Ligature slippage during standing laparoscopic ovariectomy in a mare

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Abstract — Suture ligature failure is a potential complication during laparoscopic ovariectomy techniques utilizing ligatures as a means of hemostasis. This complication in the standing mare and the successful use of laparoscopic electrosurgical instrumentation as the sole means of providing hemostasis to the mesovarium of a mare are described.

Résumé — Déplacement des ligatures au cours d'une ovariectomie par laparoscopie en station debout chez une jument. Le lâchage des sutures ligatures contitue une complication potentielle lors d'ovariectomies par laparoscopie, lorsque des ligatures sont utilisées pour produire l'hémostase. Cette complication chez le jument en station debout et l'utilisation efficace d'instruments électrochirurgicaux pour la laparoscopie comme seuls moyens d'hémostase dans le mésovarium d'une jument sont décrits.

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An 8-year-old, 450-kg, American quarter horse mare was referred to the veterinary teaching hospital for elective ovariectomy. The owners did not intend to breed the mare and felt her behavior during estrus was unmanageable for training and riding. The mare was in good condition and no abnormalities were detected on physical examination. Transrectal examination of the ovaries and results of a complete blood cell count and serum biochemical analysis were normal. A decision for standing laparoscopic ovariectomy was made.

Feed was withheld for 12 h before surgery and procaine penicillin G (22 000 IU/kg body weight (BW), IM) and flunixin meglumine (1.1 mg/kg BW, IV) were administered 1 h prior to surgery. The mare was sedated with detomidine hydrochloride (5 mg, IV) prior to being restrained in stocks. Both paralumbar fossae and a small site to the right of the ventral midline were clipped and prepped by using a povidone-iodine scrub. The abdominal wall at the sites of the portals was then infiltrated with 20 mL of 2% mepivacaine. The abdomen was inflated with CO_2 through a teat cannula inserted through the ventral abdomen (1). Insufflation was discontinued when the mare began to show mild signs of discomfort. A 10-mm incision was made dorsal to the crus of the internal abdominal oblique muscle in the left paralumbar fossa, equidistant from the tuber coxae and 18th rib (1st portal) (2); a 10-mm trocar-cannula unit was inserted through the paralumbar fossa perpendicular to the flank musculature. The trocar was removed, and a 10-mm, 32-cm, 0°-angle laparoscope (Panview Laparoscope, Richard Wolf Medical Instruments, Rosemont, Illinois, USA) was inserted to locate the ipsilateral ovary. The skin incision for the 2nd portal was made 2–4 cm caudal to the last rib and 8–10 cm ventral to the portal for the laparoscope. The skin incision for the 3rd portal was made 6–8 cm caudal to the 2nd portal and 8–10 cm ventral to the 1st portal. Trocar-cannula units were then inserted through the 2nd and 3rd portals. Laparoscopic atraumatic grasping forceps (Atraumatic grasping forceps, Richard Wolf Medical Instruments) were inserted through the cranial portal to provide traction on the ovary, while a long bitch catheter was inserted through the 3rd portal. A 30-cm spinal needle was passed through the bitch catheter, and the mesovarium was infiltrated with 15 mL of 2% mepivacaine. A modified Roeder knot was tied by using a single strand of No. 2 polyglycolic acid, and the longest strand of the ligature was passed through a hollow pushrod (3). The distal end of the longest strand was grasped with mosquito forceps to prevent it from passing back through the pushrod. The pushrod was positioned as distal as possible from the ligature loop to free enough suture material. By using the atraumatic laparoscopic forceps, the ligature's loop was grasped and the forceps were used to push the suture loop through the caudal (3rd portal) cannula. Once the ligature loop was within the abdomen, a second pair of atraumatic laparoscopic forceps were

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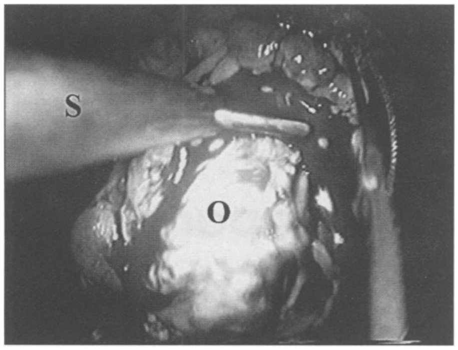

