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Ovariectomy by laparotomy, a video-assisted approach or a complete laparoscopic technique in Santa Ines sheep

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ABSTRACT

The aim of the study was to compare the use of open ovariectomy, to the video-assisted laparoscopic approach or total laparoscopic ovariectomy in Santa Ines ewes. Surgical time and body weight gain/loss were recorded and post-surgical pain assessed using a behavioral scale. Laparotomy involved a longer surgical time (75 ± 29.5 min), than the video-assisted (37.5 ± 13.04 min; $p < 0.05$) or total laparoscopic approach (27.5 ± 2.89; $p < 0.01$). Behavioral pain recorded score was higher for the laparotomy ovariectomy (5.6 ± 0.5), compared to the video-assisted (0.3 ± 0.5) and laparoscopic approaches (0.3 ± 0.5) ($p < 0.0001$). No significant differences were recorded regarding body weight gain/loss during the first 30 days post-surgery, between the techniques. The video-assisted laparoscopic and total laparoscopic techniques of ovariectomy showed a tendency to have more advantages than the use of laparotomy as such. Less surgical trauma, a shorter surgical time, minimal post-surgical stress and better surgical recovery being highlighted as the main advantages of the endoscopic approaches in sheep.

1. Introduction

Laparoscopy is a minimal invasive surgical technique and with the use of a trans-abdominal endoscope, it is possible to visually observe the organs within the abdominal cavity (Bouré, 2005). The laparoscopic approach also provides a better success rate in small ruminants, and can be performed several times in the same recipient if necessary, with minimal surgical trauma (Graff et al., 1999; Baldassarre et al., 2002; Cordeiro, 2006). Many different laparoscopic techniques have thus been applied in livestock for e.g. liver biopsy (Chiesa et al., 2009; Duarte et al., 2009), cistotomy (Franz et al., 2009), ruminoscopy (Franz et al., 2006) and ovariectomy (Bleul et al., 2006).

Ovariectomy (removal of the ovaries) results in many advantages for livestock, such as easier handling, the suppression of heat behavior in beef animals for the maintenance of male and female cattle in the same environment (Garber et al., 1990), faster weight gain and the production of a high quality carcass (Silva et al., 2006). This technique has then also been employed for the recovery of the gonads from animals of high genetic and productive performance, and was used in other reproductive techniques (Padula et al., 2002).

In the modern livestock breeding industry, surgical procedures are generally aimed at providing minimal stress. Painful procedures may decrease the productive

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performance and thus impair the body weight gain, while animal welfare remains a major concern in surgical procedures, especially in the beef industry (Fitzpatrick et al., 2006; Luna, 2008).

The aim of the present study was to compare the surgical techniques, post-operative pain and complications of ovariectomy performed by laparotomy, a video-assisted laparoscopic or a total laparoscopic approach in Santa Ines ewes.

2. Materials and methods

2.1. Animals and experimental design

The present study was conducted following the approval of the Animal Ethics and Welfare Committee of the School of Agrarian and Veterinary Sciences of the São Paulo State University (protocol No. 025988-08). The Principles of Ethics of the European Commission for experiments involving animals (Directive 86/609EEC) were followed. Eighteen adult female Santa Ines ewes were randomly allocated to one of three surgical techniques of ovariectomy. Ovariectomy was either performed by laparotomy ($n = 6$), a video-assisted laparoscopic approach ($n = 6$), or the full laparoscopic approach ($n = 6$).

2.2. Anesthetic protocol and pre-operative care

All ewes were fasted for 36 h prior to each surgical procedure. The animals were premedicated using diazepam (0.5 mg/kg, IM – Diazepam® Cristalia, Brazil), and tramadol (2 mg/kg, IM – Tramal® Cristalia, Brazil) and anesthesia was induced using a mixture of propofol (6 mg/kg, IV – Proporfol® Cristalia, Brazil) and lidocaine chloride (1 mg/kg, IV).

Anesthesia was maintained with propofol (0.5 mg/kg/min, IV) and lidocaine-chloride (1 mg/kg/min, iv) at a constant rate of infusion. After induction, the animals were intubated using a cuffed 8 mm tracheal tube, to provide 100% oxygen. The sheep were positioned and kept in dorsal recumbency for laparotomy and in the Trendelenburg position for video-assisted and normal laparoscopic ovariectomy. Local anesthesia with lidocaine chloride (2 ml) was administered at portal sites prior to skin incision in the laparoscopic procedures.

2.3. Laparotomic ovariectomy

The ovariectomy was accomplished following a 10 cm prepubic median incision laparotomically, for adequate exposure of the uterus and ovaries. Due to the difficulty in locating the internal genital tract, assisted vaginal palpation was required in some cases. Once the ovaries had been exposed, a transfixation ligature around each ovarian pedicle was performed and the ovary excised. Following final abdominal inspection, the muscular layer was sutured using a continuous simple pattern interspersed with simple interrupted knots. The skin was sutured in a simple interrupted pattern.

