How to Use Umbilical Vessel Water Infusion to Treat Retained Fetal Membranes in Mares

Mark Meijer, DVM*; Margo L. Macpherson, DVM, MS, DACT; and Reinie Dijkman, DVM, DECVP

Using simple tools that are readily available to the equine practitioner (stallion catheter, hose adapter, and garden hose), retained fetal membranes can be easily and safely removed. Authors’ addresses: Dierenkliniek Zeddam, NL7038 EP Zeddam, The Netherlands (Meijer); Department of Large Animal Clinical Sciences, College of Veterinary Medicine, University of Florida, Gainesville, FL 32610 (Macpherson); and GD Animal Health, NL7400 AA Deventer, The Netherlands (Dijkman); e-mail: m.meijer@dapdz.nl. *Corresponding and presenting author. © 2015 AAEP.

1. Introduction

Expulsion of the fetal membranes after delivery of a foal is generally an uncomplicated event. Normal fetal membrane expulsion occurs 1 to 2 hours after delivery of the foal. Fetal membranes are considered retained in the mare if they are not expelled by 3 hours after delivery.1,2 The incidence of retained fetal membranes is not high, with reports of membranes being retained in about 2–10.6% of post-partum mares.1 Disturbances in foaling (dystocia, prolonged gestation, placentitis, Caesarean section, or hydropic conditions) have been known to result in retained fetal membranes although no direct relationship exists between foaling abnormalities and incidence of retained fetal membranes. Breed predilection for retained fetal membranes has been identified. Friesian mares are reported to have a high incidence (>50%) of retained fetal membranes.3 A similar rate of membrane retention (42% over 4 years) was recently reported in Standardbred mares from New Zealand.4

The pathophysiology of membrane retention in mares has not been elucidated; therefore, preventative and/or treatment strategies are largely empirical. It has been postulated that myometrial exhaustion1,5 after dystocia or prolonged delivery and/or inadequate oxytocin release contribute to retained fetal membranes in mares. Varying portions of the membranes may be retained with the non-gravid horn or the allantochorion being the most common portion of the membranes to be retained. Complications of retained fetal membranes can range from none to toxic metritis, septicemia, and laminitis.1,5 Given the life-threatening nature of these conditions, retained fetal membranes are considered an emergent condition requiring immediate treatment.

Treatment for retained fetal membranes centers on prompt removal of the membranes. The traditional methods used to recover retained fetal membranes include administration of oxytocin1,6 (repeated oxytocin injections [10–20 IU IM every 1–2 hours] or the administration of 1.0 to 1.5 IU oxytocin/minute [60–100 IU oxytocin in 1 liter saline IV over 1 hour], administration of calcium borogluconate,7 repeated uterine lavage, the
Burn’s technique [for intact membranes],\textsuperscript{8} and manual removal of membranes. Umbilical artery infusion of bacterial collagenase has also been used to treat retained fetal membranes in mares.\textsuperscript{9} The method selected for removal of retained fetal membranes is dependent on effectiveness, safety, cost, and convenience. Mares housed in hospital conditions or on well-managed farms can be administered drugs frequently such as multiple doses of oxytocin. Further, mares housed under intensive management conditions can be monitored closely for secondary conditions to retained fetal membranes such as toxemia, laminitis, and uterine prolapse. Mares housed in general field conditions without ready access to veterinary care may require more rapid, but safe, management of retained fetal membranes.

This paper describes a novel and practical approach to removing retained fetal membranes using a low-pressure infusion of water into the umbilical vasculature. This procedure causes stretching of the umbilical vessels, interstitial swelling of the membranes, and subsequent detachment of the microvilli, resulting in rapid and gentle separation of the fetal membranes from the endometrium.

2. Materials and Methods

Between 2007 and 2015, 147 broodmares with retained fetal membranes longer than 3 hours were treated by low-pressure infusion water into either the umbilical artery or vein. The mares were all located in the Netherlands and consisted of 47 Friesian mares (32%), six Draft horse mares (4%), 12 ponies (8%), 69 Warmblood mares (47%), and a mix of Arabians, Andalusian horses, Haflingers, or Iceland ponies (9%). All mares had normal parturition, dystocia, abortion, or stillbirth. Mares undergoing Cesarean section were not included in this report.

