Post-Partum Problems: The Top Ten List

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This article reviews the top ten post-partum problems in mares. The problems are broadly broken down into two main categories: those that cause pain or systemic illness and those that do not. Problems resulting in pain or systemic illness include: septic metritis, hemorrhage from uterine or ovarian vessels, gastrointestinal problems/colic, uterine laceration and uterine horn intussusception/uterine prolapse. Issues in systemically healthy mares include: retained fetal membranes, post-Cesarean section management, post-dystocia management, hypogalactia/agalactia, and urovagina/urometra. For each topic, practical management and treatment options are presented and the prognosis for future reproductive success is discussed. Author's address: New Bolton Center, Department of Clinical Studies, School of Veterinary Medicine, University of Pennsylvania, 382 West Street Road, Kennett Square, PA 19348; e-mail: rmturner@vet.upenn.edu. © 2007 AAEP.

1. Introduction
Problem post-partum mares often fit into one of two broad categories: mares presenting as painful or systemically ill and mares presenting as systemically healthy but with post-partum problems that can affect their future wellbeing and/or fertility. The objective of this manuscript is to review the most common problems seen in these mares and to review practical management and treatment options for their problems. Additionally, prognosis for future reproductive success will be described.

2. The Post-Partum Painful/Systemically Ill Mare
The first broad group of problem mares are those with pain or systemic illness as the presenting complaint. In these cases, components of the general workup include signalment/history, general physical examination, clinical hematology and chemistry evaluation, abdominocentesis, palpation and ultrasonography of the reproductive tract per rectum, manual examination of the reproductive tract per vagina, and abdominal ultrasonographic examination. Using these data as a starting point, this manuscript will review the most common findings in mares presenting with one of the top five causes for post-partum pain or systemic illness. Common treatment options will be reviewed, and prognosis for recovery and future reproductive success will be discussed.

1. Septic Metritis
Post-partum metritis can vary in severity. In its worst form, toxic metritis can be life threatening, particularly if the affected mare becomes laminitic.

Signalment/History
Septic metritis can affect mares of any age or parity. History often includes dystocia and retained fetal membranes.

Physical Examination
Mares may present with classic signs of endotoxemia. Most are tachycardic. Fever is often present, and in severe cases, the mare’s mucous
membranes may seem toxic. Malodorous vaginal discharge may be noted.

**Clinical Hematology and Chemistry**
The most common hematologic and chemistry evaluation findings are leukopenia and hyperfibrinogenemia. Less often, leukocytosis is a finding.

**Abdominocentesis**
Abdominocentesis is often normal unless a concurrent uterine laceration is present.

**Palpation and Ultrasonography of the Reproductive Tract per Rectum**
Palpation and ultrasonography of the reproductive tract per rectum usually finds an atonic, poorly involuted uterus. Often, intrauterine fluid is present together with fetal membranes.

**Examination of the Reproductive Tract per Vagina**
Malodorous uterine fluid is usually present, and fetal membranes are often retained.

**Abdominal Ultrasonographic Examination**
The abdominal ultrasonographic examination is usually non-remarkable unless a concurrent uterine laceration is present.

**Treatment**
Treatment includes administration of broad-spectrum antimicrobials such as potassium penicillin (22,000 IU/kg, q6 h, IV) and gentamicin sulfate (6.6 mg/kg, q 24 h, IV) and administration of flunixin meglumine (1.1 mg/kg) both for its anti-inflammatory and anti-end toxic effects. If fetal membranes are present, oxytocin therapy is initiated (see section on retained fetal membranes for dosages and dosing intervals). Even if membranes are not present, oxytocin may be used in conjunction with large-volume intrauterine saline lavage to help clear the uterus of fluid and debris. Large-volume lavage typically requires a minimum of 3 l of saline and may require many more (up to 15 l or more) to be effective. Typically, we will continue to lavage until the effluent recovered is clear. Additional anti-endotoxin therapy may include equine plasma polymixin B (1.5 million IU/550 kg horse diluted and administered slowly, q 12 h, IV for 3 days) and/or pentoxifylline (7.5 mg/kg, q 12 h, PO). Affected mares should be monitored carefully for the development of laminitis and treatments designed to prevent the development of laminitis (such as icing of the hooves and stabilizing the mare on soft footing such as shavings or sand) should be instituted.

**Prognosis for Systemic Recovery**
If complications of metritis (e.g., laminitis and peritonitis) can be avoided, the prognosis for systemic recovery is good. Development of complications will lower the prognosis. In its worst form, septic metritis can be life threatening.

**Prognosis for Future Reproductive Success**
In most cases, there is an underlying cause for the metritis (retained membranes or dystocia). As such, barring these problems in the future, recovered mares often can be bred again and conceive with no increased risk of developing septic metritis after subsequent parturitions. Because metritis typically causes delayed uterine involution, one may need to delay rebreeding the mare until involution is complete. In general, allowing the mare to have one estrous after complete resolution of the metritis is usually sufficient. A complete breeding soundness examination may be prudent before rebreeding these animals.

2. Hemorrhage From Uterine or Ovarian Vessels
Hemorrhage from uterine or ovarian vessels typically occurs during parturition, and problems become obvious in the immediate post-partum period. Less commonly, hemorrhage may occur during pregnancy or up to several days post-partum. Most cases involve rupture of the middle uterine artery (MUA), utero-ovarian arteries, or external iliac arteries. Older, multiparous mares are at greatest risk. It is possible that mild cases of MUA rupture may go undiagnosed if the mare does not show clinical signs. However, in moderate to severe cases, clinical signs are often apparent. The specific signs of this problem can vary, often depending on where the rupture occurs.

**Signalment/History**
Older, multiparous mares are at higher risk. Often, the delivery is uncomplicated. The mare may have a past history of post-partum hemorrhage.

**Physical Examination**
Severe tachycardia is a common finding, usually associated with either pain, hemorrhage, or both. Pale mucous membranes are suggestive of a MUA bleed. However, membrane color may be normal during the acute phase. Classic general signs of hemorrhage from the reproductive tract include sweating, flehmen, vocalization, and muscle fasciculations. When the artery ruptures such that hemorrhage occurs into the uterus, the mare may present for colic associated with uterine distension. Alternatively, rupture can occur such that hemorrhage is in the broad ligament. In these cases, pain is often more apparent in association with stretching of the broad ligament. Lastly, rupture can occur into the abdominal cavity. These mares often are less painful, but they may bleed more profusely and may be at greater risk for sudden death because of uncontrolled hemorrhage.

**Clinical Hematology and Chemistry**
Interestingly, complete blood counts in the acute phase of hemorrhage may show an increase, decrease, or no change in packed cell volume (PCV).
This is most likely caused by splenic contraction, hemoconcentration, and redistribution of red cells. Hypoproteinemia is a more consistent finding. However, if the mare survives the acute phase, a drop in PCV usually is observed over the next several days.

Abdominoceles
Mares with hemorrhage into the abdomen or into the broad ligament often have significantly increased numbers of red blood cells (RBCs) in abdominal fluid.

Palpation and Ultrasonography of the Reproductive Tract per Rectum
This may be diagnostic, because large hematomas can often be identified in the uterine wall or in the broad ligament. Alternatively, or in addition to these hematomas, blood may be present within the uterine lumen. However, in some instances (e.g., when hemorrhage is in the abdomen), a discrete hematoma may not be identified, and per rectum examination may be unrewarding.

