How to Assess and Stabilize a Mare Suspected of Periparturient Hemorrhage in the Field

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1. Introduction

The peripartum period is defined as the time period just before, during, or immediately after parturition. Although the vast majority of foalings proceed without complications, there are certain disease processes that are more common and unique to the peripartum period. One such concern is periparturient hemorrhage (PPH). Important causes of hemorrhage in peripartum mares include arterial rupture, uterine rupture, vaginal varicose veins, cervical lacerations, and other forms of perineal trauma. PPH is a fairly broad term, but for the purpose of this paper, it will be selectively used to refer to the process whereby rupture occurs to one or more of the arterial vessels supplying blood to the uterus and related structures.

A serious and often life-threatening condition, PPH is thought to be one of the most common causes of deaths in peripartum mares. A review of 98 records from central Kentucky during the 1992 and 1993 foaling seasons revealed that reproductive complications accounted for the majority (57 of 98 cases) of deaths in peripartum mares. Of the 57 mares that experienced reproductive complications and subsequently died, rupture of a uterine artery was determined to be the cause of death in 40 of these mares. A more recent report provided concurrent evidence regarding uterine artery hemorrhage being the most common post-partum complication in mares. Rupture of the external iliac artery, utero-ovarian artery, and uterine artery have all been attributed to the onset of PPH. Both the external iliac artery and utero-ovarian artery branch directly off of the aorta and the uterine artery branches off of the external iliac artery. Regardless of the site of rupture, PPH can lead to rapid and profound blood loss, which can result in hypovolemic shock and death. Consequently, suspected cases of PPH should be considered as true emergencies that require a timely evaluation and case assessment. The objective of this report is to provide practitioners with a brief overview of PPH and offer recommendations regarding the diagnosis, stabilization, and management of mares with PPH in the field.

2. Pathogenesis

The exact mechanism by which PPH occurs is currently unknown. Rooney has hypothesized that
the onset of PPH is a result of certain physiologic changes and increased mechanical forces that occur during late gestation. Briefly, age-related degeneration of one of the aforementioned arterial vessels because of increased strain from the gravid uterus can form an aneurysmal dilatation. Added stress by a late-term fetus or uterine contractions further compromises the endothelial lining of the vessel, which results in blood dissection and eventual rupture. Profound hypovolemia usually ensues, which can lead to severe hypoxemia, multi-organ dysfunction syndrome, and death. The right uterine artery has the highest frequency of rupture relative to the other vessels. The predisposition of this vessel to rupture could potentially be caused by displacement of the uterus to the left abdominal wall by the cecum, which results in increased tension in the right broad ligament. Unfortunately, both the mechanism of PPH and the propensity to affect the right uterine artery is still a subject of conjecture, because there are no scientific reports that evaluate the pathophysiology of PPH.

In the authors' experiences, there are at least three clinical scenarios that can cause PPH. The first scenario is that of direct hemorrhage into the peritoneal cavity. This particular form of PPH can lead to peracute and extreme hypovolemia, and thus, carries a guarded to grave prognosis for survival. The second scenario is that of hemorrhage confined to the broad ligament or serosal layer of the uterus, which often leads to the development of a hematoma. In general, hemorrhage confined to the broad ligament or serosal layer of the uterus carries a more favorable prognosis than direct hemorrhage in the peritoneal cavity. Hematomas in these regions are occasionally incidental findings during reproductive evaluations early in the parturient period. Nevertheless, they can rupture days to weeks after the initial hemorrhagic event and thereby, result in death. The third scenario is that of hemorrhage confined within the uterine lumen. In all likelihood, this type of PPH does not affect one of the larger arterial vessels previously mentioned; rather, it is thought to occur after rupture or laceration of one of the smaller mural vessels. In general, the prognosis for survival is fair to good; these mares do not seem to experience profound hypovolemia like those with the other types of PPH. It should be noted that mares can concurrently experience more than one clinical form of PPH. For example, a mare may experience direct hemorrhage into the peritoneal cavity and direct hemorrhage in the uterus at the same time. Therefore, careful evaluation and timely treatment, as will be discussed below, is essential in the management of any mare experiencing any signs of PPH.

