Unilateral and bilateral laparoscopic ovariectomy of mares by electrocautery

L. J. SMITH, T. S. MAIR

Twelve horses underwent standing laparoscopic ovariectomy using electrocoagulation and fine dissection as the only means of achieving haemostasis of the severed ovarian pedicle. Four mares had bilateral ovariectomy performed as a treatment for aggressive behaviour thought to be associated with the oestrous cycle. Eight mares had unilateral ovariectomy performed for removal of a granulosa thecal cell tumour (GCT). Electrocoagulation provided an effective means of haemostasis in both normal and pathological ovaries. Only one case (removal of a GCT) had mild haemorrhage following electrocoagulation, necessitating the need for the application of endoscopic clips to achieve haemostasis. Six of the horses developed minor wound complications (none of them requiring any additional treatment). Long-term follow-up information showed complete resolution of abnormal behaviour in all eight horses with GCTs, but in one of the four horses with normal ovaries the aggressive behaviour had not been completely resolved.

SEVERAL techniques for the ovariectomy of mares have been described, including colpotomy, flank laparotomy, and ventral midline and paramedian oblique laparotomy (Trotter and Embertson 1999, Adams and Fessler 2000, Ragle 2002). Limited exposure to the ovaries, poor visualisation and haemorrhage from the severed ovarian pedicle are some of the problems associated with these techniques (Adams and Fessler 2000). Laparoscopic ovariectomy in the standing mare provides several advantages, including minimally invasive surgery, the ability to visualise the ovarian pedicle, and the avoidance of general anaesthesia (Palmer 2002). Several methods can be used for haemostasis as the mesosalpinx and mesovarium are dissected, including ligatures, clips or endoscopic staplers (Palmer 2002), although they can be technically demanding and time consuming, and can lead to complications such as the loosening or slipping of sutures (Hanson and Galuppo 1999, Palmer 2002, Ragle 2002). Electrosurgery alone has been described as a method for achieving haemostasis during the removal of normal ovaries (Walmsley 1999, Rodgerson and others 2001, Hand and others 2002), but it has seldom been described for the removal of enlarged ovaries (Hubert and others 2006, Lloyd and others 2007). It has been suggested that electrocautery alone would be insufficient to seal the blood vessels in the pedicles of enlarged ovaries because they might be larger than those in normal ovaries, which are known to be up to 10 mm in diameter (Hand and others 2002, Hubert and others 2006). However, Rodgerson and others (2001) and Hand and others (2002) have described the successful use of electrocautery for ovariectomising mares.

Hubert and others (2006) and Lloyd and others (2007) have recently described the use of electrosurgical instruments that combine electrocautery with a guillotine action for removing pathologically enlarged ovaries from mares. However, it has been suggested that sequential electrocoagulation and sharp transection of the mesovarium would be the most effective method for achieving precise dissection and adequate haemostasis, and the method has been used successfully for the removal of normal ovaries (Rodgerson and others 2001), but not for the removal of pathologically enlarged ovaries.

Ovariectomy has been advocated for the treatment of behavioural problems in mares; unilateral ovariectomy in the case of a pathologically enlarged ovary, such as a granulosa thecal cell tumour, or a bilateral ovariectomy if no ovarian pathology can be identified (Palmer 2002, Embertson 2006). The technique has been used frequently (Rodgerson and others 2001, Alldredge and Hendrickson 2004, Embertson 2006), but there have been few reports of the long-term follow-up of the mares and whether the procedure was successful in modifying their behaviour (Alldredge and Hendrickson 2004).

This paper reports the complication rates associated with standing laparoscopic ovariectomy by sequential electrocoagulation and sharp transection of both normal and pathological ovaries, and the long-term prognosis for the resolution of undesirable behaviour in 12 mares undergoing the procedure.

MATERIALS AND METHODS

Inclusion criteria

The medical records of horses that had undergone either a unilateral or bilateral standing laparoscopic ovariectomy were retrieved. The horses in which the ovariectomy had been performed by using sequential electrocoagulation with conventional bipolar electrocautery forceps, and sharp transection of the mesovarium with laparoscopic scissors, were included in the study.

Surgical procedure

The mares were assumed to be in good physical health on the basis of an initial physical examination. Feed was withheld for 36 hours preoperatively to reduce the volume of ingesta in the viscera and to allow good visualisation of the surgical field. Immediately before surgery, each horse received 22,000 iu/kg sodium benzylpenicillin, 6·6 mg/kg gentamicin, and 1·1 mg/kg flunixin meglumine or 4·4 mg/kg phenylbutazone intravenously. The intravenous antimicrobials were continued for three days postoperatively, and non-steroidal anti-inflammatory drugs were administered for 24 hours postoperatively.