Figure 1. The right ovary has been completely transected from its mesovarium and is held with laparoscopic forceps (F) in the background. This allows easier identification and coagulation of the hemorrhaging vessels within the mesovarium.

introduced through the 2nd portal. The 2 pairs of laparoscopic forceps were manipulated to open the loop of the ligature and position it over the ovary and around the mesovarium and proper ligament. Gentle traction on the mosquito forceps attached to the long strand of the suture loop kept the suture loop positioned dorsal to the ovary. The laparoscopic forceps were then removed from the 3rd portal. Maintaining gentle traction on the mosquito forceps, the pushrod was introduced through the 3rd portal to engage and advance the modified Roeder knot. The ligature was securely tightened around the mesovarium and proper ligament. The forceps and pushrod were removed from the 2nd and 3rd portals. Sharp-tooth laparoscopic forceps (Sharp-tooth laparoscopic forceps, Richard Wolf Medical Instruments) were introduced through the 2nd portal to grasp the ovary. By using laparoscopic scissors (Laparoscopic scissors, Richard Wolf Medical Instruments) passed through the 3rd portal, the mesovarium was transected approximately 5 mm distal to the ligature. The mesovarium was evaluated for hemorrhage and the long strand of suture loop was cut 1 cm from the ligature. The skin incision of the 2nd portal was enlarged to 6–8 cm, and, initially, by sharp dissection followed by blunt separation of the underlying musculature, the ovary was exteriorized. The mesovarium was again observed for hemorrhage before the laparoscope was removed. For the 2nd portal, the external sheath of the external abdominal oblique muscle was apposed with No. 0 polyglactin 910. The skin was closed with No. 0 polypropylene for all 3 portals.

The same series of steps was used through the opposite paralumbar fossa to locate and position the suture loop around the ovarian pedicle. During the transection of the mesovarium, the suture loop failed to provide hemostasis and slipped from the mesovarium, resulting in immediate hemorrhage from branches of the ovarian artery (Figure 1). With traction on the ovary by laparoscopic forceps, the remainder of the mesovarium was transected except for a small portion of the proper ligament (Figure 1). The ovary was released from the jaws of the forceps, and the laparoscopic scissors were removed from the 3rd portal and replaced with a laparoscopic bipolar electrosurgical instrument (Kleppinger bipolar forceps, syringe type, Richard Wolf Medical Instruments) (1). The bipolar electrosurgical instrument was connected to a bipolar electrosurgical generator (Model E2351, Richard Wolf Medical Instruments), which was set at 3/4 maximum power. Laparoscopic atraumatic forceps were used to grasp and help position the jaws of the bipolar electrosurgical instrument across a portion of the mesovarium to coagulate the branches of the ovarian artery. Coagulation of the vessels within the mesovarium was initiated by using a foot pedal control, which was connected to the generator, and coagulation was stopped when the tissue became blanched. This was repeated 4 times in multiple planes until no further hemorrhage was visible from the mesovarium. The laparoscopic forceps were used to retrieve the ovary and the remainder of the proper ligament was coagulated. The bipolar forceps were removed from the 3rd instrument portal and replaced with laparoscopic scissors. The remaining portion of the proper ligament was transected. The same series of steps as described for the contralateral ovary was used to remove the ovary. The mesovarium was again observed for hemorrhage before the laparoscope was removed. Closure was similar to that for the opposite paralumbar fossa.

After surgery, the mare received 1 dose of flunixin meglumine, and a 2nd dose of procaine penicillin G, 12 h after the initial dose. No signs of colic or abnormalities in the mare's vital signs, hematocrit, or plasma protein concentration were observed following surgery. The mare was discharged on the 4th day of hospitalization with the following instructions: remove the sutures in 10 d, confinement to a stall with hand walking for 2 wk, and return to training starting at 4 wk. Ten months after surgery, the mare had shown no problems related to the procedure and regular estrous behavior has presently been eliminated.