3. Risk Factors

Certain predisposing factors have been identified that could cause mares to have PPH. Probably the most recognized factor is that of age. In one study, the average age of mares whose cause of death was attributed to PPH was >18 yr (range = 12–21 yr). In a separate study, the average age of mares that died because of PPH was 18.5 yr (range = 15–22 yr), whereas the average age of mares experiencing PPH but surviving the hemorrhagic event was 11.5 yr (range = 9–15 yr). This latter report suggests that younger mares may have an increased chance of survival after PPH compared with older mares, or alternatively, mares over the age of 15 yr were more likely to die after PPH than younger mares <15 yr old.

Another identified predisposing factor is copper deficiency. In 1968, Stowe reported that mares experiencing a fatal uterine-artery rupture had significantly lower serum copper concentrations compared with mares of similar age that were not experiencing hemorrhage during the periparturient period. Copper is thought to aid in maintaining elasticity and promoting integrity of vascular walls. Serum-copper concentrations have been shown to increase in normal mares during late gestation. These observations are suggestive of the inherent importance of adequate serum concentrations of this trace mineral during the peripartum period. Consequently, pregnant mares with low serum-copper concentrations may be considered at risk for PPH.

A previous episode of PPH could possibly be considered a predisposing factor. Unfortunately, there is very little published literature evaluating the recurrence of PPH in mares. Pascoe did report on one mare that had experienced a ruptured uterine artery but had survived the hemorrhagic event. The mare was bred again, and she conceived. The mare carried that foal to term, but she subsequently died because of another episode of PPH. This report suggests that a previous episode of PPH may predispose mares to a hemorrhagic event during future parturitions. However, anecdotal evidence from large breeding farms in central Kentucky provides a conflicting viewpoint in that many practitioners from these farms have not observed recurrent episodes of PPH in individual mares.

Although not clearly delineated in studies evaluating PPH, the parity of a mare could potentially serve as a risk factor for two reasons. First, the parity of a mare, in general, often increases with increasing age, which is a known risk factor for PPH (i.e., multiparous mares are often of a more advanced age than nulliparous or primiparous mares). Second, vascular degeneration or angiosis in uterine-biopsy specimens was shown to increase in severity as the number of foalings increased in mares. This finding could be extrapolated to pathologic changes that may occur in the greater arterial vessels supplying blood to the uterus. Therefore, this could possibly implicate increased parity as a predisposing factor in the onset of PPH.

Last, dystocia, breed, body condition, and environment could perhaps serve as additional risk factors leading to PPH. Further studies would be neces-
sary to determine the association between these risk factors and PPH.

4. Diagnosis

The severity and peracute onset of PPH constitutes, with very few exceptions, a true emergency situation. Consequently, a mare suspected of PPH necessitates a rapid response, an accurate yet efficient assessment, and proper therapy. The ability to respond rapidly to a suspected case of PPH is dependent on the clinician's practice range and geography. For example, in regions with a high concentration of horses, a veterinarian may be able to respond within a matter of a few minutes; in other regions, reaching the farm or ranch may take upward of 1 h or more. Regardless of the practice type, educating clients regarding common clinical signs and initial management strategies for mares suspected of PPH can prove useful before the veterinarian arrives on the premises.

Clinical Signs

The most common clinical signs associated with PPH are those commonly observed with acute abdominal pain, such as pawing, rolling/thrashing, restlessness, and generalized discomfort. Mares may also periodically curl their lip upward (i.e., the Flehman response), breakout into a cold sweat, become reluctant to rise or lethargic, and appear “shocky.” External hemorrhage is an uncommon occurrence, but it has been reported to occur in cases of PPH. However, some mares may not show any prodromal signs of PPH other than peracute death. Physical examination findings from mares experiencing PPH include tachycardia, tachypnea, and pale mucous membranes with a prolonged capillary refill time. In general, clinical signs are more severe and physical parameters are more abnormal in mares experiencing hemorrhage directly into the peritoneal cavity compared with those experiencing hemorrhage that is confined to the broad ligament or serosal layer of the uterus.

