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Common Postpartum Problems in Mares

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Usually mares recover uneventfully after foaling and do not require any specific treatment. However, pathologies that occur in the periparturient period can have great consequences for the mare and her future reproductive career. Differentiating the cause of postpartum problems can be challenging. It is important to examine the overall systemic health of the mare, with particular attention paid to the reproductive and gastrointestinal tracts. Diagnostic tools including routine blood work, transrectal examination of the gastrointestinal and reproductive tracts, abdominocentesis and passing a stomach tube per os to identify reflux. Routine examination should also include ultrasonography. Specific details regarding diagnosis and management of some of the more common postpartum conditions, particularly those that threaten systemic health, are discussed. It should be noted that the physical exam of a postpartum mare could have vital signs that are different from a non-foaling mare.

Retained Fetal Membranes (Placenta)

The placenta is normally passed between 1 and 3 hours in the mare. Academically, a placenta is considered retained if it is not passed within 3 hours of delivery. Practically speaking, many mares will retain a placenta longer than three hours without untoward effects. However, retained fetal membranes, no matter how small the tag of tissue, can be life threatening to the mare if she develops more serious conditions such as metritis, endotoxemia and/or laminitis. Predicting which mares will develop significant illness after retaining fetal membranes is challenging. Fortunately, with proper treatment, most mares will pass the retained tissue and not suffer significant systemic illness.

To facilitate examination of the fetal membranes, the placenta should be protected from being torn by the mare. This is best achieved by tying the amnion into a knot to reduce the likelihood of the mare stepping on the placenta. The passed placenta must be evaluated carefully. The entire placenta should be weighed. The fetal membranes should weigh approximately 11% of the body weight of the foal at birth. Abnormally heavy placentas are generally an indication of placental infection/inflammation. For examination, the chorioallantois should be placed in the shape of the letter F and inspected for completeness. Both chorionic (red velvety) and allantoic (opaque white) sides of the placenta should be inspected for tears, discoloration, thickening, exudate, and avillous areas. A complete placenta (choioallantois) (Fig. 1) should have the following:

- two intact uterine horns with tips
- intact uterine body
- the cervical star as the point of rupture
- thin, opaque amnion

Figure 1. Intact equine fetal membranes viewed from chorioallantoic surface. The membranes have been configured in an “F” shape to allow for examination of the previously pregnant and non-pregnant uterine horns, uterine body and point of rupture at the cervical star.

The most common place for fetal membrane retention is the tip of the non-pregnant horn. A practical method for determining if the placenta is intact is to use a garden hose to fill the placenta while clamping it closed at the cervical star.

If the fetal membranes are retained for greater than three hours, several treatment options exist. Oxytocin is often the first line of defense for treatment of retained fetal membranes. Oxytocin promotes uterine contractions and facilitates the release of placental microvilli from endometrial crypts. There are several anecdotal methods to administer oxytocin. Frequent boluses of 10-20 IU oxytocin, IV or IM, are methods that are easily used in field conditions. Oxytocin injections are generally administered at 4-6 hour intervals. Another method for oxytocin administration is slow infusion of 30 – 60 or up to 80 - 100 IU oxytocin, mixed in 1-2 L saline, over 30 minutes. Finally, for the hospitalized patient with an IV catheter in place, 40-60 IU of oxytocin can be added to 3-5 L of lactated Ringer's solution and the fluid administered at a slow IV drip. This method of administration likely results in continuous “loading” of oxytocin receptors which may or may not be beneficial for stimulating uterine contractions and membrane release.

