DIAGNOSIS AND MANAGEMENT OF EQUINE ABORTION

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Introduction

Horse breeders are optimistic by nature, emphasizing successes and frequently dismissing pregnancy loss as an inevitable business expense. If a concerted effort is routinely made to diagnose equine abortion, substantial improvement in foal crops may be realized with minimal additional investment and management practices. Early pregnancy loss may be noticed when a bred mare returns to estrus but pregnancy loss is often not detected until the mare undergoes routine pregnancy examination. With pregnancy loss later in gestation the fetus may be found or the mare may be seen with fetal membranes hanging from the vulva. If other pregnant mares have been in contact with the aborting mare, owners should be compelled to determine the etiology of the pregnancy loss so that steps can be taken to prevent loss in other mares.

The most common noninfectious cause of pregnancy loss is twinning in the mare. There is some speculation that the excellent nutrition and anthelmintic programs on breeding farms may enhance some breed's of mares tendency to double ovulate. Although there does not seem to be an efficacious method to reduce the occurrence of twin pregnancies in these well-managed mares, scheduled ultrasonographic examinations allow for the detection of twin pregnancies so that veterinary intervention can be made if deemed necessary. Other noninfectious causes of abortion include umbilical torsion, placental insufficiency, uterine body pregnancy and developmental abnormalities. Chromosome abnormalities typically result in embryonic death but no studies have been done to investigate the incidence of chromosome abnormalities in late gestation abortions. Fescue toxicosis does not necessarily cause abortion but it is associated with perinatal death of over-term fetuses caused by edematous changes in the placenta.

Infectious causes of abortion include viral infections and bacterial infections. Equine herpesvirus 1 (EHV 1), the etiological agent of rhinopneumonitis may cause late gestation abortion or delivery of a severely compromised neonate. Efficacious diagnostic tests readily allow for a reliable diagnosis of EHV 1 abortion. Although vaccines are commercially available against EHV 1, none are 100 % effective in preventing abortion in exposed mares. Pregnant mares exposed to equine viral arteritis (EVA) and equine infectious anemia (EIA) are at risk for abortion. Vaccination against EVA prior to breeding to a stallion that is EVA positive and shedding the virus in the semen can prevent abortion in the exposed mare. Coggin's or ELISA testing of breeding stock allows for the identification carriers of EIA so that they can be eliminated from the herd.

Septicemia can result in abortion in a pregnant mare caused by a diffuse placentitis. *Leptospira* species typically cause a diffuse placentitis. Much more commonly ascending placentitis results from an infection of the caudal genital tract that gradually moves cranially in the tract and eventually infects the chorioallantois. In most cases the outcome depends on the rate of spread of the infection and in which stage of gestation that the infection occurs. In some cases the fetus has not become bacteremic but problems of asphyxia/ischemia occur in the foal because of premature separation of the chorioallantois during parturition. In these cases the chorion fails to rupture spontaneously because of a thickened, inflamed chorioallantois in the cervical star region

of the membranes. A variety of microorganisms may cause ascending placentitis with the most typical being those pathogens that are commonly associated with endometritis in the mare such as *Streptococcus zooepidemicus, Escherichia coli, Pseudomonas aeruginosa,* and *Klebsiella pneumoniae.*

A focal placentitis previously described as a nocardioform placentitis has been described in broodmares in and near the state of Kentucky. A number of microorganisms have been seen associated with this type of lesion and recently *Crossiella equi* has been found to be associated with some cases. Typically a severe inflammatory lesion occurs near the bifurcation of the uterine horns and is covered with thick tenacious brown exudate. The fetus is not infected but is compromised by placental insufficiency due to the disruption of the chorion from the endometrium. Typically the infection is cleared rapidly from the genital tract soon after expulsion of the fetus.

Immediate Post Abortion Management

Any aborting mare should be separated from other pregnant mares until the etiology of the abortion is determined and all evidence of contagious disease is eliminated. Mares that were in close contact with an aborting mare should not be housed with other pregnant mares.