The modified Roeder knot has been utilized as a means of laparoscopically ligating the mesovarium in the mare (3,4). In both reports, a single strand of No. 3 polyglactin 910 was used to create the knot. A 2nd report described a commercial polydiaxone suture (PDS) loop for laparoscopic ovariectomy (5). However, the commercial loops may not be large enough in diameter to pass around larger ovaries (4). We chose No. 2 polyglycolic acid to construct the modified Roeder knot, because it was longer than No. 3 polyglactin 910 and we did not have the commercial PDS suture loops. The suture material used in this report did require excessive intra-abdominal manipulation to open and elevate the suture loop around the mesovarium. The authors feel that the added manipulation of the suture material was due to the lack of stiffness and size of this suture material. A suture material having more memory would possibly have aided in elevating the suture loop proximally around the mesovarium.

The difficulty encountered in the placement of the suture loop proximally around the mesovarium may be due to the large pedicle from which the equine ovary is suspended. The suture loop must encompass the mesovarium and a portion of the proper ligament between the ovary and the uterine horn. Proximal placement of a suture loop in the standing mare could be optimized either by transecting a portion of the proper ligament and then placing the suture loop (4), or by passing the suture material through the mesovarium and then tying the modified Roeder knot extracorporeally.

Possible causes for the failure of the ligature in this case included failure to secure the ligature appropriately; placement of the ligature too close to the ovary; or transection of the ovarian pedicle too close to the suture ligature, causing ligature slippage. The failure of the ligature resulted in immediate hemorrhage from 3 to 4 branches of the ovarian artery. The decision to completely transect the mesovarium was to allow easier observation of the hemorrhaging vessels and easier placement of the bipolar electrosurgical forceps. Positioning and placement of the cautery instrument was aided by laparoscopic forceps manipulating the mesovarium to allow proper placement of the bipolar forceps. In this manner, the cautery instrument provided immediate coagulation of the mesovarium.

Potential intraoperative complications previously reported during standing laparoscopic ovariectomy in the mare include inadequate observation of the genital tract, hemorrhage from the abdominal wall associated with placement of the portals, inadequate ligation of the ovarian pedicle, and difficulty in exteriorizing the ovary through the abdominal wall (3,6,4). Ligature slippage during laparoscopic ovariectomy was encountered in a mare positioned in dorsal recumbency (3). Placement of a 2nd ligature was successful in eliminating the hemorrhage; however, in the standing mare, the authors feel that placement of a 2nd ligature after the 1st ligature has failed and slipped off of the ovarian pedicle would be difficult. In this mare, hemorrhage from the mesovarium did obscure envisioning the ovarian pedicle and potentially made the placement of a 2nd ligature difficult. With the viewing field of the laparoscope positioned away from the hemorrhaging vessels, the electrosurgical instrument provided easy and efficient coagulation of the ovarian vessels.

Electrosurgery is employed in many surgical procedures to minimize blood loss, provide a dry surgical field, and reduce surgery time. In humans, electrosurgery is commonly used during laparoscopic surgical procedures, such as oophorectomy, adhesionolysis, removal of benign tumors, laparoscopic assisted vaginal hysterectomies, and cholecystectomies (7–9). Electrosurgical coagulation may be used to provide hemostasis of arteries up to 1.0 mm and veins up to 2.0 mm in diameter (10). The vessels within the equine mesovarium (approximately 5–10 mm dorsal to the ovary) appear to be similar or slightly larger in size. The coagulation of the vessels and surrounding tissue did result in the generation of smoke, but this was found to be minimal and evacuation of the smoke was not required. This report also introduces the potential role of using laparoscopic electrosurgery for other procedures. Subsequently, we have successfully performed bilateral ovariectomy in mares (11) and removed cryptorchid testes by using only the electrosurgical forceps for hemostasis.

In conclusion, this case describes a potential complication during application of a suture ligature when performing laparoscopic ovariectomy. Electrosurgical instrumentation can be used to easily and efficiently coagulate vessels within the mesovarium following suture ligature slippage. CVJ

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