



Investigation of Different Pre-umbilical Surgical Incisions for Ventral Abdominal Celiotomy in Sheep and Goats

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ABSTRACT

Identifying the correct site for surgical incision and reducing unnecessary handling are crucial in veterinary surgical procedures. The current study aimed to evaluate surgical incisions in the pre-umbilical region in small ruminants with correlation to possible surgical operations in the abdominal organs. A randomized experimental study was conducted on 15 sheep (12 females and three males) and 15 goats (12 females and three males), with body weights of 44.9 ± 3.7 kilograms in sheep and 26.3 ± 4.6 kilograms in goats. Five different surgical exposures, including median, left paramedian, right paramedian, left post-xiphoid, and right post-xiphoid, were applied. The accessibility of abdominal viscera was evaluated for each incision site by documenting directly visible organs, organs that could be readily moved to the site of incision, and organs that could only be palpated. Access to the ventral ruminal sac and omentum was achieved through median, left, and right pre-umbilical celiotomy incisions. Furthermore, these surgical approaches allowed for reaching the abomasum and performing of abomasotomy. Abomasotomy and reticulotomy operations were performed through a median pre-umbilical incision. Omasum was palpable and easily examined via the right pre-umbilical celiotomy. The liver and gall bladder were exposed via a right post-xiphoid curved incision. In contrast, the reticulum was accessed for surgical intervention through a left post-xiphoid curved incision. The only recorded postoperative complication was tympany after gastrointestinal surgery. The present study indicated that choosing the appropriate pre-umbilical or post-xiphoid incision greatly improves access to targeted abdominal organs in small ruminants. Right and left pre-umbilical incisions were identified as the most effective approaches for abomasal procedures, whereas post-xiphoid incisions provided the optimal exposure to the reticulum, liver, and gall bladder. Furthermore, access to abdominal organs may vary between sheep and goats when employing the same surgical approach.

Keywords: Abomasotomy, Incision, Laparotomy, Paramedian, Small ruminant

INTRODUCTION

Sheep and goats are valuable ruminant species in both temperate and tropical agricultural regions. Sheep and goats serve as key sources of wool, meat, leather, and milk. Compared to cattle, the small ruminants are more suited to arid tropical environments, likely due to their more efficient utilization of water and nitrogen. Kidneys of small ruminants can concentrate urine to reduce water loss. Small ruminants can recycle urea into the rumen, allowing them to maintain nitrogen balance and protein synthesis even on low-quality forage (Field and Taylor, 2016; Lu Christopher, 2023).

In ruminants, many digestive issues can be treated with a laparotomy, including traumatic reticulitis, ruminal impaction, omasal impaction, ruminal distension, bezoar formation, abomasal displacement, correction of gastrointestinal displacement, vagal indigestion, and abomasal ulcers (Aubry, 2005; Fubini and Ducharme, 2016; Bayne and Edmondson, 2021). The primary reasons for ventral abdominal laparotomy incisions included abomaso- and omentopexy, bladder surgery, cesarean sections, exploratory laparotomies, intestinal surgeries, and exposure of non-pregnant genitalia, such as removing ovarian tumors, suturing a ruptured uterus, and performing ovariohysterectomies operations. Laparotomy in ruminants is typically conducted under local infiltration anesthesia following the administration of a tranquilizer (Abubakar et al., 2014; Fubini and Ducharme, 2016; Matthewes, 2016).

Ventral abdominal celiotomy is a surgical approach that necessitates restraint or sedation of animals in the dorsal recumbent position. Its utilization has become increasingly prevalent due to advancements in anesthesia, as contemporary and more sophisticated surgical procedures necessitate improved visibility and access to abdominal organs (Matthewes, 2016; Cowley et al., 2023).

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Median and paramedian incisions were mentioned in the studies of [Abubakar et al. \(2014\)](#) and [Bhattacharyya et al. \(2020\)](#) for treatment of dystocia. In large ruminants, a paramedian incision provides effective access to the right-sided stomachs and can be extended if required. Some surgeons also prefer a paramedian incision due to its stronger incision closure compared to a midline incision. The disadvantages associated with the paramedian incision included wound dehiscence, edema in the ventral abdominal incision, and the formation of seromas or hematomas ([Adugna et al., 2022](#)).