Efforts should be made to remove all aborted material from the environment. The stall should be stripped of all bedding and organic matter, washed with detergent and disinfected. Contaminated bedding should be discarded. Lime (calcium carbonate) can be spread on dirt or clay stall floors or fans can be used to help dry the stall. Buckets and feed tubs should be washed, disinfected, rinsed and dried before use. If the abortion occurs in the pasture, remove all aborted materials; allow area exposure to sun and to dry. Chemical disinfectants are not recommended for use on pastures as they may destroy the normal beneficial flora of the soil. Fortunately EHV 1 does not live long outside of living cells. Farm workers should avoid handling pregnant mares after working with infected or exposed animals.

The fetal membranes must be examined to determine that they have been expelled completely. If there is any question that a portion of the membranes have been retained, the mare should be examined by palpation and ultrasonography per rectum. Keep in mind that in some cases the chorion may still be quite intimate with the endometrium and the presence of the fetal membranes may not be apparent. Daily uterine lavage with sterile saline may help to dislodge retained membranes after a few days. Mares that have fetal membranes retained longer than 8 hours should be administered broad-spectrum antibiotics and nonsteroidal anti-inflammatory drugs in addition to repeated doses of oxytocin. Mares suspected of having delivered a twin should be examined for a second fetus or any fetal remnants.

Culture of an endometrial swab immediately after the abortion may help to identify a causative or associated microorganism, but usually after a day or two an endometrial swab is of little diagnostic value. The mare's genital tract should be examined by palpation and ultrasonography to monitor uterine involution. If the uterus contains fluid, uterine lavage with sterile saline followed by administration of a low dose (10 to 20 I.U.) of oxytocin I.V. or 250 μg cloprostenol I.M. will help to evacuate uterine contents.

Diagnostic Sample Submission

Ideally the aborted fetus and fetal membranes should be immediately taken to the diagnostic laboratory. If there is a delay in conceptus submission, cool the abortus but do not allow tissues to freeze as freezing may disrupt the histological architecture of the cells. History of the reproductive status and general health of the mare during pregnancy should be provided with the submission. Be sure to include the last breeding date, parity status, vaccination history, previous abortion information, current clinical condition with comment on lactational status and evidence of vulvar discharge, and any history of other abortions or infectious disease on the farm.

If the distance of the diagnostic laboratory from the breeding farm prohibits submission of the entire conceptus, fetal membrane evaluation and necropsy can be performed on the farm and tissue samples can be submitted to the diagnostic laboratory in a necropsy kit. Necropsy kits are often available from state diagnostic laboratories or one can be prepared as described in Table 1. The diagnostic lab should always be consulted before sending samples to obtain additional specific instructions desired by that particular laboratory.

Table 1. Contents of a necropsy kit

Sturdy waterproof insulated box	Microbiology transport culturette
Coolant packs frozen to <-20°C	Six Whirl-pak® bags for tissue samples
Laboratory submission forms	Waterproof markers for labeling
Express courier transport form	Screw-top vessel 10% buffered formalin
Blood tube mailer-paired sera samples	Blood collection tubes: serum (red), citrated (blue)
Clip-on tissue label tags	Virus transport media (VTM) (refrigerated)
Sterile scalpel	
3 ml syringes with needle	

Gloves, measuring tape, sharp knife or heavy-duty scalpels, sterile scissors and forceps, hacksaw and scale should also be available for necropsy.

Examine both the red microvillous chorionic and the shiny allantoic sides of the fetal membranes and the translucent amnion. Record any abnormalities. Measure and record the length of the amniotic and allantoic portions of the umbilical cord. Record the weight of the amnion and the chorioallantois. Obtain a 2 x 2 cm sample of amnion and chorioallantois from the pregnant horn, nonpregnant horn, body, cervical star and any lesions. Attach a labeled tissue tag to each sample and place in the 10% neutral buffered formalin. Examine the exterior of the fetus. Record the sex, crown rump length and extent of hair growth. Note any abnormalities such as meconium staining.

