How to Manage Hydrops Allantois/Hydrops Amnion in a Mare

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1. Introduction

Hydrops conditions of the placenta in the mare are uncommon, with hydrops allantois being reported more frequently than hydrops amnion. The condition in the mare usually develops during the last trimester of pregnancy and is characterized by the excessive accumulation of allantoic (hydrops allantois) or amnionic fluid (hydrops amnion). The sequelae of unnoticed or untreated hydrops allantois/amnion can be significant, including abdominal wall hernias, prepubic tendon rupture, and cardiovascular shock associated with unattended foaling and dystocia. The condition is often detected by the horse owner as a sudden onset of abdominal enlargement (over a period of a few weeks), ventral edema, varying degrees of colic, lethargy, anorexia, tachycardia, and, on occasion, dyspnea associated with intra-abdominal hypertension (Fig. 1). Differential diagnoses include twins, other causes of colic, and causes of ventral edema.

Definitive diagnosis requires a trans-rectal examination of the reproductive tract and transabdominal sonogram to detect abnormally abundant fetal fluids. The allantoic fluid volume in mares with hydrops allantois can range from 110 to 230 L, whereas a normal volume at term ranges from 8 to 18 L. Rectal examination will reveal a large, fluid-filled uterus of varying tightness with the dorsal...
wall potentially protruding above the level of the pubis and absence of fetal ballottement. Rectal exam for hydrops amnion is similar to hydrops allantois, except the uterus will not be protruding above the level of the pubis. Transabdominal sonography for hydrops allantois will reveal excessive allantoic fluid, with depth >18 cm highly suggestive of hydrops allantois. The normal amount of allantoic fluid depth is 4.7 to 22.1 cm, with a mean maximal depth of 13.4 ± 4.4 cm (Fig. 2). Imaging of the non-pregnant horn usually reveals an abnormal amount of allantoic fluid.

In hydrops amnion, the sonographic appearance of the amnion is turgid, without the normal undulating appearance. The average normal volume of amniotic fluid in the mare is 3 to 7 L. Excessive amniotic fluid depth will also be noted. Normal fluid depth of the amniotic cavity is 0.8 to 14.9 cm (mean, 7.9 ± 3.5 cm).

Treatment for hydrops usually consists of the early recognition and drainage of the excess fluid, which usually leads to termination of the pregnancy. There has been one report in literature in which conservative medical management for hydrops amnion resulted in a viable foal. This animal, however, was noted to be of small stature at 1 year of age and had limb deformities that had to have several procedures performed over the first 10 months of life until they were eventually corrected. The complicating sequelae associated with hydropic conditions may include rupture of the pubic tendon or abdominal musculature, inguinal herniation, uterine rupture, abortion, and hypovolemic shock. Uterine inertia associated with the prolonged stretching of the uterus and abdominal musculature is common during parturition. This inertia can result in dystocia and retention of fetal membranes. Given the severity of the complications associated with hydropic conditions, slow drainage of the excessive fluid(s) with resulting abortion is often recommended to salvage the mare.

The following technique describes how to safely drain excessive fluid and perform a vaginally assisted delivery in mares with hydropic conditions.

2. Materials and Methods
The following diagnostic equipment and supplies are needed:

Fig. 2. Sonographic image of a hydrops allantois. Note the excessive allantoic fluid with a depth of 30.29 cm (normal allantoic depth: 4.7–22.1 cm).

Fig. 3. Sharp, 32F Trocar to penetrate the chorioallantoic membrane. Note the waterproof “waders” worn by the veterinarian. This is important to stay dry and comfortable during the draining procedure.

Fig. 4. Several 5-gallon buckets used to quantitate the volume of allantoic fluid drained during the procedure. Quantitating the amount of fluid evacuated is important so that the veterinarian can calculate the amount of intravenous fluids needed to prevent hypotensive shock.
### AMBULATORY PRACTICE

- Ultrasound machine
- 5- to 7-mHz linear transrectal probe
- 2- to 3.5-mHz transabdominal probe
- 10- to 14-gauge intravenous catheter
- Two 1-L bottles of 8% hypertonic saline
- 40 to 60 L of polyionic crystalloids
- High-flow fluid administration set
- Prostaglandin E (PGE) gel\(^a\) (if cervical dilation is desired)
- or N-butylscopolammonium bromide gel\(^b\) (compounded)
- Brown gauze
- Lidocaine and scissors for episiotomy (“open” caslicks)
- Sterile gloves and sleeve
- 28F to 32F thoracic trocar\(^c\) (sharp tip)
- Sterilized stomach tube
- 5-Gallon bucket
- Euthanasia solution\(^d\)
- Flunixin meglumine\(^e\)
- Sedation
- Detomidine\(^f\)
- Romifidine\(^g\)
- Xylazine\(^h\)
- Prophylactic treatment with antibiotics
- Head snare
- Chains and handles
- Sterile lubricant

