Reproductive Problems of the Post-Partum Mare

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A wide variety of problems or complications may occur during the foaling process or in the first few days after foaling (Table 1). Most are relatively minor and/or transient, such as the discomfort associated with uterine involution in the early postpartum period, while others are potentially life threatening, such as a uterine rupture or laminitis secondary to a retained placenta.

Table 1. List of common and less common problems of mares in the post-partum period.

Common Problems	Less Common Problems
Reproductive System	**Reproductive System**
▪ Pain or colic postpartum	▪ Septic metritis
▪ Prolonged discharge of lochia	▪ Uterine prolapse
▪ Retained fetal membranes	▪ Uterine laceration, rupture, or trauma
▪ Vaginal trauma or bruising	▪ Hemorrhage from uterine or ovarian vessels (i.e,. uterine artery rupture)
▪ Perineal trauma or bruising	▪ Cervical laceration or trauma
▪ Uterine horn intussusception	
Intestinal System	**Intestinal System**
▪ Impaction	▪ Large colon torsion/volvulus
▪ Large colon displacement	▪ Trauma or rupture of intestinal tract
	▪ Ischemic bowel necrosis
	▪ Rectal prolapse
Urinary System	**Urinary System**
	▪ Rupture of urinary bladder
	▪ Prolapse of urinary bladder
	▪ **Urinary incontinence**
	▪ **Urovagina**
Musculoskeletal System	**Musculoskeletal System**
	▪ Abdominal wall herniation
	▪ Ruptured prepubic tendon
	▪ Diaphragm rupture
Behavioral Issues	**Behavioral Issues**
▪ Foal Rejection	▪ Aggressive/Protective Behavior
	Mammary Issues
Mammary Issues	▪ Hypogalactia/agalactia
▪ Poor quality colostrum	

Post-Partum Pain or Colic

A majority of multiparous mares do not exhibit overt signs of discomfort after foaling. However, some mares may show mild to severe signs of abdominal pain in the post-partum period. The most common cause of post-partum pain is the uterine contractions that continue after delivery of the foal has been completed. The behavioral response of mares with a low pain tolerance to these normal uterine contractions may be dramatic. Additional and more medically challenging causes of post-partum pain includes displacement, torsion or damage to a portion of the intestinal tract, inversion of a uterine horn with impending uterine prolapse, internal hemorrhage of a large blood vessel (i.e., ruptured uterine artery), trauma or other factors.[1]

It may be beneficial to administer a dose of an analgesic medication such as flunixin meglumine, phenylbutazone, dipyrone, xylazine, detomidine or butorphanol to a mare exhibiting abdominal pain in the post-partum period. Alleviation of pain may allow an affected mare to interact and bond with her foal more effectively. In addition, mares that continue to exhibit pain after foaling often do not allow their foal to nurse. Adequate pain management may therefore facilitate nursing and passive transfer of maternal antibodies in colostrum.

The continued presence of severe abdominal pain in the early postpartum period or the reoccurrence of pain following temporary relief with analgesic therapy may be a sign of a more significant medical complication than just postpartum uterine contractions. Additional diagnostic tests may include a thorough physical examination, complete blood count and serum chemistry, transrectal palpation and ultrasound, abdominal ultrasound, abdominocentesis, and an examination of the reproductive tract *per vagina*.[2]

Retained Fetal Membranes (Retained Placenta)

Retention of the placenta is one of the most common problems of the post-partum mare. The reported percentage of broodmares that retain their placentas ranges from 2 to 10 percent.[3] The incidence of retained placenta increases following abortion, dystocia, obstetrical manipulations, cesarean surgery, induction of parturition, placentitis, fescue toxicity, hydrops, and other factors that alter pregnancy or foaling. In other instances, the cause(s) of retained placenta are not known.

Retained placentas and serious sequelae are more common in draft horses than in light horse breeds. Friesian mares have a high breed incidence of retained placenta and affected mares have been noted to have a lower serum calcium level than mares that do not retain their placenta. In addition, mares with a history of retained placenta have an increased risk of having another retained placenta in the future.

