A review of the causes of abortion in UK mares and means of diagnosis used in an equine studfarm practice in Newmarket

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Summary

A retrospective survey of the records of 210 postmortem examinations of aborted equine foeti and placentae, performed at the authors' practice laboratory, revealed that umbilical cord vascular compromise was the most common diagnosis made, accounting for almost 50% of cases. Abortions associated with twin pregnancy now account for a relatively small percentage (2.9%) of cases as compared to much higher incidences (22–29%) seen prior to the introduction of ultrasound scanning and multiple pregnancy reduction techniques in routine equine studfarm practice. Placental abnormalities accounted for 53 (25.2%) of the diagnoses. 14 (6.7%) were caused by Equid Herpesvirus-1 infections. The cause of the abortion was not established in 11 (5.2%) of the cases.

Keywords: equine, abortion, diagnosis, review

Eine retrospektive Untersuchung der Aborursachen bei UK-Stuten und die Diagnosemöglichkeiten, die in einer Pferdepraxis für Gestüte in Newmarket genutzt werden

Im Rahmen einer retrospektiven Untersuchung, die im Praxislabor des Autors durchgeführt wurde, konnte festgestellt werden, dass bei 210 abortierten Föten und Plazenten die komprimitierte Gefässversorgung der Frucht in 50% der Fälle die häufigste Diagnose war. Zwillingsaborte wurden mit 2,9% viel seltener als vor (22–29%) der Einführung der Ultraschalldiagnostik und der Entwicklung manueller Embryo-reduktionsmethoden festgestellt. In 53 (25,2%) Fällen wurden Veränderungen der Plazenta festgestellt. 14 (6,7%) Aborte wurden durch das Equine Herpes Virus 1 ausgelöst. In 11 (5,2%) Fällen konnte keine Aborursache festgestellt werden.

Schlüsselwörter: Pferd, Abort, Diagnose, Übersicht

Introduction

Abortion remains a significant cause of Thoroughbred wastage. An analysis of Weatherbys' Annual Returns for Mares shows that the percentage of mares recorded as suffering pregnancy failures (early pregnancy failures and later abortions) was 9.4% in 1977 as compared to 9.5% in 2000 (Fig.1). Although the data is skewed through the 1990s by the introduction and increasing use of ultrasound scanning, which made the diagnosis of early pregnancy failures possible, current rates of pregnancy failure are almost identical to those recorded two decades previously. During this period conception and live foal rates have risen from 77.5% to 88.9% and 68.1% to 80.9%, and barren mare rates have fallen from 22.5% to 11.5% (*Ricketts,* unpublished data), in most encouraging manners. The Thoroughbred breeding industry requires further progress to be made in this area.

All equine abortions should be examined for pathological abnormalities in order to:

1. Screen for contagious diseases, such as Equid Herpesvirus-1 (EHV-1), Equine Arteritis Virus (EAV) and Taylorella equigenitalis, in order to control and prevent epidemic pregnancy failures and associated disease caused by these infectious pathogens, on the studfarm involved and on in-contact studfarms, as recommended by the Horserace Betting Levy Board's Code of Practice for the control of these diseases. This is necessary in order to safeguard the health of individual mares and the equine breeding industry as a whole.

2. Make a diagnosis of the cause of the abortion, so that specific treatment may be applied, if indicated, and so that a prognosis for future breeding performance can be given.

3. Make sure that the mare's placenta has been expelled completely, so that she can be speedily and specifically examined and appropriately treated where there are signs of retention.

Surveys of the causes of abortion in mares have been published over the years, from different parts of the world (*Mahaffey, 1968, Bain, 1969; Prickett, 1970; Platt, 1973; Dimmock, Edwards and Bruner (1974); Platt (1975); Rossdale and Ricketts (1976); Platt, 1979; Whitwell, 1980; Acland, 1993*). The aim of this study was to perform a retrospective survey of the last six year's records of postmortem examinations performed on pre-term (up to 10 months gestation) aborted foeti at an equine practice pathology laboratory in Newmarket, for comparison.