2.4. Video-assisted laparoscopic ovariectomy

The video-assisted ovariectomy was performed using three portals. Firstly, a 6 mm trocar was introduced into the linea alba, 30 cm cranial to the udder, using the Hasson technique, for insertion of a 5 mm rigid endoscope (Vilos et al., 2007). The pneumoperitoneum was established under 5 l/min. CO_2 flow rate and the intra-abdominal pressure maintained between 5 and 8 mm Hg. One 6 mm and one 11 mm instrument port was positioned bilaterally using the laparoscopic-assisted technique, 10 cm cranial to the udder and 5 cm lateral to the linea alba. A 10 mm Babcock atraumatic forceps and a 5 mm atraumatic grasping forceps were then introduced through the 11 mm and 6 mm instrument ports, respectively. The uterus, fallopian tubes and ovaries were manipulated and the ovaries then grasped and exteriorized from the abdominal cavity, via the 11 mm trocar. The ligature of the ovarian pedicle was carried out in the same manner as for the laparotomy technique. The same technique was used for the opposite ovary. After removal of both ovaries, the CO_2 pneumoperitoneum was adequately drained. Skin sutures were performed at the portal sites, using the Wolf interrupted pattern with 2-0 nylon. The muscular layer was not sutured.

2.5. Laparoscopic ovariectomy

The laparoscopic ovariectomy was carried out using a two-port technique. One 11 mm port was placed on the midline, 10 cm cranial to the udder, using the Hasson technique (Bouré, 2005). A 10 mm rigid endoscope with a working channel for instruments of up to 5.5 mm was inserted and the initial visual abdominal inspections performed. A pneumoperitoneum was located in the same fashion as in the video-assisted technique. A second 6 mm trocar was placed on the left side, using the laparoscopic-assisted technique, 5 cm from the linea alba and 5 cm from the 11 mm port. A 42 cm long Babcock forceps was introduced through the working channel of the endoscope. A second 33 cm long Babcock forceps was inserted through the 6 mm trocar, in order to manipulate the ovaries. The second forceps was used to expose the ovarian pedicle. Following adequate ovarian pedicle exposure, the first forceps was replaced by a bipolar forceps with a simultaneously coagulation and cutting function (Lina Tripol PowerBlade®, WEM & VIVAMED, Ribeirão Preto, SP, Brazil). The left pedicle was cauterized and the ovary was excised and exteriorized through the 11 mm port, along with the trocar. The 11 mm trocar was then reinserted through the abdominal incision. The same procedure was performed for the opposite ovary. The trocars were withdrawn from the abdominal cavity and the CO_2 pneumoperitoneum drained. The incisions were closed in the same fashion as for the video-assisted technique.

During the early post-operative period, all animals received a single dose of a long acting oxytetracycline (20 mg/kg, IM).

2.6. Trans and post-surgical assessment

Surgical time and trans-surgical complications were recorded for the groups and post surgical pain also assessed, using a behavioral scale proposed in the present study. This consisted of a kyphosis score for difficulty in movement and spontaneous feed intake score. The score ranged from 0 to 3 for each variable evaluated and the final score was then the sum of the scores for each variable. The maximum pain score ranged from 0 to 9. All animals were weighed weekly for a 30 day post treatment period, and the weight loss/gain compared between the groups.

2.7. Statistical analysis

Surgical time, post-surgical pain score and body weight loss/gain were recorded as the mean (±SD). An analysis of variance (ANOVA) was used and the comparison between the groups was performed using the Tukey test. A confidence level of $p < 0.05$ was considered to be significant. Trans and post-operative complications were assessed descriptively.

3. Results

The ovaries were generally difficult to locate during laparotomy and exposure of the genital tract was poor. Intense traction was required to withdraw the ovaries from the abdominal cavity. However, visualization and manipulation of the genital tract were usually easy to perform during the two endoscopic techniques.

Surgical time was longer for laparotomy (75.8 ± 29.5 min) than following laparoscopy (27.5 ± 2.9 min; $p < 0.01$) and video-assisted laparoscopy (40.0 ± 13.0 min; $p < 0.05$). The difference in surgical time between laparoscopy and video-assisted laparoscopy was not significant (Fig. 1). The behavioral pain score (Fig. 2) was significantly higher for laparotomy (5.6 ± 0.5; $p < 0.001$), than following laparoscopy (0.3 ± 0.5) or video-assisted laparoscopy (0.3 ± 0.5). No significant differences were recorded in live body weight changes between the treatments during the first 30 day post-operative period.

