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Reconstructive Surgical Procedures to Enhance Mare Fertility

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Reconstructive surgery of the caudal reproductive tract is commonly performed to restore or maintain a mare’s future fertility. Common problems that practitioners may be faced with include pneumovagina, urovagina, perineal lacerations, rectal-vaginal fistulas, and cervical tears. Surgical correction of these problems can be performed and these surgeries are generally performed standing. In most cases, standing sedation and possible epidural anesthesia is all that is needed to perform most surgeries. Practitioners that have access to standing stocks and an interest in surgery can perform many of these procedures in the field.

In the following paragraphs, I will address some of the common problems practitioners may see. I will describe various procedures used to correct these problems and my experience with them. I will also discuss some mistakes I made and the techniques that I am presently using to repair or enhance a mare’s fertility.

Preparation of Standing Perineal Surgery

The mare is restrained in standing stocks, and the tail is wrapped and elevated. Ensure you have a quick release knot on the tail in case the mare does go down in the stocks. Depending on the surgical procedure, the rectum is evacuated and the perineum, vagina, and rectum are cleaned. Epidural anesthesia may be performed for some procedures (see below). Appropriate instruments (long handle instruments) should be available, and a headlight is essential for many of these procedures. Often the mare’s foal is present, so you may have to sedate both the mare and foal during the procedure. I generally sedate the younger foals using either 50 to 100 mg of xylazine (1.1 mg/kg, intravenously). The foal can also be confined to a small pen next to the head of the mare.

Methods of Providing Anesthesia for Surgery

Local anesthesia can be achieved using local infiltration of either lidocaine or mepivacaine. Local anesthesia can be used solely for some procedures or in addition to epidural anesthesia in other procedures. The amount and location of administration of local anesthesia will often be dictated by the procedure in questions. Generally 10 to 30 mLs of lidocaine or mepivacaine is used.

Epidural anesthesia is commonly used for surgery involving the mare’s caudal reproductive tract. Numerous pharmaceutical methods of providing epidural anesthesia exist, and the type of agents(s) used is often dependent on surgeon’s preference and the particular reason for the epidural. Local anesthetics are often used in combination with alpha-2 adrenergic agonists. I personally have always used a mepivacaine and xylazine hydrochloride combination mixed with
either saline or sterile water. For a 450 kg mare, I will generally use 75 mg to 100 mg of xylazine hydrochloride and 1.5 mLs or 2 mLs of mepivacaine mixed with 6 to 7 mLs of sterile saline or sterile water. I use a “hanging drop” technique by placing a 1.5-inch, 18-gauge needle through the last sacral vertebrae (S5) and first caudal vertebra (C1). A brief description of the procedure is as follows: the site is clipped and aseptically prepped. Using sterile gloves, I will palpate the dorsal spinous process of S5 and then use the epidural space located about 1 cm caudal to this landmark on midline. Ensure the horse is standing squarely during the epidural procedure. I insert the needle in a direction perpendicular to the skin. Once the needle is just through the skin, I fill the hub of the needle with a small amount of epidural solution. The needle is then advanced until the fluid in the hub is aspirated into the epidural space. The needle can also be inserted between the first and second caudal vertebra. Elevating and lowering the tail helps identify the movable articulation between the first and second caudal vertebrae.

**Pneumovagina**

Performing an episioplasty or Caslick’s procedure commonly treats pneumovagina. In certain cases where there is atrophy or a laceration of the perineal body a perineal body reconstruction procedure (Gadd Technique) can be performed. A Gadd technique involves closure of the dorsal vulva after two large triangular flaps of vestibular mucosa, which connect dorsally, have been removed. Removal of the mucosal flaps can be performed using local anesthesia. The defect created by removing the vestibular mucosa is then sutured closed to appose the dorsal aspect of the vulva and decrease the surface area within the vestibule. The skin of the vulva is closed as with the Caslick’s procedure. Perineal body reconstruction can be performed easily and efficiently and carries a good prognosis.

**Urovagina/Urine Pooling**

This condition is primarily observed in older multiparous mares. Urovagina results from laxity of ovarian and/or pelvic supporting ligaments due to age and repeated pregnancies. Urovagina can also result from poor pelvic conformation and body condition. The sagging of uterus into the abdomen which occurs primarily during estrus when the uterus is edematous and under the influence of estrogen will pull the vagina cranially and ventrally. The urethral orifice is pulled forward and when urine is voided, some is refluxed cranially, causing vaginitis, cervicitis, endometritis, and infertility. Some mares may initially pool urine in the vagina intermittently and careful conservative management of breeding may be successful occasionally in these mares. Clinical signs include infertility, urine scalding, and often these mares have a smell like urine/ammonia. The diagnosis is either based on clinical signs or vaginal speculum exam. If the urine pooling cannot be controlled medically then surgical intervention is recommended. In some cases an endometrial biopsy is recommended prior to surgery to evaluate the endometrial tissue.