The midline incision offers two key advantages, including that it can be easily enlarged to improve surgical access, and it typically resulted in less ventral edema than a paramedian incision. However, extending a midline incision can be challenging, particularly in male animals due to the presence of the penis and prepuce. Wound closure may be compromised, and there is an increased risk of oedema at the site of the pendulous umbilicus in cattle postoperatively ([Adugna et al., 2022](#)).

In laparotomy and laparoscopy procedures, selecting an appropriate approach for each abdominal organ via precise incision sites and minimizing traumatic injuries is considered the gold standard for surgeons. According to the current literature, no specific incision sites for approaching individual abdominal organs in sheep and goats have been described. The present study aimed to comprehensively evaluate pre-umbilical abdominal incisions in sheep and goats to define the optimal approach based on surgical access, operative efficiency, and postoperative complication rates.

MATERIALS AND METHODS

Ethical approval

The present study was approved by the institutional approval number is KFU-REC-2025-ETHICS 3519, and all animal handling follows the guidelines of ARRIVE for experimental animal research. All the experimental surgical procedures were performed according to the guidelines of King Faisal University, Saudi Arabia.

Animals

The present study was conducted on 30 small ruminants, including 15 sheep and 15 goats, which were kept for research purposes in King Faisal University, Saudi Arabia. There were six males and 24 females randomly selected for experimental abdominal operations. The ages of the animals were between 2 and 4 years old, with an average body weight of 44.9 ± 3.7 kg in sheep and 26.3 ± 4.6 kg in goats. The selected animals were examined to be clinically normal based on standard body temperature, heart rate, respiratory rate, complete blood count, and blood biochemical parameters analysis. The animals were randomly selected to undergo different ventral pre-umbilical celiotomy procedures with differing laparotomy incisions targeting multiple organs.

Pre-operative preparations and anesthesia

All operations were performed in recumbent position, and all operated animals were sedated before the operation by intramuscular injection of xylazine HCl 2% (Adwia company- xylaject- Egypt) at a dose of 0.2 mg/Kg in sheep ([Mekonnen et al., 2023](#)) and 0.02 mg/Kg in goats ([Biobaku et al., 2016](#)). Linear infiltration anesthesia was achieved using lidocaine HCl 1% at the dose of 1 mL for each cm of the incision site, and the maximum dose was not exceeded than 30 mL ([Vesal et al., 2012](#)). All operated animals were aseptically prepared for the operations and were fasted 24 hours prior to operations ([Lussier et al., 2025](#)).

Study design and evaluation criteria

Five experimental surgical incisions were performed in the pre-umbilical region (Figure 1), including a median pre-umbilical celiotomy. The incision site started at the midline, 3 cm caudal to the xiphoid process, and extended caudally toward the umbilicus, with a total length of 15 cm. This procedure was performed on three female sheep and three female goats while the animals were restrained in dorsal recumbency ([Abubakar et al., 2014](#); [Dieudonné et al., 2021](#)).

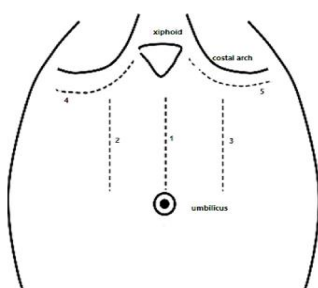


Figure 1. The sites of experimental incision at the pre-umbilical region in small ruminants. Number 1 is the median pre-umbilical incision, number 2 is the right pre-umbilical incision, number 3 is the left pre-umbilical incision, number 4 is the right post-xiphoid incision, and number 5 is the left post-xiphoid incision.

The second incision site was the left pre-umbilical celiotomy; the site of incision started 3 cm lateral to the midline and 3 cm caudal to the costal arch, with a total length of 15 cm to reach up to the level of the umbilicus. This incision was applied on three female sheep and three female goats while the animals were in dorsal recumbency (Haig et al., 2020; Dieudonné et al., 2021). The third incision site was the right pre-umbilical celiotomy; the site of incision started 3 cm lateral to the midline and 3 cm caudal to the costal arch with a total length of 15 cm. This incision was applied on three female sheep and three female goats while the animals were in dorsal recumbency (Haig et al., 2020; Dieudonné et al., 2021).

The fourth incision site was the right post-xiphoid incision; the incision was performed in a curved pattern parallel to the right ventral costal arch with a length of 10 cm in goats and 15 cm in sheep. This incision was applied to three female sheep and three female goats, and the animals were in semi-dorsal recumbency.

