of surgical procedures and possible postoperative cares were conducted on the above species of animals. Satisfactory outcomes were observed in most of the cases which were presented for surgical treatment. These outcomes were obtained by performing appropriate surgical procedures and postoperative care on time. Complications including swelling, hypothermia, bleeding, anorexia and loss of body condition were encountered during and after the surgical operation. However, they were resolved. Death was also observed in one case which was occurred due to refusal of the owner for postoperative care. Shortage of study in some of the surgical conditions and advanced surgical equipments were the limitations of this study. The study revealed that early surgical management and postoperative care are critical in any surgical operation in order to convene expected outcomes.

Based on the above conclusion of this study the followings recommendations are forwarded:

- There is a need to creat awareness on the use of surgical treatment to the general public.
- Early intervention of surgical case is very important for better prgnosis.
- Conducting appropriate surgical procedure and post-operative care is crucial inorder to prevent or minimize complications which could encounter during and after any surgical operation.
- Further research on the control of surgical complications is highly recommended.
- Building of veterinary hospital and clinic which are well equipped with the required surgical and diagnostic equipments are greatly essential.

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