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Abortion Investigation in Equines

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1. Introduction

Foetuses delivered before 310 days of gestation are classified as abortions, while foetuses delivered after 310 days of gestation are considered stillbirths. The majority of abortions are reported in early pregnancy (before day 40) and late pregnancy (last several months of pregnancy), with abortions in mid gestation being considered uncommon. With early embryonic loss foetuses are often expelled without the abortion being observed.

2. Detailed History

A detailed history is critical to any abortion investigation and should include the following;

- The gestational age of the foetus.
- Current or prior illness of the mare.
- Vaccination history of the mare and other horses on the farm.
- Success of previous pregnancies.
- Reproductive performance of other mares on the farm.
- Farm conditions (environment, feeding programs etc.).

From a diagnostic perspective it is vital that the entire **foetus and placenta** are submitted for examination. Frequently the cause of abortion cannot be determined **without the placenta**.

3. The Investigation Process

The same routine approach should be adopted with each and every foetus examined.

- External examination of the foetus.
- External examination of the placenta.
- Morphometric measurements.
- Dissection and sample collection.

3.1 External Examination of the Foetus.

Access the degree of autolysis, as this may have a negative impact on bacterial isolation, fluorescent antibody testing, virus isolation and histopathology.

Congenital malformations or deformations. True malformations, (microphthalmia, craniofacial malformations, cleft palate, brachygnathia, heart defects, aganglionosis, intestinal atresia, umbilical defects, microencephaly, cerebellar hypoplasia, hydrocephalus, hyperelastosis cutis and epitheliogenesis imperfecta) are the consequence of genetic or toxic aetiologies. Deformations on the other hand (wry nose, flexural limb deformities) arise due to restricted movement of the foetus in-utero.

Evaluate mucous membranes (oral, conjunctival) for anaemia, icterus, cyanosis, toxaemia. For icteric mucous membranes in an aborted foetus, the primary differentials are equine piroplasmosis and equine herpes virus abortion.

Age-appropriate features. Examine the foetus to determine if the anatomical characteristics are consistent with the estimated or known gestational age; i.e. is there any evidence of in-utero growth retardation. Evaluation of the body hair coat cover provides a good estimation of foetal age;

- 4 months - hair on lips.
- 5 months - hair on eyelids.
- 6 months - hair on nostrils.
- 7 months - hair on tail.
- 8 months - hair on mane, back, ears.
- 9 months - thin hair covers the body.
- 11 months normal hair coat.

In-utero growth retardation (IUGR) is emerging as an important focus area of the abortion investigation process in equines. Not only is IUGR a risk factor for foetal survival to term, but there is also emerging evidence that low foetal weight is directly related to poor athletic performance later in life. Prematurity and dysmaturity are two syndromes closely linked to IUGR.

Dysmaturity vs Prematurity

- Dysmaturity is seen in foals born in the full-term period or beyond their due date. This syndrome arises due to placental insufficiency with associated in-utero growth restriction. These animals appear normal to large in skeletal size but with emaciated body condition.
- Prematurity on the other hand are foals delivered < 320 days of gestation and these foetuses are frequently underdeveloped and some have associated placental pathology.

Pathologies Associated with IUGR

- Placentitis results in impaired placental function.
- Twinning is associated with restricted placental development.
- Umbilical cord torsion leads to hypoxia and starvation of the foetus.

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- Placental body pregnancy. The endometrial lining of the body of the uterus is not designed for foetal development and so placentas attached here do not receive the required level of nutrients.
- Under-developed placental villi result in placental insufficiency.
- Hydrops (amnion/allantois) dilute the placental nutrient supply with placental insufficiency.

3.2 **External Examination of the Placenta**

The placenta (foetal membranes) composed of the allantochorion, allantoamnion and umbilical cord must be examined after their expulsion to determine their entirety and integrity. Foetal membranes are turned "inside-out" on expulsion with the non-villous surface on the outside. Following examination of the non-villous surface, the placenta needs to be re-orientated to enable examination of the villous surface.

Any tears, missing portions of placental tissue and/or areas of chorionic (villous) surface devoid of microvilli, should alert the examiner to the possibility of a retained placenta and the mare should be returned immediately for a thorough gynaecological examination for retained placenta.