Examination of the Reproductive Tract per Vagina
If hemorrhage is suspected based on other clinical signs, examination per vagina typically is not performed. It is our concern that manipulation of the uterus could dislodge or break down a clot and therefore, result in fresh hemorrhage. If it is performed, frank blood may be identified in the uterus and vagina if the hemorrhage is intrauterine.

Abdominal Ultrasonographic Examination
Abdominal ultrasonographic examination is usually unremarkable, and as such, it is often not performed if there is other strong evidence for hemorrhage. There may be an impression of increased abdominal fluid and/or an increase in echogenicity of the abdominal fluid in cases of severe hemorrhage.

Treatment
When MUA rupture is suspected, it is our policy to minimize stressful procedures to the mare in an attempt to lower blood pressure and prevent a potentially terminal bleed. Many portions of this examination (e.g., examination per rectum and per vagina, abdominocelesis, and abdominal ultrasonographic examination) are brief and sometimes, are not performed at all.

When a diagnosis of MUA rupture is made, the clinician is often faced with the difficult decision of whether or not to institute aggressive treatments that may increase the mare's stress and blood pressure and therefore, increase the risk of severe hemorrhage and death. The alternative is to keep the mare in as peaceful a situation as possible and hope for spontaneous clotting before the mare reaches a critical level. In most instances, as a minimum, we will place an indwelling venous catheter and begin the mare on volume replacement fluid therapy. Analgesics (e.g., butorphanol tartrate, 0.01–0.02 mg/kg IV alone or in combination with xylazine, 0.4 mg/kg) and anti-inflammatory drugs (e.g., flunixin) typically are administered to improve the mare's comfort and reduce distress. Acepromazine is to be avoided because of its hypotensive effects. As soon as is practical, the mare is placed in a quiet stall, often with the doors and windows closed to minimize disturbances, and the “wait and see” approach is taken. In more desperate situations, blood transfusions and/or hypertonic saline may be administered.

IV naloxone may be administered (0.01–0.02 mg/kg), because there are anecdotal reports that suggest that this may improve survival in hemorrhaging mares. In other species, it has been suggested that the mechanism of action of this opioid antagonist is to provide analgesia and reverse hypotension in cases of hemorrhagic shock. In the horse, practitioners often describe a decrease in anxiety and an increase in comfort in mares after administration of the drug. This may be caused by naloxone's opioid-like effects when administered at subclinical doses. However, its effects in hemorrhaging horses have not been tested in controlled studies, and therefore, its use in affected mares remains controversial.

IV formalin (16 ml of 10% buffered formalin diluted in 45 ml of 0.9% saline solution and administered intravenously slowly) has also been used to treat uncontrolled hemorrhage in horses. It seems doubtful that either naloxone or formalin have a significant impact on the bleeding. On one hand, naloxone seems to do no harm. On the other hand, formalin has been shown to have adverse side effects, at least when injected intralesionally into hematomas. Additionally, one controlled study found no beneficial effect of the administration of IV formalin on hemostatic variables in healthy horses, whereas more limited evidence has identified no beneficial effect on bleeding.

Oxytocin (40 IU, q 0.5 h, intrauterine) has been suggested as a treatment for hemorrhage associated with the myometrium. However, because it is often impossible to determine with certainty the exact location of the rupture and because oxytocin may cause cramping, further discomfort, and an associated increase in heart rate and blood pressure, we typically do not use this drug.

Laparotomy can be considered in an attempt to ligate the bleeding vessel. However, anesthesia and subsequent surgery present significant risks to these animals, and it is not uncommon for affected mares to die during surgery. Additionally, the size of the mare's abdomen, the position of the uterus within the abdomen, and the problems associated with visualizing the offending vessel in the face of ongoing and severe bleeding can make ligation of the problem vessel difficult at best and sometimes impossible. In our hands, surgery is rarely attempted.
If the mare’s condition stabilizes, we typically recommend that the mare remain in a stall and not be transported for at least 2–4 wk after cessation of the bleeding. This is intended to give the clot time to form and stabilize. It has been reported that sudden death may occur even weeks after the initial bleed. This is likely caused by rupture of a hematoma (e.g., that was previously contained within the broad ligament) or dissolution of a previously formed clot.7

Prognosis for Systemic Recovery
The prognosis for recovery is variable, depending on the severity of the hemorrhage. Mild hemorrhage into the broad ligament typically is associated with a good prognosis for recovery. However, severe hemorrhage into the abdomen or uterus can be acutely fatal. It is the author’s impression that bleeding into the broad ligament may be associated with a better prognosis for survival, because the limited volume that this space can hold may result in a pressure that permits clotting and thus, limits bleeding. However, even when hemorrhage is initially contained by the broad ligament, it is possible that the ligament may lacerate, resulting in massive, acute hemorrhage into the abdomen.

Prognosis for Future Reproductive Success
If the mare survives the episode, the question is often raised as to whether or not she should be bred again. Hemorrhage from the reproductive tract does not adversely affect fertility, and therefore, affected mares are likely to become pregnant if bred again. However, experience in our clinic strongly suggests that mares that have suffered a post-partum bleed are at greater risk for experiencing additional hemorrhages in subsequent parturitions. Additionally, these subsequent bleeds often become more severe each year and may eventually result in death of the mare. Owners should be made aware of this risk before breeding the mare again. Embryo transfer is an excellent alternative when breed registries permit.

3. Gastrointestinal Problems/Colic
Post-partum mares seem to be at increased risk for several types of gastrointestinal problems. These include cecal rupture, rectal prolapse, trauma to the small colon or mesocolon, trauma to the small intestine, and large-colon volvulus.1,16–19 Trauma to the small colon or small intestine may result in ischemic bowel necrosis.17–20 The source of this trauma is speculative and has been suggested to involve pressure placed on the bowel by the position of the fetus in utero. Alternatively, acute trauma to the bowel could be caused by violent movements of the foal’s extremities during parturition. In some cases (e.g., rectal prolapse and large-colon volvulus), gastrointestinal problems can be readily differentiated from primary reproductive-tract problems. However, in other cases (e.g., trauma to the small colon, mesocolon, or small intestine), it can be very difficult to determine if the primary problems lies within the reproductive tract or within the gastrointestinal tract. In these cases, a definitive diagnosis may require laparotomy.

Signalment/History
In most instances, the signalment and history are not remarkable. It is possible that dystocia may result in an increased incidence of rectal prolapse (because of persistent straining) and also may increase the risk of trauma to the gastrointestinal tract.

