FIELD OBSTETRICS AND SUPPORTIVE CARE: PART II

Dawna L. Voelkl, DVM, Dipl. ACT
University of Missouri College of Veterinary Medicine
Dietrich H. Volkmann, BVSc, MMEdVet(Gyn), Dipl. ACT
University of Missouri College of Veterinary Medicine

Managing Significant Complications
While post-partum mares are at increased risk for a variety of complications, including rupture of the middle uterine artery, large colon volvulus, cecal perforation, and traumatized bowel, these proceedings will focus on those sequelae that are more closely associated with dystocia and its resolution. These conditions include retention of the fetal membranes, uterine laceration, intussusception of the uterine horn, uterine prolapse, and vaginal trauma.

Retained Fetal Membranes
The overall incidence of retained fetal membranes (RFM) in foaling mares has been reported to be as high as 10.6%. However, because moderate to severe dystocia is often the culmination of an abnormal late gestation, the reproductive endocrine cascade mediating parturition fails to proceed physiologically and normal preparation of the fetal membranes for release may not occur, thus making retention relatively more common. Other factors proposed to contribute to increased risk for RFM in mares suffering from dystocia include uterine trauma, abnormal uterine contractions at parturition, and myometrial fatigue.

Fetal membranes are considered to be pathologically retained at 3 hours after delivery of the foal. This constitutes the first time point for intervention. Mares that have not expelled the fetal membranes by this time should be administered oxytocin. Dose, frequency, and route of administration vary widely amongst clinicians. A single 10-20 IU dose of oxytocin administered intravenously or intramuscularly may result in passage of the fetal membranes over the ensuing several hours.

However, in mares suffering from RFM following dystocia, oxytocin therapy alone is often unsuccessful, with failure to pass the fetal membranes within 12 hours in spite of oxytocin therapy often being associated with retention for several days. The second point for intervention occurs at 6 hours, at which time bacterial colonization of the RFM becomes significant and initiation of broad spectrum antimicrobial as well as anti-inflammatory therapy is indicated. In a field setting, the most practical antimicrobial combination is procaine penicillin G (22,000 IU/kg, intramuscularly, every 12 hours) and gentamycin sulfate (6.6 mg/kg, intravenously, every 24 hours). Provision of antimicrobial coverage against the Gram negative organisms that most commonly precipitate life-threatening metritis in the mare, Escherichia coli and Klebsiella pneumoniae, is critical; thus, penicillin must not be used alone. Flunixin meglumine (1.1 mg/kg, intravenously or orally, every 12 hours) should also be administered. Although administration of oxytocin may not result in expulsion of the fetal membranes during this time period, continued administration of 10-20 IU intramuscularly every 6 hours, if tolerated by the mare, is useful in promoting evacuation of fluid accumulated within the allantoic cavity and/or uterus.

Attempts at removal of RFM using forceful traction are contraindicated, as this may result in the retention of pieces of the membranes or even just chorionic villi, i.e., “microretention”. Distention of the allantoic cavity by filling it to capacity with sterile physiologic saline for approximately 15 minutes, followed by rapid siphoning of this fluid, with or without administration of oxytocin, may aid in the expulsion of the membranes. Daily lavage may be performed using large volumes of isotonic electrolyte solutions to remove debris and toxic mediators. Lavage will be minimally beneficial while the chorion remains attached to all portions of the endometrium, as only the allantoic cavity will be flushed. In cases in which the chorion remains adherent in only one region of the uterus, usually the nonpregnant horn, lavage may be beneficial in reducing the exposure of the endometrium to bacteria, endotoxin, and other inflammatory mediators.

While cases of RFM can be treated in the field, vigilant monitoring of the mare’s systemic health, with particular attention to hydration status, renal function, evidence of endotoxemia, and signs of impending laminitis, must be performed. Following passage of the fetal membranes, they should be examined to document completeness and the uterus should be lavaged. Antimicrobial and anti-inflammatory medications are usually administered for 1-2 days after passage of the fetal membranes. Provided the mare does not develop secondary complications, prognosis for life is excellent and future fertility is good. Generally, foal heat breeding of mares recovering from dystocia/RFM is discouraged.
**Uterine Laceration**

Dystocia and vigorous obstetrical interventions increase the risk for uterine laceration. Routine manual evaluation of the birth canal and uterus following delivery of the foal may identify a catastrophic uterine tear in the immediate post-partum period. However, lacerations may affect the uterine horn tips, well beyond the reach of the average clinician, or may be relatively small and obscured by the endometrial folds, thus escaping detection. In such cases, mares are generally presented 26-42 hours following parturition with clinical signs of peritonitis secondary to contamination of the abdomen by bacteria and debris from the uterus. The most common presenting complaints in one study were depression and mild colic with other clinical signs including tachycardia, toxic mucous membranes, ileus and fever.