The fifth incision site was the left post-xiphoid incision; the incision was performed in a curved pattern parallel to the left ventral costal arch with a length of 10 cm in goats and 15 cm in sheep. This incision was applied on three male sheep and three male goats, and the animals were in semi-dorsal recumbency (Ghanshyam et al., 2020). To minimize operator-related variability and ensure consistent procedures, all surgeries were performed by the same surgeon. After opening the abdominal cavity, the surgeon assessed which organs were visible and could be surgically manipulated through the incision site, which organs could be grasped and exteriorized, and which organs could be examined by palpation but could not be exteriorized. Through each laparotomy technique, one organ was selected for surgical intervention to justify the feasibility of this exposure for such a procedure. The suture material used for closure of internal organs and abdominal muscles was catgut No. zero in goats and No.1 (Orion suture, India) in sheep with a round atraumatic needle. The skin was closed using silk No.1 or zero in all animals with a sharp needle. The follow-up period was extended up to six weeks, and all postoperative complications, such as seroma, wound dehiscence, wound infection, subcutaneous emphysema, herniation, and bloat, were recorded. Stitches were removed 12 days postoperatively in all animals.

RESULTS

In the median pre-umbilical celiotomy, the ventral sac of the rumen and the omentum were the first organs visible upon entering the abdominal cavity in both sheep and goats. The organs that were accessible via a median pre-umbilical celiotomy incision included the diaphragm in the cranial direction, the liver located cranially and to the right, and the omasum and spleen positioned cranially and to the left. Abomasotomy and reticulotomy (Figure 2A) were conducted without any complications, except for tympany observed in one goat immediately following the procedure. The condition was not well clarified in the subsequent assessment of the sheep. The organs that can be exteriorized in both sheep and goats were the abomasum, pylorus from the right aspect of the incision site (Figure 2B), and reticulum from the left side of the incision site (Tables 1 and 2).

In left pre-umbilical celiotomy, organs observed at the incision site in sheep and goats included the omentum and ventral sac of the rumen. Organs that could be exteriorized through this incision in both animals included the reticulum from the cranial aspect of the incision site and the abomasum from the lateral aspect of the incision site, especially the fundus body. The diaphragm could be examined and recognized in both animals, while the cranial part of the spleen was cranioventrally located to the right side, the omasum was located to the right side, and the liver was cranioventrally located to the right side. Abomasotomy operation was performed with proper closure of the abomasal incision in a double row of inverting suture (Figure 2C). The only postoperative complication noticed just after the operation was tympany in the left side, which was more obvious in goats than in sheep.

In the right pre-umbilical celiotomy immediately upon entering the abdominal cavity in goats, the ventral sac of the rumen, omentum, and part of the abomasum were revealed. In sheep, only the omentum covering the ventral ruminal sac was visible at the incision site. In sheep, only the abomasum and pylorus could be exteriorized through the incision site (Figure 2D). The organs in goats that were pulled out included the abomasum from the cranial side of the incision and, to some degree, the omasum from the medial side of the incision site. However, this site is the closest site to access the omasum (Figure 2E). Using this approach, surgeons could examine the diaphragm and liver cranially and the intestinal loops caudally in both sheep and goats. The Abomasotomy was successfully carried out at this site without complications, allowing excellent visualization and examination of the pylorus. The abomasal wall was then closed using a double layer of inverting sutures. The only postoperative complication observed was tympany on the left side of the abdomen, which was more distinctly noticeable in goats than in sheep.

In the right post-xiphoid celiotomy, the organs that were revealed at the site of incision included the ventral margin of the parietal surface of the liver, abomasum, and omentum. Organs that could be exteriorized through right post-xiphoid incision included part of the abomasum from the craniomedial aspect of the incision site, the gall bladder, and

the liver adherent to the costal arch. (Figure 2F). The examined and identified organs included the omasum (located cranially and toward the midline), the diaphragm cranially, and the rumen caudally. In addition, the surgeon obtained a liver biopsy without any observed postoperative complications.

In the left post-xiphoid celiotomy, the organs that were revealed at the incision site included the ventral sac of the rumen, reticulum, and omentum. Organs that could be exteriorized included the reticulum from the craniomedial aspect of the incision and the abomasum from the medial aspect of the incision. Organs which could be examined were the diaphragm cranially, the spleen ventrally, and the omasum medially. The Reticulotomy operation was performed without any postoperative complications.