Physical Examination
Findings will depend on the source of the gastrointestinal problem. Cecal rupture typically presents within 24 h of parturition.1 As a result of severe peritonitis, affected mares typically present with tachycardia, depression, hypovolemia, and toxic membranes. Body temperature may be elevated or low. Rectal prolapse is readily diagnosed by visualization of the prolapse on physical examination. The classic sign of large-colon volvulus is acute, severe abdominal pain. Physical findings in cases of trauma to the gastrointestinal tract are more vague and often are associated with progressive peritonitis. Signs may include depression, mild colic, tachycardia fever, decreased gastrointestinal motility, and gastric reflux.1

Clinical Hematology and Chemistry
Clinical hematology and chemistry usually find hemocoagulation with hypoproteinemia, leukopenia, and azotemia in the case of cecal rupture. Trauma to the intestine or colon, in some cases, is indicated by leukopenia or leukocytosis, hyperfibrinogenemia, hypoconcentration, and azotemia. In cases of peritonitis, hypoproteinemia may be identified.1

Palpation and Ultrasonography per Rectum
In some cases, large-colon volvulus can be diagnosed on palpation per rectum. In others cases, examination per rectum is non-diagnostic. This condition typically is extremely painful, and the mare’s behavior may preclude palpation per rectum, rendering it impossible or at the least unsafe. In these instances, the decision to proceed to a laparotomy is often made based solely on the mare’s severe, unremitting pain. Diagnosis can then be made during laparotomy. In cases of trauma to the small intestine, small-intestinal distension may be present. However, in many cases of trauma to the gastrointestinal tract, findings on palpation per rectum are non-diagnostic. Palpation and ultrasonographic examination of the reproductive tract typically reveals a normally involuting uterus with no apparent problems.
Palpation of the Reproductive Tract per Vagina
When a gastrointestinal problem is obvious, this procedure typically is not warranted. However, in cases in which there is difficulty in determining whether or not the primary problem is reproductive or gastrointestinal in origin, examination of the reproductive tract per vagina can be helpful. When faced with a systemically ill mare but an apparently normal post-partum reproductive tract with no obvious uterine or vaginal lacerations, the veterinarian should begin to consider a primary gastrointestinal problem as a higher likelihood.

Abdominocentesis
Abdominocentesis usually finds severe fecal peritonitis in the case of cecal rupture. Trauma to the colon or intestine is usually indicated by non-septic or septic peritonitis, and increased total protein may be present.

Abdominal Ultrasonographic Examination
This information may be helpful in determining whether or not an affected mare has peritonitis and to help rule out other, less frequent causes of post-partum abdominal pain. We typically perform transabdominal ultrasonographic examination of the abdomen only when other diagnostic tests have not led us to a definitive diagnosis.

Miscellaneous
Identification of a piece of compromised or necrotic bowel can be very difficult, particularly if overt peritonitis is not yet present. It is often difficult or impossible to definitively differentiate between a compromised bowel and a uterine laceration, particularly if the mare is recently post-partum and the uterus is too large to exam in its entirety per vagina. Definitive diagnosis may require laparotomy or laparoscopy.18

Treatment
Treatment will vary depending on the cause. Cecal rupture carries a grave prognosis, and euthanasia is recommended.1 Treatment of rectal prolapse centers around the reduction of the prolapse. Administration of epidural anesthesia can greatly facilitate this procedure. In severely affected cases, the small colon may be involved, and exploratory surgery may be indicated.21 After the prolapse is replaced, subsequent treatment will depend on the amount of damage sustained by the prolapsed tissue. In cases of trauma to the gastrointestinal tract, the prognosis depends on the duration and degree of bowel-wall necrosis and secondary peritonitis. Dolente1 summarized a series of case reports involving post-partum mares with small-colon trauma and reported only a 36% survival to discharge. It is possible that this poor outcome may in part be caused by the difficulty in diagnosing the problem. This often leads to delay in surgical intervention. Perhaps earlier surgical intervention would improve the outcome.

Prognosis for Systemic Recovery
The outcome of these cases varies widely depending on the underlying cause. Cecal rupture carries a grave prognosis. The prognosis with rectal prolapse is variable, depending on the degree of prolapse and the amount of damage sustained by the prolapsed tissue. In cases of trauma to the gastrointestinal tract, the prognosis depends on the duration and degree of bowel-wall necrosis and secondary peritonitis. Dolente1 summarized a series of case reports involving post-partum mares with small-colon trauma and reported only a 36% survival to discharge. It is possible that this poor outcome may in part be caused by the difficulty in diagnosing the problem. This often leads to delay in surgical intervention. Perhaps earlier surgical intervention would improve the outcome.

Prognosis for Future Reproductive Success
In cases in which the mare recovers from the gastrointestinal incident and assuming that the reproductive tract was normal, fertility should not be compromised, and the mare would likely be at no increased risk for primary reproductive problems in subsequent foalings. The possibility of recurrent colic remains, particularly if treatment involved surgical intervention.

4. Uterine Lacerations
In the vast majority of cases, uterine lacerations occur secondary to a dystocia. These lacerations may be sustained when the mare strains persistently against an obstruction, when a fetal extremity pushes through the uterus or vagina, or after blunt trauma to or pressure on the uterine wall from a fetal extremity.22 Alternatively, they can be caused iatrogenically by overly aggressive manipulations of a fetus or secondary to a fetotomy. Less frequently, lacerations can be sustained as part of an otherwise apparently normal delivery. It is strongly recommended that the mare’s reproductive tract be examined immediately post-partum, particularly after a dystocia, to attempt to identify a laceration early before secondary complications develop.

Early diagnosis of a uterine laceration is critical to a successful outcome. If identified early, contamination of the abdominal cavity can be minimized, and the mare can be placed prophylactically on antibiotics (e.g., potassium penicillin and gentamicin sulfate) and anti-inflammatories (e.g., flunixin meglumine) to minimize the risk of septic complications. Unfortunately, many of these mares present several days post-partum after they have already sustained significant abdominal contamination. In these cases, the prognosis for survival is lower, and the cost of treatment is higher. The purpose of this section is to emphasize how to diagnose this problem early and therefore, avoid systemic illness associated with secondary peritonitis.

Signalment/History
Mares can be of any age or breed. Dystocia is very frequently part of the history, although lacerations can sometimes be sustained even during an apparently normal delivery.23–26
Physical Examination

In the acute stage, before significant abdominal contamination has occurred, there may be no obvious outward clinical signs. However, if peritonitis develops, then signs become evident (typically over the first 24–48 h post-partum) and can include depression, tachycardia, toxic mucous membranes, ileus, abdominal discomfort, and fever.

Clinical Hematology and Chemistry

Immediately post-partum, there are no specific changes in clinical hematology or chemistry. Over time, leukopenia or leukocytosis, hyperfibrinogenemia, hemoconcentration, and azotemia may be seen in association with peritonitis and dehydration.

Palpation and Ultrasonography per Rectum

Interestingly, in some mares with uterine lacerations, we have noted apparently accelerated gross uterine involution. On per rectum examination, the uterus often feels smaller than would be expected for the stage post-partum and can be highly toned.

Palpation of the Reproductive Tract per Vagina

Many uterine lacerations sustained during parturition occur in the uterine body, although lacerations also have been reported in the uterine horns. Full-thickness lacerations represent the greatest threat. However, even partial-thickness lacerations can lead to bacterial contamination and subsequent inflammation that may transfer into the abdominal cavity. Lacerations can occur either ventrally or dorsally. If the laceration occurs in the uterine body, it is often within reach and therefore, can be identified by palpation of the luminal uterine wall per vagina. If the laceration is very large, other abdominal organs (e.g., intestine and bladder) may be present in the uterine lumen or at least readily palpable through the tear. Because the endometrial folds are very pronounced immediately post-partum, it can sometimes be difficult to identify smaller or partial-thickness lacerations amidst the folds.