Evaluation of a mare suspected to be suffering from a uterine laceration involves establishment of the diagnosis of peritonitis and attempted confirmation of the presence and location of the defect in the uterine wall. Analysis of a peritoneal fluid sample obtained via abdominocentesis reveals an increased white cell count, often in excess of 100,000 cells/µL, indicative of septic peritonitis. Leukopenia, hyperfibrinogenemia, hemoconcentration and azotemia may be noted on routine blood work. Anecdotally, findings on palpation per rectum may be suggestive of a uterine laceration, with the uterus apparently more involuted (smaller) than would be expected 1-2 days post-partum and exhibiting marked tone. Palpation per rectum may also be useful in differentiating gastrointestinal disorders that may share some clinical signs with uterine laceration and that are relatively common during this post-partum period, e.g., large colon volvulus. Uterine lacerations may be identified via manual exploration of the reproductive tract, particularly in cases in which tears have been sustained in the body of the uterus. Abdominal organs are sometimes palpable in the uterine lumen or through the defect in the uterine wall. In the largest retrospective review of confirmed uterine lacerations, all (n=11) lacerations of the uterine body were located by transrectal and/or transcervical palpation, but only 3 of 22 defects in the uterine horns were identified by these examinations. A final method of examination that is particularly useful in diagnosing tears in the dorsal body of the uterus involves transmural palpation of the uterine wall. To perform this procedure, one arm is placed into the reproductive tract and the other is simultaneously inserted into the rectum. The uterine wall is then lifted towards the rectal wall and the hand in the rectum advances along the serosal surface of the uterus, palpating for defects. In addition to some tears being beyond the reach of palpation, it should be recognized that very small tears may seal over by the time of presentation and affected mares may present only with signs associated with the resultant peritonitis.

While uterine lacerations are commonly full-thickness tears, partial-thickness defects are also possible. In such cases, the results of peritoneal fluid analysis reveal milder abnormalities than are observed in mares with fulminating septic peritonitis secondary to full-thickness uterine laceration. (It should be noted that in mares that foaled without complication and those experiencing dystocia but in which recovery was uneventful, total protein and nucleated cell counts of peritoneal fluid samples do not exceed 2.5 ng/mL and 5,000 cells/µL, respectively, in most cases.) In the absence of other identifiable causes of peritonitis, e.g., cecal perforation and other bowel trauma, exploratory laparotomy is required to confirm the diagnosis of a uterine laceration.

Treatment of large full-thickness uterine tears requires surgical intervention, while some small and/or partial-thickness defects may be managed medically. In either case, aggressive treatment of resultant peritonitis requires intravenous administration of broad-spectrum antimicrobials (usually gentamycin and potassium penicillin), anti-inflammatory medications, and balanced electrolyte solutions. In recalcitrant cases, metronidazole may be added to the antimicrobial pallet and peritoneal lavage may be performed via an in-dwelling lavage tube. Uterine lavage may be performed in mares that have undergone surgical repair of the uterine laceration, beginning one day post-operatively.

While it is certainly true that the risk of uterine trauma increases during dystocia and its resolution, uterine lacerations have also been documented to occur with apparently normal, unassisted parturitions. In the largest retrospective study examining mares confirmed to suffer from uterine lacerations, a history of obstetrical manipulations to resolve dystocia was provided for only 10 of 33 mares. Thus, caution must be exercised when performing uterine lavage on all post-partum mares in that the inability to recover fluid may suggest a defect in the uterine wall.