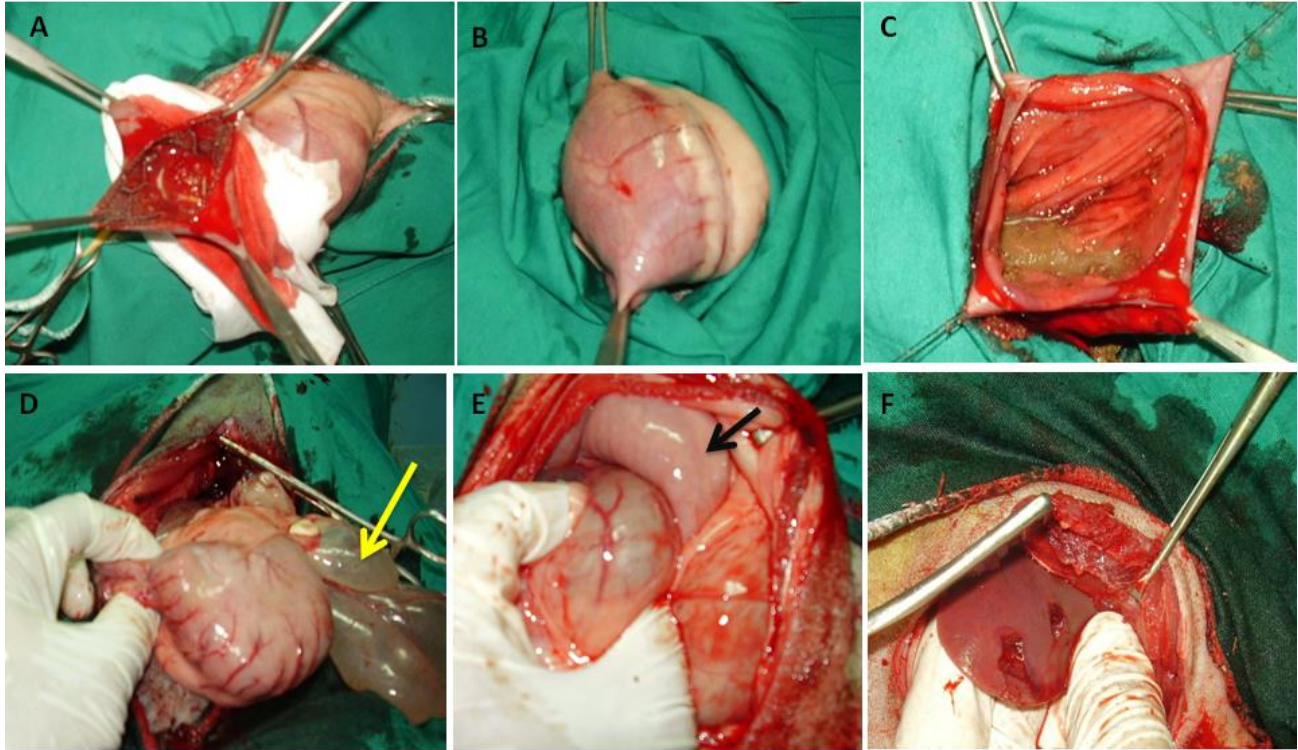


Figure 2. The different ventral pre-umbilical celiotomy incisions in small ruminants. **A:** The reticulotomy at the median pre-umbilical incision in a goat; **B:** The exposure of the abomasum at the median pre-umbilical incision in a sheep; **C:** the abomasotomy operation through a left pre-umbilical incision in a sheep; **D:** the exteriorized abomasum through a right pre-umbilical incision in sheep with multiple cysts (yellow arrow) attached to the omentum; **E:** the abomasum (black arrow) and caught omasum in a right pre-umbilical incision in a goat and **F:** the exposure of the liver through the right post-xiphoid incision in a goat.