Surgical correction of urine pooling is one of the most frustrating reproductive surgeries. The urethroplasty procedure may be performed without problems, but the outcome is difficult to predict. Surgical repair failure can result in fistula development. Fistula development results in continued urine pooling and surgical closure of the fistula can be difficult to achieve. In many cases the entire procedure should be repeated.
This technique is as follows: the mares is sedated and the urinary bladder catheterized. Epidural anesthesia is performed as described earlier. The rectum is evacuated and the vulva/vagina is cleaned using a diluted iodine solution (approximately 5 to 10 mLs of iodine per liter). The choice of urethroplasty technique generally depends on the surgeon’s preference and potentially the mare’s conformation. The general urethroplasty technique involves creating a mucosal tunnel from the urethral orifice to near the mucocutaneous junction. Techniques which create a mucosal tunnel are described in a number of manuscripts listed below:3-6

I personally perform a technique that is a combination of the Brown and McKinnon techniques. The tunnel is sutured in multiple layers (Brown), but the tunnel is made by creating the mucosal shelves for the tunnel more dorsally within the vestibule (McKinnon). The tunnel is extended to the margin of the vulva (Fig. 1). After completion of the tunnel it is important to maintain a urinary catheter within the tunnel as I feel this contributes to the success of the procedure. Generally, a Foley catheter is left in place for 14 to 21 days and the catheter is changed every 4 to 5 days. The catheter should be flushed daily with an antibiotic solution (10 mLs of gentomycin in a liter of saline) to prevent crystal blockage of the catheter. I believe the cases where the mare cannot maintain the urinary catheter are more susceptible to fistula development. Mares are discharged the same day or the following day on systemic antibiotics and nonsteroidal anti-inflammatory agents. Mares are kept on systemic antibiotics and nonsteroidal anti-inflammatory agents for 3 to 5 days.

Table 1

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<th>Described Urethral Extension Techniques</th>
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<tr>
<td>Monin Technique - Proc Am Assoc Equine Pract, 18:99, 1972</td>
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<td>Shires Technique - Proc Am Assoc Equine Pract, 32:51, 1986</td>
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Figure 1. Extension of the urethral tunnel made surgically within the vestibule to the edges of the vulva.
The main complication following urethroplasty is the risk of fistula formation (Fig. 2) and continued pooling of urine. I have observed a few mares pool urine even though there is no obvious fistula present. To evaluate for the presence of a fistula, the tunnel should be infused with sterile saline while applying pressure to the urethra sphincter and caudal opening of the tunnel. Other complications include signs of colic and straining to urinate. Parturition can disrupt a previous urethroplasty technique and a second surgery may be required to reestablish the urethral extension.

Another technique that can improve vulva conformation and potentially urovagina involves pulling the entire vestibule caudally by transecting the perineal body horizontally (Pouret technique). This horizontal perineal skin incision is about 8 cm to 12 cm long. The dissection plane is continued cranially for about 12 cm to 20 cm. By releasing the connective tissue and muscles between the rectum and vestibule, the vestibular vault can be pulled caudally to a more horizontal position (Fig. 3). The anus and caudal rectum retract cranially. With caudal traction on the vulva, the new caudal position is sutured in place at the site of the perineal body transection. This creates a shelf below the anal sphincter, which often becomes contaminated and collects fecal material, but this does not represent a significant long-term problem. This technique has been described for alleviating pneumovagina as well.

**Recto-Vaginal Lacerations**

Perineal lacerations generally occur during foaling in primiparous mares, because of the forceful expulsion of the foal. The extent of the damage varies and can be classified into three degrees. First-degree perineal lacerations involve the mucosa of the dorsal vestibule and vulva. These lacerations are generally treated by performing an episiotomy or Caslick's. Second-degree lacerations involve the submucosa and muscularis of the vagina/vestibule and perineal body. The laceration does not involve rectal mucosa or anal sphincter. Most of these lacerations heal satisfactorily by second intention. In cases with significant damage, pneumovagina may result. As with first degree lacerations, an episiotomy may be all that is needed to correct the pneumovagina. In cases with significant disruption of the perineal body, a Gadd technique may
be required. Third-degree perineal lacerations are the most serious due to fecal contamination of vestibule, vagina, and uterus resulting in infertility. The laceration involves penetration through the rectal-vaginal shelf and musculature of the vagina, vestibule & rectum (Fig. 4). Repair is usually delayed until the necrotic tissue has sloughed and the wound has healed by second intention. In most cases, three to four weeks postpartum is adequate. However the repair should be performed as soon as possible to prevent long-term fecal contamination of the uterus. Preoperative preparation and postoperative management involves softening the feces to minimize tension on the surgical repair. If available, mares should be placed on lush pasture prior to surgery until feces are soft and then kept on lush pasture for at least two weeks after surgery. Other methods for softening the feces include substituting hay and grain diet with a pelleted ration 3 to 4 days before surgery and administering mineral oil in the feed or via a nasogastric tube (up to 2 to 3 liters). Perioperative antibiotics and nonsteroidal anti-inflammatory agents are administered.

