

Ovariectomy of granulosa cell tumors in mares by use of the diagonal paramedian approach: 12 cases (1989–1995)

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Objective—To describe the short- and long-term survival rates in horses undergoing ovariectomy for granulosa cell tumors by use of the diagonal paramedian approach.

Design—Retrospective case study.

Animals—12 horses with granulosa cell tumors.

Procedure—A diagonal paramedian approach for unilateral ovariectomy was used for removal of each mare's granulosa cell tumor. Information about complications and outcomes was analyzed.

Results—Only minimal complications were detected postoperatively when the diagonal paramedian approach was used, regardless of the preferred technique for ovarian pedicle ligation or incisional closure and the use of pre- and postoperative medications. Clinical signs of moderate or severe postoperative abdominal pain were not evident in any of the 12 horses. Short- and long-term survival rates were 100%.

Clinical Implications—The diagonal paramedian approach was advantageous for ovarian tumor removal, because the ovary was immediately adjacent to the body wall at a portion of the incision site. Size of the ovary was not a limitation, because muscle tissues at the edges of the incision were flexible and easily retractable. All of these factors improved exposure, decreased traction on the ovary, increased our ability to observe the vasculature, and decreased postoperative morbidity, aiding in the removal of granulosa cell tumors in mares. (*J Am Vet Med Assoc* 1997;211:204–206)

The prevalence of ovarian tumors can be as high as 5.6% of all neoplasms in horses.¹ The most common ovarian tumor of horses is the granulosa cell tumor, accounting for 2.5 to 4.4% of all tumors in horses.¹ Grid or flank incisions in standing or recumbent mares and vaginal, ventral midline, ventral paramedian, and diagonal paramedian approaches have been recommended for ovariectomies in mares. Removal of tumors can alleviate behavioral problems and allow mares to resume reproductive or performance use.^{1–3} However, removal of ovaries, whether normal or neoplastic, has been associated with perioperative complications including hemorrhage, signs of abdominal pain, formation of seromas or hematomas, shock, peritonitis, intestinal adhesions or herniation, diarrhea, myositis, nerve paresis, incision line infection, dehiscence, and sudden death.^{4–7} Causes of these complications are often unclear.³ These complications may be lessened

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by adequate exposure to ensure vascular ligation and minimization of distractive forces on the ovarian pedicle stump or incision site.³

The diagonal paramedian approach for ovariectomy has been described, and the short-term survival rate of mares with neoplastic ovaries has been reported.² The purpose of the study described here was to provide additional information by evaluating long-term survival in 12 horses in which granulosa cell tumors were removed via a diagonal paramedian approach.

Criteria for Selection of Cases

Only horses that had undergone surgery for removal of a granulosa cell tumor between December 1989 and August 1995 were included in this study. Mares with follow-up information obtained ≥ 6 months after discharge following a unilateral ovariectomy by the diagonal paramedian approach were evaluated. Information examined for each horse included breed, age, sex, duration of clinical signs prior to surgery, rectal temperature, heart rate, respiratory rate, PCV, total serum protein concentration, results of per rectal examination to assess size of the ovaries, transrectal ultrasonographic appearance of both ovaries, and confirmation of the neoplasm by histopathologic examination. Short- and long-term survival were also examined. Short-term survival rate was defined as the proportion of horses that were discharged from the hospital. Long-term survival rate was defined as the proportion of horses that were still alive at the time of follow-up evaluation (≥ 6 months after discharge from the hospital).

Results

Signalment—Twelve horses had granulosa cell tumors and underwent a unilateral ovariectomy. Horses ranged from 3 to 24 years old (median, 9.5 years). The right ovary was affected in 6 horses, with diameters ranging from 10 to 20 cm (median, 15 cm). The left ovary was affected in 6 horses with diameters ranging from 10 to 25 cm (median, 15 cm).

Surgery—Mares were placed in dorsal recumbency. A diagonal skin and subcutaneous incision were made over the desired ovary, extending 5 cm from the base of the mammary gland laterally toward the cranial aspect of the flank fold.² Incisions were 10 to 20 cm in length, depending on size of the affected ovary. The rectus abdominis muscle was exposed. The rectus abdominis muscle fibers were bluntly separated in 6 horses and incised in 3 other horses, but the method was not recorded in the 3 remaining horses. The underlying internal sheath of the rectus abdominis was

incised and the peritoneum opened to enter the abdominal cavity.