If a laceration is suspected but none is identified on initial palpation per vagina, then transmural palpation of the uterine wall should be performed. For this procedure, the veterinarian places a sterile arm into the uterus and a second arm into the rectum. The dorsal uterine wall then is trapped between the examiner’s hands. By applying gentle pressure and slowly “walking” across the dorsal surface of the uterus, it becomes easier to flatten out the endometrial folds and identify small full-thickness and partial-thickness lacerations. Transmural palpation of the uterine wall limits the depth to which the examiner’s arms can reach, and therefore, in the immediately post-partum mare when the uterus is quite large, it is useful only for the caudal portions of the uterine body. Even with standard transvaginal palpation of the uterus, the size of the uterus immediately post-partum often makes it impossible to reach the tips of the uterine horns, particularly in large mares. However, by pulling the endometrium gently caudally with the fingers, one usually can reach the majority of the uterus.

Small lacerations can close very quickly within a few days of the injury. Therefore, if the transvaginal examination is not performed immediately post-partum, it is possible that a previously existing laceration could no longer be identifiable. Therefore, if a mare has signs of peritonitis (particularly after a dystocia), a uterine laceration should be suspected, even if a specific laceration cannot be palpated. Be aware that one alternative cause for post-partum peritonitis is traumatized bowel (see above).

Abdominocentesis

Immediately post-partum, abdominocentesis may show minimal changes. However, within 1–2 days of the injury, signs of peritonitis often are present. Even with partial-thickness lacerations, some more mild abnormalities may be identified on abdominocentesis. In cases of full-thickness lacerations, signs of septic peritonitis typically are found.

Abdominal Ultrasonographic Examination

Immediately post-partum, no changes may be noted. Later, increased fluid, increased echogenicity of the abdominal fluid, and possibly fibrin tags may be seen in association with peritonitis.

Miscellaneous

In some cases in which a uterine laceration is strongly suspected but cannot be identified on palpation, exploratory celiotomy may be indicated to identify and close a potential laceration and to definitively identify the cause of developing peritonitis. Celiotomy or laparoscopy, in some cases, are the only ways to differentiate between a uterine laceration and a gastrointestinal injury. There is one report in which dilute methylene blue was infused into a damaged uterus, and the diagnosis of a full-thickness laceration was made laparoscopically when dye was visualized leaking into the abdomen.

Treatment

Both conservative medical treatment and aggressive surgical treatment of uterine lacerations have been described. Based on these reports, there is no clear evidence to indicate that medical versus surgical treatment is associated with a better or worse outcome. In general, we make the decision on how to treat the mare based on clinical signs, the size of the laceration, and the perceived potential for abdominal contamination. For example, large lacerations sustained during a complicated and potentially contaminated delivery may warrant surgical repair, whereas smaller lacerations sustained...
during delivery of a fresh foal may do well with only conservative therapy. Regardless of whether or not surgery is performed, mares with uterine lacerations should be treated with broad-spectrum systemic antimicrobials and anti-inflammatory drugs. Fluid therapy and abdominal lavage often are indicated. Uterine lavage usually is not helpful; in cases of relatively large lacerations, uterine lavage is contraindicated, because most of the lavage fluid will spill over into the abdomen, taking any contaminated uterine contents with it. If the mare develops septic peritonitis, then treatment for ileus and abdominal pain is necessary.\(^1\)

**Prognosis for Systemic Recovery**

The prognosis for systemic recovery is variable and depends largely on the degree of abdominal contamination that is sustained. As such, a better outcome will be associated with early identification and treatment of lacerations, whereas a poorer outcome can be expected in cases where the laceration goes undiagnosed for some time, thus resulting in extensive abdominal contamination.

**Prognosis for Future Reproductive Success**

If the mare recovers systemically, the uterus typically heals such that the laceration can no longer be identified. Although we do not have firm numbers on breeding success, it seems likely that most recovered mares will be of normal fertility and will be at no increased risk of problems in subsequent foalings. The exception to this is mares that develop abdominal and uterine adhesions secondary to peritonitis. We have infrequently seen mares with severe adhesions manifest recurrent and significant abdominal pain. Additionally, in rare cases, uterine adhesions can prevent normal uterine clearance and therefore, cause problems with fertility.

5. Uterine Horn Intussusception/Uterine Prolapse

Uterine prolapse is uncommon in mares, but when it occurs, it can be a life-threatening situation.\(^27\)

Therefore, uterine prolapse should be treated as an emergency.

**Signalment/History**

Older, multiparous mares are at greatest risk, probably because of repeated stretching and extreme relaxation of the reproductive tract during pregnancy and parturition. Intussusceptions and prolapses may be more common after prolonged dystocia, because the uterus may be more atonic. Additionally, the weight of retained fetal membranes combined with prolonged straining to pass the membranes act as predisposing factors.\(^28\)

**Physical Examination**

In cases of complete uterine prolapse, the diagnosis is apparent on physical examination. The prolapsed organ should be examined carefully for lacerations and for the overall condition of the tissue. Evidence of significant ischemia or necrosis is associated with a poor prognosis for survival. Cases of partial prolapse or intussusception of the tip of a uterine horn may be more difficult to identify. In these cases, persistent tenesmus, general restlessness, colic, and tachycardia may be present.

**Clinical Hematology and Chemistry**

In the acute stages, there may be no significant changes in blood work. If the condition goes untreated, hemoconcentration and azotemia may be seen in association with dehydration.

**Palpation and Ultrasonography per Rectum**

These procedures are not performed in cases of complete uterine prolapse, because they are not necessary and may induce additional straining. In cases of partial prolapse, palpation and particularly ultrasonography of the reproductive tract per rectum may reveal the intussuscepted uterine horn. Ultrasonographically, this may appear as telescoping of concentric rings of soft tissue at the distal tip of a horn.

**Palpation of the Reproductive Tract per Vagina**

In cases of partial prolapse/intussusception, palpation per vagina is diagnostic, because the inverted piece of the reproductive tract can be palpated telescoping through the normal portions of the tract. In cases when the fetal membranes are also retained, it is common to find the retained portion of the membranes firmly attached to the area of the reproductive tract that is prolapsing. It is our interpretation that this finding suggests that the weight of the membranes contributes to the problem.

**Abdominocentesis**

Abdominocentesis is often unremarkable unless a uterine laceration and associated peritonitis are present. An increase in RBCs may be found.

**Abdominal Ultrasonographic Examination**

This procedure typically is not performed unless peritonitis is suspected.

**Treatment**

Treatment centers around complete replacement of the prolapse. Incomplete replacement will result in continued straining and reoccurrence of the prolapse. Epidural anesthesia combined with IV analgesia and sedation are strongly recommended before attempting to replace the prolapse. In our experience, epidural anesthesia is a key component to successful treatment, because it typically breaks the cycle of renewed straining/reprolapse and allows for some time for the uterus to involute. As soon as a prolapse is identified, any tissue protruding from the vagina should be elevated to prevent development of excessive dependant edema. One simple
method is to suspend the prolapsed tissue in a sheet or sling that is supported by two assistants.