Epidural anesthesia is performed and the rectum and vulva/vagina are cleaned of gross contamination using a dilute iodine solution. The method of repair can involve one or two stages. A one stage repair involves complete closure of the rectal-vaginal shelf and perineal body. In a two stage repair, the rectal-vaginal shelf is repaired initially, and then at least three to four weeks later, the perineal body is repaired to complete the second stage. Generally the second stage can be performed using local anesthesia.

Closure of the rectal-vaginal shelf can be performed using either of two methods. In both methods, an incision is made to create a rectal shelf and a vaginal shelf on both the left and right sides of the defect (Fig. 5). The incision is made generally through the demarcation of the rectum and vagina, but should extend more into the vagina as the incision courses caudally. This helps eliminate tension on the final repair. Shelves are created at the cranial aspect of the defect as

![Figure 4. Third-degree perineal laceration.](image)
well. It is important to extend cranially about 2 to 4 cm when creating the shelves in the cranial aspect of the defect, and the shelves on the sides should be undermined laterally so that there is minimal tension on the closure. The shelves can be closed using a simple continuous pattern in a cranial to caudal direction. The vaginal side is closed first in 3 to 4 layers and then followed by the rectal side (Fig. 6). Another method involves moving in a cranial to caudal direction using an interrupted six-bite pattern to close both the vaginal and rectal layers together. Postoperatively, mares are treated with broad-spectrum antibiotics and nonsteroidal anti-inflammatory agents. It is important to keep the feces soft so that the surgical repair does not dehisce. Mineral oil (2 to 3 liters) may have to be given via nasogastric intubation once daily to keep the feces soft in some cases. The main complication following surgery is the potential for fistula formation or dehiscence along the suture line. The prognosis is generally very good to excellent following repair, but this may be due to the advantages of the lush grass in Kentucky. Recurrence the following year is a possibility, therefore special attention during parturition is important.

Figure 5. Repair of a third-degree laceration. An incision has been made to create a rectal shelf and a vaginal shelf on both the left and right sides of the defect.

Figure 6. Repair of a third-degree laceration. Closure of the defect is performed by apposing the left and right sides of the vaginal shelf first. The rectal shelf is repaired last.

Recto-Vaginal Fistula

Recto-vaginal fistulas occur when the foal's foot penetrates through the rectal-vaginal shelf, but does not damage the anal sphincter and perineal body (Fig. 7). Generally the fistula is caudal to the remnant of the hymen (within the vestibule), but in rare cases can be cranial to it (within the vagina). Some fistulas can heal spontaneously and do not require surgical repair. The fistula is generally large after parturition, but contracts to only a few centimeters in diameter in 3 to 4 weeks. Fistulas can also occur with partial dehiscence of a surgically repaired third degree rectal vaginal tear. Surgical repair is required to restore the mare’s fertility. Perioperative management
is the same as for third degree rectal vaginal tears. Methods of surgical repair include the following: converting the fistula to a third degree perineal laceration, direct closure through the vagina, direct closure through the rectum, or transecting the perineal body horizontally to expose the fistula for repair. I personally prefer to transect the perineal body horizontally and then transect the fistula to create a rectal defect and a vaginal defect (Fig. 8). The rectal defect is closed first in one layer by everting the edges of the fistula into the rectum. Closure of the rectal side first ensures a stronger and easier closure. The vaginal defect is then closed in 2 to 4 layers using an inverting pattern. Absorbable suture material is used for closure of both the rectal and vaginal defects. The dead space between the rectal and vaginal closures is left open to heal by second intention. The skin is closed on the left and right sides of the perineal incision but the center is left open to provide drainage. Postoperatively, mares are treated with broad-spectrum antibiotics and nonsteroidal anti-inflammatory agents. The prognosis is generally very good to excellent following repair, but this may be again due to the advantages of the lush grass in Kentucky. Recurrence the following year is a possibility, therefore special attention during parturition is important.

