

Mare Problems in the Last Month of Pregnancy

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Medical problems in the last month of pregnancy may have devastating effects on the foal or both the mare and the foal. This paper will review the most common medical complaints in the last month of pregnancy in the mare. A general overview of the evaluation of the colicky mare in advanced pregnancy is provided as a guideline for differentiation between genital and nongenital causes of colic. Diagnosis and management of specific genital causes of colic as well as some specific condition related to the reproductive tracts are discussed in detail. Authors' address: Department of Veterinary Clinical Sciences, College of Veterinary Medicine, Washington State University, Pullman, WA 99164, e-mail: tibary@vetmed.wsu.edu. *Corresponding and presenting author. © 2012 AAEP.

1. Introduction

There has been substantial progress in the identification and management of high-risk pregnant mares in the last 5 years. Mares at risk of pregnancy loss include those with a history of medical or reproductive problems. Barren mares, old maiden mares, mares with cervical defects, and mares with recurrent pregnancy loss may all have difficulties in mid to late gestation. Mares with history of a medical or surgical problem that may be exacerbated by pregnancy including those with chronic cardiovascular or respiratory disease, gastrointestinal, metabolic, or endocrine disorders may also experience problems. Problems requiring immediate clinical evaluation to maximize foal and mare survival may also arise throughout pregnancy. It is important to communicate with owners on how previous and current disorders may adversely affect the mare's pregnancy during the prebreeding examination.

Clients should be instructed to closely monitor pregnant mares. Parameters that are easy for clients to monitor are the general demeanor of the mare, feeding behavior, mammary gland develop-

ment, and vaginal discharge. Vaginal discharge may be very discrete and should be suspected if the hair under tail is clumped. The major complaints during pregnancy can be grouped into the following: (1) colic; (2) abnormal vaginal discharge; (3) abnormal mammary development; (4) abnormal abdominal development or shape; and (5) accidents during the pregnancy.

This paper discusses the major disorders occurring in the last month of pregnancy, with special emphasis on the clinical diagnostic approach and referral protocols. Although the last month of gestation is defined as beginning around day 300, this can be variable because many physiological factors affect gestation length (breed of mare, breed of sire, season, nutrition, etc).

General Evaluation of the Colicky Pregnant Mare

The late pregnant mare is prone to colic, and the cause may be of gastrointestinal or genital origin.¹ Nonreproductive causes of colic include anterior enteritis, large colon volvulus, small intestinal incarceration, large colon impaction, tympany, small colon obstruction, and colitis.¹⁻³ Large colon volvu-

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lus occurs most commonly.⁴⁻⁶ Colic causes of genital origin include first stage of labor, uterine torsion, uterine rupture, preparturient hemorrhage, and hydrops. Inguinal herniation or ruptured prepubic tendon should also be considered genital because they are induced by the heavy gravid uterus. Attaining a diagnosis of the cause of colic relies on a systematic approach including history, physical examination, and ancillary tests if needed. Approach to diagnosing the cause of colic in the late pregnant mare is a challenge because examination can be restrictive due to the large size of the uterus, particularly when performing transrectal palpation or abdominocentesis.

Historic data to include are the mare's age, parity, stage of pregnancy (breeding date), previous colic episodes, previous surgery, response to analgesia, and degree and duration of pain. Management aspects to consider, especially for the hobby breeder, include changes in exercise, feeding, and water access. Colic signs vary in intensity from mild to severe. Some mares may show intermittent signs of discomfort, particularly after feeding. Underweight, malnourished, or stressed mares may be prone to developing gastric ulcers that may cause mild, often postprandial, colic. Other mares may go off feed intermittently, whereas some may be described as dull or reluctant to move. It is important to determine if there is a persistent tenesmus or violent colic because these cases may require immediate referral to a surgical hospital.

Physical examination should include heart rate, respiratory rate, capillary refill time, and auscultation of all abdominal quadrants. Mucous membranes should be evaluated for evidence of endotoxemia, presence of severe hyperemia, icterus, or paleness. Degree of dehydration should be estimated. The overall appearance of the mare (girth) and any abdominal distension should be noted. Late pregnant mares may not show a typical cardiovascular response to pain because they had several months to adapt to the demands of the growing fetus and placenta. Nasogastric reflux is always significant. Gastric distention can occur secondary to outflow obstructions, including extraluminal effects of displaced gastrointestinal viscera from the gravid uterus.

Transrectal evaluation of the abdominal content in advanced pregnancy presents a great challenge, even for experienced equine practitioners. In the case of violent colic, extreme caution should be exercised because mares can fall suddenly to the ground. The gravid uterus in the last month of pregnancy occupies the great majority of the abdomen, and displacement of some of the gastrointestinal tract is not uncommon.^{1,7} Because of the enlarged uterus, many gastrointestinal structures cannot be palpated rectally, and absence of obvious palpable abnormalities does not rule out gastrointestinal pathology. Transabdominal ultrasonography should be performed on all mares to evaluate

the gastrointestinal tract as well as the fetus and placenta.