Clinical Assessment

Often, a clinician can gather important information over the phone while he or she is driving to the farm or ranch. Questions pertaining to the type, onset, severity, and duration of the signs can be asked during this time. Other potentially useful questions include those pertaining to the age of the mare, the complications observed during foaling, the relative pallor of the mare’s mucous membranes, the warmth of the mare’s distal extremities, the presence of a cold sweat, and the presence of the Flehman response. In suspected cases of PPH, the clinician can instruct the foaling attendant to keep the mare quiet and confined to a stall with no excessive auditory or visual stimulation. If the mare is severely painful, the clinician can instruct the owner or attendant to remove the foal to prevent the mare from harming the foal. The foal can be placed in a confined area just outside the stall where the mare can still see the foal. The authors have created such an area by using bales of straw or hay. It is important to realize that some mares may become even more distressed or anxious if the foal is removed, thereby leading to unwanted and untoward effects on the mare. Consequently, the disposition and mentation of the mare should be carefully evaluated before, during, and after removal of the foal.

Last, the clinician may consider having the attendant administer a proper dose of flunixin meglumine for analgesic purposes. This particular recommendation is at the discretion of the clinician and may be omitted if the clinician is unfamiliar with the foaling attendant or if there is risk of the attendant being harmed by the mare.

On arriving to the farm or ranch to evaluate a suspected case of PPH, the clinician should use a systematic yet efficient method to accurately assess the patient’s condition. The first step is to visually examine the mare before entering her stall. Evaluating the mare’s attitude, relative level of pain or anxiety, and other clinical signs can be easily and quickly assessed by observing the mare for ~15 s.

The second step is to properly restrain the mare and foal to allow for further evaluation. To do so, it is ideal to have one of the attendants place a halter and lead rope on the mare and have another person near the foal to quickly remove it from the stall if the mare becomes violently painful. No more than three people (i.e., two attendants and the veterinarian) should be in the stall. If the mare is severely anxious or painful, the clinician can immediately administer flunixin meglumine if not already given by the attendant; 1.1 mg/kg or 500 mg/500 kg, IV as well as a sedative or tranquilizer to facilitate further evaluation. The authors have found that administration of butorphanol tartrate (0.02 mg/kg or 10 mg/500 kg) alone can be useful in relieving signs of anxiety. Alpha-two agonists (e.g., xylazine and detomidine) can also be used alone or in combination with butorphanol to provide more profound sedation. The phenothiazine tranquilizer, acepromazine, is thought to be contraindicated in cases of PPH because of its potential to exacerbate the relative hypovolemic state of the mare.

After proper physical and (possibly) chemical restraint of the mare, the clinician should proceed with a swift physical examination using the “head-to-tail” approach. Beginning with the head, important areas to evaluate include the pallor and capillary refill time of the gingival mucosa, scleral injection, relative warmth of the ears, and character of the pulse in the transverse facial artery or maseteric artery. Proceeding caudal, the clinician can then run his or her hands along the lateral cervical region, dorsal thorax, and abdomen to feel for the presence of a cold sweat. Auscultation of the heart can then be performed to evaluate for the presence of tachycardia and a cardiac murmur/arrhythmia. The abdomen should also be ausculted to assess...
within a 35-ml catheter-tip syringe, and adding breaking open the capsules, placing the contents sules (0.25 g/capsule), the dose is often prepared by rhage in horses. Distributed in packets of 16 cap-

increasingly popular for use of controlling hemorrhage. Because time is of the essence, the clinician may forgo aseptic preparation and placement of the cath-

eter. After the catheter is placed, the veterinarian will collect blood for a complete blood count and biochemistry panel.