Initial treatment of mares consisted of a maximum of three oxytocin\textsuperscript{a} (10–20 IU, IM) injections every 1–2 hours. Mares that did not expel fetal membranes after oxytocin administration underwent infusion of the umbilical vasculature. Mares were restrained in stocks or in a box stall. The perineal area of the mare was cleaned prior to the procedure. Immediately before starting the procedure, mares were administered oxytocin\textsuperscript{a} (10–20 IU IM). A foal nasogastric tube or stallion catheter (with a maximum external diameter of 9 mm) was attached to a water hose using a hose connector with flow control valve (Figs. 1 and 2). An umbilical vessel (vein or artery, both are equally effective) was incised longitudinally using a standard scalpel blade (Fig. 3). The catheter, attached to the flow control fitting on the garden hose, was slowly advanced up the vessel under low water pressure until it could not be advanced further (Figs. 4 and 5). The veterinarian manually held the tube in situ and adjusted the water flow depending on the physical reactions of the mare (Fig. 6). In mares showing mild discomfort (shifting weight, mild efforts to kick), fluid flow was discontinued for a short period to allow the mare to relax and progress of placental release to be assessed. If the membranes remained firmly attached, low-pressure fluid infusion was resumed. After 3–5 minutes of intravascular fluid infusion, gentle traction was placed on the neck of the membranes at the mare’s vulva. Traction was continued until the membranes were released (Fig. 7), the mare demonstrated discomfort, or tearing of the membranes was suspected.

3. Results

In the majority of the cases (135/147; 91.8%), full separation and expulsion of the placenta occurred within 5–10 minutes of umbilical vasculature infusion. In four mares (2.7%), incomplete separation and tearing of the membranes occurred. In all four cases, the duration of the retained placenta was...
unknown but likely exceeded 12–24 hours after foaling. It was suspected that prolonged retention resulted in small, unrecognizable tears in the membranes causing subsequent tearing. In the cases of incomplete membrane expulsion, mares underwent repeated uterine lavage and oxytocin therapy over a 3–4-day period. For eight mares (5.4%), the time from onset of vascular infusion to expulsion of the membranes was more than 15 minutes but less than 30 minutes. Eight mares (5.4%) showed mild signs of discomfort, comparable with the discomfort experienced by postpartum mares after oxytocin administration or mild colic. By reducing the water flow infusion rate, the mares experienced less pain. Two mares were treated with additional uterine lavages for 3 days after placental removal by infusion because of intraluminal fluid retention in the uterus. Additional secondary side effects to the procedure (i.e., inverted uterine horn, uterine prolapse, uterine artery hemorrhage, unresolvable colic, metritis) were not noted after this procedure in any mare.

Follow-up pregnancy rates were available for only a small percentage of treated mares. It was recom-

Fig. 3. Incising an umbilical vessel of the placenta using a #10 scalpel blade.

Fig. 4. Introducing the foal nasogastric tube into the incised umbilical vessel.
mended that mares should not be bred on foal heat after retained fetal membranes (independent of treatment type). A total of 12 mares (all Friesian) were inseminated after the extraction of fetal membranes using this technique (three mares on prolonged foal heat (ovulation by day 15–16), five mares on the second estrus post-partum and four mares in cycles 2 or 3 post-partum). All mares became pregnant on the first cycle of breeding.

4. Discussion

Regulations dictated by the Royal Netherlands Association of Veterinarians are published for the treatment of retained fetal membranes in the Netherlands. Under these guidelines, manual removal of fetal membranes is mandated within 6 hours postpartum if traditional methods for membrane removal (i.e., oxytocin administration, uter-
ine lavage) fail. Because of the need to safely remove fetal membranes by 6 hours post-partum, removal using umbilical vasculature infusion was investigated. Traditional manual removal of fetal membranes in mares (manual separation of the chorioallantois from the endometrium combined with twisting of the membranes) is controversial because of the risks of hemorrhage, impaired uterine involution, tearing of the placenta, damage to the endometrium, and uterine prolapse. Similar complications were not noted in mares undergoing umbilical vasculature infusion. The degree with which the membranes were attached, as well as the duration of membrane retention, can affect the outcome of manual membrane removal using any procedure.