Prognosis for life in mares suffering from uterine laceration is somewhat dependent upon the interval between parturition and treatment. Failure to survive has been associated in the short-term with marked septic or hypovolemic shock, reinforcing that prompt diagnosis and initiation of treatment contributes significantly to successful outcome, and over the long-term the formation of adhesions or the development of laminitis. While no significant published data regarding subsequent fertility exists, repaired uterine lacerations often heal so effectively
as to prevent future identification of the lesion. Thus, in the absence of adhesions impairing uterine clearance, we suspect that fertility will not be significantly impaired.\(^5\)

**Intussusception of the Uterine Horn**

Inversion of the tip of a uterine horn is a rare cause of colic in the post-partum mare, but may be more common following protracted dystocia due to uterine atony\(^5\) or as a result of excessive straining against\(^9\) or extreme traction on retained fetal membranes.\(^10\) If uncorrected, the condition may progress to complete uterine prolapse, a life-threatening condition in the mare, or the inverted uterine horn tip may become devitalized and, ultimately, necrotic, necessitating surgical intervention.\(^10\)

The mare affected by an intussuscepted uterine horn demonstrates mild to moderate colic, persistent straining, and tachycardia. Some debate exists regarding the usefulness of palpation per rectum in the diagnosis of this condition. While some authors advocate palpation per rectum, stating that the intussusception may be identified as a thickened, shortened uterine horn,\(^10\) others prefer to forego this procedure, as it may exacerbate straining. Concentric rings of uterine wall may be identified by transrectal ultrasonography.\(^5\) Manual evaluation of the uterine lumen allows for palpation of the inverted horn tip projecting towards the uterine body, which is diagnostic.

Mares in which an early diagnosis of uterine horn intussusception is made generally suffer no significant systemic illness. In order to reduce straining during the correction and diminish the likelihood of recurrence, epidural anesthesia is administered in addition to sedation and systemic analgesia. The uterine horn is everted to its normal anatomic position through the infusion of isotonic fluids to distend the lumen or via manual eversion. In mares in which the clinician cannot reach the horn tip, the smooth end of a sterile, disposable speculum may be used to extend one’s reach and ensure full eversion.\(^5\) Uterine lavage may then be performed. Following return of the horn tip to its normal anatomic position, oxytocin (10-20 international units intravenously per 500 kg mare) is administered to increase uterine tone and deter recurrence. Failure to completely correct the inversion results in continued straining as soon as epidural anesthesia expires.

Post-procedural care includes administration of broad-spectrum antimicrobials and systemic anti-inflammatory agents, as well as intravenous fluid therapy as indicated. The prognosis for subsequent fertility is generally good with timely diagnosis and replacement of the inverted horn tip presuming no significant damage to the endometrium has occurred.

**Uterine Prolapse**

Complete prolapse of the uterus is a rare event in the mare and is associated with the same risk factors that result in intussusception of the uterine horn. Complete uterine prolapse may occur hours to days after parturition, with or without retention of the fetal membranes. Diagnosis is readily apparent at presentation and is often possible over the phone. In cases in which the problem is identified by the owner, the clinician should advise the client to place the prolapsed tissue into a garbage bag or sheet and elevate it to the level of the vulva. Not only will this procedure deter the continued accumulation of edema in the prolapsed tissue, rendering subsequent replacement easier, it will also decrease the opportunity for trauma to the tissue and reduce the tension on the broad ligament and, hence, the probability of rupture of a major uterine vessel. Expeditious replacement of the uterus is critical to survival of the mare.

As in the treatment of uterine horn inversion, systemic analgesia and epidural anesthesia are applied. Caution must be exercised in sedating mares with uterine prolapses, as decreased blood pressure induced via administration of commonly employed tranquilizers may exacerbate preexisting shock. Prior to replacement, the uterus is cleaned using sterile saline and examined carefully for lacerations, the presence of an everted bladder or bowel loop within the prolapsed tissue, and evidence of ischemia and necrosis. Lacerations deeper than simple endometrial tears should be closed using absorbable suture.\(^10\) Gentle traction may be applied in an attempt to remove fetal membranes, if present; however, vigorous efforts at removal are contraindicated as they may result in additional trauma to the endometrium.\(^5\) In order to deter continued edema in the prolapsed tissue, the cleaned uterus may be suspended in a sling and elevated. Beginning with the caudal portion of the uterine body and working towards the horn tips, the prolapse is replaced by kneading the tissue into the vagina using a flat hand with obstetrical lubricant applied.\(^5,10\) Following replacement, a large volume of sterile saline is infused into the uterine lumen in order to ensure that both horn tips have been fully distended, i.e., do not remain intussuscepted, and oxytocin (10-20 IU intravenously) is administered. Supportive care includes the administration of balanced polyionic fluids supplemented with calcium borogluconate, broad spectrum systemic antimicrobials, anti-inflammatory medications, and tetanus prophylaxis. Post-replacement monitoring must consider the potential for hemorrhagic shock secondary to rupture of one of the large uterine vessels, for the development of metritis.
followed by endotoxemia and laminitis, and for the occurrence of peritonitis secondary to ischemia of bowel segments trapped within the prolapse. With prompt, effective treatment and barring complications, the prognosis for life is good. Future fertility appears to be inversely related to the degree of trauma inflicted upon the exposed endometrium.