Retention may include the entire chorioallantoic membrane or only a portion of the membrane. The most common site of partial retention is the tip of the non-pregnant horn. Autolysis of the placenta is associated with rapid bacterial growth within the uterine lumen, which may lead to toxic metritis. Bacteria, toxins, and inflammatory fluid accumulate within

the uterine lumen and may be pass through the inflamed uterus and lead to systemic endotoxemia and laminitis.

The most common bacterium cultured from mares with a retained placenta is *Streptococcus equi* subsp. *zooepidemicus*, although infection with Gram-negative bacteria capable of endotoxin production may be more clinically important. Diagnosis of retained placenta is obvious if fetal membranes are visible protruding from the vulva. However, diagnosis may not be obvious if only a small portion of the placenta is retained within the uterus (i.e. the tip of the non-pregnant horn). Consequently, every equine placenta should be examined once it has passed to determine if the entire structure is present.

The placenta should be spread out on a clean surface in a 'Y' or 'F' pattern. The tip of the 'pregnant' placental horn will be noticeably thicker than the tip of the 'non-pregnant' horn. The non-pregnant horn is thinner and can sometimes remain adhered to the endometrium and tear apart from the remainder of the chorioallantois when the main portion of the placenta is passed. If an area of tissue appears to be missing, a thorough examination of the uterus is indicated and appropriate therapy initiated. In most instances the interior of the uterus is examined manually with a gloved hand inserted through the cervix. The hand is rotated 360° throughout the entire uterine lumen, including both uterine horns. Tags of placental tissue free within the uterine lumen or adhered to the uterine wall are relatively easy to identify. Alternatively, a transrectal ultrasound examination may be performed to identify the presence and location of retained placental tissue.

It is important to emphasize that a mare may become systemically ill even if only a part of the placenta is retained. Mares with a retained placenta may not exhibit visible clinical signs of illness in the first few hours after foaling. However, mares may become depressed, anorexic (off feed) and have an elevated body temperature if the placenta has been retained more than 6 to 24 hours. Rapid bacterial growth and production of endo- or exotoxins within the uterine lumen in the presence of placental tissue and fluid may predispose the mare to metritis, peritonitis, and laminitis. Consequently, a retained placenta can be life threatening to a mare.

Initially, the amnion should be tied in a knot above the hocks of the mare to prevent the mare from stepping on or kicking at the placenta. Tying up the amnion may also help prevent the amnion from being torn away from the remainder of the fetal membranes. If the amnion is not attached, there may be insufficient weight applied to the umbilical cord to stimulate release of the chorioallantois from the uterus.

Strategies for the management of a retained placenta vary with the duration of retention and health of the mare. Possible techniques include:
- Oxytocin administration
- 'Burns technique'
- 'Dutch technique' or 'Umbilical Blood Vessel Infusion Technique'
- Manual removal
- Administration of additional medications such as a calcium- magnesium-borogluconate solution

Oxytocin Administration. Initial treatment often involves administration of one or two doses of oxytocin (5 to 20 units per dose) to promote uterine contractions and expulsion of the placenta. Oxytocin may be administered as intramuscular or intravenous boluses or as a prolonged intravenous infusion (i.e. 100 units of oxytocin added to a liter of fluid administered slowly intravenously). On an equine breeding operation, it is common for farm personnel, under directions from a veterinarian, to administer an intramuscular dose of oxytocin to a mare that has not passed her placenta within 3 hours. A second dose is often administered 1 to 2 hours later if the placenta still has not passed. If the placenta has still not passed within 1 to 2 hours after the second dose, veterinary intervention is recommended.

Burns Technique. A procedure called the 'water technique' or 'Burns technique' may be utilized if oxytocin therapy is not successful.[4] A sterilized stomach tube is passed along the umbilical cord into the allantoic cavity of the retained chorioallantoic membrane. The chorioallantoic membrane is manually clamped around the stomach tube and a large volume (3 to 5 gallons) of warm water, to which a small volume of povidone-iodine solution has been added as a disinfectant, is pumped into the allantoic cavity. The water refills the allantoic cavity and is allowed to remain in the chamber for 3 to 5 minutes. The fluid is then allowed to egress from the allantoic cavity.