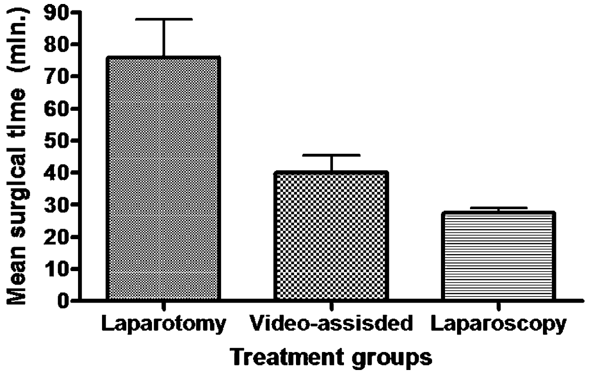

Fig. 1. Comparison of the mean surgical time between the laparotomic, video-assisted or total laparoscopic ovariectomy in sheep.

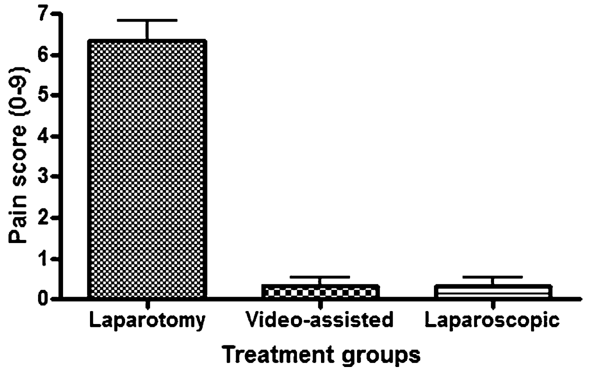

Fig. 2. Post-surgical behavioral pain score among sheep submitted to laparotomic, video-assisted or total laparoscopic ovariectomy.

4. Discussion

The approach to the ovaries was found to be difficult during the laparotomic procedure, due to the presence of extensive gastrointestinal viscera and the caudal topography of the genital tract of the ewe. Vaginal palpation performed may be useful during this surgical step in laparotomic ovariectomy. In the video-assisted and laparoscopic ovariectomy no difficulties were experienced in locating the ovaries. The Trendelenburg position, pneumoperitoneum and amplification of the field of view with the aid of a rigid endoscope and camera system played a crucial role during the endoscopic procedures. Endoscopic approaches resulted in shorter surgical times. Several studies have indicated that laparoscopic surgical procedures usually imply short surgical times in livestock e.g. ovariectomy in cows (Bleul et al., 2005), liver biopsies in sheep (Duarte et al., 2009) and ovarian follicular aspiration in goats (Cordeiro, 2006) and sheep (Teixeira et al., 2010b).

In the present study for endoscopic evaluations, an intra-abdominal CO_2 pressure of 5 mm Hg provided a satisfactory intra-abdominal field. Furthermore, no visceral injury was observed during trocar insertion and surgical handling. However, other studies have indicated that a higher intra-abdominal pressure is required to obtain a good visual field and to avoid visceral injury during trocar insertion (Tabet et al., 2005; Cordeiro, 2006; Duarte et al., 2009; Teixeira et al., 2010a). It is evident that a higher intra-peritoneal pressure is not necessary to access the reproductive tract of sheep when the Trendelenburg position is used. High intra-abdominal pressure may lead to respiratory depression, acidosis and an increase in $EtCO_2$ in animals under spontaneous breathing (Uemura et al., 2004).

Generally both laparoscopic techniques were less invasive than the open surgical procedure, and resulted in lower pain scores. The performance of the laparotomy technique plays an important role in post-operative pain. While this technique required a 10 cm-long median incision, the video-assisted approach required two punctures of 6 mm and one of 11 mm, and the general laparoscopic assisted ovariectomy required one puncture of 6 mm and one of 11 mm. This fact was also observed when conventional and laparoscopic approaches for cistotomy (Franz et al., 2009) and ovariectomy (Bleul et al., 2005) were compared in cows.

The endoscopic approaches proved to be less painful than laparotomy. Even though no changes regarding body weight gain/loss were recorded between the groups during the 30 days of post-operative assessment, the sheep subjected to the video-assisted and laparoscopic techniques generally showed better post-surgical recovery, compared to those submitted to the open procedure. The behavioral pain score used in the present study identified variations in post-surgical pain between the groups, satisfactorily. Furthermore, this study recorded physiologic changes similar to those stated in other studies, regarding the pain and welfare of ruminants (Mellor and Stafford, 2004).

Regarding the body weight loss/gain, all ovariectomy techniques assessed in the present study may be acceptable for use in sheep, with no difference being detected between the groups. Meirelles et al. (2007) observed a negative effect on body weight gain in cows submitted to a vaginal accessed colpotomy. Although Silva et al. (2006) did not observe any body weight gain changes, a better carcass quality was reported to be obtained with ovariectomy accessed through the flank in Nelore heifers.

5. Conclusion

The endoscopic techniques showed advantages above the laparotomy procedure of ovariectomy in sheep, which resulted in minimal invasiveness, less post-operative pain, a shorter surgical time and a faster recovery time.

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