Normal "non-lesions" placenta

- Yolk-sac remnant in the umbilical cord, which may present as a collapsed sac-like structure, fluid-filled sac or contain mineralised concretions.
- Hippomanes are yellow to tan, soft party-like free-floating aggregates within the allantoic sac. They are formed by concretions of urinary calculi on a central nucleus of desquamated foetal membranes.

3.3 **Morphometric Measurements**

3.3.1 Foetal weight: weight is obtained once the placenta has been removed at the level of the umbilicus.

3.3.2 Crown rump length: is a straight line measure from the crown of the head to the rump of the foetus.

3.3.3 Placental weight: the normal placenta of a near term thoroughbred mare should weigh about 11% of the body weight of the foal or approximately 5 to 6.5 kg.

Age (Days)	Crown-Rump Length (Cm)	Mass/Weight (Kg)
60	6	0.017
90	16	0.160
120	25	0.7
150	35	1.6
180	48	4.0
210	60	10
240	75	17
270	85	20
300	95	29
330	100	42
Average Birth Weight		42-55

3.3.4 Umbilical cord length: the mean cord length of a full term thoroughbred = 55cm. Cords ≥ 83cm are of abnormal length.

3.4 **Foetus Dissection and Sample Collection**

3.4.1 Indicator Gross Lesions of the Equine Foetus

Gross Lesion	Causes
Fresh well preserved foetus	Equine Herpesvirus, Dystocia
Pinpoint pale foci in the liver	Equine Herpesvirus
Foetal pneumonia	Equine Herpesvirus, Bacterial abortion, Caterpillar-associated abortion.
Placentitis – cervical star area	Bacteria, Fungi
Placentitis – base of horns	Nocardiform
Placentitis – diffuse (haematogenous)	*Leptospira* sp, *Salmonella* sp
Non-ruptured cervical star	Premature placental separation, Equine herpesvirus
Large avillous area chorion	Twinning, Nocardiform
Umbilical cord oedema	Torsion, Dystocia, Caterpillar-associated abortion, Fescue toxicosis
Placental oedema	Dystocia, Fescue toxicosis

3.4.1.1 Equine herpes virus abortion

Of the equine herpesviruses EHV-1 is most commonly associated with equine abortion, while EHV-4 is less frequently involved.

Aborted foetuses are usually fresh and usually exhibit highly suggestive gross pathology of generalised icterus, pneumonia with fibrin plugs in airways and pale pinpoint foci of necrosis in the liver.

3.4.1.2 Bacterial abortion

Bacterial infections of the foetus and/or placenta are important. Placentitis is the most common pathological presentation of bacterial abortion, with foetal infection less common. Bacteria most frequently associated with ascending placentitis include *Streptococcus zooepidemicus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Streptococcus equisimilis*, *Enterobacter agglomerans*, *Klebsiella pneumoniae*, and alpha-haemolytic *Streptococcus* spp). Diffuse placentitis may be observed with *Leptospira* spp, *Salmonella* spp, *Histoplasma* spp and *Encephalitozoon*. Atypical placentitis with unusual distribution at the base of the horns is a characteristic finding with Nocardiform bacteria.

3.4.1.3 Fungal abortion.

Mycotic abortion is uncommon in equines with ascending placentitis being the most common pathology described. Fungi most commonly involved include *Aspergillus* sp, and the *Mucorales* fungi.

3.4.1.4 Protozoal abortion.

Infection of pregnant mares with *Theileria equi* is quite common in endemic areas. The consequence of infection depends on the stage of pregnancy that infection occurs, but includes reproduction failure (involved in up to 11% of all failures in South Africa), abortion, neonatal piroplasmosis (foals 2 to 3 days of age) and birth of asymptomatic carriers. Infection with *Theileria equi* can be persistent with development of carrier mares which can produce further infected foetuses, randomly in subsequent pregnancies.

3.4.1.5 Miscellaneous causes of abortion.

- Umbilical torsion: to qualify as a cause of abortion the following criteria need to be met – (1) more than four twists plus (2) oedema, (3) congestion and (4) haemorrhage of the twisted cord. These latter changes are most outspoken on either sides of the twist. Excessive cord length is considered an important predisposing factor. Abortion only occurs when excessive twists interfere with blood and urine flow. Most umbilical torsion associated abortions occur between 6 and 8 months.