The mares were sedated with a combination of either 0·02 to 0·03 mg/kg detomidine hydrochloride or 0·1 mg/kg romifidine, and 0·3 mg/kg butorphanol tartrate administered intravenously, and were restrained in stocks with their heads cross-tied. The paralumbar fossae were clipped and prepared aseptically using a povidone-iodine scrub. After the infiltration of the three portal sites with approximately 20 ml mepivicaine hydrochloride, a standard laparoscopic approach was used (Palmer 2002); in cases of bilateral ovariectomy, the left side was approached first. A 10 to 12 mm dilating-tip trocar-cannula unit was inserted through the paralumbar fossa perpendicular to the musculature, the trocar was removed and the camera was introduced. Once the camera was in place, carbon dioxide was used to inflate the abdomen. Subsequent portals were then made under visualisation with either a forward, or 30° forward oblique viewing rigid endoscope.

Veterinary Record (2008) **163,** 297-300

L. J. Smith, BVMS, MRCVS, **T. S. Mair,** BVSc, PhD, DipECEIM, DEIM, DESTS, MRCVS,
Bell Equine Veterinary Clinic, Butchers Lane, Mereworth, Kent ME18 5GS

The surgical field of view was maintained by a surgical assistant, allowing the surgeon to manipulate instruments through the other two portals. Laparoscopic Babcock forceps were introduced through an instrument portal, the ovary was grasped and the mesovarium was infiltrated with 10 ml of 2 per cent mepivicaine hydrochloride, via a laparoscopic injection needle. The bipolar electrocautery forceps (Rotating Tripolar Forceps 32 cm/10 mm diameter; Seitzinger) were introduced through the most dorsal instrument portal and placed across the cranial aspect of the mesovarium, and the cranial mesovarium was coagulated until blanching of the tissues was evident. The forceps were then removed and replaced with laparoscopic scissors to transect the mesovarium distal to the site of coagulation. This process was repeated several times in a caudal direction, until the entire mesovarium was transected. The remaining stump was observed for the adequacy of haemostasis. The free ovary was then securely grasped, before being removed by connecting two of the portals into a flank laparotomy incision. The incision was extended if necessary to allow for the removal of very large ovaries, or, in cases of cystic ovaries, intra-abdominal decompression was used to minimise the size of the incision required. In the latter case, the abdomen was lavaged with a large volume of sterile, polyionic fluid before the portals were closed, in all cases, with a deep layer of 5 metric polyglactin 910 in a simple interrupted pattern; the subcutaneous tissues and skin were also closed with polyglactin 910 in a simple interrupted pattern.

If a bilateral ovariectomy was required, an identical method was used to remove the other ovary through the paralumbar fossa on the other side.

In cases of suspected pathology, sections of the ovary were examined histopathologically.

Follow-up

The progress of the mares was followed up by questioning the owners by telephone to establish whether, in their opinion, the behavioural signs that had precipitated the ovariectomy had improved, and to record any complications associated with the surgery.

RESULTS

Short-term follow-up

Four mares undergoing bilateral ovariectomy for behavioural modification, and eight mares undergoing unilateral ovariectomy for the removal of a suspected granulosa thecal cell tumour, satisfied the inclusion criteria. They ranged in age from three to 19 years, and their median age was nine-and-a-half years. Four of them were either pure or part-bred thoroughbred, three were either pure or part-bred Arab, two were warmbloods and three were native pony breeds.

The four mares undergoing a bilateral ovariectomy were undergoing the procedure for behavioural modification, and they had all shown a marked improvement in their behaviour after the administration of an oral progestogen (altrenogest). Two of the mares were aggressive towards their owners immediately before and during their seasons, and the other two were aggressive towards people at all times. No ovarian abnormalities were identified initially, either by rectal palpation or a transrectal ultrasonographic examination.

Six of the eight mares undergoing a unilateral ovariectomy owing to a suspected tumour were originally examined for aggressive behaviour towards people and other horses, and the other two were examined for colic. When they were initially examined by rectal palpation, an enlarged ovary was identified that had a cystic honeycombed appearance on ultrasonographic examination.

In one mare, a mild, persistent haemorrhage from the stump was observed after the removal of an enlarged ovary with a suspected tumour. The haemorrhage was controlled by the application of laparoscopic clips. In two of the mares, the pathological ovaries were greatly enlarged and cystic, and they were decompressed within the abdomen before being removed. However, no incisional complications occurred in either case.