The need for sedation depends on colic signs. Sedatives should be short-acting and rapidly cleared (xylazine or romifidine). The degree of rectal edema and amount and nature of fecal material in the rectal cavity must be evaluated. Mares may have a dry edematous rectum with thick mucus. Ample lubrication and local administration of lidocaine may help in the rectal examination. Epidural analgesia may also aid in rectal examination, but it must be considered carefully, particularly if referral is a possibility (ie, trailer ride). Primiparous mares may show recurrent signs of discomfort because of a large fetus. The first rule-out during transrectal palpation is uterine torsion. Mares with uterine torsion may show severe pain on palpation of the broad ligament (see below). An inability to advance the hand deep into the rectum may be due to hydrops allantois or large intestinal distension. Large intestinal distension is generally accompanied by severe straining. Palpation of distended small intestine warrants further evaluation for a non-strangulating or strangulating/ischemic small intestinal lesion. Decision of medical or surgical treatment will depend on the amount of gastric reflux and peritoneal fluid character. Palpation of the large colon may reveal displacement or gas distention. Palpation of tight tenia (bands) across the pelvic inlet is a significant finding in colonic volvulus.

The most common large colon problems in the late pregnant mare include displacement, volvulus, impaction, and tympany.^{1,3} Although rare, mares with large colon volvulus typically have a history of acute onset of violent colic, cardiovascular compromise, and progressive abdominal distension. Gastric reflux is present in about one-third of the cases.³

Distention of the large colon, cecum, and small intestine may be a consequence of external compression by the fetus.⁸ Palpation of the cecum is severely hindered by the gravid uterus. Tight tenia are suggestive of gas accumulation caused by colonic obstruction or displacement. Cecal rupture should be considered in mares with signs of endotoxic shock and contaminated peritoneal fluid.

Fecal balls should be palpable within the small colon. Impaction or gas distention may result from compression or impingement against the pelvic brim by the fetus.

Transrectal and transabdominal ultrasonography are performed to evaluate the gastrointestinal tract and fetal well-being and placental health. Reproductive parameters to be measured include the combined utero-placental thickness (CUPT) and a baseline biophysical profile of the fetus (heart rate, breathing movements, fetal activity, and tone).⁹⁻¹¹ Increased CUPT and evidence of fetal stress (sustained bradycardia or tachycardia) may indicate impending delivery.¹²

Ancillary tests may include complete blood count and serum biochemistry as well as abdominocentesis. Abdominocentesis is indicated when a genital

cause of colic is not identified or when there is abnormal fluid accumulation in the peritoneal cavity. Abdominocentesis is complicated in the late-term mare by the large size of the uterus. It is preferably performed after identification of a ventral fluid pocket by ultrasonography. There is an increased risk of perforation of the uterine wall. Ideally, the abdomen should be tapped with a teat cannula as close to the xyphoid as possible. Peritoneal fluid in the normal pregnant mare is similar to that of normal open mares. Complete blood count, serum biochemistry, and blood gas determination should be considered on a case-by-case basis.

Management of the Colicky Pregnant Mare

The effects of maternal colic on survival of the fetus have been described. Risk of abortion or delivery of severely compromised, premature foals is increased in mares that have prolonged endotoxemia and in mares in the last 60 days of gestation that have intraoperative hypoxemia and hypotension during surgery.^{1,5,6} In a retrospective review of 115 cases of colic in pregnant mares, abortion rate was 20.5% for surgical patients and 10.6% in medically managed mares. Foal survival was not dependent on the type of surgical lesion.⁶ In another study of 153 cases of colic in pregnant mares, the odds ratio for stillbirth or abortion was 3.5 times that of medically treated mares.⁴ The most significant risk factors for abortion or stillbirth were mare hypoxemia, duration of anesthesia (>3 hours), and hypotension during surgery.⁴ Signs of endotoxemia did not affect pregnancy outcome in either medical or surgical cases. Although these studies have not looked specifically at mares in the last month of pregnancy, it is very likely that advanced stage of pregnancy would exacerbate the risks, given the increased oxygen requirements of the fetus and the potential devastating effect of increased pressure exerted on the major vessels by the gravid uterus when mares are placed in dorsal recumbency. The risk for placentitis after colic surgery is increased in mares in advanced pregnancy because of contamination of the vagina during the long period of dorsal recumbency and relaxation of the anatomical structures that prevent contamination (perineum, vestibulovaginal sphincter, and possibly the cervix). Mares undergoing colic surgery may benefit from a Caslick's operation before abdominal surgery.⁴ Although mares have foaled without assistance as early as 10 days after surgery, it is highly recommended that foaling be monitored in a veterinary hospital if a laparotomy was performed in the last month of pregnancy.