**Trauma to the Vagina and Vestibule**

While perineal lacerations and contusions of the birth canal may be observed in mares foaling spontaneously and apparently without incident, development of vaginal hematomas, abscesses and necrosis are more commonly associated with protracted dystocia and intensive obstetrical interventions. Minor mucosal abrasions and contusions generally heal without treatment. However, mares exhibiting colic and/or sanguinous or malodorous vulvar discharge post-partum in which gastrointestinal and uterine origins, respectively, have been excluded, must be examined for severe trauma to the caudal reproductive tract.

Hematomas associated with the vaginal wall are palpable per vaginum as fluctuant swellings located most commonly in the ventral or ventrolateral aspect of the vaginal wall. Palpation per rectum may assist in determining the extent of the hematoma, as disruption of the pudendal or a vaginal artery may result in a large hematoma dissecting along intrapelvic fascial planes, potentially draining into the abdominal cavity. Mares suffering from hematomas confined to the vaginal wall may be treated using an intravaginal ice pack fashioned by filling a rectal sleeve with crushed ice and inserting it into the caudal reproductive tract for 20-30 minutes two to three times daily. Additionally, an anti-inflammatory medication such as flunixin meglumine or phenylbutazone should be administered for several days. Such hematomas generally self-resolve, consolidating over several weeks. However, hematomas should be monitored closely for abscessation. Abscessation should be suspected in mares in which a hematoma fails to decrease in size or in which malodorous discharge develops. In the absence of vulvar discharge, a static mass may be examined using ultrasonography per rectum or vaginum to confirm the diagnosis of an abscess and to locate an appropriate area of the abscess to lance to provide a portal for drainage and lavage, provided no communication with the peritoneal cavity exists. Due to the ventral or ventrolateral location of the majority of hematomas and abscesses, the establishment of drainage can be challenging. In addition to daily lavage of the abscess cavity using a dilute povidone iodine solution, mares should be administered systemic antimicrobials such as trimethoprim sulfamethoxazole for at least 10 days.

The approach to treatment of vaginal lacerations depends upon a number of factors, including the depth of the laceration, whether or not the laceration communicates with the peritoneal cavity, and chronicity at the time of diagnosis. Diagnosis is facilitated by vaginal speculum examination to identify the location of the defect and manual exploration to ascertain the depth of the laceration. Acute full-thickness lacerations accessing the abdominal cavity require immediate suturing per vaginum to prevent herniation of bowel and the development of peritonitis. Acute partial-thickness vaginal lacerations extending deeper than the submucosa may also benefit from repair. However, partial thickness lacerations discovered several days following parturition generally cannot be sutured and should, instead, be managed to heal by second intention. Lavage of the wound using dilute betadine solution may be performed initially, followed by application of an emollient such as a dry cow mastitis preparation every other day to provide local antimicrobial therapy and deter adhesion formation. Application of the ointment should be preceded by manual disruption of any developing fibrinous adhesions. Prophylaxis against tetanus should be provided and broad spectrum systemic antimicrobial and anti-inflammatory medications should be administered for 5-7 days.

Prolonged presence of a foal in the birth canal, extensive intravaginal manipulations and the presence of untreated vaginal lacerations predispose dams, particularly miniature mares and donkey jennies, to the development of necrotic vaginitis. Necrotic vaginitis may self-resolve in some mares, while others present with clinical signs of lethargy, depression, anorexia or weight loss. The presence of necrosis is confirmed by visualization of green to black mucosa by vaginal speculum examination. Subsequent manual evaluation may result in readily debrided malodorous vaginal tissue. Both of these examinations may elicit a painful response from the mare. Treatment includes long-term (at least 10 days) administration of an appropriate antimicrobial medication based upon culture and sensitivity test results, provision of prophylaxis against tetanus, manual debridement of devitalized tissue, and daily topical application of an emollient containing antibiotics and steroids. Defects in the vaginal mucosa are filled by granulation tissue over approximately one week; however, strictures may form, with negative implications for future fertility.
REFERENCES