After appropriate analgesia has been supplied, the prolapse should be palpated to determine if bladder or portions of the gastrointestinal tract are present. A urinary catheter may be necessary to empty a prolapsed bladder before replacement. The uterus and perineum are then cleaned with sterile saline. If lacerations are present, they should be sutured. If fetal membranes are retained, gentle attempts can be made to manually remove them. However, if resistance is felt, traction should be immediately discontinued to avoid further damage to the uterus. If they cannot be removed, membranes can be trimmed before replacement of the uterus to reduce the weight of the membranes and the associated tension on the uterus. The uterus can then be replaced using the flat of the hand beginning with the caudal most portions of the prolapse and proceeding to the most anterior portions. Care should be taken to insure that the uterine horns are completely everted, because even small remaining intussusceptions of the tips of the uterine horns will result in renewed straining and reprolapse after the anesthesia is gone. We have found that the rounded end of a sterile mare vaginal speculum works very well as an extension to the arm to insure complete replacement of even the tips of the uterine horns.

When replacement is complete, oxytocin should be administered to increase uterine tone and help prevent reprolapse. Oxytocin should not be administered before replacement, because it may cause the uterus to become less malleable and therefore, more difficult to replace. Broad spectrum antibiotics and non-steroidal anti-inflammatory drugs typically are administered, and supportive therapy, including IV fluid administration, is indicated. Uterine lavage may be performed after replacement as long as it does not cause renewed straining on the part of the mare. Large-volume (3–15 l) saline lavage can serve two purposes. First, it will aid in evacuation of contaminants, and second, it will help expand the uterus and insure that all parts of the uterus are returned to their proper positions.

Prognosis for Systemic Recovery

Complete prolapse of the uterus should be treated as an emergency, because continued prolapse can lead to permanent damage to the uterus and potentially, to rupture of the uterine vessels. Rupture of the uterine vessels can result in hemorrhagic shock and sudden death. Ischemia and necrosis of the uterus is associated with a poor prognosis. However, if the prolapse is successfully replaced and no secondary complications develop (septic metritis, peritonitis, or hemorrhage), then the prognosis for recovery is good.

Prognosis for Future Reproductive Success

Future fertility after prolapse depends largely on the degree of damage sustained by the reproductive tract. In cases in which replacement is rapid and complete, future fertility can be good. Zent reported that the risk of future uterine prolapse may be increased in mares with a history of previous prolapse.

3. Post-Partum Problems in Systemically Healthy Mares

The second broad group includes healthy post-partum mares presenting for management. These mares may require care after dystocia and/or Cesarean section or treatment of retained fetal membranes to avoid later development of problems. Poor milk production and urovagina are other examples of problems that can occur post-partum that do not affect the systemic wellbeing of the mare. Common treatment options will be reviewed, and prognosis for recovery and future reproductive success will be discussed.

1. Retained Fetal Membranes

In the mare, the fetal membranes are defined as retained if they are not passed in their entirety within 3 h of the completion of second-stage labor. The incidence of retained fetal membranes (RFM) in the mare can be as high as 10%. Complications arising from RFM include metritis, laminitis, and endotoxemia. These secondary problems can be life threatening and thus, significantly decrease the prognosis for systemic recovery. The goal, therefore, is to identify RFM early and begin therapy to both encourage passage of the membranes and prevent the development of secondary complications.

The pathogenesis of RFM is multifactorial. In cattle, enzymatic breakdown of collagen and other proteins is necessary for the membranes to pass efficiently. Lack of this “collagenolysis” is probably one underlying cause of RFM. This breakdown in collagen likely occurs gradually over the last several weeks of gestation and depends on the progression of hormonal changes that occur before normal parturition. Thus, any process that interferes with the normal physiology of the pre-partum period in the cow can increase the risk of RFM. In addition, the cessation of blood flow through the placenta that occurs when the umbilical cord breaks may lead to collapse of the fetal vessels and a corresponding decrease in size of the chorionic microvilli. Therefore, any process that causes swelling of the microvilli or endometrium will adversely affect membrane passage. Although placentation is different in the mare, it is likely that similar processes are involved in the pathophysiology of fetal-membrane retention in this species. Therefore, abortion, induction of parturition, Cesarean section (particularly if it is performed before the mare enters first-stage labor), twin pregnancy (which can
result in abnormal pre-partum physiology), dystocia, contamination of the uterus at parturition, placentitis (which can cause inflammation of the microvilli and microcotyledons), and other miscellaneous pathologies such as hydropic conditions can increase the risk of RFM in the mare.

**Signalment/History**

RFM can occur in any breed and at any age, but it is more common in draft breeds than in light-horse breeds and more common in mares ≥ 15 yr of age.\(^{32,35}\) Friesian mares are at significantly increased risk, even after an uncomplicated delivery. In one study, 54% of Friesian mares retained their fetal membranes after normal foalings.\(^{36}\) Friesian foaling at 5–17 yr of age had the highest incidence of RFM. Interestingly, mares of this breed also are unusually tolerant of the retained membranes and typically do not develop any of the severe secondary complications, even without treatment.\(^{37}\)

**Physical Examination**

If the membranes have not passed within 3 h of delivery of the foal and if the membranes are retained in their entirety, then a diagnosis of RFM is apparent on physical examination. However, in some cases, the fetal membranes may be torn, and only small parts of the membranes may be retained. In these cases, the diagnosis may not be apparent on routine physical examination, because the small retained pieces may not be large enough to protrude from the vulva.

If a diagnosis of RFM is made, treatment should be initiated, and the mare must be monitored carefully for any signs of complications including metritis, laminitis, and endotoxemia. Physical examination of the fetal membranes themselves is necessary to be certain that the membranes have completely passed, and often, it is helpful in identifying a potential cause for cases of membrane retention. Therefore, after they have passed, the membranes should be examined grossly and if they are still in good condition, possibly histologically to (1) confirm full passage of the membranes and (2) try and identify potential underlying causes for retention such as placentitis. The most common site of partial fetal membrane retention is the tip of the non-pregnant horn. Therefore, lacerations or holes in this portion of the placenta should raise a warning flag for potential partial membrane retention. It is recommended that the veterinarian specifically identify the avillous area at the tip of each uterine horn that overlaid the oviduct papilla, because this portion of the placenta represents the distal most tip of each uterine horn.

**Other Diagnostics**

Early on in the progress of RFM, well before any secondary problems develop, there are a few additional diagnostic tests that are required. Palpation and ultrasonography of the reproductive tract may be helpful in identifying partially retained membranes. In some cases of partial retention, only small portions of the membranes remain attached. These pieces may not be large enough to be seen protruding from the vulva. Thus, a diagnosis of RFM could be missed. In cases in which there is no definitive evidence that the placenta has been passed in its entirety, palpation and ultrasonographic examination of the uterus can lead the clinician to suspect partial membrane retention. Palpation of the reproductive tract typically reveals a poorly involuted uterus. As the disease progresses, there is often a build up of intruterine fluid, although this may not be present in the earlier stages. Ultrasonographically, retained membranes appear as distinctive hyperechoic areas within the lumen of the uterus.

Palpation of the reproductive tract per vagina can also be helpful in arriving at a diagnosis. It often is possible to palpate partially retained membranes by this route. The character of the uterine contents can be assessed (appearance and odor) to help give the veterinarian some idea of the state of the intrauterine environment.