Additional treatments are frequently added to the administration of oxytocin particularly in cases of dystocia, prolonged retention or cesarean section. A typical treatment protocol in the field would include broad spectrum antibiotics (penicillin and gentamicin, ceftiofur or trimethoprim sulfamethoxazole) and an anti-inflammatory agent (flunixin meglumine). If the mare showed more serious signs of illness, therapies such as metronidazole (anaerobes), polymixin B (endotoxin scavenger), or fluid therapy (systemic support) might be considered. Commonly used drugs are listed below:
• Systemic antibiotics to prevent bacterial growth - for at least 5 to 7 days
  o Potassium Penicillin - 22,000 units/kg, IV, q 8 h
  o Procaine Penicillin - 22,000 units/kg, IM, q 12 h
  o Gentamcin - 6.6 mg/kg, IV, q 24 h
  o Ceftiofur (Naxcel) - 2.2 - 4.4 mg/kg, IM, q 24 h
  o Trimethoprim sulfa - 15-30 mg/kg, PO, q 12 h
  o Metronidazole - 25 mg/kg, PO, q 12 h
  o Polymixin B - 1000-6000 units/kg, IV (slowly), q 12 h

• Anti-inflammatory agents
  o Flunixin meglumine - 1 mg/kg, IV, q 12 h (anti-inflammatory dose)
  o Phenylbutazone - 2.2-4.4 mg/kg, PO, q 12 h
  o Pentoxifylline - 8.5 mg/kg, PO, q 12 h

• IV fluids spiked with of calcium borogluconate (125 ml of 23% calcium borogluconate added to 5 L fluids\(^1\) (if mixed with oxytocin may cause precipitation).

Daily large volume uterine lavages with 0.9% saline or lactated Ringer’s solution are a routine part of managing mares with retained fetal membranes. Homemade (non-sterile) saline can be made in large batches by mixing 35 grams of table salt (NaCl) with 4 L of tap water resulting in approximately a 0.9% NaCl solution. The saline should be warm (40-42°C). In a typical 12 L stainless steel bucket, 3 oz of salt measured in a urine specimen cup provides an approximate 0.9% NaCl solution. For postpartum mares, lavage volumes of up to 10-12 L at a time are infused into the uterus using a sterile/clean nasogastric tube and stomach pump (Fig. 2). The fluid is then siphoned back from the uterus with careful attention to bits of tissue that are expelled. This procedure may be complicated by tissue occluding the tip of the tube. Carefully guarding the end of the tube with a gloved hand will allow lavage of the uterus; however, it may result in recovery of small volumes of fluid at a time.

![Equipment for performing large volume uterine lavage in the postpartum mare including: 12 L stainless steel bucket, clean/sterile stomach pump and large bore nasogastric tube, table salt, urine specimen cup, sterile sleeve and lubricant.](image)
Several procedures have been advocated to promote mechanical release of the fetal membranes. One technique, termed the “Burn’s Technique” involves distention of the chorioallantois to promote release of microvilli from the endometrium and subsequent placental release.² This procedure is possible to perform only if the chorioallantois is intact. The chorioallantois is distended with large amounts (up to 12 L) of saline through a sterile nasogastric tube. The fetal membranes are tied or held closed around the tube in the vestibule and tied with umbilical tape or held closed with the operator’s hand. Fluid is maintained in the uterus for several minutes. Some will clamp the tube off and walk the mare with the fluid in the uterus. The placenta and fluid are often expelled as one unit. Any remaining fluid is siphoned off using a standard lavage technique. The Burn’s technique is thought to stimulate endogenous oxytocin via stretch activation of the uterus thus promoting expulsion of the membranes.

If a small piece of placenta is retained, it can be difficult to retrieve through routine procedures (Fig. 3). Often, these placental remnants are small enough that they are contained within the uterine lumen. Consequently, even with strong uterine contractions, the mare has difficulty expelling the tissue. If possible, exteriorizing the tissue and placing a small amount of weight may facilitate release. This technique is controversial. A common procedure practiced at the University of Florida includes attaching a small plastic bottle with approximately 250 ml fluid to the placental tag with suture material or umbilical tape. Alternatively, a rectal sleeve filled with a small amount of lubricant gel can be used. The goal is to apply gentle but persistent tension on the tissue tag to promote release. Caution must be used to avoid significant weight attached to the placenta as uterine prolapse can occur as a result of this procedure. Mares with small weights attached to fetal membranes should be observed closely until the tissue is released. Once the tissue is expelled, it should be examined carefully to be sure it is intact. Often, these small remnants are the full tip of the non-pregnant uterine horn (Fig. 4).