Materials and methods

The records of postmortem examinations of 210 pre-term (up to 10 months gestation) aborted, predominantly Thoroughbred, foeti performed by the authors between 1996 and 2001 were

examined to review their causes. Postmortem examinations were performed on the aborted foetus, umbilical cord and placental membranes, in most cases, usually on the same day or the day

the case) were fixed in Carnoy's fixative for same day or overnight processing and in 10% formol saline for routine histopathological processing (haematoxylin and eosin stains)
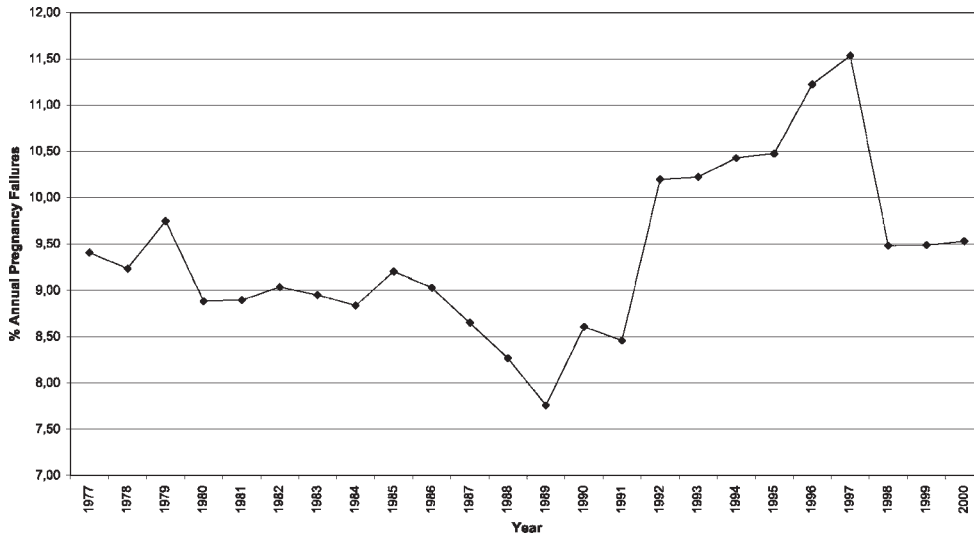

Fig. 1: Weatherby's Annual Returns for UK and Irish Thoroughbred Mares – Pregnancy Failures

Weatherby's Jahresstatistik für UK und irische Vollblut-Stuten – Trächtigkeitsabbrüche

after the abortus was found by the stud staff. Records of full term stillborn and neonatal foal examinations were excluded from this survey.

The foetus was weighed, its crown-rump length and umbilical cord length were measured and it was examined externally and internally for gross pathological features, using standard necropsy techniques. Swab samples (peritoneal, pleural fluids and/ or heart blood and placental tissue or fluids, as appropriate to the presented condition of the foetus and placental membranes) were collected for aerobic bacterial culture on blood and McConkey's agar, microaerophilic bacterial culture on specialised haemolysed blood agar and, where appropriate, anaerobic bacterial culture, at the authors' laboratory, using standard microbiological techniques. Where indicated, specific fungal cultures were performed using Sabouraud's agar. Tissue samples (liver, lung, spleen, thymus, adrenal gland, horns, body and cervical pole of placenta and other organs as appropriate to

at the authors' laboratory, using standard histopathological techniques. Tissue samples (liver, lung and spleen) were collected into viral transport media and submitted for EHV PCR and viral culture at the Animal Health Trust's Diagnostic Pathology Laboratory in Newmarket. In unusual cases, tissue samples were submitted for specific immunoperoxidase staining for EHV antigen at the Animal Health Trust's Diagnostic Pathology Laboratory.

Results were reported to the attending clinician in stages, as appropriate to the case:

1. Gross and rapid-fixed (Carnoy's) histopathological pathological findings were reported on the same or next day.
2. Bacteriological and conventionally-fixed (formol saline) histopathological findings were reported on the third or fourth day.
3. Virological findings were reported usually on the second to fifth day (PCR) or at approximately 10–14 days (culture).
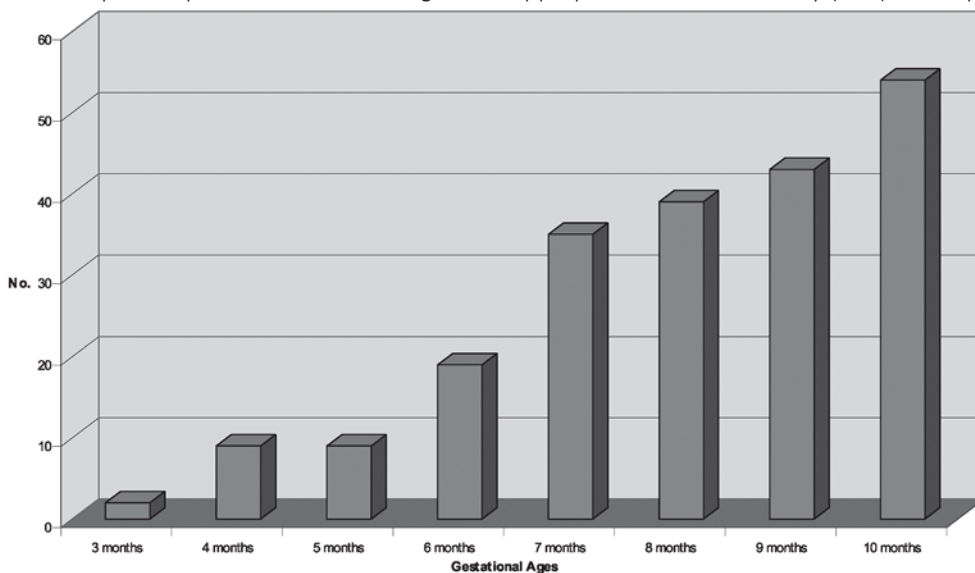