Hemostatic Agents

The authors’ current hemostatic agent of choice is aminocaproic acid (40 mg/kg or 20 g/500 kg) diluted in 1 l of isotonic saline and administered through the IV catheter. In humans, aminocaproic acid has been reported to be an inhibitor of fibrinolysis because of its inhibitory effects on plasminogen-activator substances.11 It is thought to have a similar action in horses, which results in the formation and stabilization of blood clots. This medication should be administered over the course of ~20 min, because anecdotal reports suggest that extrapyramidal signs may become apparent after rapid administration of this drug. This hemostatic agent can be adminis-
tered every 6 h at a maintenance dosage of 10–20 mg/kg or 5–10 g/500 kg. A recent study indicated that more prolonged therapeutic levels of aminocaproic acid can be achieved in healthy horses with a loading dose of 70 mg/kg followed by a constant rate of infusion of 15 mg/kg/h.12 However, such a means of administration is not likely possible in a field situation and should be reserved for hospitalized cases.

The Chinese herb, yunnan baiyao, has become increasingly popular for use of controlling hemorrhage in horses. Distributed in packets of 16 capsules (0.25 g/capsule), the dose is often prepared by breaking open the capsules, placing the contents within a 35-ml catheter-tip syringe, and adding ~20 ml of lukewarm water to form a paste. The resulting paste is then administered orally through the syringe. The authors currently use 16 capsules (4 g) per 500 kg horse, which is a dosage of ~8 mg/kg given every 6 h. This herb can be administered as soon as possible to mares suspected of experiencing PPH, because the onset of action is likely to depend on the herb’s absorption by the gastrointestinal tract. Although the mechanism of action of this herb is currently unknown, it has been shown to decrease template bleeding time in healthy halo-
thane-anesthetized ponies.13 Moreover, anecdotal reports from veterinarians in central Kentucky have been favorable regarding the relative efficacy of this herb as an adjunctive treatment in cases of PPH.8 Other hemostatic agents that have been used to treat acute and uncontrollable hemorrhage in horses include naloxone, conjugated estrogens, and formalin. Because naloxone is a pure opioid antagonist, administration leads to its binding of opioid receptors, thereby preventing binding of endogenous opioids. As a consequence, a relative reduction in physiologic hypotension could occur because of increases in cardiac output, total peripheral resist-
ance, and mean arterial pressure. Unfortunately, controlled studies have found the effects of naloxone to be of little consequence in canine acute-hemorrhage models.14,15 In horses, the reported dose is 8–32 mg/450 kg diluted in 500 mL of isotonic saline.5 The authors are of the opinion that naloxone does not likely exert a hemodynamic effect, but rather, it may relieve signs of anxiety. Thus, naloxone should not be administered to a mare sus-
ppected of PPH if she has already been given butorphanol because of the antagonistic actions of the two drugs. Conjugated estrogens have been shown to be of benefit in treating humans when long-lasting hemostasis is required.11 The mecha-
nism of action of conjugated estrogens is not known in humans. The current recommended dose for use in horses is 25 mg/kg; however, controlled studies evaluating the efficacy of conjugated estrogens in controlling hemorrhage in horses are lacking. Formalin has been used to treat horses with severe hemorrhage. Reports on the efficacy of formalin have been conflicting. An early study reported a 75.2% decrease in coagulation time after treatment with various doses and concentrations of formalin.16 A more recent study was unable to determine a significant difference in coagulation parameters or template bleeding times between normal horses treated with formalin and control animals.17 Certain side effects (e.g., lacrimation, salivation, muscle fasciculation, tachycardia, and tachypnea) have been reported after administration of high concentrations of formalin. The current recommended dose is 30–150 mL of 10% buffered formalin in 1 l of isotonic fluids.18

Volume Replacement and Resuscitation

During or after administration of the hemostatic agent, the clinical condition of the mare should be carefully but quickly assessed again. If she is rapidly deteriorating, certain resuscitative measures can be instituted. These include administration of hypertonic saline (3–5 mL/kg or 2 l/500 kg) or hetastarch (6–10 mL/kg or 3 l/500 kg). Another catheter can be placed in the contralateral jugular vein, and isotonic fluids can be rapidly bolused (10–20 l/500 kg) either as an alternate to or in addition to other measures. However, caution should be exercised with rapid volume replacement. A dramatic rise in blood pressure could potentially disrupt blood-clot formation, which could intensify the severity of the hemorrhage. A shock dose of
corticosteroids (e.g., prednisolone sodium succinate, 2 mg/kg or 1 g/500 kg, IV) may also be administered if the mare’s clinical condition is suggestive of severe cardiovascular compromise. Recurrent pain or anxiety can be managed with further administration of butorphanol and/or an alpha-two agonist. Nevertheless, the clinician should use discretion and avoid frequent administration of sedation to avoid adversely affecting the hypovolemic state of the mare.