- Premature placental separation. This results from partial or complete detachment of the chorion from the endometrium before or at foaling. An identifying feature of this condition is that the cervical star remains intact and does not rupture.

- Twinning.

- Caterpillar-associated abortion. Two forms of caterpillar-associated abortion have been described. In the USA mare reproductive loss syndrome (MRLS) is associated with ingestion of Eastern Tent Caterpillars (*Malacosoma americanum*), while in Australia equine amnionitis and foetal loss (EAFL) has been described with ingestion of the processionary caterpillar (*Orchrogasterl unifer*).

Diagnostic Sampling

Laboratory Procedure	Tissue Samples
Bacterial / Fungal culture	Stomach fluid, placenta, liver (fresh)
Histopathology and IHC	Full complement tissues (10% buffered formalin). (Liver, kidney, lung, heart, adrenal gland, spleen, thymus, brain, intestine, placenta).
Fluorescent Antibody (FAT)	Kidney, liver, placenta (fresh)
Polymerase Chain Reaction (PCR)	Lung, liver, kidney, placenta
Antibody serology	Mare serum, foetal heart blood

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MULTIPLE-CHOICE QUESTIONS

QUESTION 1

At what stage of pregnancy are MOST equine abortions reported?

a. Between 3 and 5 months
b. Between 6-8 months
c. Before 40 days
d. After 120 days
e. After 7 months

QUESTION 2

Which of the following conditions would be considered a DEFORMATION rather than a congenital abnormality?

a. Micropthalmia
b. Wry nose
c. Cleft palate
d. Hydrocephalus
e. Craniofacial malformations

QUESTION 3

In a four-month gestational age foetus where would you expect to find body hair?

a. On the lips
b. On the eyelids
c. On the tail
d. On the mane
e. On the nostrils

QUESTION 4

Which of the following pathologies have NOT been associated with in-utero growth retardation in equines?

a. Placentitis
b. Umbilical cord torsion
c. Placental body pregnancy
d. Flexural limb deformities
e. Hydrops

QUESTION 5

In the aborted equine foetus which of the following sets of gross pathological lesions would be HIGHLY SUGGESTIVE of probable equine herpesvirus-associated abortion and would warrant that samples be collected to exclude EHV?

a. Umbilical cord oedema and placental oedema
b. Large avillous areas on the placenta with associated placentitis
c. Pinpoint white foci in the liver, icterus (jaundice) and pneumonia
d. Pneumonia and umbilical cord oedema
e. Foetal mummification

QUESTION 6

Which of the following infectious agents are MOST COMMONLY associated with ascending placentitis in the mare?

a. Nocardiform bacteria
b. *Salmonella* spp
c. *Leptospira* spp
d. *Encephalitozoon*
e. *Streptococcus zooepidemicus*

QUESTION 7

What is the MOST COMMON pathology observed with a fungal abortion in the mare?

a. Foetal pneumonia
b. Ascending placentitis
c. Diffuse placentitis
d. Atypical placentitis
e. Foetal hepatitis

QUESTION 8

With in-utero *Theileria equi* infection which of the following syndromes have NOT been documented?

a. Reproduction failure
b. Abortion
c. Neonatal piroplasmosis
d. Birth of asymptomatic carriers
e. Retained placenta

QUESTION 9

Which of the following statements regarding umbilical torsion in the equine foetus is FALSE?

a. The umbilical cord is a normally twisted structure (average 4.4 twists) due to foetal movement
b. The length of the umbilical cord has no correlation to the incidence of umbilical cord tension
c. Abortion only results when excessive twists compromise blood and urine flow
d. In twisted cords associated with abortion there is marked oedema, congestion and haemorrhage of the cord, especially either side of the twist
e. Most cases of umbilical torsion occur around 6-8 months of gestation

QUESTION 10

Of the tissue sample sets listed below, which would be considered the MOST IDEAL for bacterial and fungal culture in an abortion investigation?

a. Heart and adrenal gland
b. Stomach fluid and placenta
c. Liver and kidney
d. Intestine and lymph node
e. Thymus and spleen

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