Fig. 2: Foetal postmortem examinations – gestational ages

Ergebnisse von 210 fetalen post mortem-Untersuchungen – Trächtigkeitsalter

Results

210 records of foetal postmortem examinations were reviewed. Gestation lengths ranged from 3 to 10 months with peak numbers (54, 26%) seen at 10 months (Fig. 2). 101 foeti (48%) were male and 109 (52%) were female.

Bacteriological examinations revealed no growth of organisms in 137 (65%) foeti, no significant growth of pathogens (growths considered to be contaminants or postmortem invaders) in 66 (31%) cases and 7 (3%) cases where there were pure heavy growths of pathogens (3 Streptococcus zooepidemicus, 3 Escherichia coli and 1 Staphylococcus aureus).

The primary diagnoses (1 diagnosis per case) made after all examinations were complete are presented in Table 1. By far the most frequent diagnosis was umbilical cord vascular compromise (46.2%), characterised by clear signs of cord stricture, excessive twisting, enlargement, oedema, haemorrhage and/or thrombosis and sometimes obstruction to urachal urine flow. These changes were coupled with clear signs of

Tab. 1: Foetal postmortam examinations – Diagnoses

Ergebnisse von 210 fetalen post-mortem Untersuchungen – Diagnosen

Diagnosis	N.	%
Umbilical cord vascular compromise	97	46.2
Placental abnormalities	**53**	**25.2**
Premature placental separation	17	8.1
Chronic placentitis	12	5.7
Placental abnormality	10	4.8
Acute placentitis	5	2.4
Cervical pole placentitis	5	2.4
Cervical pole ischaemic placentopathy	3	1.4
Fungal placentitis	1	0.5
Foetal abnormalities	39	18.6
Herpesviral infection	14	6.7
Cardiovascular collapse	11	5.2
Congenital abnormality	10	4.8
Bacterial septicaemia	3	1.4
Fungal pneumonia	1	0.5
Twinning	6	2.9
Maternal illness	4	1.9
Unknown	11	5.2
Total abortions	210	100

compromise to foetal vascular outflow (haemorrhagic peritoneal and/or pleural fluid and visceral, particularly hepatic, congestion and haemorrhage, and enlargement of the foetal bladder). These cases had a mean umbilical cord length of 86.5 cm, whereas other cases (those unrelated to umbilical cord vascular compromise) had a mean cord length of 62.1 cm. Chi squared analysis of this data revealed a P-value of <0.0001, confirming significantly longer (24.4 cm) mean umbilical cord lengths in the cords suffering vascular compromise.

Placental abnormalities accounted for 53 (25.2%) of the diagnoses. Premature placental separation (gross and histo-pathological evidence of extensive villous degenerative change, with no other abnormalities to suggest a primary cause) was diagnosed in 17 (8.1%) cases. A variety of non-specific placental abnormalities, such as diffuse or focal chorionic oedema, without significant inflammatory change, were noted in 10 (4.8%) of cases. Cases of diffuse chronic (12, 5.7%) and acute (5, 2.4%) placentitis and focal cervical pole placentitis (5, 2.4%) were not always associated with a significant growth of a bacterial or fungal pathogen. Non-inflammatory cervical pole ischaemic placentopathy, probably associated with vascular disturbances, was diagnosed in 3 (1.4%) cases.

Foetal abnormalities accounted for 39 (18.6%) of the diagnoses. Infection was diagnosed in 18 cases, of which 14 (6.7%) were EHV-1, 3 (1.4%) involved bacterial septicaemia and 1 (0.5%) was a case of fungal pneumonia. Cardiovascular collapse, characterised by signs of visceral, particularly hepatic, congestion and haemorrhage, without significant umbilical cord or placental abnormalities to explain them, was diagnosed in 11 (5.2%) cases. Congenital abnormalities, including failure of closure of the abdomen and a variety of major skeletal malformations were diagnosed as the primary problems in 10 (4.8%).