Table 1. Ventral pre-umbilical incision sites and organs handled through incisions in goats

Type of incision	Organs seen at the site of incision	Exteriorized organs	Examined organs	Applied operation
Right pre-umbilical incision	Rumen, omentum, and a small part of abomasums	Abomasum and omasum	Part of the intestines, the diaphragm, and the liver	Abomasotomy (pylorus)
Median pre-umbilical incision	Omentum and rumen	Abomasum, pylorus, and reticulum	diaphragm, liver, omasum, and spleen	Abomasotomy and reticulotomy
Left pre-umbilical incision	Omentum and rumen	Abomasum and reticulum	Liver, spleen, omasum, and diaphragm	Abomasotomy (fundus and body)
Right post-xiphoid incision	Omentum, liver, and abomasums	Abomasum, gall bladder, and liver	Omasum, rumen, and diaphragm	Liver biopsy
Left post-xiphoid incision	Rumen, reticulum, and omentum	Reticulum and abomasum	Diaphragm, spleen, and omasum	Reticulotomy

Organs seen at the site of incision mean those organs directly exposed after opening the peritoneal cavity. Exteriorized organs mean organs that were easily pulled out and exposed from the incision site. Examined organs mean organs that were only palpated through the incision site.

Table 2. Ventral pre-umbilical incision sites observed organs, exteriorized, and examined through incisions in sheep

Type of incision	Organs seen at the site of incision	Exteriorized organs	Examined organs	Applied operation
Right pre-umbilical incision	Rumen and omentum	Abomasum	Part of the intestines, diaphragm, and liver	Abomasotomy (pylorus)
Median pre-umbilical incision	Omentum and rumen	Abomasum, pylorus and reticulum	diaphragm, liver, omasum, and spleen	Abomasotomy and reticulotomy
Left pre-umbilical incision	Omentum and rumen	Abomasum and reticulum	Liver, spleen, omasum, and diaphragm	Abomasotomy (fundus)
Right post-xiphoid incision	Omentum, liver, and abomasum	Abomasum, gall bladder, and liver	Omasum, rumen, and diaphragm	Liver biopsy
Left post-xiphoid incision	Rumen, reticulum, and omentum	Reticulum and abomasums	Diaphragm, spleen, and omasum	Reticulotomy

Organs seen at the incision site mean those organs directly exposed after opening the peritoneal cavity. Exteriorized organs mean organs that were pulled out and exposed from the incision site. Examined organs mean organs that were palpated through the incision site.

DISCUSSION

In the present study, all laparotomy operations were performed in the recumbent position under the effect of local analgesia and pre-anesthetic sedation. Typically, in small ruminants, abdominal surgery was done in the recumbent position, and general anesthesia was rarely indicated for abdominal surgery (El-Hawari et al., 2020; Al-Ali et al., 2023). The present study was conducted using five pre-umbilical incisions. Three of these were common and widely used in veterinary surgical practice, one was a median incision (Abubakar et al., 2014; Dieudonné et al., 2021), two were paramedian incisions (Haig et al., 2020; Dieudonné et al., 2021), and two were post-xiphoid incisions (right and left). The left post-xiphoid incision was previously described by Ghanshyam et al. (2020) for the treatment of diaphragmatic hernia in buffaloes and the removal of Extrareticular abscesses. The right post-xiphoid incision was performed as a mirror reflection of the left post-xiphoid incision to evaluate its accessibility to abdominal organs.

Many digestive, intestinal, obstetrical, and urinary tract issues can be treated with laparotomy or laparoscopy. Moreover, experimental studies of the rumen, spleen, intestine, urinary bladder, liver, and kidney were also performed via laparotomy (Newman and Anderson, 2005; Seif et al., 2005; Fubini and Ducharme, 2017).

The median ventral pre-umbilical celiotomy was performed in the present study with application of abomasotomy and reticulotomy operations. The abomasotomy operation through this site was previously described by Fubini and Ducharme (2017) for excision of ulcerative patches or removal of phytobezoars, impacted feed, or sand. The recommended approach was the right paramedian in the patient with lateral or dorsal recumbency. However, in the case of performing an abomasotomy in standing cattle from the left flank region, only a small part of the abomasum could be visualized (Trent, 1990). At the median ventral pre-umbilical incision site, the pylorus can be more extensively exteriorized compared to the right pre-umbilical celiotomy approach. In the current study, during the median ventral pre-umbilical celiotomy, the reticulum was located at the incision site just cranial to the abomasum, enabling a reticulum operation to be performed subsequently. This finding aligns with the anatomical description of Dyce et al. (2010), who reported that the reticulum of small ruminants is relatively larger than the reticulum of cattle, and it extends farther caudally within the abdominal cavity.

