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Laparoscopic ovariectomy in a pygmy goat

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Abstract: The aim of this study was to describe a laparoscopic ovariectomy in a pygmy goat. This minimally invasive surgical technique was performed for the first time on this type of animal at the Clinic for Reproduction and Obstetrics, Faculty of Veterinary Medicine, University of Zagreb. The owner requested this surgical procedure because of its advantages, such as the reduction of the incision size, the duration of surgery, the improved visualisation of the surgical site, the minimum extent of the anatomical approach and the reduction in any trauma, pain and postoperative complications including improved cicatrisation.

Keywords: endoscopic surgery; small ruminants; spaying

Over the past decade, pygmy goats have become an increasingly popular pet. The main reasons are their hardiness, climate adaptation and friendly personality. The onset of puberty typically occurs at 6–8 months of age, but varies depending on the season of birth, the breed, the nutritional status, and the presence of a male. Pygmy goats and does of larger breeds may reach puberty as early as 3 months old (Smith and Sherman 2010).

However, breeding should be delayed until the animal has reached at least 60% of its mature body weight to allow for higher conception rates and safer parturition. The average duration of a standing oestrus is 36 hours, but can range from 24–48 h depending on the age, breed, season, and presence of a male.

Oestrus detection is based on behavioural signs such as: bleating, flagging of the tail, reddened vulva, vaginal discharge (which causes the tail hairs to stick together), and the occasional "riding" by other does (Smith and Sherman 2010). The oestrus will occur every 18 to 24 days (21 days on average). Due to these symptoms, the owner was encouraged to consider neutering the animal as he did not intend to mate her.

A laparoscopic ovariectomy is a minimally invasive surgical technique for neutering female animals (Katic and Dupre 2017). Laparoscopic procedures in small animals are also used for cholecystectomy (Leggett et al. 2000), ovariohysterectomy (Karadjole et al. 2012), cryptorchidectomy (Runge et al. 2014), gastropexy (Gandini and Giusto 2016), abdominal organ biopsy, splenectomy and others (Steffey 2016; Balsa and Culp 2019). The advantages of a minimally invasive surgery are well known, especially in dogs, and include the better visualisation of the structures within the abdominal cavity, the reduced severity of pain in the postoperative period, and a faster patient recovery (Devitt et al. 2005; Culp et al. 2009; Case et al. 2011).

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The aim of this study was to describe the surgical technique in a small ruminant and to outline the advantages of minimally invasive surgery.

Case description

CASE HISTORY

A one-year-old, female pygmy goat was presented to the Clinic for Reproduction and Obstetrics, Faculty of Veterinary Medicine, University of Zagreb for an elective laparoscopic ovariectomy. The pygmy goat lived in the home with its owners. In March 2017, the owner observed the first heat of the animal that manifested with a vaginal discharge, redness and swelling of the labia, a lack of appetite, bleating and an aggressive behaviour. After the first heat, the animal showed signs of oestrus every 21 days. The last oestrus was on September 5, 2017. The owner decided to come to the clinic, although different veterinarians advised him against a laparoscopy due to its risks. In addition, we decided to perform an ovariectomy after the oestrus to avoid the risk of bleeding, which is increased during the oestrus.