#### Evaluation of the Mare

Once a diagnosis of hydrops allantois or amnion is confirmed, fetal viability is determined, and under development and milk electrolytes (when warranted) will be assessed to estimate the level of fetal maturity. Client communication is critical to establish the relative value of the mare or fetus, the risks posed to each, and the potential sequelae. Mares that present early in gestation may undergo elective termination of pregnancy by intramuscular injection of cloprostenol\(^l\) (500 \(\mu\)g IM q 12 h until delivery), as long as the amount of fluid is not too excessive to send the mare into shock with spontaneous abortion. Cases that occur later in gestation, or those with profound abdominal enlargement with large volumes of fluid within the uterus, usually require controlled drainage of the hydric fluid before expulsion of the fetus to control cardiovascular shock. Mares that present during the last 2 to 4 weeks of pregnancy may be managed by conservative therapy (maintain abdominal wrap for support, veterinary evaluation at least weekly, and have veterinary staff available for correction of dystocia and hypotensive shock) or partial drainage. The aim of the partial drainage is to maintain pregnancy for as long as possible for additional fetal maturation to occur. A physical exam of the mare will be performed along with complete blood cell count, fibrinogen, and serum biochemistry. In the authors’ experience, mares with high muscle enzymes (creatinine kinase >1200 U/L) are at risk for rupture of abdominal musculature or the prepubic tendon. These mares should have controlled drainage of the fluid because of the high risk for fatal complications. In our experience, it is not uncommon to have an animal that is hypocalcemic. Hypocalcemic patients will be more vulnerable to hypotensive shock when the abdominal pressure is released during hydric drainage. These animals may require intravenous calcium supplementation before and during drainage.

#### Hydrops Drainage

The technique for drainage involves several considerations, with the most important being safety and comfort for both veterinarian and the patient. Location (stocks or stall) is determined by the individual preference and the condition of the mare.

The mare may have to be initially sedated and treated with flunixin meglumine (1 mg/kg IV) for ease of management. The tail should be wrapped and the perineal area should be surgically prepared. If present, the caslicks should be “opened.” Sterile technique should be followed during the procedure. Prostaglandin E\(^a\) or N-butylscopolammonium\(^b\) bromide gel is gently massaged onto the cervix if cervical dilation is desired. A PGE\(_1\) gel can be made by crushing 200 \(\mu\)g of misoprostol\(^l\) tablets, resuspending in 1.5 to 2 mL of saline, and further mixing with 1.5 to 2 mL of sterile lubricant. PGE\(_2\) gel may also be used.\(^{11}\) After 5 minutes, the cervix can be gently dilated manually. The veterinarian should be careful not to excessively dilate the cervix because he or she will not be able to control the rate of drainage of the fluid. If the veterinarian does not want to abort the fetus or induce the mare, then the dilation of the cervix may not be recommended. Once dilated, the mucus plug will be easily removed and the chorionic-allantoic membrane can be palpated. The use of either a 28F or a 32F, sharp-tipped trocar\(^c\) is then used to penetrate the chorionic-allantoic membrane...
(Fig. 3). If a hydrops amnion has been diagnosed, then the trocar must penetrate both the chorioallantoic and the amnion membranes. A small, sterilized stomach tube is then placed through the trocarized membrane(s) to aid in the drainage of the fluid. The hydropic fluid will be collected for culture. The allantoic or amniotic fluid is then drained in a slow (over 1–2 hours, depending on the volume of fluid to be drained) and controlled manner. To help control the drainage of fluid, a clamp on the tubing or a finger can be used as a “valve” at the end of the tube. During the drainage process, the heart rate of the patient is evaluated every 5 to 10 minutes. Should the heart rate increase above 56 to 60 bpm, then the drainage should be halted and the administration rate of intravenous fluids (colloids and/or crystalloids) can be increased until the heart rate returns to baseline. The fluid will be collected in 5-gallon buckets so that the amount of fluid drained can be calculated (Fig. 4). Knowing the exact amount of fluid drained will enable the practitioner to calculate the amount of crystalloids that the animal should receive during and after the procedure. During this process, pericervical separation of the placenta is common.