The right ventral pre-umbilical incision was made, and the abomasotomy was performed through an incision starting post-xiphoid and extending to the level of the umbilicus (Haig et al., 2020; Dieudonné et al., 2021; Tsukano et al., 2021). The present study revealed that this site of approach is an ideal site for reaching the pyloric region of the abomasum, which aligns with the findings of Aubry (2005). However, Tsukano et al. (2021) noted that the right paramedian incision for right paramedian abomasopexy in cattle was made 10 cm caudal to the sternum and 10 cm lateral to the right of the midline. Furthermore, the right ventral pre-umbilical incision offered superior visualization of the pyloric region of the abomasum in comparison to the median pre-umbilical incision (Fubini and Ducharme, 2017).

Concerning the location of the right ventral preumbilical incision in the current study, it was optimally positioned 3-4 cm lateral to the midline, with careful attention to preventing injury to the cranial epigastric vessels. In this type of approach, goats were observed to differ from sheep in the organs that were visible and could be exteriorized at the incision site. Rumen, omentum, and a small part of the abomasum were visualized in the goat at the site of incision, while in the sheep, rumen and omentum were the only organs visualized. This may be attributed to anatomical

differences between sheep and goats, as the topographical anatomy of the abdominal organs differs slightly between sheep and goats. In goats, the abomasum, especially its pyloric part, extends more cranially and slightly to the right side of the ventral abdominal wall compared to sheep. This positional difference results in the visibility of the abomasum during the right ventral pre-umbilical incision in goats. In contrast, in sheep, the rumen and omentum occupy a greater extent of the ventral abdominal cavity, thereby restricting direct access to the abomasum (Dyce *et al.*, 2010). The present study revealed that in right ventral pre-umbilical celiotomy, the omasum was more easily accessible and handled through the right paramedian incision than other approaches. The omasum in small ruminants is predominantly located on the right side of the abdominal cavity, positioned between the liver cranially and the abomasum caudally, and is attached to the lesser curvature of the abomasum. Due to the right-sided and slightly ventral orientation, a right ventral or right paramedian pre-umbilical incision offers more direct access and facilitates easier manipulation of the omasum in comparison to median or left-sided approaches. Access to omasum through this site of incision could reduce the need for excessive tissue retraction and minimize interference from abdominal organs (Dyce *et al.*, 2010; Fubini and Ducharme, 2017).

The left ventral pre-umbilical celiotomy was performed lateral and to the left of the midline until reaching the level of the umbilicus. Through this approach, the rumen and omentum were observed at the incision site in both sheep and goats, while the reticulum and abomasum (fundus and body) were exteriorized through the incision site. Moreover, liver, spleen, omasum, and diaphragm could be palpated through the left paramedian pre-umbilical incision in both sheep and goats (Dyce *et al.*, 2010). In both sheep and goats, the rumen occupies most of the left side of the abdominal cavity. Consequently, when the left ventral pre-umbilical incision was performed, the rumen and its covering omentum were the initial structures encountered upon entering the abdominal cavity. The reticulum is positioned cranially to the rumen and slightly to the left. The fundus and body of the abomasum are placed on the ventral abdominal floor, curving toward the left side, thereby allowing for exteriorization through a left paramedian incision. Through the left paramedian pre-umbilical incision, the liver was palpable cranially and slightly to the right, while the spleen, attached to the dorsal sac of the rumen, was accessible along the left cranial abdomen wall. The omasum and diaphragm were palpated using this approach, although they are not typically exteriorized due to their fixed attachments and proximity to the cranial abdominal wall (Dyce *et al.*, 2010; Fubini and Ducharme, 2017; Konig and Liebich, 2020). However, the current study elucidates that in small ruminants, abomasotomy targeting the body and fundus regions was most effectively performed via the left pre-umbilical paramedian incision, which offered direct access and facilitated exteriorization of the abomasum. The current results regarding the abomasum align with the findings of Silva *et al.* (2023), who found that a 12 cm paracostal incision in the abdominal wall was not suitable for accessing the greater curvature of the abomasum in goats, while a 15 cm paramedian incision caudal and lateral to the xiphoid provided easy access to the abomasum.