CASE FINDINGS

During the preoperative evaluation of the patient, the following values were determined: temperature 39.6 °C; pulse 166 beats per min; 96 breaths per min; 11 ruminal contractions per 5 min; pale pink mucous membranes in the oral cavity and the capillary refill time (CRT) was 1.5 seconds. The values of the temperature, pulse, respiration (TPR) (physiological values for adult pygmy goats are: temperature 39.3–40 °C; pulse 60–80 beats per min; 15–30 breaths per min; and 7–14 ruminal contractions per 5 min) were elevated (Harwood and Mueller 2018) and the most likely reason was the excitement of the animal in an unknown space. A blood sample was collected on the day of surgery; the haematocrit value was 29% and the total protein value was 69 g/l which was within the physiological values (Smith and Sherman 2010). The body score index was 4 (scale 1–5) and the weight of the animal was 19.5 kg. Food was withheld 24 h before the general anaesthesia and water was withheld around 12 h prior to surgery as recommended (Harwood and Mueller 2018). A perioperative antibiosis (Tardomyocel®comp. III- Dihydrostreptomycinsulfate 155 mg, Benzylpenicillin-Procaine 25 mg, Benzylpenicillin-Benzathine 84 mg per 1 ml; Bayer, H.C. AG, Levekusen, Germany; 3.0 ml/50 kg) was administrated subcutaneously 30 min prior to the start of surgery to ensure tissue perfusion (Harwood and Mueller 2018).

ANAESTHESIA PROTOCOL

For the premedication, a combination of acepromazine (Calmivet; Grovetbv, Utrecht, the Netherlands; 0.05 mg/kg) and ketamine (Ketamidor 10%; Richter Pharma AG, Wels, Austria; 2 mg/kg) was applied intramuscularly. After 20 min, an intravenous catheter was inserted in the cephalic vein and propofol was applied (Propofol 1%; Fresenius Kabi GmbH, Graz, Austria; 7 mg/kg). An endotracheal tube was then inserted (6.5 mm). An oesophageal probe was also inserted to prevent aspiration pneumonia through the potential ruminal reflux alongside the tube. Prior to starting the procedure, the abdomen was clipped after the endotracheal intubation and aseptically prepared for the laparoscopic surgery. During the aseptic preparation, the animal was supplied with oxygen. The animal was positioned in dorsal recumbency and the table was positioned to elevate the abdomen by 25 to 30 degrees.

Maintenance of the anaesthesia was provided by a combination of oxygen and isoflurane [Forane; Abbott Laboratories LTD, Queensborough, United Kingdom; minimum alveolar concentration (MAC)]. Fentanyl was applied in the form of boluses (Fentanyl Jenssen, 50 μg/ml; Jenssen Pharmaceutica, Beerse, Belgium; 5 μg/kg i.v., 4 μg/kg i.v., 2.5 μg/kg i.v.) for the intraoperative pain management.

Throughout the procedure, the respiratory and cardiac rate, pulse oximetry, FiO_2, $EtCO_2$, tidal volume per minute, inhaled and exhaled anaesthetic agent and airway peak pressure were monitored with a multi-parametric monitor.

SURGICAL PROCEDURE

On this patient, we used a 3-portal laparoscopic approach to perform the ovariectomy (Karadjole et al. 2010). A skin incision, approximately 1 cm long, was made 1 cm to 2 cm caudal to the um-

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bilicus. The first 10 mm of an Aesculap reusable trocar (Aesculap, B Braun, Tuttlingen, Germany) was inserted using a modified Hasson technique. A pneumoperitoneum was established though this portal with an electronic insufflator to 12 mmHg with a flow rate of 10 l/min using CO_2. A 10 mm diameter, 30° angle of a vision telescope (Laparoscope Hopkins II; Karl Storz, Tuttllingen, Germany) was used and a thorough inspection of the abdominal cavity was performed (Figure 1). Following this, two 5 mm portals (Aesculap single use trocar; B Braun, Tuttlingen, Germany) were inserted 3–5 cm lateral to the *linea alba*, 5 cm to 7 cm caudal to the first portal, while being observed through the laparoscope. In the dorsal recumbency, the left ovarian pedicle, proper ligament, and suspensory ligament were segmentally sealed and transected using 5 mm laparoscopic bipolar grasping forceps with mechanical scissors (Aesculap®AdTec® combi; B Braun, Tuttlingen, Germany). The ovary was extracted through the 10 mm portal under direct visualisation.