The ovaries, located immediately adjacent to the body wall at the site of the incision in all horses, were easily exteriorized with a minimal amount of traction accompanied by pushing on the ventral part of the abdomen around the incision. Exposure of the ovarian pedicle and proper ligament of the ovary was noticeable. Stapling devices^a were used for vessel ligation in 8 horses. In 7 of these horses, 2 staples were applied, and in the other horse, a single staple and a ligature were used. In 4 horses, vessels were ligated by use of various suture materials.

Incisional closure varied among horses. In all but 1 horse, the peritoneum and internal sheath of the rectus abdominis muscle were left unopposed. In that horse, the internal sheath of the rectus abdominis muscle was closed by use of No. 2 polyglycolic acid in a simple interrupted pattern. External to this layer, closure varied by suture materials and patterns. Polyglactin 910 or double-stranded polyglycolic acid (No. 2) was used for closure of the rectus abdominis muscle, with or without the external sheath of the rectus abdominis muscle. In 9 horses, the muscle and external sheath were closed together (8 in a continuous pattern, 1 in an interrupted pattern). The muscle was sutured separately from the external sheath in 3 horses (2 in a continuous pattern, 1 in an interrupted pattern). A subcuticular suture pattern was the final closure in 5 horses, whereas skin was closed as the final layer in 6 horses. In 1 horse, the subcutaneous and skin layers were left open to heal by second intention.

Several antibiotics were administered before and after surgery, in addition to anti-inflammatory medications such as flunixin meglumine or phenylbutazone. Antibiotics included procaine penicillin G, potassium penicillin, gentamicin, ampicillin, ceftiofur, and trimethoprim-sulfamethoxazole. Median duration of antibiotic administration was 3 days. Mares were confined to stalls after surgery for a period ranging from 1 to 5 weeks. Resumption of activity of the mares began 6 to 8 weeks after surgery. Both of these time periods reflected surgeons' preferences.

None of the 12 horses undergoing surgery by means of diagonal paramedian approach for removal of granulosa cell tumors had signs of serious postoperative acute abdominal pain. However, several minor complications were encountered. Mild incisional swelling was evident in 9 horses, and mild postoperative (1 to 2 days after surgery) signs of depression with anorexia in 6 horses were the most common complications. Other complications included signs of mild pain associated with walking on the day after surgery (1 horse). These postoperative events were not considered to be major complications after abdominal surgery because of their short, transient nature.

Despite the variation in total surgery time, the affected ovary was exteriorized within 10 minutes (from the time of incising the skin) in all horses, which reflected surgical exercises for teaching students. For all horses, long-term follow-up by telephone conversation with owners was performed 6 to 85 months after

surgery. None of the horses in this study developed wound infections, hernias, or fatal complications. All mares survived surgery and were discharged from the clinic 2 to 7 days (median, 4.5 days) after surgery. All 12 horses were alive, and 3 horses intended for use in pleasure riding were being ridden successfully. One horse was in training for showing competition. Eight horses were being used as broodmares; 4 successfully conceived, and 2 of these successfully foaled.

Discussion

Ovariectomy can be performed by several methods, including a grid incision in the flank of standing or recumbent mares or via vaginal, ventral midline, paramedian, and diagonal paramedian approaches.¹⁻³ Each approach has limitations and well-recognized associated complications.^{1,3} In addition, removal of a large neoplastic ovary is a surgical procedure that presents further problems and potential complications.^{6,8} When incisions are not located directly adjacent to an affected ovary, excessive traction on the ovarian pedicle can cause a marked decrease in blood pressure because of pain and a vagosympathetic response.^{6,8} A high number of postanesthetic complications during neoplastic ovarian removal may be related to this pain and decrease in arterial pressure.^{6,8}

Using the flank approach, neoplastic ovaries may be difficult to exteriorize because of the thick and muscular wall in this area, the limited size of the paralumbar fossa, the thick layer of retroperitoneal fat in large mares, and the short ovarian pedicles of enlarged ovaries.^{1,9} For mares in which this technique is used, ovaries must be < 15 cm in diameter to enable them to be exteriorized.¹ Commonly encountered complications include exsanguination, formation of seromas or hematomas, wound dehiscence, and scarring of the flank.^{2,5,6}