If the mare remains quiet or free of anxiety, maintenance fluid administration (2 ml/kg/h or 24 l/500 kg/day) with isotonic fluids can be administered in an attempt to provide adequate perfusion of vital organs. Various management strategies exist for delivering maintenance fluids and are predicated on the resources available at the farm or ranch. One option is to have the foaling attendant administer 1–2 l of isotonic fluid every 1–2 h through a primary IV set. Another option is to hang 20 l of fluid using a coiled large-animal IV set and transfer sets suspended over the stall.

Administration of plasma and whole blood can be useful to provide clotting factors, improve oncotic pressure, and in the case of whole blood, provide oxygen-carrying cells. The technique for collection and administration of whole blood to horses has been described. Administration of plasma or whole blood require significant resources, and they also need to be administered fairly slowly. As such, their use may be considered prohibitive in a field emergency, particularly when rapid volume replacement is necessary. Nonetheless, administration of plasma or whole blood may be considered viable treatment options if the mare has been stabilized but is severely anemic.

Certain well-managed farms or stables, especially those that routinely foal out mares, may have supplemental oxygen or an oxygen tank available. Providing supplemental oxygen is considered a mainstay of treatment in humans experiencing uncontrollable hemorrhage. Supplemental oxygen can be provided to adult horses through nasal insufflation at a rate of 8–10 l/min. Humidification of the oxygen is ideal, but it is not deemed essential, particularly in critical cases.

6. Important Considerations

After the initial therapy has commenced, certain diagnostics can be performed to further evaluate the patient. Abdominal ultrasonography is a useful and non-invasive means for detecting the presence of free fluid within the abdomen. Although a 3-MHz sector probe is ideal for imaging of the abdomen, the 5-MHz linear probe commonly used for reproductive purposes can often prove useful in detecting the presence of abdominal fluid. The ultrasonographic appearance of active bleeding within the abdomen is characterized by the presence of numerous small hyperechoic reflections floating around the abdominal viscera, which has been described as “swirling smoke.” This finding is suggestive of an active arterial bleed within the abdomen, but it is not a definitive diagnosis, because other disease processes (e.g., uterine or intestinal rupture) may yield similar ultrasonographic findings. Abdominocentesis can be a useful means for differentiating between the different disease processes. For example, peritoneal-fluid analysis from a mare with a ruptured uterus often shows the presence of septic suppurative peritonitis, but this finding is not as likely in a mare with an arterial rupture. Because abdominocentesis is an invasive procedure and can lead to unwanted stimulation, prudence dictates that it is only performed after adequate stabilization of the mare.

A manual examination of the vestibule, vagina, cervix, and uterus may be useful if external hemorrhage is present or if intra-uterine hemorrhage is suspected. Doing so may help identify the source of hemorrhage. Nevertheless, such a procedure can prove stressful to the mare, so an evaluation should only be performed if the mare is deemed stable.

As mentioned above, a blood sample is immediately collected from the mare after placement of an IV catheter. The sample can be submitted for a complete blood count (CBC) and biochemistry profile. Values that are of particular interest include the packed cell volume (PCV) and total protein (serum or plasma). In the authors’ experience, the initial blood sample often shows a normal PCV, which is likely caused by compensatory splenic contraction; however, the PCV is often mildly low in total protein as well. That protein decreases acutely is perhaps because of the one-third space loss into the peritoneum, broad ligament, or uterus. The authors perform periodic monitoring (e.g., every 12–24 h) with CBCs and biochemistry profiles to monitor the relative concentration of leukocytes, the degree of anemia and hypoproteinemia, and the relative extent of azotemia. These values are useful in directing future treatments.