Place the fetus in right lateral recumbancy to permit easy access to the organs. Reflect the entire left forelimb and the left hind limb at the hip. Skin the entire left side of the trunk. Incise the body wall behind the ribs, reflecting as much of the abdominal body wall as possible with out touching underlying viscera. Upon opening the body cavity, aspirate any available peritoneal, pleural or pericardial fluid. Place this fluid in a red-top tube and label source. With sterile instruments, collect two 2-cm pieces of spleen, liver and kidney for virus isolation and

fluorescent antibody assay. Pool a set of these samples in one Whirl-pak® bag[1] and add enough virus transport media (VTM) to cover samples. Place the second sample from each of these organs in a separate Whirl-pak® bag and add enough VTM to cover each organ for fluorescent antibody assay.

Enter the thoracic cavity by incising the diaphragm or removing the left chest wall. Be careful to prevent contamination of the underlying tissue. Aseptically collect a larger piece of lung (20 cm^2) for bacterial culture and place in a sterile, labeled Whirl-pak® bag. Do not add VTM to this bag. Using sterile scissors, snip a hole in the stomach and use a culture swab to sample the gastric fluid. Transport the swab in transport culture media.

Collect a wide range of tissue including samples from at least kidney, spleen, heart, thymus and several sections of lung and liver and place them into the 10% neutral buffered formalin. Formalin-fixed samples of adrenal, stomach, eyelid, tongue or somatic skeletal muscle, small and large intestine and brain may also be useful diagnostically. Retain a 20 cm^2 piece of liver in a sterile Whirl-pak® bag for potential toxicology testing. Aqueous eye fluid can be placed in a red-top tube for later toxicological testing.

An acute serum sample should be obtained to determine serum antibody titers against equine arteritis virus, EHV 1 and leptospirae. A convalescent sample should be obtained in 2 to 4 weeks. The paired sera samples should be submitted simultaneously for assay.

All samples should be labeled and packed in the transport box containing the coolant packs. Newspaper should be stuffed into any remaining space to stabilize the temperature and contents of the package. Necropsy kits should be sent by express courier to the laboratory.

Diagnostic Tests

There may be differences in the particular tests performed by each diagnostic laboratory for the identification of the etiologies of equine abortion. A diagnostic work-up should include gross evaluation of the fetus and fetal membranes and histological examination of fetal organs and the different sections of the chorioallantois and amnion. Aerobic cultures of fetal stomach fluid, body cavity fluids and fetal lung tissue should be performed to identify a causative microorganism. If a norcardioform or fungal placentitis is suspected, samples should be carefully cultured for these microorganisms.

Fluorescent antibody testing for EHV 1, EVA and *Leptospira* species and virus isolation for EHV 1 and EVA can be performed on spleen, liver and kidney samples. Histopathology of lung, liver and thymus samples using immunohistochemistry will reveal evidence of virus in those fetal tissues. Antibody titers against EHV 1, EVA and *Leptospira* species can be obtained on paired sera collected immediately after abortion and then 2 to 4 weeks later. A 4-fold increase in the titer indicates recent infection.

[1] Whirl-Pak, Nasco, 901 Janesville Avenue, P.O. Box 901, Fort Atkinson, WI 53538-0901, custserv@eNASCO.com

Prevention

Resident broodmares should be kept separated from transient (competitive, performance) horses on the farm. Limit the number of mares in each mare group and keep young maiden mares separated from older multiparous broodmares. Any new mares entering the broodmare band should be held in quarantine for three weeks prior to turnout with the resident mares. All mares should have a negative Coggin's test before entering the farm.

Pregnant mares should be vaccinated against EHV 1 repeatedly throughout gestation because the duration of acquired immunity to equine rhinopneumonitis is short. Most pharmaceutical companies recommend that their equine rhinopneumonitis vaccine be administered at 5, 7 and 9 months of gestation. Some breeding farms will have an additional vaccination performed at 3 months of gestation or more conveniently, all pregnant mares may be administered EHV 1 vaccine every other month. The vaccines that are approved for use in pregnant mares are killed virus preparations. Some breeding farms use the inactivated live virus preparations and feel that the mares have a reduced incidence of abortion from rhinopneumonitis. At this time no vaccine is 100% effective in preventing abortion caused by EHV 1.