After re-establishing the pneumoperitoneum, and with the goat repositioned in the left lateral recumbency, a right ovariectomy was performed using the same technique as described above. Immediately after the removal, the ovaries were checked to ensure the complete removal and the pneumoperitoneum was released after having a verified haemostasis. The instruments were removed from the three portals and the abdominal incisions were closed using a 0 USP monofilament absorbable material (MonoPlus®; B Braun, Melsungen, Germany) and 3/0 USP non-absorbable material (Dafilon®; B Braun, Tuttllingen, Germany) was used for the skin with a simple interrupted suture pattern.

The surgical procedure was completed in 36 min, extubation followed 15 min afterwards and the animal was in a sternal position 5 min after the extubation. The goat received flunixin meglumine (Finadyne; MSD Animal Health, Walton, United Kingdom; 1 mg/kg i.v.) every 24 h for 3 days. A physical examination and wound inspection were performed daily for the next 3 days to detect any postoperative complications. The surgical wound healed properly and the stiches were removed 10 days after the surgical procedure.

DISCUSSION

Laparoscopies in small ruminants are used for artificial inseminations, ovariectomies, cystotomies, renal biopsies, embryo transfer, and ovum collection for *in vitro* fertilisation (Vrisman et al. 2014).

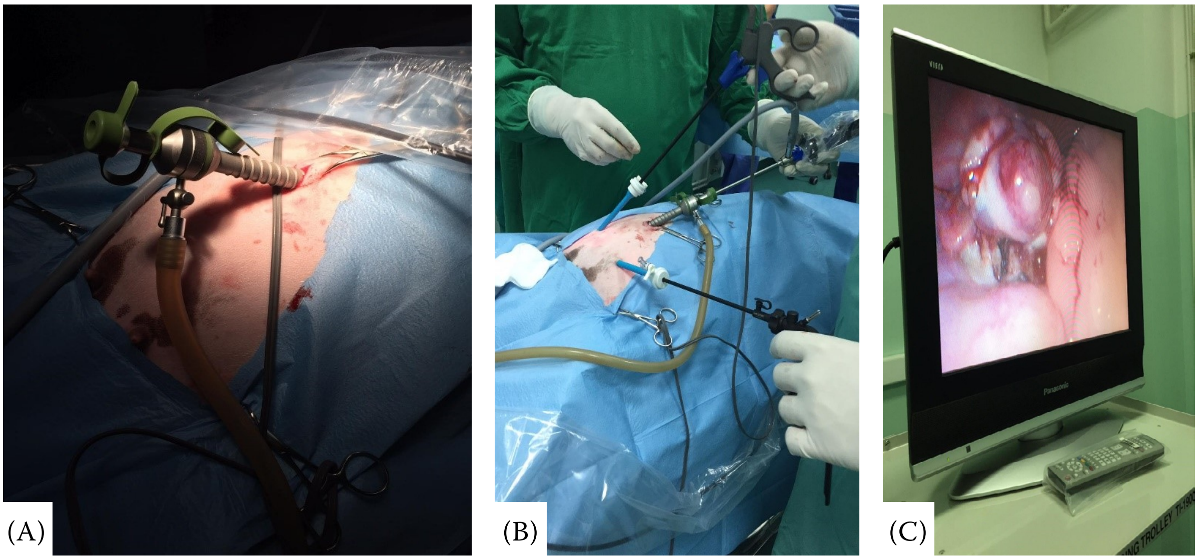

Figure 1. Laparoscopic ovariectomy in the pygmy goat. (A) A pneumoperitoneum was established with the insufflation of CO_2 through a rigid trocar with a silicone flap valve (Ø 10 mm) and a stainless-steel threaded shaft. A Backhaus towel clamp was used to prevent CO_2 leakage. (B) A vision telescope (30° angle) was inserted through a 10 mm trocar and after the insertion of 5 mm disposable trocars, 5 mm laparoscopic grasping forceps and 5 mm laparoscopic bipolar grasping forceps with mechanical scissors were introduced into the abdominal cavity. (C) The right ovary after the procedure of sealing and transecting the ovarian pedicle, proper ligament, and suspensory ligament