Postoperatively, six of the 12 horses developed minor complications associated with their incisions. Two developed mild emphysema around the incision created for the removal of the ovary, two had slight haemorrhage from the incision and two developed mild swelling around the incision. None of the postoperative complications resulted in increased morbidity, or required supplementary treatment or prolonged hospitalisation. Two of these six horses underwent a bilateral ovariectomy for the removal of normal ovaries for behavioural reasons, and four had an enlarged ovary with a suspected tumour removed. The presence of a granulosa thecal cell tumour was confirmed histologically in all eight cases in which a tumour had been suspected.

Long-term follow-up

The mares' owners were contacted by telephone between six months and four years after the operations to find out whether the ovariectomy had improved their behaviour. The owners of the eight mares that underwent a unilateral ovariectomy to remove an ovary with a granulosa thecal cell tumour reported that their aggressive behaviour towards people and other animals had resolved within six weeks of the surgery; two of them reported that their mare's behaviour showed a marked improvement when they were discharged from the hospital.

The owners of three of the four horses that underwent a bilateral ovariectomy for behaviour modification reported that the aggressive behaviour had resolved. In two cases, there had been a steady improvement in behaviour over approximately three months, and in the other case, the mare's behaviour had improved over a period of 18 months. However, the owner of the other mare that had undergone bilateral ovariectomy four years earlier reported that although its aggressive behaviour had improved slightly in the first two months, it had not resolved.

Overall, 11 of the 12 owners reported that an ovariectomy had rectified the behavioural problems. None of the mares had any long-term complications associated with the surgical wounds.

DISCUSSION

The technique of sequential electrocoagulation and transection was successful for the removal of both normal and pathological ovaries. Only one case had mild, but persistent, haemorrhage, which required the application of endoscopic clips; it was one of the first in the study, and was an overweight Arab mare. The mild haemorrhage might have had no harmful effects if no additional haemostasis had been applied, and it is possible that improved dissection techniques in later cases led to the more effective application of the electrocautery forceps.

Six of the mares had postoperative incisional complications, a lower rate than reported by Rodgerson and Brown (2001), despite the strict definition of incisional complications applied. However, comparisons between studies are made difficult by the lack of definition of what constitutes an incisional complication in many studies. Lloyd and others (2007) reported a rate of incisional drainage or partial dehiscence in six of 55 cases (10·9 per cent), but such complications were not observed in any of the horses in this study. Postoperative incisional complications have been associated

with increased trauma to the edges of the incision (Phillips and Walmsley 1993, Honnas and Cohen 1997, Rodgerson and Brown 2001, Rambags and others 2003). It might have been expected that the removal of normal ovaries would have resulted in fewer complications than the removal of enlarged ovaries with tumours (Rambags and others 2003), but two of the four mares undergoing a bilateral ovariectomy for behavioural modification had such complications. Furthermore, no incisional complications were observed in the two mares in which cystic ovaries were decompressed before being removed from the abdomen. It has been suggested that intra-abdominal decompression might result in intraperitoneal contamination of the abdomen, which could predispose to incisional complications, although granulosa thecal tumours are generally considered to be benign (Rambags and others 2003). The lavage with large volumes of sterile, polyionic fluids before the incisions were closed may have removed any contamination. The results suggest that intra-abdominal decompression may be a suitable option for minimising the length of the incision required for the removal of enlarged ovaries.

Only one of the mares developed mild, persistent haemorrhage from the ovarian pedicle, which required additional haemostasis, and the results suggest that the technique may result in lower incisional complication rates than other techniques (Rodgerson and Brown, 2001). However, the small number of cases limits the conclusions that can be drawn.

The aggressive behaviour of the mares that had a unilateral ovariectomy to remove an ovary with a tumour resolved within six weeks and two of the owners reported that the aggressive behaviour had resolved almost immediately. However, such a rapid resolution is unlikely. The aggressive behaviour of mares with granulosa thecal cell tumours is often associated with a high serum concentration of testosterone (McCue 1992, Pinto and Paccamonti 2004), which would persist longer than the postoperative period of hospitalisation. It is likely that the eventual successful outcome led to the owners having a more positive recall of immediate postoperative events.

Two of the owners of the four mares that underwent a bilateral ovariectomy for behavioural modification reported that their aggressive behaviour resolved gradually over approximately three months, and one reported that the mare's behaviour had improved gradually over a period of 18 months. The other mare's behaviour improved only slightly and did not meet its owner's expectations. It is important that owners have a realistic expectation about the results of a bilateral ovariectomy; any long-standing cases are likely to have a component of learned behaviour in their aggression that is unlikely to be resolved quickly by surgery.

