Urogenital Surgery in the Horse
Brett Woodie, DVM, MS, DACVS
Rood & Riddle Equine Hospital, Lexington, KY, USA

Rupture or tearing of the uterus occurs most commonly at foaling. It is thought that dystocias and malposition of the foal are the causes of uterine tears. However, it is not uncommon for a mare to develop a uterine tear with a normal foaling. Typically the size of the uterine tear is small but they can be very large and involve uterine arteries. If a uterine artery is torn then severe hemorrhage can occur and the mare will show signs of hypovolemic shock.

Determining that a mare has a uterine tear is not always an easy task. The mare will typically present with a fever, mild degree of abdominal pain, and/or depression. This usually occurs 2–3 days from foaling. This can vary depending on the type of post-partum treatment that has been given. Evaluation of the mare should include palpation per rectum, vaginal, and uterine examination. It is very difficult to palpate a uterine tear since they typically occur near the tip of the uterine horn. The surgeon must make sure that the tear is not in the body of the uterus with respect to surgical planning. A tear in the uterine body is best approached with the mare standing and not under general anesthesia. Transabdominal ultrasound is another diagnostic modality that is useful. Typically the mare will have peritoneal effusion. The volume that is present will depend on the duration of the tear and whether uterine lavage has been performed as part of the post-partum treatment. Often if there is a tear in the uterus the veterinarian will not retrieve all of the lavage fluid that is instilled. This is dependent on the location of the tear. A tear that is located dorsally may not allow the lavage fluid to access the abdominal cavity as a ventral tear would. Collection and analysis of a peritoneal fluid sample is a vital part of assessing a mare with a potential uterine tear. A uterine tear will cause peritonitis and the abdominal fluid will be representative of that. The color of the fluid is usually red and may smell like lochia. The severity of the peritonitis will be dependent on the duration, location, and if uterine lavage with irritating solutions have been performed. Laboratory evaluation of the abdominal fluid will yield an elevated white blood cell count and elevated total solids concentration. A large number of neutrophils will be seen cytologically and some of the neutrophils will have phagocytized bacteria. The peritoneal fluid should be submitted for bacterial culture.

There are two treatment options for a horse with a uterine tear: medical and surgical. It is possible to resolve a uterine tear with medical alone but this is not advisable. Medical treatment alone has a high risk of the mare developing abdominal adhesions, becoming infertile and potentially developing severe septicemia. The best treatment option is to combine medical and surgical therapy. During the surgical procedure the uterine tear can be repaired, the abdomen lavaged, and an abdominal drain can be placed. A caudal ventral midline approach with the mare in dorsal recumbency under general anesthesia is the best surgical approach. Once the abdomen in entered the surgeon usually encounters a large volume of reddish colored peritoneal fluid. A peritoneal fluid sample should be submitted for culture if this was not done pre operatively. The uterus is exteriorized and the dorsal and ventral aspects are examined for a tear. Typically there is only one tear but the entire uterus should be thoroughly examined. There are various suture patterns and materials that are appropriate to use for repair of the tear. If the mare has retained her placenta the surgeon must make sure that it is not incorporated in the repair of the tear. An absorbable suture material (usually #2) placed in an inverting pattern is typically used. The primary suture line is then oversewn. Following repair the remainder of the abdomen should be explored and thoroughly lavaged and suctioned. A large bore drain such as a 32 French thoracic drain should be placed so that post-operative lavage can continue. It is advisable to perform an omentectomy so the omentum will not obstruct the abdominal drain. Routine closure of the abdomen and securing the abdominal drain are performed.

The use of intravenous broad spectrum antibiotics will continue during the post-operative period. The abdomen should be lavaged twice per day with 5–10 liters of warm sterile fluids (such as lactated ringers). This should continue for at least 2–3 days post-operative depending on how the mare is doing. It
is best to place a one way valve on the opening of the drain so that fluid can drain continuously from the abdomen.

The best prognosis for the mare will be attained thorough early surgical intervention and aggressive post-operative medical treatment.

Perineal lacerations typically occur during unassisted foaling, most commonly in primiparous mares. It is hypothesized that the front foot of the foal catches on the dorsal transverse fold of the vestibulovaginal junction, and the mare’s abdominal press forces the foal’s foot through the roof of the vestibule and into the mare’s rectum. A rectovestibular fistula results if a foaling attendant is present to replace the foal’s foot back into the vestibule or if the foal retracts its foot. If this does not occur then a perineal laceration is the result.