Clinical signs in mares experiencing PPH can mimic those of abdominal pain related to intestinal abnormalities (e.g., large-colon torsion, mesenteric rent with secondary small-intestinal strangulation, cecal perforation, etc.). As part of a routine colic evaluation, most practitioners usually pass a nasogastric tube and perform a rectal evaluation. Although these are very useful diagnostic measures, discretion is advised in performing these procedures in mares suspected of PPH. Passing a nasogastric tube can prove extremely stressful and thereby, lead to unwanted stimulation. A rectal examination can also prove stressful; in addition, it can cause the mare to make a forced abdominal press, which could potentially dislodge a blood clot that is forming at the site of hemorrhage. It is also worthy of mention that mares suspected of PPH should not be restrained with a twitch so as to avoid further stress. In the authors’ opinions, nasogastric intubation and rectal palpation should only be performed after PPH
has been ruled out or the mare is deemed stable enough for these particular procedures.

Broad-spectrum antibiotics, such as procaine penicillin G (22,000 IU/kg, q 12 h, IM) and gentamicin (6.6 mg/kg, q 24 h, IV) should be administered to prevent secondary complications, such as abscessation of a hematoma. Flunixin meglumine (1.1 mg/kg, q 12–24 h, IV) can also be used for analgesic and anti-inflammatory support. Treatment with flunixin meglumine (1.1 mg/kg, q 12–24 h, IV) is also warranted to provide both analgesic and anti-inflammatory support. Because both aminoglycosides and non-steroidal anti-inflammatory drugs have the potential to induce or exacerbate renal dysfunction, these medications should be administered with caution in a severely azotemic patient. Lastly, pentoxifylline* (8.5 mg/kg, q 8–12 h, PO) could potentially be used because of its proposed ability to improve flexibility of red blood cells and thus, deliver oxygen to ischemic tissues. To the authors’ knowledge, it is unknown if pentoxifylline has any adverse effects on the clotting cascade or interacts with the hemostatic agents mentioned above.

Treatment for suspected cases of PPH can be expedited with prior preparation, such as use of a “hemorrhage kit.” Furnishing a large fishing-tackle box with certain resources and treatments is a viable means to consolidate and organize essential items (Table 1). Please note that isotonic saline, and not heparinized saline, should be used to periodically flush the catheter. Heparinized saline may interfere with ongoing blood-clot formation, so it is contraindicated in a mare suspected of PPH.

Stabilization of the mare is judged by the veterinarian’s clinical impression and periodic evaluation of physical parameters. Improvement in the mare’s attitude, as well as a subjective decrease in pain, after initial treatment are encouraging clinical signs. A relative decrease in heart rate, improvement in the pallor of the mucous membranes, strengthening of the peripheral pulse, and increase in warmth of the distal extremities are suggestive of a favorable response to treatment. In the authors’ experience, mares suspected of PPH can be stabilized fairly rapidly (e.g., 30–60 min on initiating treatment). Mares that continue to remain painful or shocky despite hemostatic support and resuscitative measures may continue to deteriorate or die.

After the mare is considered “stable,” discretion lies with the clinician whether or not the mare should be referred to a hospital for further evaluation and care. In addition to the clinical state of the mare, other factors, including distance and time required for transportation, availability of transportation, welfare of the foal, and finances, must be factored into the decision to refer or keep on-site for further management.

Table 1. Items for a “Hemorrhage Kit”