In a majority of cases, refilling the allantoic cavity and re-distending the chorioallantoic membrane results in a dissociation of the remaining microcotyledons of the chorionic membrane that are still attached to microcaruncles of the endometrium. Subsequently, the now freed chorioallantoic membrane is able to be passed in its entirety. The water technique is only effective if the chorioallantoic membrane is intact. Water cannot fill and distend the allantoic cavity if the chorioallantoic membrane is torn. In the event that the Burns Technique does not result in separation/release of the chorioallantois from the uterus, the procedure still essentially acts as a placental lavage to remove some of the bacteria and associated toxins.

Umbilical Blood Vessel Infusion Technique ('Dutch Technique'). Recently a procedure has been described in which tap water is infused into one of the umbilical blood vessels.[5] The hypothesis is that infusion of water results in distention of capillaries and formation of edema within the chorion which may result in release of microcotyledons from the maternal endometrium. The technique is successful in a majority of cases of retained placenta. If the 'Umbilical Blood Vessel Infusion Technique' is not initially successful, the procedure may be repeated utilizing a different umbilical blood vessel.

Equipment needed for the 'Umbilical Blood Vessel Infusion Technique':
- Water source
- Garden hose
- Adapter for garden hose
- Stallion catheter or foal stomach tube

Clinical Procedure for the 'Umbilical Blood Vessel Infusion Technique':

1. A small incision is made into one umbilical blood vessel
2. A small catheter (i.e., a 6 mm stallion catheter or foal stomach tube) is passed proximately up the vessel
3. An adapter, purchased at a hardware store, is fitted onto a standard garden hose
4. Water is slowly infused into the blood vessel through the catheter for 3 to 5 minutes
5. The water is held in the retained membrane for approximately 5 minutes
6. Gentle traction is placed on the placental tissue to encourage passage

Manual Removal. Manual removal of retained placentas in mares is controversial.[6] Manual removal has been associated with severe hemorrhage, placental tearing, delayed uterine involution, endometrial damage, intussusception of a uterine horn and partial or complete uterine prolapse. It may be advantageous to initiate other options before attempting to manually remove a retained placenta. However, implementation of a careful technique to gently dissociate the chorioallantois from the endometrium has been used successfully in many clinical cases.

One technique for manual removal is to grasp with one hand a portion of the chorioallantois that has detached from the endometrium and gently position the other hand at the junction where the chorioallantois is still attached. Gentle pressure applied with the fingertips can be used to very slowly and methodically 'unlock' the attached chorioallantois from the endometrium. An analogy that might apply would be a very slow separation of two attached pieces of Velcro®. A second technique for manual removal is to very slowly and methodically twist the free portion of the chorioallantois. Eventually as the membrane is twisted the microcotyledons will (hopefully) detach from the endometrium. In no instance is it recommended or warranted to apply a large amount of traction on the retained fetal membranes. This will invariably end up causing significant discomfort to the mare, trigger uncontrolled uterine contractions which could lead to a uterine prolapse, and tear off pieces of the membrane.

Calcium Gluconate. Administration of a calcium-magnesium-borogluconate solution along with oxytocin has been described for mares with refractory cases of retained placenta. A study showed that post-partum Friesian mares that retained their placenta had lower blood calcium levels than similar mares that did not retain their placenta.[7] Consequently, intravenous administration of a calcium containing solution may be beneficial in treatment of retained placentas in Friesian mares and possibly mares of other breeds.

Calcium Gluconate Technique
- Add 100 to 150 mls of 23 % calcium gluconate solution to 1 liter of lactated Ringer's solution
- Administer intravenously through a short-term catheter over a period of 45 to 60 minutes
- Administer 20 units of oxytocin intravenously when all of the calcium containing fluid has been infused

Other Treatments. If the entire chorioallantois or a portion of the chorioallantois (i.e., tip of the non-pregnant horn) remain retained for more than 6 to 12 hours after foaling, additional medical treatments and management practices may be indicated to prevent toxic metritis and laminitis.   Additional treatments may include the following:

- Systemic administration of broad-spectrum antibiotics (i.e., penicillin and gentamicin)
- Intrauterine infusion of antibiotics or antiseptics to prevent bacterial growth in the uterus postpartum
- Oxytocin administration
- Uterine lavage to promote uterine involution and remove bacteria, debris, and inflammatory fluid from the uterine lumen
- Nonsteroidal anti-inflammatory drugs (i.e., flunixin meglumine; Banamine®) to prevent endotoxemia and laminitis
- Acepromazine and/or topical nitroglycerine (2%) to promote peripheral vasodilation and prevent laminitis
- Frog support pads to help prevent laminitis
- Housing mare and foal in a deeply bedded stall to prevent laminitis.
- Additional therapy may include administration of anti-endotoxin hyperimmune plasma and polymixin B to prevent endotoxemia, tetanus vaccination and possibly a Caslick vulvoplasty to limit aspiration of air into the uterus

Medical therapy in at-risk mares should be instituted early since complications can be severe and life-threatening. In some cases, the amnionic membrane may become detached from the umbilical cord after foaling. This is most commonly due to the mare stepping on the membrane. In that event, the only structure protruding out of the vulva will be a short portion of umbilical cord. A consequence of the amnion being torn away from the umbilical cord is that there is no longer any weight and therefore no traction being put on the chorioallantoic membrane to promote normal dissociation from the endometrium and passage out of the uterus. One option is to attach a container holding a small volume of water equivalent to the weight of the amnion (i.e., a gallon jug approximately one-third filled with water) to the umbilical cord. The gentle constant traction from the weight of the container will help with passage of the placenta.

The prognosis for mares with retained placenta for survival and future fertility is generally favorable but decreases if retention is markedly prolonged or treatment is delayed and if the mare becomes systemically ill. Complications include metritis, peritonitis, laminitis and (rarely) uterine prolapse. Foal-heat breeding is usually avoided in mares with retained placenta or prolonged vaginal discharge. Affected mares may be bred successfully on subsequent heat cycles.

Inversion of a Uterine Horn

A single uterine horn tip may become inverted as a result of straining secondary to retained placenta or due to excessive traction on a piece of retained placenta.[3] Inversion of a uterine horn may progress to complete uterine prolapse. Clinical signs include abdominal discomfort (mild colic) and straining within a few hours after foaling that is

unresponsive to analgesics.

Diagnosis is based on palpation of the tips of the uterine horn *per rectum* and palpation of the uterine lumen *per vagina*. Palpation *per rectum* will reveal a uterine horn that is shorter than normal and extremely thickened. Transrectal ultrasonography of an inverted uterine horn would show concentric rings of soft tissue within the uterine horn. Palpation of the uterus *per vagina* will reveal a dome-shaped inverted tip of the horn projecting into the uterine lumen. In some cases, placental tissue may still be attached to the inverted uterine horn. If the mare is uncomfortable and straining, sedation and/or administration of an epidural should be considered to prevent further inversion or advancement of the condition to a complete uterine prolapse. Eversion of the effected horn can be accomplished manually by gently extending a closed hand or fist proximately up the uterine horn or by slowly and cautiously putting pressure on the inverted horn using the blunt end of a sterile bottle (i.e., a wine bottle) to provide additional extension beyond the reach of one's hand.

Alternatively, infusion of several liters of fluid into the uterine lumen may result in eversion of an inverted uterine horn. Low doses of oxytocin (i.e., 5 to 10 units) may be administered to promote uterine involution and expulsion of fluid. Non-steroidal anti-inflammatory drugs (i.e., flunixin meglumine) may be administered to relieve discomfort. If untreated, the invaginated uterine horn may become necrotic. Surgical resection of a portion of the uterus may subsequently be indicated.

Uterine Prolapse

Prolapse of the uterus refers to displacement of the uterus outside of the vulva. Uterine prolapse is relatively rare in the mare and is most likely to occur within hours after foaling.[1] However, prolapse may occur several days later. Factors that predispose mares to uterine prolapse include the following:

- Dystocia
- Vaginal trauma with associated tenesmus
- Retained placenta; especially if excessive manipulation or traction is applied during attempts to relieve a retained placenta
- Excessively high doses of oxytocin used in the treatment of retained placenta