First-degree injuries typically do not require surgical intervention. If needed a Caslick procedure can be performed. Repair of second-degree injuries requires a Caslick procedure and reconstruction of the perineal body. Second degree perineal lacerations can be difficult to diagnose in the early post-partum period. Eventually the mare will develop a sunken perineum and be predisposed to pneumovagina and urine pooling if the perineal body is not reconstructed. All third-degree perineal lacerations require surgical repair. The management is divided into two categories: immediate treatment and surgical repair. Repair of a third-degree perineal laceration in the acute stage should not be attempted. The tissue is very edematous, contaminated with feces, and some tissues may not be viable. Repair should be delayed at least 3–4 weeks or longer (6–8 weeks) if possible to allow healing of the injured tissues. Initial therapy should be toward wound care and cleaning of the contaminated tissues. Systemic anti-inflammatories and antibiotics are required. Administration of tetanus prophylaxis is warranted based on the immunization status of the mare. The contaminated tissues should be cleaned as needed. The use of a garden hose is beneficial. Third-degree perineal lacerations result in bacterial contamination of the vagina and uterus. Inflammatory uterine changes are reversible after surgical repair. A uterine biopsy is not needed because no correlative information exists comparing preoperative uterine biopsy grades with conception data after surgery.

Dietary changes may be necessary so that the mare has soft feces without an excessive amount of water content. There are many methods that can be used to soften the feces. Pasturing the mare on lush green grass, administering laxatives such as mineral oil or magnesium sulfate via a nasogastric tube, and feeding wet bran mashes are just a few examples. Dietary changes should be instituted well before surgery so the fecal consistency is soft by the date of surgery. If the mare has firm formed feces the surgery should be postponed because dehiscence of the suture repair is likely. Often the surgery is delayed until the foal is weaned so that the foal does not have to enter the hospital environment but the timing of the surgery may be dictated by the urgency to get the injury repaired and the mare rebred.

Surgery is performed with the mare sedated and restrained in stocks. The use of epidural anesthesia is necessary. Following surgery the mare will need to maintain soft feces for at least 2 to 3 weeks.

The Aanes technique or a two-stage repair is designed to minimize the chance for obstipation, which can lead to failure of the repair. In the first stage of the repair the rectovestibular shelf is reconstructed without repair of the perineal body. Three to four weeks later the second stage or perineal body repair is performed.

Balfour retractors or stay sutures can be used to provide access to the surgical site. Initial dissection begins cranially in a frontal plane at the level of the rectovestibular shelf. A combination of sharp and blunt dissection is used to divide the tissue into rectal and vestibular shelves. The rectal shelf should comprise two-thirds of the thickness and the vestibular shelf one-third. The plane of dissection is continued cranially for a distance of 3–5 cm. The cranial dissection is important to relieve tension at the tissue edges. The incisions are continued laterally and caudally along the scar tissue junction of the rectal mucosa and vestibular mucosa. The dissection is continued laterally until the tissue shelves can be apposed on the midline without tension. Hemostasis using ligatures can be performed if necessary. Once sufficient dissection has been achieved reconstruction of the tissue shelves can begin. It is important to have adequate dissection performed so that the tissue shelves are under minimal tension during the repair.
The first suture line apposes the vestibular shelves. A continuous horizontal mattress pattern of #1 or #2 absorbable suture material is used to invert the vestibular mucosa into the vestibule. This pattern should be interrupted when approximately one-quarter to one-half of the vestibular defect is closed. This allows easier access for placement of the second set of sutures. The next row of sutures is placed dorsal to the first in an interrupted fashion in the perirectal and perivestibular tissues. These sutures are placed in a purse string fashion. It is crucial that the rectal mucosa is not penetrated. These two suture patterns are alternated until the level of the dorsal commissure of the vulva is reached. This technique does not repair the anal sphincter or perineal body. The second stage of the repair is performed 3 to 4 weeks later. It consists of removing the epithelium from the triangular surface of the perineal body and apposing these tissues on midline as was described in the section on perineal body reconstruction. The function of the anal sphincter is gained by suturing the tissues of the perineal body. No attempt is made to isolate and suture the muscle fibers of the anal sphincter. A Caslick procedure is performed if necessary.