<table>
<thead>
<tr>
<th>Item</th>
<th>Number</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-gauge IV catheters</td>
<td>3–4</td>
<td>Venous access</td>
</tr>
<tr>
<td>72” primary IV sets</td>
<td>2–3</td>
<td>Fluid delivery</td>
</tr>
<tr>
<td>Catheter caps</td>
<td>2–3</td>
<td>Catheter maintenance</td>
</tr>
<tr>
<td>2-0 ethionol suture</td>
<td>1–2</td>
<td>Secure catheter</td>
</tr>
<tr>
<td>1 l 0.9% saline</td>
<td>1</td>
<td>Drug delivery</td>
</tr>
<tr>
<td>Aminocaproic acid (250 mg/ml)</td>
<td>4</td>
<td>Hemostasis</td>
</tr>
<tr>
<td>Yunnan Baiyao (16 caps/packet)</td>
<td>1 packet*</td>
<td>Hemostasis</td>
</tr>
<tr>
<td>Lavender-top blood tubes</td>
<td>3–4</td>
<td>Complete blood count</td>
</tr>
<tr>
<td>Red-top blood tubes</td>
<td>3–4</td>
<td>Biochemistry panel</td>
</tr>
<tr>
<td>Butorphanol (10 mg/ml)</td>
<td>1 ml†</td>
<td>Analgesia/anti-inflammatory</td>
</tr>
<tr>
<td>Flunixin meglumine</td>
<td>10 ml</td>
<td>Analgesia/anti-inflammatory</td>
</tr>
<tr>
<td>20-gauge, 1.5-in needles</td>
<td>10</td>
<td>Facilitate drug delivery</td>
</tr>
<tr>
<td>18-gauge, 1.5-in needles</td>
<td>10</td>
<td>Facilitate drug delivery</td>
</tr>
<tr>
<td>20-ml Luer-tip syringes</td>
<td>3</td>
<td>Facilitate dilution of ACA</td>
</tr>
<tr>
<td>12-ml Luer-tip syringes w/saline</td>
<td>3–4</td>
<td>Catheter maintenance</td>
</tr>
</tbody>
</table>

*The author usually has a 35-ml catheter-tip syringe filled with Yunnan Baiyao powder previously made up. Addition of small amount of tap water can be used to form a paste to be delivered orally.
†The author usually labels and wraps the syringe in tinfoil to avoid light exposure.

7. Discussion

PPH is a severe and life-threatening condition in mares. Peripartum mares experiencing acute and/or uncontrollable signs of abdominal pain should be methodically yet efficiently evaluated for signs suggestive of PPH. Suspected cases of PPH should receive rapid treatment to promote hemostasis, resuscitate the cardiovascular system, and maintain adequate circulation to all vital organs. Because time is often of the essence in the initial management of mares with PPH, evaluation and treatment often occur concurrently. The clinician can exact preparedness by familiarizing himself or herself, as well as his or her clients, with common historical findings and clinical signs associated with PPH. He or she can expedite and facilitate treatment by using a “hemorrhage kit.” Other adjunc-
tive diagnostics, such as transabdominal ultrasonography, abdomincentesis, manual vaginal/uterine examinations, and bloodwork, can be performed after preliminary therapy has been started. On reaching a more exact diagnosis and if the mare is deemed stable, consideration can then be given to referral to a tertiary care center for further evaluation, treatment, and monitoring. Alternatively, the clinician's judgment may lead him or her to elect to continue treatment and management on site. Doing so can prove to be a time-consuming endeavor, but it may also prove to be in the best interest of the mare's welfare. Regardless of the option pursued, mares with PPH can remain in a critical condition for days, if not weeks. Nonetheless, initial assessment and stabilization can prove extremely rewarding when the practitioner's treatment and management results in preserving the life of the mare.

References and Footnotes

4. Pascoe RR. Rupture of the utero-ovarian or middle uterine artery in the mare at or near parturition. Vet Rec 1979;104:77.

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bTorbugesic, Fort Dodge Animal Health, Fort Dodge, IA 50501.
dDormosedan, Pfizer Animal Health, New York, NY 10017.
eAmicar, Wyeth-Ayerst Laboratories, Madison, NJ 07940.
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gSlovis, NM. Personal communication, 2006.
hHypertonic Saline Solution 7.2%, Bimeda, Inc., Le Sueur, MN 56058.
i6% Hetastarch, Hospira, Inc., Lake Forest, IL 60045.
jSolu-Delta-Cortef, Pharmacia & Upjohn Co., Kalamazoo, MI 49001.
kBain, FT. Personal communication, 2005.
lPentoxifylline Extended Release Tablets, Apotex Corp., Weston, FL 33326.