The right and left post-xiphoid crescent incisions were rarely mentioned in the literature. However, the current study demonstrated that the right post-xiphoid incision provided superior visualization of the liver compared to other incision sites, and liver biopsies were obtained by this approach. The liver in sheep and goats is located on the right side, caudal to the diaphragm, and extends from 8 to 12 intercostal spaces, with only a small part crossing the midline to the left. Due to this position, a right post-xiphoid (cranial pre-umbilical) incision just below the xiphoid process and slightly to the right of the midline provides direct, unobstructed access to the diaphragmatic and visceral surfaces of the liver (Dyce *et al.*, 2010; Fubini and Ducharme, 2017). The left post-xiphoid incision in the current study demonstrated the presence of the rumen, reticulum, and omentum at the site of incision in both sheep and goats. Additionally, the abomasum and reticulum were mobilized to the site of incision in both species, with adequate access to the reticulum. Consistent with the current findings, Ghanshyam *et al.* (2020) and Sangwan and Kumar (2025) also indicated the left post-xiphoid pre-umbilical celiotomy as a feasible surgical approach to the reticulum for the repair of diaphragmatic hernias and the excision of extra-reticular abscesses in buffaloes. The current findings demonstrated that access to the reticulum and the performing reticulotomy operation can be accomplished via median and left post-xiphoid incisions. However, the left post-xiphoid incision was considered the ideal site for approaching the reticulum because no organ retraction was required, and the reticulum appeared spontaneously at the site of the left post-xiphoid incision. In contrast, minor abomasal retraction was required in the median incision to access the reticulum in both sheep and goats.

During the current study, the tympany that appeared after the abomasum and reticulum surgeries might be caused by long dorsal recumbency, which results in occlusion of the cardiac opening with ruminal content and subsequently traps gases inside the rumen. Gas escape from the reticulum or abomasum into the peritoneal cavity caused tympany; however, its presentation was not distinct in sheep. This may be attributed to variations in ruminal capacity, faster progression of the condition, or the presence of an extensive wool layer covering the left flank abdominal wall, thereby concealing the presence of slight tympany. However, the occurrence of postoperative tympany in the current study was likely related to the gastrointestinal nature of the surgery rather than the incision site performed in ruminants (Constable *et al.*, 2017; Fubini and Ducharme, 2017). In the current study, none of the performed incision sites required elongation,

and no postoperative complications such as seroma, edema, abscessation, suture dehiscence, or herniation were observed. The current findings demonstrated that precise incision planning, adherence to aseptic techniques, and secure closure of the abdominal wall align with surgical observations in small ruminants (Fubini and Ducharme, 2017).

CONCLUSION

The present study indicated that using a precise pre-umbilical incision type could provide significantly superior exposure to the targeted abdominal organ without postoperative complications. Ventral ruminal sac and omentum were accessed through median pre-umbilical, left pre-umbilical, and right pre-umbilical celiotomy incisions. Abomasum was reached through median, left, and right pre-umbilical celiotomy incisions. Choosing the incision type to access the abomasum depends on the specific region of the abomasum to be operated upon. The body and fundus were reached through left pre-umbilical celiotomy incision, while the pyloric part was reached through the right or median pre-umbilical celiotomy incisions. The most suitable incision site for omasum examination was the right pre-umbilical celiotomy. The exposure to the liver and gall bladder was performed through a right post-xiphoid curved incision without any evidence of postoperative complications. A left post-xiphoid curved incision was employed to access the reticulum for surgical intervention. Further investigations are necessary to examine the blind approach through small incision (1-3cm) from all previously mentioned sites of incision via laparoscopy and to describe its related access to abdominal organs.

DECLARATIONS

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Availability of data and materials

All data and materials are available upon reasonable request from the corresponding author.

Authors' contributions

El-Hawari and Almubarak contributed to the conceptualization of the study. Abdel-Raheem conducted the formal analysis. Abdullah was responsible for writing the original draft of the manuscript. El-Hawari and Marzok handled the investigation and validation of the research data. Aboueilla provided supervision and methodology support. Abdullah and Abdel-Raheem were involved in data curation and funding acquisition. All authors read and approved the final edition of the manuscript for publication.

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Competing interests

The authors declared that there is no conflict of interest.

Ethical considerations

The authors have checked the publication ethical issues, including plagiarism, consent to publish, misconduct, double publication and/or submission, and redundancy, before submission of the article. The authors declare that no AI use for writing this article.

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