The standard of practice in many equine hospitals is to place all colicky mares on preventative treatment for complications against enterotoxemia, placentitis, and uterine contractions. Altrenogest is commonly used to maintain myometrial quiescence in mares. Practitioners have commonly used a double dose in mares after severe colic episodes,

during treatment of placentitis, or after colic surgery. Recent reports suggest that altrenogest treatment in the last 2 months of pregnancy was associated with an earlier parturition and prolonged second stage labor, causing increased problems in newborn pony foals. Also, foals born to altrenogest-treated mares have a lower neutrophil-to-lymphocyte ratio.^{13,14} However, in a review of medical and colic cases, pregnancy outcome was not affected by progestin (altrenogest) therapy.⁴ More studies on the effect of long-term altrenogest treatment on foal adjustment to extrauterine life are needed.

Endocrine evaluation may be included in the monitoring of the high-risk pregnancy mare. The most common hormones monitored are total progestins and estrone sulfate. Total progestins fall rapidly in cases of imminent abortion or may increase progressively over a few days in cases of placentitis. Severe fetal compromise or fetal death is followed by a rapid decline in estrone sulfate.¹⁵ Interpretation of progestin levels should be based on the assay used because normal values can vary greatly, depending on the level of cross-reactivity with progesterone metabolites. Normal progestin levels are between 2 and 12 ng/mL until the last 23 weeks of pregnancy.¹⁶ In one study, total estrogen levels below 1000 pg/mL were associated with abortion in mares with placentitis.¹⁷

Specific Genital Causes of Colic in the Late Pregnant Mare

Idiopathic Colic

In the last month of pregnancy, primiparous or old mares may experience mild discomfort or low-grade colic due to fetal movements and position or slight displacement of the large colon by the gravid uterus. Signs that may be observed include yawning, pawing, dullness, and occasional rolling or grunting while in lateral recumbency. Physical examination parameters are often within normal limits, but fluctuation of heart rate may be noted. Gut sounds should be present. It is important to proceed with palpation in cases of low-grade colic to rule out large colon impaction and uterine torsion.

Mares in the first stage of labor or in the process of aborting display similar symptoms and may be mistaken for a pathologic colic. Transrectal palpation may reveal an open cervix with a fetus engaged in the birth canal. The first stage of labor is easily confirmed by vaginal examination.

In the last month of pregnancy, the fetus should be in anterior presentation. Deviations from this normal presentation may cause discomfort to the mare. Administration of analgesics (low dose of flunixin meglumine) and laxatives (mineral oil or magnesium sulphate by stomach tube) should alleviate some of these episodes of colic. Mares that are chronically showing discomfort or mild colic without evidence of genital or gastrointestinal abnormalities should preferably be on diet favoring soft feces (such as a bran mash).

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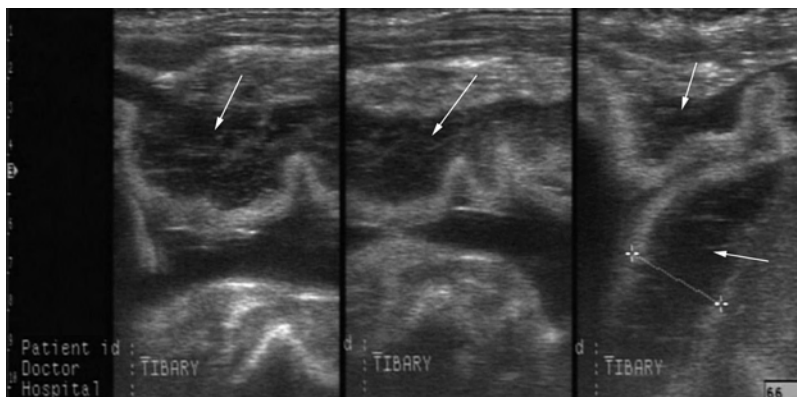


Fig. 1. Transrectal ultrasonogram showing severe placental edema (arrows) in a late-term mare (10 months) with uterine torsion (360°).

Uterine Torsion

Uterine torsion occurs generally after the 8th month of pregnancy. However, some cases have been reported as early as 110 days. It is hypothesized that fetal positioning in preparation for birth may be a factor in late-term uterine torsion. The mare dropping quickly to the ground before rolling has been suggested as a predisposing factor. Most uterine torsion cases reported in late pregnancy are often accompanied by excessive fetal activity in the flank region, recurrent colic, straining, and premature lactation.¹⁸ Abdominal pain is variable and depends on the extent of the torsion. The owner may report signs of restlessness, sweating, anorexia or poor appetite, frequent urination, wide-legged stance in the hind limbs, stretching, looking at the flank, rolling, and kicking at the abdomen. Signs may last several days. The interval between the beginning of this syndrome and the final diagnosis greatly affects the chances of fetal survival. Some mares may show mild signs of colic on and off for a few weeks. The most common historic fact is repeated bouts of mild colic after treatment with analgesics. Some mares may not show any outward signs of illness.¹⁹