Figure 3. Fetal membranes (chorioallantoic surface) missing the tip of the non-pregnant uterine horn.

Figure 4. Tip of non-pregnant horn from fetal membranes retained in a mare. The tissue was retrieved after several days of uterine lavage and placing a small weight on the exteriorized tissue.
Manual retrieval of fetal membranes is controversial. Results from a recent study suggest that manual removal of membranes in the immediate postpartum period will not significantly diminish future fertility. Normal post-foaling mares were included in this study and it is likely that the membranes were in the process of detaching at the time of removal. It is postulated that retained fetal membranes differ physiologically from membranes in normal foaling mares suggesting that the two populations are not comparable. Gently twisting fetal membranes, sometimes with the aid of the membranes wrapped around a sweat scraper, has also been anecdotally described as an effective method for removal of fetal membranes. Consequences of aggressive manual removal of placental membranes include hemorrhage, retained tissue and uterine prolapse.

Exercise in mares with retained fetal membranes is essential for promotion of uterine contractions and expulsion of the membranes. Exercise should be controlled and in an area where the mare can be observed for the possibility of uterine prolapsed or laminitis.

Mares that retain fetal membranes are not good candidates for breeding on foal heat. Generally, these mares are allowed to ovulate spontaneously on foal heat and then treated with prostaglandin (short cycling) to undergo luteolysis. Alternatively they can be bred on their second natural estrous cycle postpartum.

**Metritis/Laminitis/Septicemia Complex**

Metritis is a condition that occurs infrequently in normal postpartum mares. However, metritis is a life-threatening condition and requires prompt treatment. Metritis is often secondary to retained fetal membranes or gross contamination at foaling. For mares that experienced foaling complications, clinical signs of metritis often become evident 12-24 hours after delivery, although signs may occur as early as 8 h or as late as 3 to 4 days after foaling. Hallmark clinical signs for metritis include fetid vulvar discharge. Fetid vulvar discharge should not be confused with normal lochia production in the postpartum mare. Lochia is not malodorous but can be variable in color (reddish brown to white, and may be dependent on how far after delivery the mare is). Additional clinical signs include fever, muddy mucous membranes, and leucopenia that could lead to endotoxemia and laminitis in advanced cases.

Metritis is an emergency condition and must be treated immediately to avoid complications such as endotoxemia, septicemia, laminitis and death. The first line of treatment includes evacuation of uterine contents to eliminate toxins. Again, homemade saline can be used in the postpartum mare. In addition, oxytocin is administered in small boluses (10 - 20 IU, IM, q 4-6 hrs) to aid in mechanical evacuation of the uterus. When possible, exercise is also beneficial for mechanical uterine evacuation.

If the mare becomes systemically ill, she should be treated routinely for endotoxemia using broad spectrum systemic antibiotics for aerobic and anaerobic bacteria, non-steroidal anti-inflammatory drugs and IV fluids for systemic support (drug dosages listed under retained fetal membranes). Mares with acute toxemia might benefit from administration of Polymyxin B, an antimicrobial with endotoxin scavenging properties. The drug is thought to be most effective in the first 24-48 hours after insult after which time tolerance to the toxic effects of
lipopolysaccharide/endotoxin develops. Mares administered Polymyxin B must be well hydrated and monitored carefully due to potential nephrotoxic and neurotoxic effects of the drug. Polymyxin B is costly and is typically reserved for the mare showing signs of acute toxemia.

Preventative measures for laminitis that are employed include icing of feet every 2 hours and deep bedding in the stall with or without packing of the soles. The systemically ill mare frequently requires hospitalization and close monitoring until disease resolves.

**Peripartum Hemorrhage**

Postpartum hemorrhage is a rare but often grave event. Hemorrhage most frequently occurs in older, multiparous mares but has also been reported in young mares. Hemorrhage may or may not be associated with dystocia. While hemorrhagic crises most frequently occur in the postpartum period, occasionally mares will suffer hemorrhage prior to foaling. The middle uterine artery ruptures most frequently. Other vessels that can rupture include the external iliac, utero-ovarian and vaginal arteries.