In the described procedure the infusion of water into the allantochorion via the umbilical vasculature appears to induce edema and swelling of the tissue (Figs. 7 and 8). It is postulated that the placental microvilli stretch under pressure causing separation of the fetal membranes from the endometrium. The weight of the placenta concurrently increases (but is controlled by support from the veterinarian) and which may also enhance the separation. Fluid may also “leak” into the space between the chorion and endometrium, thus facilitating further membrane separation.

In 2014, four placentas were examined histologically after performing this procedure. In addition, five normal placentas were infused with water or saline and samples for histology were collected be-
fore starting the infusion of water, 2 minutes later, and again 5 minutes later. Macroscopic swelling of the placenta was seen and the maximum increase in weight was 100%. Histology showed interstitial edema in all layers of the placenta and distinct washing out of erythrocytes in the vessels in the placentas treated with plain water and saline (Fig. 8). In the water-treated group, additional hydropic degeneration of the epithelial cells, consisting of cell swelling and karyopyknosis could be appreciated when compared with the non-treated placenta, possibly due to the osmotic swelling of these cells (Figs. 8 and 9). Low water pressure seems to induce sufficient edema and cellular degeneration to facilitate detachment of the membranes. This osmotic swelling and cellular degeneration results in a more rapid separation of the chorioallantois from the endometrium (< 10 min), than is reported after hydrolyzing the placental structures by umbilical artery injection of bacterial collagenase (< 6 h) and is also more rapid compared with the Burn’s technique, which is somewhat similar in its approach. Furthermore, infusion of the umbilical vasculature of retained membranes is not fully reliant on an intact placenta. In those cases that resulted in delayed release of membranes or incomplete expulsion, the inability to induce the interstitial edema of the placental tissues may have occurred due to tissue autolysis (after delayed treatment) and leaking of the membranes. The water-induced degeneration of the epithelium, which probably enhanced the membrane separation, probably did not occur in these cases. It was clear from this group of mares that the umbilical vascular infusion procedure for membrane removal was more successful in mares having retained membranes less than 12 hours in duration.

There are several advantages to using this method for gentle but manual removal of retained fetal membranes in mares. A primary advantage is safety for both the mare and the veterinarian. Furthermore, the method is hygienic, noninvasive, rapid, and effective. It is very useful in small ponies or Miniature horse mares where management through uterine lavage or manual removal often leads to discomfort and resistance of the mare. Few mares undergoing this procedure showed significant signs of discomfort. In mares that became uncomfortable, reduction in water pressure quickly resolved signs of discomfort. A second advantage to this procedure is rapid removal of membranes in most cases. For veterinarians traveling long distances to treat mares with retained fetal membranes, prompt resolution of the condition can be essential to the wellbeing of the mare given that return trips can be challenging. In the reported group of mares, little subsequent treatment was necessary once the membranes were removed. Adjunct therapy including large-volume uterine lavage, antimicrobial and anti-inflammatory therapy, and oxytocin would be beneficial in some cases.

In summary, medical management of retained fetal membranes using oxytocin is the preferred first treatment method in most mares. However, the results of this report suggest that the treatment of retained placenta in 147 mares by infusion of water into the umbilical vessels is an effective and practical tool for the equine veterinarian. Little equipment is required other than a stallion catheter (or foal nasogastric tube), hose adapter, and garden hose. The procedure is easy to perform and results in expulsion of membranes in less than 10 minutes in most cases. Mares tolerate the procedure well, making it safe for both the mare and the veterinarian. The procedure was atraumatic and effective when performed in membranes retained for less than 12 hours in this group of mares.

Acknowledgments

Declaration of Ethics

The Authors declare that they have adhered to the Principles of Veterinary Medical Ethics of the AVMA.
Conflict of Interest
The Authors declare no conflicts of interest.

References and Footnote

Oxytocin-ject REGNL 3030; Dopharma Research, BV, Raamsdonksveer, The Netherlands.