Diagnosis of uterine torsion is made by examination per rectum examination. The broad ligament should be palpated carefully for tightness and direction. The ligament on the side of the torsion tends to be more caudal and palpates as a tight vertical band, whereas the opposite ligament is pulled horizontally across the top of the uterus. Unlike cattle, vaginal examination is generally not rewarding because the cervix is almost never involved in the torsion. The degree of torsion varies from 180° to 360° (rarely greater than 360°) and is sometimes difficult to ascertain. Some earlier studies have suggested that counterclockwise torsions are more common, but more recent reports found the opposite.² Direction of the torsion may not be easy to identify in some mares. In these cases, surgical correction is the only option.^{1,20}

Fetal and placental evaluation should be performed by transabdominal ultrasonography. Long-standing uterine torsion may show changes such as uterine and placental edema, placental separation, and congested broad ligament (Figs. 1, 2, and 3). F3 Abdominocentesis is indicated if the mare is depressed, endotoxemic, or pale, as uterine rupture may be a complication of uterine torsion.²¹

Three approaches are described for correction of uterine torsion: rolling under general anesthesia, standing flank laparotomy, and ventral midline laparotomy. The method chosen depends on the stage of pregnancy, mare breed, and degree of dam and fetal compromise. At term, the fetus may be manipulated vaginally to correct the uterine torsion. Manipulations are performed in the standing mare after epidural anesthesia. The mare should be placed on a slope so that the hindquarters are slightly elevated to facilitate manipulation.²²



Fig. 2. Transabdominal ultrasonogram of an area of placental detachment (arrows). UW indicates uterine wall; P, placenta.

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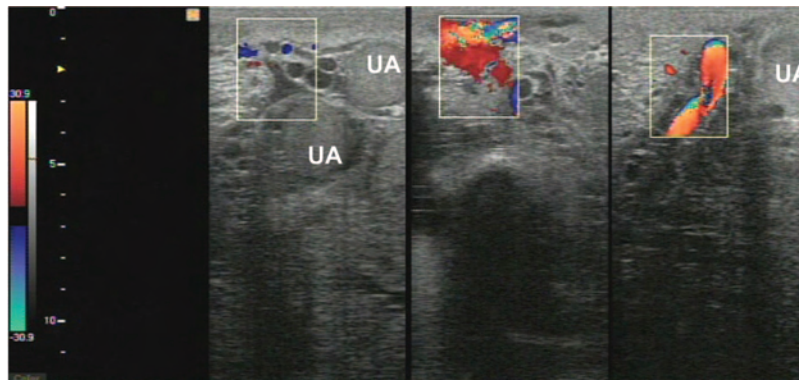


Fig. 3. Transrectal color Doppler ultrasonogram of the congested broad ligament in a late-term mare with uterine torsion (>360°). Note the large uterine artery (UA) and the tortuous arteries within the broad ligament (squares).

Rolling under general anesthesia may be performed at any stage.²³ However, it has been suggested that rolling in the last stage of pregnancy increases the risk for uterine rupture. The mare should be positioned in lateral recumbency on the side of the direction of the torsion. The uterus is maintained in stable position by pressure applied by a person sitting or standing on a plank placed on the dorsal flank. The mare is then rolled in the same direction as the torsion.²³ It may be necessary to roll the mare several times before the torsion is corrected. The mare is placed in a sternal position and checked per rectum after each roll. This technique has been associated with low incidence of uterine rupture and hemorrhage²⁴; however, these complications are relatively rare when the torsion is diagnosed and treated early.²

Surgical correction of uterine torsion may be accomplished by laparotomy, using a standing flank approach on the side of the torsion or under general anesthesia, using a ventral midline approach. Standing flank laparotomy offers the advantage of avoiding anesthetic complications. The incision is made on the side of the uterine torsion. A fetal hock is grasped gently and the whole fetouterine unit is rocked back and forth until it completely flips over. Large (near term) or dead fetuses may not respond well to this technique, and it may be necessary for another person to assist with the pendulum swing of the uterus via the other flank.² In large draft horses, correction of torsion via flank laparotomy is the preferred method in the authors' experience. In these breeds, in the last month of pregnancy a bilateral flank approach is often needed. Detorsion of the uterus may be facilitated by flooding the peritoneal cavity with large amounts of sterile fluid (lactated ringer's solution [LRS]).