General signs of discomfort or colic in a late pregnant or foaling mare may indicate a hemorrhagic event and should be thoroughly investigated to rule out a gastrointestinal problem. The clinical signs for a mare with peripartum hemorrhage are variable depending on the source and severity of hemorrhage. The mare that suffers an acute rupture of a vessel with a direct bleed into the abdomen rapidly experiences hypotensive shock and frequently dies. The mare will be agitated and uncomfortable, tachycardic, tachypnaeic, sweaty and her body temperature will drop. Mucus membranes are pale and CRT is greater than 2 seconds. Medical intervention is rarely helpful in these situations. Alternatively, hemorrhage may be contained within the broad ligament and a clot may form. In this instance, the mare often will show strong signs of discomfort as the tension on the broad ligament increases. Mares that experience hemorrhage directly into the uterus or vagina often show fewer signs of discomfort. However, with hypovolemia, these mares are also anxious. In all cases of hemorrhage, the mare may also demonstrate the Flehman response. Vulvar bleeding is the most common sign in mares with trauma to uterine or vaginal vessels.

Diagnosis is initially made after identification of clinical signs. Confirmation of hemorrhage is made using a variety of tools. Changes in peripheral packed cell volume often lag after the hemorrhagic event due to splenic contraction. However, total protein concentration will decrease prior to decline in hematocrit and a significant drop in either can aid in diagnosis.

Transabdominal ultrasound examination is useful for identifying active hemorrhage with evidence of free fluid in the abdomen. While the amount of fluid in the abdomen will be variable in each mare, the fluid character is typically echogenic (cellular) with swirling patterns. Rarely will the site of hemorrhage be identified from a transabdominal approach. However, transabdominal ultrasonographic examination is simple and should be the first diagnostic tool implemented after physical examination. Transabdominal ultrasound examination can also be used to identify pockets of free fluid so that abdominocentesis can be performed, if necessary, to confirm hemorrhage. Gross and cytological evaluation (including PCV and TP) of abdominal fluid can confirm abdominal hemorrhage.
Careful evaluation of the reproductive tract, using transrectal palpation and ultrasonography, can reveal bleeding in the broad ligaments or uterus. Blood may be either free-flowing, clotted or both. Care must be taken to prevent disruption of existing clots as the clot may be the primary reason the mare has survived the hemorrhage. Transrectal ultrasonographic examination is more likely to reveal the site of hemorrhage than transabdominal examination. However, the risks of disrupting a clot (that may be saving the mare’s life) are also high with transrectal manipulation, so determining the site of the hemorrhage may be academic in the acute phase. Transrectal ultrasonographic examination of the tract may be more useful for monitoring clot stabilization or continued bleeding after the mare has stabilized.

Treatment for mares with peripartum hemorrhage is challenging and often controversial. If the mare survives the initial hemorrhage, it is likely that a clot has formed. In all cases, keeping the mare quiet is paramount to her survival. Some advocate removing the foal to reduce the activity level of the mare. In the author’s experience, the mare often becomes very agitated when the foal is removed, thus increasing her blood pressure and exacerbating her systemic crisis. Others advocate tranquilization to keep the mare quiet. Agents that affect blood pressure, such as acepromazine, should be avoided in mares experiencing hemorrhagic crisis.

A variety of therapies have been recommended to treat hemorrhagic shock in horses. Volume replacement, either with colloids or crystalloids, are often advocated in horses experiencing shock. One or two large bore catheters can be placed in jugular veins to facilitate rapid volume replacement. Fluid replacement can consist of the following:

1. Colloids: 3-4 L plasma, IV, to provide clotting factors and protein replacement. Alternatively, whole blood can be administered but may be more labor intensive since it is not commercially available and requires collection from a donor animal. A blood transfusion may be necessary in a rapidly deteriorating animal as it increases oxygenation to the animal via red blood cells. Cross matched donors (geldings are best) that are negative for equine infectious anemia should be used for blood transfusion.
3. Follow hypertonic saline with 1-2 L warmed polyionic crystalloid fluid such as isotonic saline, Normosol-R or plasmalyte. These solutions provide volume expansion, buffering and dispersal of fluid to intravascular spaces.