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Apart from dogs and cats, a laparoscopic ovariectomy has also been described in mares (Colbath et al. 2017), cows (Bleul et al. 2005) and sheep (Teixeira et al. 2011a; Barros et al. 2015). To our knowledge, there is only one similar study in goats (Daniel et al. 2019), though Rutherford and Finding (2009) reported a laparoscopic castration in a male cryptorchid pygmy goat. Teixeira et al. (2011a) and Fazili et al. (2015) reported that the main advantages of a laparoscopic ovariectomy in sheep and goats are a shorter surgical time, less trauma, and a better recovery.

This case report described the use of a three-portal laparoscopic technique under general anaesthesia for an ovariectomy in a pygmy goat (Karadjole et al. 2010). Several studies described the use of a single, two, or three port technique for laparoscopies in bitches (Dupre et al. 2009; Karadjole et al. 2010, Case et al. 2011; Runge et al. 2012). Similarly, Daniel et al. (2019) and Rutherford and Finding (2009) used a three-port technique for laparoscopies in goats.

In contrast, Teixeira et al. (2011a) used a two-port technique for a laparoscopic ovariectomy in sheep. Likewise, Barros et al. (2015) suggested a single-port laparoscopic approach for an ovariectomy in sheep using a pre-tied loop ligature. In previous studies, a technique using two or three-ports was described for a laparoscopic ovum pick-up (LOPU) in small ruminants (Teixeira et al. 2011b; Cordeiro et al. 2014).

Teixeira et al. (2015) reported a much shorter time for the LOPU procedure when using the three-port technique in sheep. However, Case et al. (2011) reported that there were no significant differences in the surgical time between the two and three port techniques, while the single port technique took a significantly longer time in bitches. Moreover, the surgical time is also highly dependent on the type of vessel-sealing devices used (Katic and Dupre 2017).

It could also be agreed that the three-port technique is a faster and better approach for performing a laparoscopic ovariectomy in goats, though the duration of the procedure relies largely on the experience and training of the surgical team. Furthermore, the three-port technique provides better visibility of the ovaries and uterus, and allows for the easier manipulation with forceps during the procedure. The greatest challenge in this procedure was the recumbency of the animal, the anaesthetic protocol and establishing a pneumoperitoneum. It is worth mentioning that for a better visualisation of the reproductive organs, the patient should be tilted into the Trendelenburg position, with the head lower than the abdomen (Fransson 2015). This position moves the organs cranially, which may improve the working space, but adds to the reduction in the pulmonary compliance (Fransson 2015). In our case, this was achieved by tilting the head position by 25 to 30 degrees. Previous studies suggested tilting the head position between 20 to 45 degrees (Rutherford and Finding 2009; Teixeira et al. 2015). Furthermore, Teixeira et al. (2011a) concluded that a higher intra-peritoneal pressure is not required to approach the reproductive organs of sheep when the animal is in the Trendelenburg position. In their study, the intra-peritoneal CO_2 pressure was 5 mmHg. However, a higher intra-peritoneal CO_2 pressure allows for the good visualisation of the reproductive organs (this study; Rutherford and Finding 2009; Katic and Dupre 2017; Daniel et al. 2019).

Moreover, we inserted a reusable trocar using the modified Hasson technique (Katic and Dupre 2017). A blind technique using a Veress needle can also be used to establish the pneumoperitoneum (Richter 2001; Cordeiro et al. 2014). However, we opted for a mini laparotomy in the Hasson technique as this method avoids the blind introduction of a sharp needle or cannula in the peritoneal cavity. Also, the incorrect placement of a Veress needle may cause the accidental insufflation of the subcutaneous tissue or injuries to the abdominal organs (Mayhew 2017). During our laparoscopic procedure, there were no visceral injuries, no bleeding from the ovarian pedicles and the surgery was successful.