The initial dissection is the same in the single-stage repair as in the two-stage repair. The Goetze modification of the single stage repair utilizes a six-bite suture pattern. The suture is typically #2 absorbable material and is placed in an interrupted pattern. The first suture is placed at the cranial edge of the dissected shelf and follows this sequence. The first bite is deep in the left vestibular flap in a ventral to dorsal direction. The second bite is in the left rectal submucosa taking care not to penetrate the rectal mucosa. The third bite is in the right rectal submucosa. The fourth bite is through the right vestibular flap in a dorsal to ventral direction. The fifth bite reenters the right vestibular shelf axial to the fourth bite in a ventral to dorsal direction. The sixth bite is in the left vestibular flap from dorsal to ventral and is positioned axial to the first bite. When the suture is tied the rectal edges should be apposed and the vestibular edges should be everted into the lumen of the vestibule. The sutures should be placed approximately 1.5 cm apart. Any sutures that are loose or placed too far apart should be replaced because failure to do so will compromise the repair. Closure of the rectal mucosa is not necessary. This repair is continued to a point approximately 4–6 cm cranial to the cutaneous perineum. At this point the perineal body is repaired as previously described. A Caslick operation is performed if necessary. The single stage repair can be performed using the Aanes reconstruction technique as described for the two-stage repair. There is another modification of the single stage repair that has been reported. This technique described by Stickle uses a three-layer closure.

Rectovestibular fistula formation is the result of a perineal laceration from the dorsum of the vestibule into the rectum, without disruption of the anal sphincter. They can form secondary to an unsuccessful repair of a third-degree rectovestibular laceration. Small fistulae will sometimes close with conservative therapy, but larger ones require surgical repair. Fistulas are most commonly 3–5 cm in diameter and located cranial to the perineal body. Surgical approaches include conversion of the fistula into a 3rd degree perineal laceration, horizontal approach through the perineal body or a direct suturing technique.

The horizontal approach through the perineal body is made by making a horizontal skin incision midway between the ventral aspect of the anus and the dorsal commissure of the vulva. A combination of blunt and sharp dissection is utilized to separate the perineal body. This plane of dissection is continued through the fistula for a distance of 3 cm. Stay sutures or Allis tissue forceps can be used to help retract the tissue during dissection. It is important not to penetrate into the rectum or vestibule prior to reaching the fistula. The dissection should be such that the rectal shelf of tissue is thicker than the vestibular shelf. The fistula in the rectal tissue is closed transversely using an interrupted Lembert pattern of 0-absorbable suture material. The fistula in the vestibular shelf is closed longitudinally in a continuous horizontal mattress pattern. This results in the suture lines being oriented at right angles to one another. This orientation of the suture patterns is felt to be stronger and more likely to resist tension during defecation. The dead space created by the approach is closed using interrupted purse string sutures. The skin is closed in continuous or interrupted pattern. An alternative is to allow the dead space and skin to heal by second intention.

Direct suturing techniques have been described for successful repair of rectovestibular fistulas. Recently a mucosal pedicle flap technique for repair of rectovestibular fistulas was reported. This technique is performed as a standing procedure. The edges of the fistula were debrided by full thickness...
excision of 2 mm of the margin of the fistula. The fistula dimensions were assessed and a dorsally based
U-shaped mucosal and submucosal pedicle flap was dissected from the vestibular wall. The flap is
rotated 90 degrees so that the vestibular mucosa is continuous with the rectal mucosa covering the fistula.
The flap is held in place by absorbable suture material placed in an interrupted pattern.

Injury such as a cervical laceration may lead to infertility. Lacerations of the cervix usually occur as
a result of excessive stretching during foaling. Cervical injury is more likely to develop during dystocia or
in association with a fetotomy. Cervical lacerations have been reported to occur during normal
parturition or during the abortion of a relatively small fetus. Any injury that disrupts the normal function
of the cervix may lead to infertility. The incidence of cervical lacerations is reported to be higher when
parturition is induced. This may be the result of the cervix not relaxing adequately prior to foaling.

The most common clinical signs associated with cervical lacerations are failure to conceive,
endometritis, early fetal abortion, and persistent infertility. All mares that have undergone dystocia
should have their cervix examined during the post-partum period. It is best to perform a visual as well as
a manual inspection of the cervix. Palpation of the cervix is crucial to making a diagnosis of a cervical
laceration. Lacerations can be easily missed on visual examination alone. This is especially true if the
mare is near estrus with a relaxed cervix. Diestrus is the optimal time to evaluate the cervix. During this
stage of her reproductive cycle the cervix should be constricted in size and allow an accurate
determination of cervical competency. The manual examination of the cervix is performed as follows. The
mare should be restrained in a manner so that it is safe for the veterinarian and the horse undergoing the
examination. The hand is inserted into the vagina of the mare and the cervix is identified at the most
cranial aspect of the vaginal fornix. When using the right hand to examine the cervix the examiner places
the thumb in the lumen of the cervix and uses the index finger to palpate the cervix from the most dorsal
aspect to the most ventral aspect of the right side of the cervix. To examine the left side of the cervix the
examiner inserts the index finger into the lumen and uses the thumb to palpate the cervix from the most
dorsal to the most ventral aspect of the left side of the cervix. If a cervical laceration is present the severity
and extent should be determined. Not all cervical lacerations require surgical repair. It has been reported
that surgery is unnecessary if 50% or less of the vaginal cervix is involved. However, the economic impact
of fetal loss must be considered and if it is possible to improve the chances that a mare will conceive and
carry the foal to term surgical intervention is warranted.