Other therapies that may be beneficial for mares experiencing hemorrhagic crisis include:

- aminocaproic acid (inhibits fibrinolysis; 3.5 mg/kg/min for 15 minutes then 0.25 mg/kg/min for 4-6 hours)
- flunixin meglumine (anti-inflammatory, 1 mg/kg, IV, q12 h)
- broad spectrum antibiotics (prophylactic)
- Yunnan baiyao (Chinese herb thought to decrease bleeding times)
- naloxone (pure opioid agonist, 0.01-0.02 mg/kg, IV)
- formalin (30-100 mg 10% formalin diluted in 1 L 0.09% saline solution).

Uterine Tear/Rupture

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Uterine tears most frequently occur in the postpartum mare after dystocia or forceful assisted foaling. However, uterine tears can also occur as a result of a normal foaling, particularly if the foal is large. The most common locations for uterine tears are the dorsal wall of the uterine body or the tip of the pregnant horn. Strong uterine contractions and fetal limb activity make these sites particularly vulnerable to trauma. Development of clinical signs is directly correlated to the severity of the tear (partial vs. full thickness) and location, either on the dorsal or ventral aspect of the uterus.

Clinical symptoms are often insidious, particularly with a slow-leaking, dorsally located lesion. Frequently, the mare is normal for the first few days after delivery. As peritonitis develops, the mare becomes increasingly ill. Typical signs include dullness, listlessness, inappetence, decreased gut motility, poor perfusion and increased heart rate. Occasionally, vulvar bleeding is detected.

Diagnosis of uterine tears can be challenging. Tears are often small and contract quickly after parturition. Additionally, edema within the uterine folds can make them hard to identify while tears located at the tip of a uterine horn are difficult to reach, particularly in large mares. Uterine tears are detected most often by manual palpation in the immediate postpartum period. All mares experiencing dystocia or assisted delivery should have a thorough digital examination of the uterus performed.

Uterine tears need to be ruled out in any postpartum mare that presents with general malaise. Abdominocentesis is often the most accurate method for diagnosing uterine tears, particularly those that have been present for a few days. Abdominal fluid collected from mares with uterine tears is consistent with septic peritonitis and is characterized by an elevated white blood count (often with toxic cellular changes), hemorrhage and/or bacteria. Abnormalities in systemic blood parameters, such as neutropenia, toxicity and increased fibrinogen are also seen in mares experiencing toxicity secondary to peritonitis.

As peritonitis can be life-threatening it must be addressed rapidly. Mares with uterine tears require systemic antibiotic coverage, administration of non-steroidal anti-inflammatory agents, fluid therapy and possibly peritoneal lavage. While many believe that surgical correction of uterine tears is the most expedient means for resolving peritoneal contamination, there have been reports of mares surviving uterine tears after medical management. Cost and length of hospitalization were not different after surgical correction of uterine tears vs. medical management. Short-term differences in return to reproductive function were also not seen, but long-term effects of potential adhesion formation in mares treated medically for uterine tears and peritonitis were not evaluated. Once peritonitis is resolved, prognosis for recovery is good.

Mares with significant compromise to uterine integrity or uterine rupture have a more life-threatening condition than slow-leaking, small tears. Outright uterine rupture typically occurs after prolonged foaling and dystocia. Mares suffering uterine rupture generally have extensive gross contamination of the abdominal cavity. Immediate surgical correction of the ruptured uterus, and aggressive therapy for peritonitis provide the best prospects for saving the life of the mare. The prognosis for survival is grave in mares with a uterine rupture.
Cervical Trauma/Tears

The combined actions of coordinated uterine contractions moving the fetus into the pelvic canal and continued oxytocin secretion promote cervical dilation during equine parturition. However, the rapid nature of equine parturition predisposes the mare to cervical trauma if the cervix is not adequately dilated at the time of delivery. Dilation requires that both the inner smooth muscle layer with a circular orientation and the outer, longitudinal smooth muscle layer relax to allow passage of the fetus. Explosive delivery, passage of a large foal, assisted delivery before cervical relaxation and dystocia are all causes of cervical trauma and/or lacerations.