Midline celiotomy is generally the best choice when there is a high risk for uterine wall compromise. In cases of severe uterine damage, delivery of the fetus may be the only choice to preserve the life of the mare. This approach is also recommended for chronic uterine torsion.¹⁹

Medical management after correction of uterine torsion is similar to that described for placentitis or postsurgical colic, except that antimicrobials are used only after surgical correction. Uterine thickness and vascular integrity should be monitored daily for 3 to 5 days. Measuring serum levels of progestins and estrone sulfate may be helpful in identifying mares with fetomaternal compromise. In imminent cases of abortion, total progestins and estrone sulfate decrease rapidly.¹⁵ Prognosis for fetal viability and normal foaling is excellent if the condition is diagnosed and treated before severe uterine compromise. Outcome of uterine torsion has been summarized recently in a retrospective study of 63 cases. Mare and foal survival rates were significantly lower (65% and 32%) when diagnosed at more than 320 days of gestation compared with mares diagnosed at less than 320 days (97% and 72%).² The poor survival of foals in advanced pregnancy is believed to be due to disruption of uterine blood flow resulting in fetal hypoxemia. Complications of uterine torsion include uterine rupture, irreversible thrombosis and uterine ischemia, hematoma, and extreme venous congestion.² Gastrointestinal complications of the uterine torsion include constriction of the small intestine.

Abnormal Vaginal Discharge

Mucopurulent or hemorrhagic vaginal discharge at any time during pregnancy should be immediately investigated by the clinician. The clinician should be aware that novice owners may be alarmed by observation of urine sediment on the vulvar lips and medial aspects of the legs in mares.

Hemorrhagic Vaginal Discharge

Bloody vaginal discharge in the pregnant mare without outward signs of discomfort or illness is not an uncommon complaint. The most common cause is hemorrhage from vaginal varicose veins. The extent of bleeding is variable and may be observed when the mare squats to urinate. In some cases, a large pool of fresh blood and blood clots may be

observed when the mare is recumbent. Many practitioners are often tempted to perform a manual examination of the cervix — this is discouraged because it may hinder the ability to determine the origin of the blood. Diagnosis is best performed by vaginal examination, using a Polanski speculum. The vaginal varicosities are usually found laterally on the cranial aspect of the vestibulovaginal fold and in some cases on the dorsal vaginal wall (Fig. 2). In the authors' experience, these are more frequent in older, large-frame mares. Application of astringent cream^a may help in some cases; however, these products have not been thoroughly evaluated in pregnant mares. Laser cautery is an option if the bleeding becomes more frequent and abundant.^{25,26}

Blood may originate from the placenta in the cervical star region in some cases of placentitis, although this is not common. If the mare presents with colic and vaginal bleeding, abortion or foaling must be ruled out. If there is no evidence of cervical or vaginal bleeding, the urinary bladder should be examined by endoscopy.

Mucopurulent Discharge

Ascending placentitis should be suspected in pregnant mares with mucopurulent vaginal discharge, particularly if there are other predisposing factors (ie, advanced age, loss of body condition, abnormal perineal conformation, etc). Mares with placentitis will often show premature mammary development and lactation. Although the majority of cases of ascending placentitis are caused by bacteria, fungal ascending placentitis has been reported as a cause of abortion.²⁷ Samples of discharge should be obtained for cytological and microbiological evaluation.^{27,28} The degree of placental compromise should be evaluated by transrectal ultrasonography. Management of placentitis in the mare has been reviewed extensively and includes treatment with anti-inflammatory drugs, antimicrobial therapy, tocolytics, scavengers of inflammatory products (ie, pentoxifylline), and improvement of blood flow and fetal oxygenation.^{10,16,29} However the positive effect of pentoxifylline therapy on uterine blood flow has been questioned in recent studies. In one study, long-term treatment (70 days) did not increase uterine artery blood flow in pregnant aged mares with endometriosis and increased placental vascular resistance, which may be detrimental to the fetus.³⁰ Short-term administration of therapeutic doses of pentoxifylline (17 mg/kg per os BID) was not associated with any significant increase in uterine artery blood flow in normal pony mares between 18 and 190 days of gestation.³¹

Abnormal Mammary Gland Development

Abnormal mammary gland development in the last month of pregnancy includes the two extremes (1) premature udder development and lactation and (2) absence of the expected mammary gland development.



Fig. 4. Ventral wall and mammary gland edema.

Premature lactation is a feature of placentitis, impending abortion, or premature delivery of twins. It is important to verify the breeding date(s) before examination. Miniature horses usually have a shorter pregnancy length, and this peculiarity should be taken into consideration when addressing a complaint of premature lactation. Increased mammary size may also be observed in cases of mastitis or severe mammary gland edema (Fig. 4).

Absence of mammary gland development in the last month of gestation may be due to the effects of fescue toxicosis or simply an error of breeding date. The first step in the diagnosis of failure of mammary gland development is to ascertain that the mare is still pregnant.