Surgery should be performed during diestrus and at least 3 weeks post-partum. Trying to repair a
cervix earlier than 3 weeks post-partum is very difficult and the surgeon will have a more positive
outcome to wait until 3 weeks post foaling. The mare should be sedated, restrained in stocks and epidural
anesthesia is used to desensitize the surgical site. The use of topical local anesthesia on the cervix can be
used as an adjunct to epidural anesthesia. Gaining access to the cervix can be difficult due to its forward
location in the reproductive tract. Using a modified Finochietto retractor with long blades (Sontec
Instruments, Englewood, CO) is very helpful in repairing cervical lacerations. Long handled instruments
are necessary to repair cervical lacerations. The cervix should be retracted caudally so that it is closer to
the surgeon. Two methods for retracting the cervix include Knowles cervical forceps and the use of stay
sutures. The Knowles cervical forceps are more traumatic than stay sutures and are not necessary. Three
stay sutures using large diameter suture material (#2) are placed in the external cervical os by hand or
with the aid of long needle holders. The stay sutures must be positioned such as to accentuate the cervical
defect not to interfere with the dissection and repair of the cervical laceration. The long ends of the stay
sutures should be held with a hemostat and the needle removed. An assistant should apply gentle, steady
caudal traction on the stay sutures so the surgeon has access to the cervix. The cervix can usually be
retracted to the level of the vestibulovaginal junction. The scar tissue/edges of the cervical laceration are
excised using a scalpel blade or a scissors. Following excision the three layers of cervical tissue should be
evident. Repair of the defect is accomplished by a three-layer closure. The first layer, the inner cervical
mucosa, is the most difficult to close and probably the most important. This layer is closed using 0 or #1
absorbable suture material in a continuous horizontal mattress pattern to invert the mucosa into the
cervical lumen beginning at the most cranial aspect of the defect and working caudally. Following each
bite the surgeon should check whether the cervical lumen was penetrated and to ensure that the cervical
lumen is patent. The second layer in the cervical muscle is apposed using #1 absorbable suture material
placed in a simple continuous pattern. The third layer, the outer cervical mucosa is closed using #1 absorbable suture material placed in a simple continuous pattern. The mare should not be bred for at least 30–45 days following surgery.

Urovagina and urine pooling is the accumulation of urine in the vaginal fornix of the mare. This abnormality is most often seen in thin, multiparous mares in which the cranial vagina slopes ventrally. Mares often have a sunken appearance to their anus and dorsal vulva and frequently have had a Caslick procedure performed. Excessive closure of the dorsal vulva during a Caslick procedure may contribute to urine reflux by causing back-splash of urine into the vagina.

Urovagina is diagnosed by finding an accumulation of urine in the fornix of the vagina during vaginal examination. It is best to perform a speculum examination of the vagina during estrus because some mares only pool urine when the reproductive tract is under the influence of higher circulating levels of estrogen. Examination of the mare on several occasions and finding urine in the cranial aspect of the vagina confirms the diagnosis. Surgical intervention is usually required for treatment of urine pooling. Manual evacuation of urine from the cranial aspect of the vagina prior to breeding may improve conception rates but this does not address the long-term negative side effects of urovagina. Definitive surgical treatment for urine pooling involves modification of the external urethral orifice. The urethral extension is a conduit to channel urine caudally so that it can not accumulate in the cranial aspect of the vagina.

Urethral extension procedures have the advantage of being able to extend the urethral opening as far caudally as necessary. A common pitfall of urethral extension procedures is fistula formation along the suture repair. In most instances fistula formation must be repaired. The surgeon should wait until tissue inflammation has subsided before attempting another repair.