Diagnosis of cervical trauma can be challenging in the immediate postpartum period. Under normal delivery conditions, the mare’s cervix is edematous after delivery. Furthermore, the longitudinal folds of the cervical lumen become grossly exaggerated following expulsion of the foal making it difficult to accurately evaluate cervix integrity digitally. For the mare suffering dystocia, gross digital evaluation of the cervix can reveal overt cervical lacerations and tissue trauma. For those mares with normal foaling or less severe trauma, it is best to digitally evaluate cervical integrity during diestrus following the first postpartum estrus. The cervix should be evaluated for patency, presence of adhesions, tears in the muscle lacerations and its ability to close.

Mares with acute cervical trauma must be managed aggressively to circumvent adhesion formation. After cleansing the perineal area, the cervix is examined digitally for adhesions and, if present, broken down manually. Adhesions commonly reform rapidly, so mares need to be managed daily. The cervix should be treated for 7 or 8 days, the mare given 1 to 2 days off, and the cervix re-examined to determine if adhesions have reformed. If they have, treatment is re-instituted for 6 to 8 days. A second follow up evaluation is performed after the second postpartum estrus. At this time, the integrity of the cervix can be evaluated as well as presence of adhesions. Ointments containing steroids can be applied locally to help prevent adhesion formation. Panalog® is a commercially available cream containing neomycin and thio{}streptone (antibiotics), nystatin (antifungal) and triamcinolone (corticosteroid to reduce inflammation) that can be used for this purpose. Alternatively, “homemade” ointments can be prepared and used at a significantly lower cost. A variety of formulations exist but generally consist of a base ointment (a jar of furacin, lanolin or A&D ointment), steroid (20-40 mg dexamethasone), and in some cases, a vehicle (dimethyl sulfoxide, DMSO). Care should be exercised to prevent deposition of a steroid containing ointment in uterine lumen, when possible. Mares diagnosed with cervical lacerations may require surgical intervention if the defect entails more than 50% of its length, 25% of its diameter or is located in the ventral aspect of the cervical canal. Assisted reproductive techniques, such as embryo transfer, are alternative options for mares with cervical defects.

Trauma to the Caudal Reproductive Tract

The tissues of the caudal reproductive tract can be damaged after a difficult foaling (Fig. 5). Mild bruising in the vestibule and vulvar region commonly occurs after normal foaling. However, extensive trauma, and even ischemic necrosis, can occur after assisted foaling, dystocia or delivery of a large foal. The caudal tract should be evaluated both visually (via vaginal speculum) and digitally to determine the extent of any lesions. Significant bruising or tears
within the vagina, vestibule or urethral orifice must be addressed similarly to cervical trauma to avoid adhesion or abscess formation. Damaged areas should be carefully cleaned using dilute antiseptic solution (5 ml 10% povidone iodine solution in 1 L saline) or plain saline and topical ointment applied. Early in the healing period, mares should be evaluated and treated on a daily or every other day basis. During the treatment phase, the goal is to promote tissue healing from the “outside in” so that pockets of dead space do not form and predispose to abscess formation.

With significant trauma, one can expect sloughing of the damaged tissue. Mares suffering from ischemic tissue necrosis occasionally become systemically ill. Prophylactic administration of broad spectrum antimicrobials and anti-inflammatory agents is recommended. In addition, the structural integrity of the vulva is often compromised after foaling trauma. Therefore, a Caslick’s suture or perineal reconstruction procedure may be required to address vulvar defects (Fig. 6).

Figure 5. Trauma to the vulva and vestibule after foaling.

Figure 6. Appearance of the vulva after foaling induced trauma and treatment. Note loss of integrity to vulvar lips and need for reconstructive surgery (to replace temporary suture).

Summary

In most cases, foaling is an expedient and uneventful process. Like many other things that affect horses, postpartum complications are rare, but they often pose a significant health and/or fertility risk to the mare. Rapid identification of a problem and administration of useful treatment can save the life of the mare both figuratively and as a reproductive unit.

References