There is controversy over the universal use of EVA vaccine and at this time most broodmares are not yet vaccinated against this equine virus. Horse owners should be informed that some countries would prohibit the importation of any horse that has a serologic titer to equine arteritis virus. It is recommended that mares that are booked to a stallion that is known to shed virus in his semen have a serologic test performed to determine if they have an EVA titer. If their titer is negative, they should be vaccinated against the equine arteritis virus. Owners should maintain a record of their negative titer prior to vaccination as evidence of a passively acquired vaccination titer. The EVA vaccine is a modified live virus and vaccinated horses must be isolated for three weeks after injection as there is risk of virus shedding. Annual vaccination of nonpregnant mares is recommended prior to breeding.

As twinning is the most common cause of noninfectious pregnancy loss management steps should be taken to detect and eliminate twin pregnancies. The AVMA liability trust recommends that all mares should be examined by palpation and ultrasonography per rectum twice prior to 30 days of gestation to increase the chance of detecting a twin pregnancy.[1] There are several options for twin management. The first option is to do nothing. The majority of twins present during the mobility phase of the embryo are likely to resolve spontaneously. Twins detected after fixation are less likely to resolve spontaneously.[2] General recommendation is for some form of veterinary intervention. Prostaglandin can be administered when the twins are first detected and the mare can be rebred at the next ensuing estrus. Unfortunately mares that double ovulated at the initial breeding may tend to double ovulate at the next estrus. Manual reduction to a singleton pregnancy by manual crushing of one conceptus prior to 30 days of gestation is successful in producing a singleton at term as often as 95% of the time.[3] Between 40 and 70 days of gestation, transvaginal aspiration of one conceptus may result in a singletons at term. Between 90 and 130 days of gestation, intracardiac injection of KCl into one fetus may allow nearly half of the remaining twins to develop to term.[4] Pregnancies should be examined periodically throughout the remainder of gestation.

Mares that have an incompetent perineal musculature, vestibulovaginal ring or cervix may benefit from surgical augmentation of the caudal genital tract. Episioplasties such as a Caslick's Operation or Gadd's Procedure will help to prevent pneumovagina and subsequent ascending infection of the genital tract. Significant cervical lacerations involving greater than a third of the length of the cervix will need to be corrected surgically to contain the early mobile embryo and prevent contamination of the developing conceptus later in gestation. Mares with transient urovagina or urometra may be able to conceive and establish pregnancy but will be at risk for ascending placentitis late in gestation. It may be beneficial to perform a urethral extension prior to breeding to prevent urine and bacterial contamination of the conceptus when the tone of the genital tract relaxes as the mare prepares for parturition.

Efforts should be made to maintain the body condition of the pregnant mare. Intra pelvic fat/muscle can greatly enhance the competency of the caudal genital tract. The dental health of the broodmare should be maintained. Mare should be on a regular anthelmintic administration schedule and the farm should practice parasite control management. Particular attention needs to be made to the feed ration when pasture grass starts to wane in the fall and winter. The caudal genital tract of some older multiparous mares may appear competent at the time of breeding. However as the weight of the developing conceptus pulls the genital tract ventrally in midgestation and the mare's body condition fades in the fall and winter, chronic contamination of the caudal genital tract may occur. These mares are at great risk for developing ascending placentitis.

Summary

The production of a healthy foal requires many intrinsic and extrinsic systems to function in concert. If disruption occurs in any aspect of the pregnancy the fetus is at risk for death and expulsion. Successful identification of the etiology of pregnancy loss requires the veterinarian to be comprehensive in his approach to investigating the abortion. A thorough evaluation of the mare, fetus, fetal membranes, pregnancy management and the mare's environment will enhance the chances of identifying the cause of abortion so that management changes can be made to prevent future losses.

References

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