Management of a mare with a uterine prolapse should be directed initially at preventing rupture of large uterine blood vessels and then with replacement of the uterus into the abdomen. The mare should be kept restrained and quiet. Straining should be decreased by administration of sedation (i.e., xylazine or detomidine and butorphanol) and, if possible, a caudal epidural or general anesthesia. The uterus should be elevated to the level of the vulva to prevent further damage, relieve tension on the broad ligament and uterine blood vessels, improve circulation and reduce edema. The tail should be wrapped and the perineum and the exposed surface of the uterus cleaned with soap and water. Any placental remnants that have remained attached should be gently removed if possible. Endometrial lacerations should be closed with absorbable sutures if required. Table sugar may be applied to the surface of the uterus to reduce edema, decrease the size of the

uterus and allow for easier reduction. Obstetrical lubricant or petrolatum jelly should be applied to the endometrium and the uterus gently 'kneaded' back through the vagina. Care must be taken to make sure that a section of intestine or the urinary bladder is not entrapped within the prolapsed uterus. Once the uterus has been replaced, the lumen may be distended with sterile saline to ensure that the horn tips are fully replaced. The fluid in the uterus is then allowed to exit by gravity flow.

The position of the horn tips should be confirmed by palpation per vagina or per rectum. Failure to completely evert the uterine horns into a normal position may result in continued discomfort, straining, and recurrence of the prolapse. If fluid therapy is unsuccessful, administration of acepromazine or Buscopan® may cause sufficient uterine relaxation to allow for eversion of the horn tip(s) during fluid infusion. Low dose oxytocin therapy (5 to 20 units) may be subsequently initiated to promote uterine involution. Mild, controlled exercise (i.e., hand walking) may be beneficial in repositioning the uterus within the abdomen. Additional therapy may include broad spectrum systemic antibiotics, intrauterine antibiotics, non-steroidal anti-inflammatory drugs, tetanus prophylaxis, acupuncture, and a Caslick vulvoplasty in mares with poor vulvar conformation.

Re-evaluation of the mare a few hours after successful repositioning of the uterus may be indicated. The examination should include assessment of discomfort/pain, position of the uterus per rectum or per vagina, and possibly a transabdominal ultrasound examination to determine if an excessive amount of free fluid is present in the abdominal cavity as a possible indicator of a full-thickness uterine tear. Complications of uterine prolapse include internal hemorrhage, incarceration and ischemic damage of intestines, endometritis, metritis, septicemia, endotoxemia, laminitis and death. However, mares generally recover if treated promptly and if there is no significant damage to the uterine blood supply or innervation. It is possible that some mares may be able to be rebred later in the same season if there are no complications.

Uterine Laceration, Rupture or Trauma

Uterine tears, ruptures or trauma may occur during a normal foaling or a dystocia.[2] In addition, uterine rupture has been documented prior to parturition in mares with uterine torsions and placental hydrops. Ruptures may occur during the second stage of labor in an apparently normal foaling, during a dystocia or obstetrical manipulations or as a consequence of uterine lavage. Uterine tears and ruptures usually occur at the dorsal aspect of the uterus due to penetration by a fetal limb or iatrogenically during assisted delivery or fetotomy. Complications of uterine ruptures include septic peritonitis, hemorrhage, and herniation of abdominal contents through the uterine rent.

Clinical signs may include abdominal pain, bloody vaginal discharge, and signs of peritonitis such as fever, depression, and anorexia. Diagnosis of a uterine tear or rupture is usually made by history, clinical signs, manual examination of the interior of the uterus, abdominocentesis, transabdominal ultrasonography and exploratory celiotomy. Unfortunately, the large size of the postpartum equine uterus usually makes evaluation of the entire internal surface of the uterus impossible. Peritoneal fluid in mares with

postpartum uterine tears usually has elevated white blood cell counts, increased total protein and other abnormalities, whereas peritoneal fluid analysis is usually normal in postpartum mares without uterine tears. In some cases, clinical signs are not evident for several days following foaling. Laparoscopy has been used in conjunction with intrauterine infusion of new methylene blue dye to diagnose a uterine tear located at the tip of a uterine horn that could not be detected by manual examination of the internal surface of the uterus following a dystocia. Passage of an intact placenta following a dystocia does not guarantee that uterine damage has not occurred, as uterine tears have been diagnosed without causing a corresponding placental lesion.