Abnormal Ventral Wall or Abdominal Girth

Causes of abnormal ventral wall or abdominal development in the late pregnant mare include (1) prepubic tendon rupture; (2) rupture of the mammary suspensory ligament; (3) body wall hernia; and (3) hydrops.³²⁻³⁴ The primary complaint in these cases may include excessive ventral edema, abdominal pain, colic, lameness or reluctance to walk, recumbency, or respiratory distress.³⁵

Prepubic tendon rupture tends to be acute in onset compared with hydrops allantois.^{9,33} Advanced mare age, breed (draft), and hydrops are the most important predisposing factors for prepubic tendon rupture. Initially, the mare may present only for rapidly developing ventral edema that progresses toward the mammary gland. A very tense, painful udder with hemorrhagic secretions is often observed in advanced cases.^{9,35}

Transrectal palpation is very useful for the diagnosis of hydropic conditions. The uterus is generally extremely distended, making it very difficult to ballot the fetus. In severe cases, the quantity of fluid may be so large that complete examination per rectum is almost impossible without heavy sedation or epidural analgesia. An increase of ≥ 4 cm in

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Fig. 5. Arabian mare with hydrops allantois.

abdominal girth measured daily indicates that hydrops is likely.

F5

Transabdominal ultrasonography may be helpful to assess ventral wall defects and confirm hydrops (Fig. 5). Differential diagnosis between hydrops amnios and hydrops allantois may be possible from biochemical analysis of fluid samples obtained from the larger cavity. Allantoic fluid is usually very high in potassium and creatinine.³³ Although there is a case report of managing a mare with hydrops amnios that resulted in delivery of a live foal, pregnancy is terminated in most cases to avoid complications such as prepubic tendon rupture, inguinal herniation, and uterine rupture.^{9,33}

F6

Induction of abortion or parturition may be attempted with controlled fetal fluid expulsion. Intravenous fluid therapy should be started (Fig. 6), and controlled fluid expulsion may be achieved by placing a large Foley catheter through the cervix and the allantochorion and draining the fluid over several hours before induction. Dystocia caused by malposition of the fetus and uterine inertia is often

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Fig. 6. Abnormal umbilical cord after induction of abortion in a mare with hydrops allantois.

a complication. Postpartum complications include hypovolemic shock and retained fetal membranes. Hypovolemic shock may be managed by administration of hypertonic saline and isotonic IV fluids.³³

Management of mares with body wall defects depends on the severity of the defect. Mares should be on stall rest and provided abdominal support, using homemade or commercial bandages.⁹ Administration of analgesics (flunixin meglumine IV or PO) or phenylbutazone (IV or PO) should be part of the management because the condition can be extremely painful.³⁵ Additional therapy including IV fluids, antimicrobials, and supportive therapy for placental function and fetal well-being (altrenogest, pentoxifylline, and vitamin E) may be considered in some cases. Conservative management is associated with relatively good outcome for the mare and fetus.³⁵ Induction of parturition carries risks of delivery of premature foals but may help salvage the mare. Emergency laparotomy is indicated if an intestinal incarceration is suspected. Elective cesarean section may be considered as a terminal procedure in severely debilitated mares; however, foal survival depends greatly on its readiness for birth. Recently, it has been shown that a large dose of dexamethasone (100 mg) given intramuscularly to mares on 3 consecutive days starting at 315 days of pregnancy induced parturition within 1 to 8 days from the last injection.³⁶ Foals delivered were healthy and appeared mature. This treatment may have a potential application to improve maturation and foal survival outcome in severely debilitated mares. However, this remains merely a speculation.

Prolonged Pregnancy

Prolonged pregnancy is a common complaint in practice, and owners are often worried about possible complications during foaling when mares are overdue (generally past 355 days). Although pregnancy length is quite variable, it is not uncommon to have pregnancies of up to 365 days with the birth of healthy normal foals. The most common causes of prolonged pregnancy are fescue toxicosis and intrauterine growth retardation. Fescue toxicosis is typically found in mares on pastures where tall fescue is infected by the toxigenic endophyte *Neotyphodium coenophialum*. The effects of ergopeptine alkaloids produced by the endophyte on pregnant mares have been thoroughly reviewed.³⁷ These alkaloids stimulate D2-dopamine receptors, causing lactotropes in the adenohypophysis to decrease production of prolactin. The resulting hypoprolactinemia is suspected to induce changes in utero-fetoplacental steroid metabolism and/or direct inhibition of corticotropes in the fetal anterior pituitary. Alterations in placental function result in decreased relaxin secretion and no increase in circulating progestins in the last month of gestation. In addition, exposed mares and their foals have decreased circulating concentrations of thyroxine (T4).

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The combined effects on placental function and alterations in the fetal hypothalamic-pituitary-adrenal axis are believed to be the cause of delayed signaling for parturition.³⁷

Clinically, mares with fescue toxicosis show very poor mammary development and an absence of the typical changes in mammary gland secretions (waxing, increases in calcium concentration) observed in normal pregnancy. Ultrasonographic placental evaluation often shows thickening and edema. Mares with prolonged pregnancy caused by fescue toxicosis are at a high risk for unattended foaling (because of an absence of premonitory signs), premature placental delivery (red bag), and dystocia. The ultimate consequence of all these effects is fetal asphyxia and birth of a weak or dysmature foal.