The results of this study show that the technique of sequential electrocoagulation and transection is effective for the laparoscopic removal of either normal or pathological ovaries for the purpose of modifying the aggressive behaviour of mares. The long-term follow-up showed that a unilateral ovariectomy was a suitable treatment for aggressive behaviour due to pathological changes in an ovary. However, when considering a bilateral removal of normal ovaries for behavioural modification, although the prognosis for improved behaviour is good, owners should have realistic expectations not only of the period over which any improvement may occur, but also of the extent of any improvement.

References

ADAMS, S. B. & FESSLER, J. F. (2000) Ovariectomy. In Atlas of Equine Surgery. Philadelphia, W. B. Saunders. pp 245-252

ALLDREDGE, J. G. & HENDRICKSON, D. A. (2004) Use of high-power ultrasonic shears for laparoscopic ovariectomy in mares. *Journal of the American Veterinary Medical Association* **225,** 1578-1580

EMBERTSON, R. M. (2006) Ovaries and uterus. In Equine Surgery. 3rd edn. Eds J. A. Auer, J. A. Stick. St Louis, W. B. Saunders. pp 855-864

HAND, R., RAKESTRAW, P. & TAYLOR, T. (2002) Evaluation of a vessel-sealing device for use in laparoscopic ovariectomy in mares. *Veterinary Surgery* **31,** 240-244

HANSON, C. A. & GALUPPO, L. D. (1999) Bilateral laparoscopic ovariectomy in standing mares: 22 cases. *Veterinary Surgery* **28,** 106-112

HONNAS, C. M. & COHEN, N. D. (1997) Risk factors for wound infection following celiotomy in horses. *Journal of the American Veterinary Medical Association* **210,** 78-81

HUBERT, J. D., BURBA, D. J. & MOORE, R. M. (2006) Evaluation of a vessel-sealing device for laparoscopic granulosa cell tumour removal in standing mares. *Veterinary Surgery* **35,** 324-329

LLOYD, D., WALMSLEY, J. P., GREET, T. R. C., PAYNE, R. J., NEWTON, J. R. & PHILLIPS, T. J. (2007) Electrosurgery as the sole means of haemostasis during the laparoscopic removal of pathologically enlarged ovaries in mares: a report of 55 cases. *Equine Veterinary Journal* **39,** 210-214

MCCUE, P. M. (1992) Equine granulose cell tumors. Proceedings of the 38th Conference of the American Association of Equine Practitioners. Orlando, USA, November 29 to December 2, 1992. pp 587-593

PALMER, S. E. (2002) Laparoscopic ovariectomy in the standing horse. Equine Diagnostic and Surgical Laparoscopy. Ed A. T. Fischer. Philadelphia, W. B. Saunders. pp 189-196

PHILLIPS, T. J. & WALMSLEY, J. P. (1993) Retrospective analysis of the results of 151 exploratory laparotomies in horses with gastrointestinal disease. *Equine Veterinary Journal* **25,** 427-431

PINTO, C. R. F. & PACCAMONTI, D. L. (2004) Equine Internal Medicine. Eds S. M. Reed, W. M. Bayly, D. C. Sellon. St Louis, W. B. Saunders. pp 1039-1049

RAGLE, C. A. (2002) Ventral abdominal approach for bilateral laparoscopic ovariectomy. In Equine Diagnostic and Surgical Laparoscopy. Ed A. T. Fischer. Philadelphia, W. B. Saunders. pp 181-188

RAMBAGS, B. P. B., STOUT, T. A. E. & RIJKENHUIZEN, A. B. M. (2003) Ovarian granulosa cell tumours adherent to other abdominal organs; surgical removal from 2 warmblood mares. *Equine Veterinary Journal* **35,** 627-632

RODGERSON, D. H., BELKNAP, J. K. & WILSON, D. A. (2001) Laparoscopic ovariectomy using sequential electrocoagulation and sharp transaction of the equine mesovarium. *Veterinary Surgery* **30**, 572-579

RODGERSON, D. H. & BROWN, M. P. (2001) Hand-assisted, laparoscopic ovariectomy technique to remove granulosa theca cell tumours in four mares. Proceedings of the 47th Conference of the American Association of Equine Practitioners. San Diego, USA, November 24 to 28, 2001. pp 123-125

TROTTER, G. W. & EMBERTSON, R. M. (1999) The uterus and ovaries. In Equine Surgery, 2nd edn. Eds J. A. Auer, J. A. Stick. Philadelphia, W. B. Saunders. pp 575-583

WALMSLEY, J. P. (1999) Review of equine laparoscopy and an analysis of 158 laparoscopies in the horse. *Equine Veterinary Journal* **31,** 456-464