Although elective ovariectomies and, therefore, laparoscopic ovariectomies are not performed routinely in small ruminants, the advantages known for dogs and cats can also be applied for pygmy goats. This technique provided an excellent approach and visualisation of the reproductive organs in comparison to a laparotomy (Teixeira et al. 2011a).

It can be concluded that the most significant outcome for the patient was the minimum postoperative pain and rapid recovery. The owner provided feedback on the postoperative recovery, stating that the pygmy goat had returned to her normal daily rhythm the next day.

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Conflict of interest

The authors declare no conflict of interest.

REFERENCES

Balsa IM, Culp WTN. Use of minimally invasive surgery in the diagnosis and treatment of cancer in dogs and cats. Vet Sci. 2019 Mar 20;6(1):33.

Barros FFPC, Teixeira PPM, Silva MAM, Coelho CMM, Lopes MCS, Kawanami AE, Chung DG, Coutinho LN, Riberio RB, Padilha LC, Vicente WRR. Single-port laparoscopic ovariectomy using a pre-tied loop ligature in Santa Inese wes. CiencRural. 2015 Nov;45(11):2033-8.

Bleul U, Hollenstein K, Kahn W. Laparoscopic ovariectomy in standing cows. Anim Reprod Sci. 2005 Dec;90(3-4): 193-200.

Case JB, Marvel SJ, Boscan P, Monnet EL. Surgical time and severity of postoperative pain in dogs undergoing laparoscopic ovariectomy with one, two, or three instrument cannulas. J Am Vet Med Assoc. 2011 Jul;239(2):203-8.

Colbath AC, Hackett ES, Lesser CS, Hendrickson DA. Left paralumbar laparoscopic bilateral ovariectomy in mares. Vet Surg. 2017 May;46(4):574-9.

Cordeiro MF, Teixeira PPM, Oliveira MEF, Di Filippo PA, Dias DPM, Beretta CAG, Doria RGS, Feliciano MAR, Coutinho LN, Vicente WRR. Reproductive efficiency of adult and prepubertal goats subjected to repeated follicular aspiration. Arq Bras Med Vet Zootec. 2014 Feb; 66(1):137-44.

Culp WT, Mayhew PD, Brown DC. The effect of laparoscopic versus open ovariectomy on postsurgical activity in small dogs. Vet Surg. 2009 Oct;38(7):811-7.

Daniel AJ, Easley JT, Holt TN, Griffenhagen GM, Hackett ES. Laparoscopic ovariohysterectomy in goats. J Am Vet Med Assoc. 2019 Jan 15;254(2):275-81.

Devitt CM, Cox RE, Hailey JJ. Duration, complications, stress, and pain of open ovariohysterectomy versus a simple method of laparoscopic-assisted ovariohysterectomy in dogs. J Am Vet Med Assoc. 2005 Sep 15;227(6):921-7.

Dupre G, Fiorbianco V, Skalicky M, Gultiken N, Ay SS, Findik M. Laparoscopic ovariectomy in dogs: Comparison between single portal and two-portal access. Vet Surg. 2009 Oct;38(7):818-24.

Fazili MR, Shah AR, Bhat MH, Khan FA, Khajuria A, Yaqoob SH, Naykoo NA, Ganai NA. Normal laparoscopic anatomy of the caprine pelvic cavity. Vet Sci Dev. 2015 Jul; 5(2):6012.

Fransson BA. The laparoscopic working space: Pneumoperitoneum techniques and patient positioning. In: Fransson BA, Mayhew PD, editors. Small animal laparoscopy and thoracoscopy. Iowa, USA: Wiley Blackwell; 2015. 90 p.

Gandini M, Giusto G. Laparoscopic single-port ovariectomy and gastropexy in dogs. Schweiz Arch Tierheilkd. 2016 Nov;158(11):755-8.

Harwood D, Mueller K. Goat medicine and surgery. In: Harwood D, Mueller K, editors. Anaesthesia, fluid therapy, euthanasia. 1st ed. Florida, USA: Taylor and Francis Group; 2018. p. 333-7.