Treatment of uterine tears or ruptures is dependent on severity and clinical signs. Small dorsal tears may be managed conservatively by administration of oxytocin to promote uterine involution, broad spectrum antibiotics and non-steroidal anti-inflammatory drugs. Uterine lavage is generally contraindicated due to the potential for enlarging the tear and/or forcing uterine debris through the tear into the abdominal cavity. Larger tears require surgically repair and more aggressive medical management. In addition to the treatments noted above, fluid therapy and peritoneal lavage may be beneficial in mares with peritonitis. Maintaining the mares in cross ties after surgery, tetanus prophylaxis and suturing of the vulva to reduce pneumovagina may also be beneficial. Uterine massage per rectum at 3- to 5- day intervals may help prevent formation of adhesions. Early recognition and aggressive treatment will improve mare survival and enhance future reproductive potential.

Uterine Artery Rupture (Periparturient Hemorrhage)

Rupture of one of the major arteries supply blood to the uterus or ovaries is the major cause of death in mares in the period immediately after foaling.[8,9] Blood vessels most commonly involved include the middle uterine, utero-ovarian, and external iliac arteries. In most cases, the hemorrhage is either contained within the broad ligament or ruptures out of the broad ligament into the abdominal cavity. Rarely evidence of hemorrhage is evident as a vaginal discharge. Rupture of an artery within the broad ligament will often result in significant hemorrhage that is contained within the broad ligament or between the musculature (myometrium) and outer (serosal) surface of the uterus. Affected mares develop a large hematoma within the broad ligament and exhibit shock and significant abdominal pain, but typically survive. In contrast, arterial rupture not contained within the broad ligament leads to rapid blood loss or exsanguination into the peritoneal cavity, shock, and death.

The incidence of arterial rupture is highest in older mares, and associations between age, vascular degeneration and declining serum copper levels have been reported. The cause of rupture has been suggested to be a combination of factors such as stretching of the blood vessels by the gravid uterus, pressure associated with abdominal straining and uterine contractions during foaling. Clinical signs exhibited depend on location of the hemorrhage and amount of blood lost. Affected mares may show severe colic and profuse sweating. Evidence of hemorrhagic shock such as pale mucous membranes, increased pulse and respiratory rate, low body temperature, circling or staggering,

weakness and prostration may become evident.

Diagnosis can often be made based on clinical signs alone. However, diagnostic tests such as abdominocentesis, transabdominal ultrasonography, and periodic assessment of packed cell volume (hematocrit) and total protein levels may be valuable in determining the location and extent of the hemorrhage so that a treatment strategy and prognosis can be given. Transrectal palpation and ultrasonography of the broad ligament may reveal an enlarged structure with the ultrasound appearance of an organizing blood clot. However, palpation may not be prudent initially due to the possibility of disrupting a clot and causing further hemorrhage.

Mares should be confined to a darkened stall to limit activity and prevent excitement. It is generally recommended that the foal remain with the mare to minimize anxiety in the mare. Analgesics, such as flunixin meglumine and butorphanol tartrate may be administered to control pain. Tranquilization of mares with arterial ruptures should be performed with caution since many drugs decrease blood pressure and accentuate hypovolemic shock. Corticosteroids may be administered for shock. Transfusion of whole blood should be considered when clinical and laboratory signs of severe blood loss are present. Administration of plasma and hypertonic saline, isotonic fluids or synthetic volume expanders (i.e., Hetastarch) may also be indicated, but again should be used with caution. An attending veterinarian may consider administration of additional medications such as naloxone hydrochloride, aminocaproic acid (Amicar®, loading dose: 40 mg/kg, diluted in 1 liter of sterile saline administered IV over 30-60 minutes; maintenance dose: 20 mg/kg, diluted in 1 liter sterile saline administered IV over 30-60 minutes q 6 hours) or ergonovine maleate to improve circulation and control hemorrhage. Administration of oxytocin to promote uterine involution is controversial, as the induced uterine contractions may disrupt blood clots and reinitiate bleeding. Surgical intervention is usually not attempted due to the medically compromised status of an affected mare and the difficulty in locating the source of the hemorrhage.

Hematomas that remain contained within the broad ligament usually regress over a few weeks to months. Mares that have experienced an artery rupture and survived are usually fertile once the hematoma regresses and can usually deliver a foal without recurrence of hemorrhage. However, owners should be advised that fatal artery ruptures during a subsequent foaling have been documented in mares that survived a previous artery rupture episode.

References

Available upon request.