The mare should be sedated, restrained in stocks and have epidural anesthesia to desensitize the perineum. Balfour retractors or stay sutures can be used to provide access to the surgical site. When self-retaining retractors are used excessive lateral retraction should be avoided because this makes apposition of the vestibular mucosa more difficult. Insertion of a 30 French Foley catheter will help ensure an adequate lumen diameter of the urethral extension and helps prevent urine contamination of the surgery site. Long handled instruments will be needed for the surgical procedure. There are three surgical techniques that are typically used to perform urethral extensions. These techniques are the Brown, McKinnon, and a combination of the Brown and McKinnon techniques.

The Brown technique involves creating tissue flaps beginning at the level of the transverse urethral fold and continuing to just inside the labia. The free edge of the transverse urethral fold is incised with a scalpel in a horizontal plane creating dorsal and ventral tissue flaps of equal thickness. It is important not to create holes in the flaps during the dissection. The transverse incision is continued caudally along the vestibular wall to create a dorsal and ventral shelf of vestibular mucosa and submucosa. Dissection dorsally and ventrally will allow the flaps to be apposed on midline without any tension. It is critical that the dissection generates tissue flaps large enough to result in a urethral tunnel of adequate diameter. The ventral shelves of tissue from opposing sites are sutured using 2-0 absorbable material in continuous horizontal mattress pattern that inverts the mucosa of the ventral shelf into the new urethral lumen. The submucosa is closed using 2-0 absorbable suture material in a continuous pattern. The dorsal shelves are sutured using 2-0 absorbable suture material in a continuous horizontal mattress pattern that everts the mucosa into the vestibule.

In order to perform the McKinnon technique a horizontal incision is made in the mucosa of the transverse fold of the urethra 2 cm cranial to the caudal free edge. Incisions are made in the lateral walls of the vestibule approximately one-half the distance from the floor of the vestibule. Dissection of the tissue flaps continues in a ventral direction until the flaps can be apposed on midline without tension. The tissue flaps are sutured using a one-layer technique of 2-0 absorbable suture material in continuous horizontal mattress pattern inverting the mucosa into the lumen of the urethral tunnel. The initial dissection over the transverse urethral fold results in the cranial aspect of the closure to assume a Y pattern before the two suture lines meet on midline. Fistula formation is most common at the junction of the Y suture pattern. The exposed submucosal tissue heals by second intention.
Combining the McKinnon and Brown techniques for urethral extension can be done as well. The initial dissection is similar to the Brown technique. The caudal free edge of the transverse fold of the urethral orifice is incised into dorsal and ventral shelves of equal thickness. The incisions are continued caudally along the ventrolateral walls of the vestibule to a point approximately 2 cm cranial to the labia. Submucosal dissection is performed to create dorsal and ventral vestibular tissue flaps that can be apposed on midline and create a urethral lumen of adequate diameter. A 30 French Foley catheter can be inserted into the bladder to help determine the location of the incisions and prevent urine contamination of the surgical field. The dissection of the vestibular walls is not as dorsal as described for the McKinnon technique. Closure of the tissue flaps is as follows. The mid-point of the caudal free edge of the transverse urethral fold is grasped with an Allis tissue forceps and retracted caudally. Suturing begins at the junction of the right ventral flap of the transverse fold and the right ventral flap of the vestibular wall. A continuous horizontal mattress pattern using 2-0 absorbable suture material is used. The mucosa of the ventral flaps should be inverted into the lumen of the urethral extension. During closure it is important to retract the transverse fold caudally. This suture pattern is continued caudally to the midpoint of the transverse fold and the suture is tied. The right dorsal flap of the transverse fold and the right dorsal flap of the vestibular wall are sutured next using a continuous horizontal mattress pattern of 2-0 absorbable suture material that everts the mucosa into the vestibule. The procedure is repeated for the left side. The remainder of the roof the urethral tunnel is created by first suturing the right and left ventral vestibular tissue flaps followed by the dorsal flaps. The ventral flaps are apposed using 2-0 absorbable suture material in a continuous horizontal mattress pattern inverting the mucosa into the urethral lumen. The dorsal flaps are apposed using 2-0 absorbable suture material in a continuous horizontal mattress pattern everting the mucosa into the vestibular lumen. The most difficult part of the repair is the junction of the “Y” of the three tissue layers - transverse urethral fold and right and left vestibular tissue flaps. This location is most prone to dehiscence and fistula formation. A third layer of suture using 2-0 absorbable suture material placed in a simple continuous pattern can be used starting just cranial to the Y junction and proceeding caudally. Maintaining a urinary catheter post operatively for some time is based on surgeon preference.