When using a colpotomy, the procedure must be done without observation of the ovarian pedicle and limited to an ovary that is < 10 cm in diameter.¹ Similar to the flank approach in a standing mare, it is imperative the mare remain stationary. Extremely nervous or apprehensive horses may not respond as predicted to tranquilizers, analgesics, or sedatives.¹⁰ Colpotomy should not be performed on mares that pool urine in the vagina or have evidence of uterine, cervical, or vaginal infections.¹⁰ Reported complications include delayed healing of the vaginal incision, development of abscesses or hematomas at the incision site, and formation of adhesions of abdominal contents to the incision, with or without adverse clinical signs.¹⁰ Tearing of the cervix during surgery can create incompetent breeding animals or embryo transfer recipients.¹⁰ The possibility of evisceration may further require that the mare be amenable to cross-tying for as long as 1 week after surgery.¹⁰⁻¹²

Although the ventral midline approach allows for a bilateral procedure to be performed, several surgical difficulties are recognized.¹³ Exteriorization of an ovary with this approach can be extremely difficult because of the short, broadly attached pedicle.¹³ Anesthesia of the ovarian pedicle by local infusion of mepivacaine hydrochloride has been useful to minimize hypoten-

sion associated with traction on the ovary.^{6,8} Some surgeons may perform the procedure without observing the ovarian pedicle, using an ecraseur to decrease traction. The ecraseur, however, may not always provide hemostasis, and closure of the ventral midline incision site just cranial to the mammary glands may be difficult because of a considerable amount of subcutaneous fat.¹³

The ventral paramedian approach also can allow for a bilateral ovariectomy, but excessive tension often is placed on 1 or both ovaries.³ Several abdominal layers must be incised. As a result of the increased vasculature encountered by use of this approach, hemorrhage may increase the time required for incision and closure.⁹ Seromas and hematomas can form as a result of traction on the ovary and trauma to exposed muscle edges.⁹

The diagonal paramedian ovariectomy approach is advantageous for ovarian tumor removal, because the abdominal wall is consistently incised adjacent to the ovary. As a result, ovarian size is not a limitation when performing the diagonal paramedian approach, and this approach allows for excellent exteriorization of the structures to facilitate ovarian pedicle ligation. Unilateral and bilateral removal of normal ovaries can also be achieved by this approach. If the muscle fibers of the rectus abdominis are longitudinally separated by blunt dissection, hemorrhage can be minimized. Because the body wall is thinner at the site for a diagonal paramedian approach than for a ventral paramedian approach, the muscle edges are flexible and more easily retractable. This improves exposure, decreases the amount of traction needed to exteriorize the ovary, increases observation of the vasculature, and aids in the use of stapling instruments for removal of granulosa cell tumors in mares.¹⁴

In the study described here, 12 mares underwent the diagonal paramedian approach for removal of a granulosa cell tumor. Severe postoperative complications were not detected, and 100% of the mares survived the short- and long-term periods. This high survival rate compares favorably with the high short-term success reported for mares with bilateral ovariectomies of nonneoplastic ovaries via use of colpotomy.⁷ In that study, only mild postoperative complications of peritonitis and signs of pain in the lumbar region were evident. In our study of the diagonal paramedian approach, results were superior in that we encountered minimal complications, compared with earlier reports of mares with granulosa cell tumors that were removed by use of several surgical approaches, including flank incision in standing and recumbent mares and ventral midline, paramedian, and vaginal approaches.⁶ Although comparisons among the aforementioned surgical procedures were not reported, 32 of 77 (41.6%) of those horses had postoperative complications, 5 of 77 (6.5%) died in the short-term period, and 1 of 77 (1.3%) was euthanized after a long-term period as a result of ovarian complications after surgery.⁶

In our study, we found that mild incisional swelling and short-term signs of depression and anorexia were the most commonly reported postoperative complications. Signs of moderate or severe postoperative abdominal pain were not detected in any of the horses. Although comparison of the diagonal paramedian approach to other ovariectomy techniques for removal of a neoplastic ovary would be beneficial, comparison of mares in our study with other case-matched controls from the same teaching hospital was not possible because of the limited number of mares with neoplastic ovaries admitted to the teaching hospital each year and the limited number subjected to alternative approaches for ovariectomy. Nevertheless, analysis of our results indicated that the diagonal paramedian approach consistently provided adequate exposure for removal of the neoplastic ovary, allowed minimal traction on the ovarian pedicle, allowed good exposure that facilitated ligation and provided vascular security, and resulted in excellent long-term survival rates.

*Thoraco Abdominal 90, 4.5 mm staples, US Surgical, Norwalk, Conn.

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