If partial drainage and maintenance of the pregnancy is the goal, then these mares will be treated with additional antimicrobial therapy, flunixin meglumine (1 mg/kg PO or IV q 12 h for 5–7 days) and double-dose altrenogest (0.088 mg/kg PO q 24 h).

Extraction of the Fetus and Fetal Membranes

Manual extraction of the fetus can be performed, or the natural sequence of parturition can be allowed to occur. Weakening of the abdominal musculature (from overstretching) as well as uterine inertia are common findings that result in an inadequate stage II abdominal press and delivery. Malpositioning and malpostures are very common, and assisted vaginal delivery is usually needed; however, care must be taken not to traumatize the cervix. The expelled fetus generally is alive, and humane euthanasia will be warranted. The fetus should have a full necropsy as well as appropriate cultures and viral isolation to rule out an infectious disease.

Retention of fetal membranes should be expected, and appropriate treatment for removal and prevention of metritis-laminitis complex is indicated. Treatment generally consists of the prophylactic antimicrobials, and a low dose of oxytocin (10–20 IU) should be administered intramuscularly initially. Oxytocin administration should be repeated at 1- to 2-hour intervals to effect. The sensitivity to oxytocin may vary, and a positive response is indicated by the passage of fluid from the vagina. Oxytocin stimulates uterine contraction by increasing calcium release from the myometrium. Oxytocin concentrations are typically low throughout gestation and increase during parturition. Uterine sensitivity to oxytocin increases toward term, potentially as the result of receptor abundance or regulation of signaling pathways after receptor binding. Because most of these mares are several weeks from their foaling date, the receptor regulation of oxytocin may be altered and the response to a typical dose of oxytocin may be blunted. If the mare has already received oxytocin intramuscularly and failed to respond, then an intravenous drip of oxytocin (0.6 IU added to 1 L of saline, should be started. The drip rate will vary on the individual mare (30 minutes to 1 hour).

The key to preventing metritis, endotoxemia, and laminitis is uterine lavage. Uterine lavage can be performed between the membranes and endometrium or by use of the Burn’s technique of expanding the allantoic cavity to facilitate separation. This can be repeated until the fluid comes back clear. If a section of membrane can be reached, then it may be gently twisted off the endometrium and removed. However, if it is firmly adhered, then traction should be avoided because it may result in uterine inversion or tearing. It is not uncommon to have fetal membranes be retained for 2 to 3 days. To help prevent toxic metritis the uterus may be lavaged with large volumes of fluids 2 to 3 times per day if necessary. Intrauterine infusion with antimicrobials is recommended by these authors but remains controversial. Prophylactic treatment for laminitis should include deep bedding, with or without cryotherapy of the hoofs, flunixin meglumine (1.1 mg/kg IV q 12 h or q 8 h if endotoxemic), and hoof pads.

3. Results

More than 30 mares over the past 10 years have been treated by these authors’ with the use of this technique. Approximately 90% of these mares exhibited signs of hypotensive shock during the drainage of fluid, which included muscle tremors, elevated heart rate, and colic. These signs subsided with appropriate fluid/collodion therapy. The majority of the mares recovered well from the procedure and later were discharged from the hospital. One mare died after 72 hours as a result of rupture of a uterine artery. In 10 mares that were within 4 weeks of term, maintenance of the pregnancy has been attempted after partial drainage of the allantoic compartment. These mares were treated with additional antimicrobial therapy, flunixin meglumine (1.1 mg/kg IV or PO q 12 h for 3–5 days), and altrenogest (0.044–0.088 mg/kg PO q 24 h). In cases in which partial drainage has been attempted, fetal death can occur as a result of fetal asphyxia that results from varying degrees of placental separation. Iatrogenic fetal infection can also occur, secondary to contamination of the placental fluids during drainage. To date, all the authors’ mares that were treated with partial drainage aborted a nonviable fetus.
4. Discussion

Neither hydrops allantois nor amnios are common conditions in the pregnant mare, but, if not detected early, can lead to the death of both mare and foal. Hydrops amnion, unlike hydrops allantois, develops gradually over several weeks to months during the second half of gestation. Although swallowing in the fetus plays a role in the maintenance of fetal fluid balance, other mechanisms may be important. Amniotic fluid in mares is composed of secretions of the amnion and the nasopharynx of the fetus, fetal saliva, transudation from maternal serum, and fetal urine.  