Karadjole T, Macesic N, Karadjole M, Shek Vugrovecki A, Bakmaz A, Kreszinger M, Bacic G. Darstellung der Durchfuhrung der laparoskopischen Ovariektomie bei Hunden [Laparoscopic ovariectomy in the bitch]. Tierärztl Umsh. 2010 Feb;65(2):78-81. German.

Karadjole T, Macesic N, Bacic G, Beck A, Folnozic I, Prvanovic N, Karadjole M, Visnjic S. Laparoscopic ovariohysterectomy in a bitch with endometrial hyperplasia – A case report. Vet Arhiv. 2012 May;82(3):311-8.

Katic N, Dupre G. Laparoscopic ovariectomy in small animals. In Pract. 2017 Apr;39(4):170-80.

Leggett PL, Churchman-Winn R, Miller G. Minimizing ports to improve laparoscopic cholecystectomy. Surg Endosc. 2000 Jan;14(1):32-6.

Mayhew PD. Fundaments of laparoscopy and thoracoscopy. In: Johnston SA, Tobias KA. Veterinary surgery: Small animal expert consult. Canada: Elsevier; 2017. p. 317-24.

Richter KP. Laparoscopy in dogs and cats. Vet Clin North Am Small Anim Pract. 2001 Jul;31(4):707-27.

Runge JJ, Mayhew PD, Case JB, Singh A, Mayhew KN, Culp WT. Single-port laparoscopic cryptorchidectomy in dogs and cats: 25 cases (2009–2014). J Am Vet Med Assoc. 2014 Dec 1;245(11):1258-65.

Runge JJ, Curcillo PG II, King SA, Podolsky ER, Holt DE, Davidson J, Agnello KA. Initial application of reduced port surgery using the single port access technique for laparoscopic canine ovariectomy. Vet Surg. 2012 Oct; 41(7):803-6.

Rutherford DJ, Finding E. Laparoscopic castration in a cryptorchid pygmy goat. Vet Rec. 2009 Jul 4;165(1):27-8.

Smith MC, Sherman DM. Reproductive system. In: Smith MC, Sherman DM, editors. Goat medicine. 2nd ed. USA: Wiley-Blackwell; 2010. p. 572-3.

Steffey MA. Laparoscopic-assisted surgical procedures. Vet Clin North Am Small Anim Pract. 2016 Jan;46(1):45-61.

Teixeira PPM, Padilha LC, Motheo TF, Silva MAM, Oliveira MEF, Vicente WRR. Ovariectomy by laparotomy, a video-assisted approach or a complete laparoscopic technique in Santa Ines sheep. Small Rumin Res. 2011a Aug;99(2-3): 199-202.

Teixeira PPM, Padilha LC, Oliveira MEF, Motheo TF, Silva ASL, Barros FFPC, Coutinho LN, Flores FN, Lopes MCS,

https://doi.org/10.17221/113/2020-VETMED

Bandarra MB, Silva MAM, Vasconcelos RO, Rodrigues LFS, Vicente WRR. Laparoscopic ovum collection in sheep: Gross and microscopic evaluation of the ovary and influence on oocyte production. Anim Reprod Sci. 2011b Sep;127(3-4):169-75.

Teixeira PPM, Padilha LC, Silva ASL, Barros FFPC, Coutinho LN, Silva MAM, Flores FN, Lopes MCS, Vrisman DP, Conceicao MEBAM, Vicente WRR. Ovum pick-up technique in recently weaned ewe lambs subjected to ovarian stimulation. Acta Sci Vet. 2015 Jun;43:1-9.

Vrisman DP, Choaire E, Strucher F, Oliveira MS, Ribas TMB, Coutinho LN, Mariano RSG, Oliveira MG, Vicente WRR, Silva MAM, Teixeira PPM. Laparoscopy of the genitourinary tract of small ruminants. Anim Reprod. 2014 Oct; 11(4):511-6.

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