**Treatment**

Administration of oxytocin can effectively cause passage of retained fetal membranes. We recommend beginning oxytocin therapy as soon as a diagnosis is made (i.e., 3 h after delivery of the foal if the membranes have not yet passed). Sometimes, a single injection of 10–20 IU, IV can result in membrane passage within minutes. However, many times the results are not as dramatic. If an initial dose of oxytocin proves ineffective, we place affected mares on a regular treatment regimen of oxytocin. Dose and frequency of administration are highly variable and depend largely on clinician preference. If the mare begins to show signs of discomfort in association with uterine contractions, then the dose and/or frequency is reduced. The following are typical schedules used at our hospital.

- 10–20 IU, IV or IM every 15 min for one 2-h block in the morning and one 2-h block in the evening.
- 10–20 IU, IV or IM every 1 h around the clock.
- Continuous oxytocin infusion through IV catheter. Dose varies depending on mare comfort level but typically starts at a dose of 1 IU/min in an appropriate crystalloid solution.

Carbetocin,\(^{k}\) a long-acting oxytotic product, is available in the United Kingdom and Canada. This drug reportedly results in prolonged uterine contractions, and therefore, it allows for reduced frequency of dosing. However, to the author’s knowledge, it is not available in the United States, and no controlled studies have been published on its effects on treatment of RFM in the mare. In some refractory cases, prostaglandin (250 μg cloprostenol\(^{1}\) or 10 mg dinoprost tromethamine\(^{2}\)) may be admin-
stered, because it has longer uterotonic effects than does oxytocin.

It is my experience that if oxytocin does not cause passage of the membranes within ~12 h, then it is common for the membranes to be retained for days until they necrose and fall away from the endometrium. Nonetheless, regular oxytocin treatment should be continued, because it will maintain uterine tone and favor expulsion of debris and fluid.

More recently, intraumbilical infusion of collagenase has been reported as a treatment for RFM. Two hundred thousand units of bacterial collagenase dissolved in 1 l of sterile saline were infused into the umbilical-cord vessels of RFMs. In treated mares, the retained membranes were passed within 6 h of treatment with no reported side effects. This treatment is based on earlier work in cows in which bacterial collagenase was shown to effectively hydrolyze the collagen links between the membranes and the endometrium. It should be noted that the single study in mares examined a very small number of animals with RFM (n = 4) and included no untreated controls. This treatment is likely to be difficult to administer in cases of chronically retained, partially necrotic fetal membranes. Additionally, in cases in which the membranes are partially autolyzed, it seems unlikely that injection into the umbilical vessels would result in effective perfuse of the chorioallantois. In fact, this problem was encountered in one of the four mares in the 1998 study.

Although it is contraindicated to forcibly extract retained membranes, it is reasonable to attempt to encourage passage of the membranes by applying gentle pressure. If resistance is met, this should be discontinued immediately before damage is done to the endometrium.

Uterine lavage may be helpful at evacuating debris from the uterus. In cases of full retention, keep in mind that the lavage is acting on the allantoic side of the fetal membranes and not on the endometrium itself. However, if one fills the uterus with large volumes of saline, this will result in uterine distention and potentially, endogenous oxytocin release that may further aid in membrane passage.

If the membranes are partially separated from the endometrium, then the lavage may be effective at clearing necrotic debris from the endometrial surface and therefore, may decrease the risk of secondary metritis. We typically perform uterine lavage one time daily when membranes are retained.

In cases of chronic retention, we may tie small weights (e.g., 250-ml bottles of saline) to the retained membranes. It is our hope that this weight will provide a steady but gentle increased traction on the membranes that will encourage passage. Heavy weight is to be avoided, because it is more likely to cause the membranes to lacerate or damage the endometrium.

If the membranes still are not passed 6 h after the completion of second-stage labor, then broad-spec- trum antibiotic treatment (e.g., potassium penicillin and gentamicin) as well as non-steroidal anti-inflammatory drugs (e.g., flunixin meglumine) are begun in an attempt to prevent secondary complications. Mares are carefully monitored for signs of endotoxemia and laminitis, and additional treatments may be added if adverse signs develop over time.

**Prognosis for Systemic Recovery**

In uncomplicated cases of RFM in which the membranes are eventually passed without development of secondary complications, the prognosis for survival of the mare is excellent. If secondary complications arise, the prognosis is reduced proportionately. In the worst cases of septic metritis and laminitis, death can occur.

**Prognosis for Future Reproductive Success**

If the mare survives and does not develop secondary problems, her prognosis for future fertility is good. Depending on the length of time of retention and the development of secondary complications, for most breeds, we recommend that affected mares not be bred on foal heat. The mare’s uterus should be examined during her first post-partum diestrus, and if everything looks good at that time, she can be bred on her subsequent estrus. However, keep in mind that it has been reported that there is no difference in conception rates after the first breeding than at the end of the breeding season in mares that have or have not retained fetal membranes, regardless of the length of time of retention. Friesian mares are particularly resilient. In this breed, it has been reported that reproductive performance (defined as pregnancy rate, foaling, and foal-heat breeding) did not differ between Friesian mares that did or did not retain their fetal membranes. Nor did it differ in Friesian mares from whom the retained membranes were or were not extracted manually. Therefore, in Friesians at least, RFM and manual removal of the fetal membranes are not valid reasons to avoid foal-heat breeding.

2. Management of Mares After Cesarean Section

Cesarean section in the mare most commonly is limited to the referral hospital setting. Proper management of the post-Cesarean section mare is important for the mare’s survival and future reproductive success. Additionally, practitioners should be aware of the prognosis for mares and foals after the Cesarean section so that they will be better able to advise mare owners facing the possibility of referral of a mare for possible surgery.

**History**

Cesarean section most often is performed to deliver a foal when delivery per vagina proves to be impossible or is too risky for the mare. Thus, many mares presenting for care after Cesarean section have a history of severe dystocia. Elective Cesarean...
ans also may be performed in cases where vaginal delivery is considered dangerous for the mare (e.g., body-wall rupture or pelvic fractures with reduced pelvic diameter), in mares with a history of recurrent dystocias, or concurrently with colic surgery.40,41

Management

Management of mares after Cesarean section includes routine post-celiotomy care (e.g., fluid therapy, systemic antibiotics, non-steroidal anti-inflammatories, incisional care, monitoring of patient comfort, and overall physical condition, etc.). Specific care of the reproductive tract is also instituted. Because Cesarean section is associated with a higher incidence of RFM, most mares are begun on a course of oxytocin treatment immediately after surgery or even during surgery. This is intended to minimize the risk of RFM and also to encourage uterine involution.

There is considerable variation among clinicians as to whether or not uterine lavage is performed after Cesarean section.41,42 Some elect for daily uterine lavage in an attempt to keep the uterus free of unwanted debris and fluid accumulation. Others avoid post-operative lavage for fear of leakage into the abdomen or fear of irritation to the recently closed incision site. To the author's knowledge, there have been no reports designed specifically to study the efficacy of uterine lavage at improving post-operative fertility. We typically monitor post-Cesarean section mares by daily palpation and ultrasonography per rectum beginning 24–48 h after Cesarean section. If significant amounts of unwanted uterine fluid accumulate or if the character of the lochia becomes malodorous, then uterine lavage may be performed. If the uterus seems to be involuting well, then we often choose not to perform uterine lavage and instead manage the mare with oxytocin as needed (see section on RFM for doses and dosing intervals).