Whether the problem arises because of an increase in secretion or decrease in resorption or both is not clear. It has been suggested that the fetus might actively regulate the volume and composition of the amniotic fluid by deglutition, and the prevention or impairment of swallowing may lead to hydramnios.

The pathophysiology of hydrops allantois in the mare remains unknown. Some authors have suggested that the increase in fluid is a placental problem caused either by increased production of fluid or decreased transplacental absorption. Others have proposed that the etiology is related to placentitis and heritability. One of the authors (N.M.S.) has diagnosed two cases of hydrops allantois associated with leptoispirosis that was isolated from the fetus and placenta.

Early management is aimed at preventing body wall tears and hypotensive shock, which improves the mare's prognosis, because obtaining a live foal has not been reported with hydrops allantois and has been reported only once with hydrops amnios. Hydropic conditions have a higher incidence of a deformed fetus with facial, genetic, or congenital abnormalities. Clients who therefore wish to invest in saving the fetus should be informed of these potential deformities and of the poor prognosis for fetal survival. The medical management for hydropic conditions described have been very efficacious in preventing life-threatening complications in the mare (100% success) but poor in regard to maintain a viable pregnancy (0% success). This procedure does not require a hospital setting and can be performed in the field, provided that the veterinarian has all of the necessary equipment. Careful patient assessment, which would include a full physical, complete blood cell count, and serum biochemistry, should always be performed before initiating the drainage of the allantoic or amniotic fluid. The technique for drainage may take several hours; therefore, comfort for both the patient and veterinarian would be required. Mares that present early in gestation may undergo elective termination of pregnancy by intramuscular injection of cloprostenol, as long as the amount of fluid is not too excessive to send the mare into shock with spontaneous abortion. If the allantoic or amniotic fluid is excessive, then partial drainage with or without manual extraction of the fetus can be attempted. Most of the mares presented to our hospital for drainage of hydropic fluid had signs of hypotensive shock (ie, muscle tremors, elevated heart rate, and colic). These signs subsided with appropriate fluid/colloid therapy. For successful medical management of hydropic conditions, the access to a central vein (ie, placement of a jugular intravenous catheter) and the use of crystalloids and, when warranted, colloids, should always be available when this procedure is performed. The fluid should always be drained in a control manner over a period of 1 to 2 hours. The slow drainage will allow the animal’s blood pressure to compensate to the decreased intra-abdominal pressure that was associated with the hydropic condition. Once the partial drainage has been completed, then either manual extraction of the fetus or the natural sequence of parturition can be allowed to occur. Retained fetal membranes and fetal malpositioning/dystocia are very common with this medical condition. The technique described is very successful in decreasing the sequelae (ie, abdominal wall hernias, prepubic tendon rupture, and cardiovascular shock) of untreated hydrops allantois/amnion of the mare. Because it is possible that a heritable component to this condition exists, breeding to a different stallion may be prudent.

References and Footnotes


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*a*Prepidil, Pharmacia & Upjohn, Kalamazoo, MI 49001.

*b*N-butylscopolammonium bromide 5 mg/mL gel, Hagyard Pharmacy, Lexington, KY 40511.

*c*28F or 32F Argyle 41-cm Trocar Thoracic Catheter, Tyco Healthcare, Mansfield, MA 02048.

*d*Beuthanasia, Merck Animal Health, Summit NJ 07901.

*e*Banamine, Merck Animal Health, Summit, NJ 07901.

*f*Dormesedan, Pfizer Corporation, Orion Pharmaceuticals, Exton, PA 10017.

*g*Sedivet 1%, Boehringer Ingelheim Vetmedica Inc, St Joseph, MO 64506.

*h*Xylazine, IVX Animal Health, Inc, St Joseph, MO 64503.

*i*Estrumate, Merck Animal Health, Summit, NJ 07901.

*j*Hespan 6%, Braun Medical, Irvine, CA 92614.

*k*Hypertonic saline solution 7.2%, Nova-Tech Inc, Grand Island, NE 68801.

*l*Misoprostol 200–μg tablets, IVAX Pharmaceuticals Inc, Miami, FL 33137.

*m*Regumate 0.22%, Merck Animal Health, Summit, NJ 07901.

*n*Oxytocin 20 IU/mL, Bimeda Inc, Le Sueur, MN 56058.