To avoid these effects, mares should be removed from infested pasture at least 30 days before the expected foaling date. Domperidone (1.1 mg/kg q 24 hours PO), sulpiride (3.3 mg/kg q 24 hours PO), and perphenazine (0.3 to 0.5 mg/kg q 24 hours PO) have all been used experimentally to prevent the endocrine alterations and clinical signs associated with ergopeptine alkaloid toxicosis in pregnant mares. Administration of domperidone 10 to 14 days before the expected foaling date has proven to be a useful prophylactic approach to ergopeptine alkaloid toxicosis in the pregnant mare. Treated mares should be monitored for colostrum loss.

In some areas of Northwestern United States and Canada, prolonged pregnancy has been associated with congenital foal hypothyroidism and ingestion of mustard plant.

Other Complications During Late Gestation

Several preexisting conditions or disorders may be exacerbated by advancing pregnancy. The metabolic demands of the pregnancy may put mares that already have compromised liver or kidney function in jeopardy.³⁸ Similarly, the increased size of the fetus and placental function can increase demands on cardiovascular and respiratory functions. Mares with ruptured hind suspensory ligament(s) or severe cases of osteoarthritis may become incapacitated in late pregnancy. Many cases present in late pregnancy with simple depression and poor demeanor, and often these are managed symptomatically until foaling.

Research is limited on the effect of endocrine or metabolic disorders on pregnancy. In recent years, the relationship between pituitary pars intermedia dysfunction, equine metabolic syndrome, pregnancy-associated laminitis, and disturbances of fetal and placental function have been discussed.³⁹ Studies show that postprandial glycaemic and insulinemic responses are enhanced in the last trimester of pregnancy in mares. Pregnant mares fed a high starch ration have prolonged hyperglycemia and hyperinsulinemia.⁴⁰ These metabolic changes may play a role in the exacerbation of equine metabolic syndrome by preg-

nancy and predisposition to laminitis.⁴¹ Acute lameness has been reported in mares in late gestation with chronic laminitis and has been attributed to increased weight.¹⁶ These mares may experience abortion or prolonged pregnancy as the result of decreased placental function and intrauterine growth retardation.

2. Conclusion

Mares in the last month of pregnancy can be challenging patients because of the wide variety of syndromes associated with pregnancy and its metabolic and physical effects. Substantial progress has been made in recent years in the identification of high-risk mares and their management. Veterinarians must approach medical complaints in pregnant mares with a suitable plan and be willing to refer the case if close continual observation and rapid veterinary assistance is not possible. Stabilization of the patient and referral is often the best course of action in cases of severe nonresponsive colic. Stabilization should include rehydration, anti-inflammatories, and antimicrobial therapy.

References and Footnote

1. Steel CM, Gibson KT. Colic in the pregnant and periparturient mare. *Equine Vet Educ* 2002;(Manual 5):5-15.
2. Chaney KP, Holcombe SJ, LeBlanc MM, et al. The effect of uterine torsion on mare and foal survival: a retrospective study, 1985-2005. *Equine Vet J* 2007;39:33-36.
3. Boening KJ, Leendertse IP. Review of 115 cases of colic in the pregnant mare. *Equine Vet J* 1993;25:518-521.
4. Chenier TS, Whitehead AE. Foaling rates and risk factors for abortion in pregnant mares presented for medical or surgical treatment of colic: 153 cases (1993-2005). *Can Vet J* 2009;50:481-485.
5. Santschi EM, Slone DE. Maternal conditions that cause high-risk pregnancy in mares. *Compend Contin Educ Pract* 1994;16:1481-1487.
6. Santschi EM, Slone DE, Gronwall R, et al. Types of colic and frequency of postcolic abortion in pregnant mares: 105 cases (1984-1988). *J Am Vet Med Assoc* 1991;199:374-377.
7. Hurcombe S. Colic in late-term pregnant mares and foals, in *Proceedings*. North Am Vet Conf 2011:129-132.
8. Davis JL, Posner LP, Elce Y. Gabapentin for the treatment of neuropathic pain in a pregnant horse. *J Am Vet Med Assoc* 2007;231:755-758.
9. Macpherson ML. Identification and management of the high-risk pregnant mare, in *Proceedings*. World Equine Vet Assoc 2007;53:293-304.
10. Tibary A, Fite C, Sghiri A, et al. Pregnancy complications and evaluation of fetal well-being, in *Proceedings*, 9th World Equine Vet Assoc, 2006:196-206.
11. Troedsson MHT. High risk pregnant mare. *Acta Veterinaria Scand* 2007:49.
12. Bucca S, Fogarty U, Collins A, et al. Assessment of fetoplacental well-being in the mare from mid-gestation to term: transrectal and transabdominal ultrasonographic features. *Theriogenology* 2005;64:542-557.
13. Neuhauser S, Palm F, Ambuehl F, et al. Effects of altrenogest treatment of mares in late pregnancy on parturition and on neonatal viability of their foals. *Exp Clin Endocr Diab* 2008;116:423-428.
14. Neuhauser S, Palm F, Ambuehl F, et al. Effect of altrenogest-treatment of mares in late gestation on adrenocortical function, blood count and plasma electrolytes in their foals. *Equine Vet J* 2009;41:572-577.