Prognosis for Systemic Recovery of the Mare

The prognosis for systemic recovery in mares undergoing Cesarean section has improved dramatically over the last few decades and now is very good. Overall survival rates in mares undergoing elective or emergency Cesarean section without concurrent colic surgery is ~90% with a 100% survival rate reported in a small group of mares undergoing exclusively elective Cesareans.40–43 Lower survival rates (38%) can be expected in mares undergoing Cesarean section concurrently with colic surgery. In these cases, the poor outcome is more likely caused by problems associated with the gastrointestinal tract than problems with the Cesarean section itself.

In one study, mares undergoing Cesarean section had a lower incidence of complications than those undergoing controlled vaginal delivery (CVD). Thus, Freeman et al.41 suggested that Cesarean section may be preferable to CVD if dystocia is protracted and CVD is likely to be difficult and prolonged. In contrast, a second study identified no difference in outcome between mares undergoing Cesarean section versus CVD. Byron et al.43 recommended selection of the delivery method that is likely to result in the fastest delivery of the foal.

Prognosis for Future Reproductive Success of the Mare

There is a misconception that a mare’s future reproductive success is adversely affected by Cesarean section. In contrast, using modern surgical methods and anesthesia, several reports indicate that the prognosis for future fertility in post-Cesarean section mares is very good. In one report, all mares bred back in the year after elective Cesarean section became pregnant.40 In other studies involving mares presenting for largely emergency Cesarean sections, the pregnancy rate in the year after surgery ranged from 50% to 72%.42,43 Notably, in one study, pregnancy rates in mares bred the same year as the Cesarean section were 60%.43 Thus, mares most often are able to return to a successful breeding career after Cesarean section; in some cases, they can even return to successful breeding within the same breeding season. In general, we make decisions on future breeding management on a case-by-case basis. For example, mares undergoing Cesarean section early in the year and who experience minimal post-operative complications may be returned to breeding later that same year, whereas mares undergoing surgery later in the year and who experience significant complications may be best waiting until the next year before breeding.

Prognosis for Survival of the Foal

The prognosis for survival of foals delivered by Cesarean section depends very largely on the duration of second-stage labor.43,44 Unfortunately, in most cases, the decision to proceed to a Cesarean section is made only after many hours of attempting a vaginal delivery, thus greatly reducing the chances of delivering a live foal with minimal complications. Delivery of a live foal after Cesarean section varies from 11% to 42%, and survival of the foal to discharge from the hospital is lower (5–31%).41–43 As might be expected, survival of foals delivered by appropriately timed elective Cesarean section was much higher (seven of eight foals survived to discharge in one study).40 The wide range in foal survival consistently depends on the duration of second-stage labor.43 Thus, whether or not a mare has a Cesarean section is not what determines outcome for the foal. Rather, it is how long it takes for a foal to be delivered, regardless of delivery method, that is the critical factor. Therefore, refer early.

3. Management of Mares After Dystocia

Many aspects of management of mares after Cesarean section also apply to the post-dystocia mare.
Because many dystocias are managed on the farm, this work often falls on the general practitioner.

History
Mares of any age and breed can experience dystocias. Recurrent dystocia occurring in separate years in the same mare is uncommon (6 of 247 dystocia cases in one report).\textsuperscript{43} Mares with a history of reduced pelvic diameter (e.g., secondary to a pelvic fracture or mass) may be at increased risk.

Management
Management of the dystocia itself is beyond the scope of this manuscript. However, it is worth noting that a recent report describes severe complications after contamination of the abdominal cavity with even small amounts of a commonly used polyethylene-polymer obstetrical lubricant (PEP, J-Lube).\textsuperscript{45} Contamination of the peritoneal cavity with as little as the equivalent of 1 l of a 1% (w/v) solution of J-Lube can result in toxic, suppurative peritonitis and often death within minutes of the contamination. Therefore, it may be prudent to avoid the use of J-Lube in cases in which a uterine laceration is present, in which there is a high risk of damage to the uterus during mutations, or when Cesarean section is likely.

After correction of a dystocia and vaginal delivery of the foal, the mare will be at increased risk for RFMs. As such, we typically begin all affected mares on oxytocin treatment after the foal is delivered and continue the treatment until the membranes pass or until the mares becomes uncomfortable as a result of the uterine contractions (see section on RFM for doses and dosing schedules). The reproductive tract should be examined per vagina in an attempt to identify any significant damage to the tract sustained during the delivery. Usually, the uterus is too large to permit full evaluation of the uterine horns per vagina. However, it is recommended that an attempt be made to examine as much as is feasible, because dystocia will increase the risk of uterine and vaginal lacerations. Early identification of these problems is critical to a successful outcome (see above).

Contamination of the uterus is inevitable after vaginal manipulations of the foal. Contamination can vary from minimal to severe. This contamination combined with the common complication of RFM leads me to perform uterine lavage regularly on most mares after dystocia. In general, an initial lavage is performed either after delivery of the foal or the next day. Daily examinations of the reproductive tract by palpation and ultrasonography per rectum are then performed to monitor uterine involution. If significant fluid or debris is identified in the lumen, then daily lavages with sterile saline are performed until the uterus appears clear. No controlled studies have been performed to show that post-dystocia uterine lavage results in improved recovery. However, it is my opinion that the procedure is, at worst, innocuous, and in many cases, it greatly aids uterine clearance and speeds involution.

We do not routinely perform abdominocentesis on mares after correction of a dystocia. Abdominocentesis becomes important in cases in which significant uterine damage is suspected. It has been reported that elevation of a single peritoneal fluid value (nucleated cell count, total protein, or percentage of neutrophils) in post-partum mares may be incidental. However, increases in two or more of these values is likely to be clinically significant.\textsuperscript{46}

Prognosis for Systemic Recovery of the Mare
The prognosis for systemic recovery in mares after resolution of a dystocia by assisted vaginal delivery (AVD) or CVD is excellent (~90%).\textsuperscript{43,44} One study suggested that CVD may be associated with more complications and a poorer outcome (only a 71% survival rate in mares undergoing CVD).\textsuperscript{41} This may be a result of the more prolonged deliveries in CVD mares in the 1999 study rather than a primary effect of the CVD itself. If a fetotomy is necessary to resolve the dystocia, then survival is lower (56%). Byron et al.\textsuperscript{43} reported that this may have been attributable to the economic necessity of performing fetotomy in some mares that would have been better served by Cesarean section. Alternatively, poorer outcomes in mares undergoing fetotomy may be caused by the fact that fetotomy is frequently used only as a “last resort” after prolonged attempts at manipulations of the foal.\textsuperscript{29} These mares, therefore, will be at increased risk for damage to the reproductive tract; this is not a result of the fetotomy itself but rather a result of the prolonged duration of the entire process.

Prognosis for Future Reproductive Success of the Mare
Overall pregnancy rates are good after resolution of a dystocia using either AVD or CVD. If mares were bred in the same season as the dystocia, pregnancy rates were lower than long-term pregnancy rates (58% vs. 66%, respectively).\textsuperscript{53} The author is aware of no studies that report fertility after appropriate use of fetotomy. It seems likely that fertility after fetotomy will vary largely depending on the degree of damage sustained by the reproductive tract after initial attempts at mutation and subsequent fetotomy and also based on the experience of the individual performing the fetotomy.