![Figure 7. Mare with rectal-vaginal fistula. One of the foal’s limbs is exiting the rectum indicating disruption of the rectal-vaginal shelf.](image1)

![Figure 8. Repair of a recto-vaginal fistula. Closure of the fistula is performed by transecting the perineal body horizontally and then transecting the fistula to create a rectal defect (R) and a vaginal defect (V). The rectal defect is closed first followed by the vaginal defect.](image2)

**Cervical Lacerations**

Cervical tears are a significant cause of infertility in mares. Late-term abortion, difficult dystocia, delivery of a large foal, and trauma during natural mating has been associated with the development of cervical tears.  

The inability of the cervix to close properly will potentially result in a chronic uterine infection. Digital exam of the cervix is valuable for evaluation, as lacerations are not always evident on visual exam. I like to evaluate the cervix during diestrus, because it is easier to identify the injury within the fibromuscular layer. With my index finger in
the cervical os, I compress the fibromuscular layer between my index finger and thumb. The entire circumference of the cervix is examined to potentially locate a tear. Surgical repair of large cervical lacerations is needed to restore the future fertility of a mare. Surgical repair should be delayed until three to four weeks after parturition. I generally prefer to perform the surgery during diestrus. This surgery requires long instruments, a good headlight and a dorsal speculum. In most cases, cervical lacerations are repaired with the mare standing in stocks using epidural anesthesia. Tears that involve the dorsal aspect of the cervix are easier to repair standing. Tears that involve the ventral aspect of the cervix are generally more difficult to repair with the mare in a standing position. The cervix is retracted caudally using either stay sutures or cervical retractors. I prefer stay sutures placed on each side of the defect. The edges of the defect are debrided using long handled scissors (Fig. 9) and closed using a two- to three-layer closure (Fig. 10). The goal of the surgical repair is to create a cervical os and cervical canal that one finger can be passed through easily.

Figure 9. Repair of a cervical laceration. The edges of the cervix are debrided using long handled scissors.

Figure 10. Repair of a cervical laceration. The edges of the cervix are closed using a two- to three-layer closure.

Tears that involve the ventral aspect of the cervix are generally more difficult to repair because of lack of visibility of this area. In some cases, the temperament of the mare or a small vestibule (limiting visualization) makes standing surgical repair difficult. Secure closure of ventral cervical lacerations can be achieved by positioning the mare into a Trendelenburg position. The hindquarters of the mare are elevated using a hoist system. These tears can be easily and efficiently repaired in this position.

Postoperatively, mares are treated with broad-spectrum antibiotics and nonsteroidal anti-inflammatory agents. Recommendations are made to digital apply antiseptic or antibiotic
ointments to the cervix every couple days for 10 to 14 days to ensure the cervical os remained patent. Prognosis is generally good but this depends on the size and location of the cervical tear. A uterine cytology and culture should be obtained two to three weeks after cervical repair as the majority of these mares are presented for surgery because of chronic bacterial or yeast endometritis. Blood that refluxes into the uterus during surgery, repeated entry of one’s finger into the cervix after repair and the inability to clear the infection before surgery contribute to the chronic infection. The infection needs to be treated appropriately and may require repeated treatment before the mare can be bred successfully. The mare may become pregnant after a cervical repair, but she may develop ascending placentitis because the cervical repair can’t withstand the weight of the pregnancy. In these cases, a purse string apparatus may result in delivery of a viable foal. A surgically repaired cervix frequently tears again during parturition and will require future surgical repair. In some cases, elective cesarean section is performed as the mare enters parturition. Elective cesarean section helps prevent further damage to the repaired cervix and therefore a future cervical repair. In breeds other than Thoroughbreds, embryo transfer is a good option.

**Oviductal Obstruction**

In mares that consistently fail to conceive when inseminated naturally or artificially from fertile stallions and have no identifiable pathology to the reproductive tract, a tentative diagnosis of blocked oviducts can be made. In cases involving a blockage caused by normal oviduct cellular debris, a laparoscopic technique to dilate the oviducts can be performed. The procedure is performed through both paralumbar fossae so that each ovary and associated oviduct can be visualized and treated. Using a laparoscopic injection needle, PGE2-laced triacetin gel is applied directly onto the surface of the oviduct. This can be performed easily and efficiently using a laparoscopic technique. If the laparoscope is an operating scope, only one portal site is needed. In one report describing 15 mares with a tentative diagnosis of temporary oviduct obstruction, 14 (93%) conceived within the same or subsequent breeding season after having this laparoscopic technique performed.

**References**