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15. Ousey JC. Hormone profiles and treatments in the late pregnant mare. *Vet Clin N Am Equine Pract* 2006;22:727–747.
16. LeBlanc MM. Ascending placentitis in the mare: an update. *Reprod Domest Anim* 2010;45:28–34.
17. Douglas R. Endocrine diagnostics in the broodmare: what you need to know, in *Proceedings*. Annual meeting of the Society for Theriogenology. 2004:106–115.
18. Frazer GS, Embertson RM, Perkins NR. Complications of late gestation in the mare. *Equine Vet Educ* 2002;(Manual 5):16–21.
19. Freeman DE. Chronic uterine torsion: a rare and unusual disease. *Equine Vet Educ* 2010;22:487–488.
20. LeBlanc MM. Common peripartum problems in the mare. *J Equine Vet Sci* 2008;28:709–715.
21. Pascoe JR, Meagher DM, Wheat JD. Surgical management of uterine torsion in the mare: a review of 26 cases. *J Am Vet Med Assoc* 1981;179:351–354.
22. Vanderplassche M. Dystocia. In: McKinnon AO, Voss JL, editors. *Equine Reproduction*. Philadelphia: Lea and Febiger; 1993:578–587.
23. Riggs L. How to perform non-surgical correction of acute uterine torsion in the mare, in *Proceedings*. Am Assoc Equine Pract 2006;52:256–258.
24. Wichtel J, Reinerstson E, Clark T. Nonsurgical treatment of uterine torsion in seven mares. *J Am Vet Med Assoc* 1988;193:337–338.
25. Frazer GS. Differential diagnosis for vaginal haemorrhage in the mare. *Equine Vet Educ* 2005;17:153–155.
26. DeLuca C, Dascanio JJ, Berry DB. Nd:YAG laser treatment of a vestibulovaginal varicosity in a 15-year-old pregnant mare. *J Equine Vet Sci* 2007;27:217–220.
27. Laugier C, Foucher N, Sevin C, et al. A 24-year retrospective study of equine abortion in Normandy (France). *J Equine Vet Sci* 2011;31:116–123.
28. Tibary A, Fite CL. Reproductive tract infections. In: Sellon DC, Long MT, eds. *Equine Infectious Diseases*. Elsevier; St. Louis 2007:84–103.
29. Macpherson ML, Bailey CS. A clinical approach to managing the mare with placentitis. *Theriogenology* 2008;70:435–440.
30. Ousey J, Koelling M, Willis D, et al. Effects of pentoxifylline on uterine blood flow, and placental and fetal development in young and aged mares with endometriosis. *Anim Reprod Sci* 2010;121:343–344.
31. Bailey CS, Sper RB, Schewmaker JL, et al. Uterine artery blood flow remains unchanged in pregnant mares in response to short-term administration of pentoxifylline. *Theriogenology* 2012;77:430–436.
32. Bucca S, Romano G. Case of equine hydramnios in late pregnancy. *Ippologia* 2000;11:35–38.
33. Christensen BW, Troedsson MHT, Murchie TA, et al. Management of hydrops amnion in a mare resulting in birth of a live foal. *J Am Vet Med Assoc* 2006;228:1228–1233.
34. Lyle SK, Paccamonti DL. High risk pregnancy in the mare: practical implications for the practitioner. *Pferdeheilkunde* 2010;26:29–35.
35. Ross J, Palmer JE, Wilkins PA. Body wall tears during late pregnancy in mares: 13 cases (1995–2006). *J Am Vet Med Assoc* 2008;232:257–261.
36. Ousey JC, Kolling M, Kindahl H, et al. Maternal dexamethasone treatment in late gestation induces precocious fetal maturation and delivery in healthy Thoroughbred mares. *Equine Vet J* 2011;43:424–429.
37. Evans TJ. The endocrine disruptive effects of ergopeptine alkaloids on pregnant mares. *Vet Clin North Am Equine Pract* 2011;27:165–173.
38. Johns I, Del Piero F, Wilkins P. Hepatic encephalopathy in a pregnant mare: identification of histopathological changes in the brain of a mare and fetus. *Aust Vet J* 2007;85:337–340.
39. Johnson PJ, Messer NT, Ganjam SK, et al. Pregnancy-associated laminitis in mares. *J Equine Vet Sci* 2009;29:42–46.
40. George LA, Staniar WB, Cubitt TA, et al. Evaluation of the effects of pregnancy on insulin sensitivity, insulin secretion, and glucose dynamics in Thoroughbred mares. *Am J Vet Res* 2011;72:666–674.
41. Firshman AM, Valberg SJ. Factors affecting clinical assessment of insulin sensitivity in horses. *Equine Vet J* 2007;39:567–575.

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