Prognosis for Survival of the Foal
The duration of second-stage labor is the single most important determinant of the outcome of the foal. It has been reported that for every 10-min increase in stage II labor beyond 30 min, there is a 10% increased risk of the foal being dead at delivery and a 16% increased risk of the foal not surviving to discharge.\textsuperscript{44} In foals surviving to discharge, the
length of stage II was 44–71 min. For non-surviving foals, the length was 85–249 min.\textsuperscript{43,44}

The length of time spent on attempting vaginal correction of a dystocia on the farm is only one component of the length of second-stage labor. In mares referred to secondary care facilities for dystocia resolution, travel distance, travel time, time spent arranging for transport, loading the mare, etc. all will play a role.\textsuperscript{44} The best outcome for the foal was reported in those mares that spent minimal time on the farm in second-stage labor before being referred to a local (10-min average travel time) referral institution for rapid delivery of the foal.\textsuperscript{43}

4. Hypogalactia/Agalactia

Poor milk production in a post-partum mare is an uncommon but significant problem for the wellbeing of the foal. Although hand feeding of an under-nourished foal is an option, this is a time-consuming and difficult undertaking. Therefore, development of methods to stimulate milk production in poor producing mares is desirable.

**Poor Nutrition**

A common and often overlooked reason for poor milk production is poor nutrition. The nutritional demands of the lactating mare are significantly greater than those of even late pregnant mares. Some mare owners are simply unaware of the increased metabolic needs of mares nursing foals. Simple improvements in nutrition sometimes are all that is needed to stimulate milk production. Restricted water intake, selenium deficiency, and stress also have been implicated as causes for hypogalactia in mares.\textsuperscript{47}

**Fescue Toxicosis**

One of the hallmarks of fescue toxicosis is poor milk production. The effects of endophyte-infected fescue on lactating mares have been well described and involve suppression of prolactin release by an ergot alkaloid toxin produced by the endophyte.\textsuperscript{48,49} Prolactin levels will return to normal if the mare is removed from the source of the toxin for 2–3 wk. Because dopamine suppresses prolactin release, the use of dopamine antagonists are central to treatment of agalactia associated with fescue toxicosis. Domperidone (1.1 mg/kg, PO q 24 h) or sulpiride (1 mg/kg, IM q 12–24 h) is commonly used for this purpose.

**Miscellaneous Comments**

Recently, hormonal induction of lactation in non-foaling mares has been reported.\textsuperscript{50} The originally reported protocol has been refined and simplified over the past several years, and it has now developed into a practical and simple method for reliably inducing lactation in non-foaling mares.\textsuperscript{51} The technique involves

- Days 1–7: 150 mg progesterone and 50 mg estradiol 17β, IM.
- Day 7: 5 mg prostaglandin, IM.
- Days 1–10: 500 mg sulpiride, q 12 h, IM.

Place the foal on the mare beginning on day 1 of treatment to supply suckle stimulation. The foal will initially require supplementation. The foal must be an aggressive suckler for this to work. If not, the mare can be milked manually five times a day until milk production is sufficient for the foal.

Oxytocin may be administered discretionarily at 5 IU, IV, or IM to enhance milk let down.

By day 10, 80% of treated mares will lactate sufficiently to support a foal.

An oral formulation of sulpiride is reportedly in development and may be available soon. The oral formulation will be easier to administer and also will be substantially less expensive than the injectable form.

5. Urovagina/Urometra

Urovagina (vesicovaginal reflux) is the retention of incompletely voided urine in the cranial vaginal fornix.\textsuperscript{52} If this condition is severe and/or if the mare’s cervix is open, urine may gain access to the uterus, resulting in urometra and a secondary endometritis. This condition is most often seen in older, multiparous mares and can occur after both normal deliveries and dystocias. Stretching and relaxation of the caudal reproductive tract occurs during vaginal delivery and leads to urine pooling. Pre-existing poor perineal conformation also may contribute to the condition.

Urovagina and urometra are associated with reduced fertility because of the resulting secondary endometritis, vaginitis, and cervicitis.\textsuperscript{53} Additionally, the accumulation of urine in the vagina and uterus leads to changes in pH that can adversely affect spermatozoa.

**Clinical Signs and Diagnosis**

In cases of severe urovagina and urometra, the mare may intermittently discharge urine from her vulva. This can lead to urine scalding of the perineum and inner thighs. In more mild cases, outward signs may not be evident. However, echogenic fluid (urine) may be apparent on transrectal ultrasonographic examination of the vagina and uterus. If urovagina is suspected, a definitive diagnosis can be made based on vaginal speculum examination and visualization of urine in the anterior vagina.

**Treatment**

Many older mares will pool urine in the post-partum period, but it is important to recognize that most will correct after they come under the influence of progesterone after their foal-heat ovulation. Therefore, if a diagnosis of urovagina/urometra is made in a post-partum mare, the decision as to whether or not surgery is indicated should be delayed until after
foal heat. Ideally, affected mares should then be examined during their 20 day heat, because the incidence of urine pooling is highest during estrus. If urovagina persists even after the mare has been through a post-partum diestrous period, surgical correction of urovagina may be indicated. This procedure has been described elsewhere.\textsuperscript{54}

Whether or not a mare corrects after her foal heat, conservative management of urovagina is advised during the early post-partum period, because many mares develop secondary urometra that can delay uterine involution. In our experience, mares with post-partum urovagina can pool very large volumes of fluid in the uterus. In our clinic, post-partum mares that accumulate significant amounts of uterine fluid are treated with daily large-volume uterine lavages. These lavages can be both therapeutic and diagnostic, because the character of the effluent can aid in the diagnosis of urometra.

In severely affected post-partum mares, urine re-accumulates quickly in the vagina and uterus. Although daily lavages may result in evacuation of the uterine contents, the fluid typically reaccumulates quickly such that the uterus is again distended with urine within 24 h of lavage. These mares are maintained on daily, large-volume saline lavage and regular oxytocin injections until resolution of the problem. Lavage is continued until the effluent recovered is clear. This may require as much as 15 or more l of saline. Exercise also is likely to be beneficial, because it may aid in mechanical evacuation of uterine fluid. A Caslicks procedure may help some mares, because pneumovagina can predispose the mare to urovagina.\textsuperscript{55}

Simple nursing care may be indicated if urine scalding of the skin is seen. This includes regular washing of the affected areas to remove residual urine and application of protective ointments such as zinc oxide to protect the skin. Additionally, poor body condition can predispose to urine pooling because of a loss of pelvic fat and a secondary sunken perineum.\textsuperscript{56} Thus, weight gain often is beneficial.

**Prognosis for Future Reproductive Success of the Mare**

If the condition of urovagina/urometra resolves or can be corrected surgically, the prognosis for future fertility of the mare is often good. Because this condition is most common in older mares, a complete breeding soundness examination, including endometrial swab for culture and endometrial biopsy, is typically indicated to better assess the mare’s potential fertility and to ascertain the extent of any secondary problems (e.g., bacterial endometritis) that may have resulted from the urovagina.

Mares that have developed urovagina/urometra subsequent to foaling are at increased risk for developing the condition after future foalings. Often, the problem worsens with each foal.

**References and Footnotes**

7. Pascoe RR. Rupture of the utero-ovarian or middle uterine artery in the mare at or near parturition. *Veterinary Record* 1979;104:77.


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