The inability of the mares to sustain twin pregnancy was the cause of the abortion in 6 (2.9%) cases.

Maternal illness (3 cases of acute colitis and 1 uterine torsion) accounted for 4 (1.9%) cases.

The cause of the abortion was not established following 11 (5.2%) examinations, when no significant foetal, placental or umbilical cord abnormalities were detected.

Discussion

Whitwell (1980) reported that her survey of the diagnostic pathological examinations at the Animal Health Trust in Newmarket, between 1969 and 1979, showed that twinning was the largest single cause of abortion in mares, with an incidence varying between 22% and 29%. Our survey confirms that abortion associated with twin pregnancy has been significantly reduced by the widespread use of and developments in expertise with ultrasound scan examinations in routine equine studfarm practice. This technology has facilitated the early diagnosis of multiple pregnancy and its successful reduction to singleton pregnancy.

It is recognised that twisting is a normal feature of the equine umbilical cord but in these normal cases there is no evidence of significant foetal vascular compromise. Our survey confirms

that umbilical cord vascular compromise now accounts for almost 50% of the pregnancy failures presented for examination at this practice laboratory. It appears that cords over 80 cm long are more likely to predispose to abnormalities (excessive twisting, kinking, pinching and developmental abnormalities) leading to vascular compromise *(Whitwell, 1980)*. *Whitwell and Jeffcott (1975)* surveyed 143 normal full-term Thoroughbred foals and found that mean umbilical cord length was 55 cm. Our survey of umbilical cords from 86 foeti aborted from 3 to 10 months for reasons unrelated to umbilical cord vascular compromise revealed a mean cord length of 62.1 cm. The factors which control cord length remain unknown but comparison of the results of these surveys may suggest a trend to long-cordedness and one must suspect that genetic predispositions may be involved. *Whitwell and Wood (1992)* found that umbilical cords are slightly longer in male foeti and that there was a small sire effect. Clearly, if these sires are successful and therefore popular, long-cordedness may be unwittingly selected for. They also found that umbilical cords are longer in foeti from older mares and from multiparous mares, presumably for uterine environmental reasons.

Placental abnormalities accompanied approximately 25% of the abortions and 10.5% of cases were associated with placentitis. Neither nocardiform placentitis *(Zent, Williams and Donahue, 1999)* nor leptospirosis *(Ellis and O'Brien, 1988; Poonacha, 1991)* were recognised in this series.

Only 41 (19.5%) of abortions were associated with infection of the foetus and/or placenta and, of these, 14 (6.7%) were EHV-1 infections. 9 diagnoses involved single isolated unvaccinated mares on different premises and 5 cases involved fully vaccinated mares on two studfarms. One 'outbreak' involved 2 mares for which there was probably lateral spread but the other involved 3 apparently isolated cases (and another full-term stillbirth) relating back to probable infection earlier in pregnancy, assumed to have been associated by respiratory infection in young foals at foot. It is clear that EHV infection remains a significant cause of abortions and neonatal loss in mares in spite of vaccination and good management.

Whitwell (1980) found that 13% of abortions and stillbirths were attributed to infection by bacteria or fungi. 27 cases in our series were associated with non-EHV-1 infection of the foetus and/or placenta, which is also 13% of the total. This apparent lack of improvement is disappointing in view of the advances that have undoubtedly been made in studfarm hygiene and equine gynaecological medicine since the 1970s which have contributed to improvements in fertility rates (see above). Understandably, the pregnant mare remains largely without gynaecological supervision during the majority of her mid and later pregnancy and the potential for ascending infections to gain access through the vagina and cervix remain.

Neither T. equigenitalis, Klebsiella pneumoniae nor Pseudomonas aeruginosa were isolated during any of these foeto/placental examinations, in comparison with positive diagnoses recorded in the 1970s survey reported by *Whitwell (1980)* and *Whitwell (1988)*. This reflects the much lower incidence of these potential venereal pathogens in the UK equine population following the industry's application of the HBLB's Code of Practice for their control from 1977 onwards.

No cases of abortion associated with EAV infection were seen in this series. This and the absence of cases of nocardiform placentitis and leptospirosis in this series demonstrate clear geographical differences in some causes of equine abortion. In spite of detailed investigations, the cause of a proportion (5% in this series) of equine abortions remain undiagnosed *(Whitwell, 1980)*. Although this is a constant source of frustration to the pathologist and clinician and of disappointment to the manager and owner, the wondrous complexity of pregnancy is such that one should perhaps not be too surprised that some fail for undeterminable, perhaps functional reasons. Some, but not all of these undiagnosed cases were associated with advanced decomposition of the foetus, non-presentation of the placental membranes or incomplete presentation of the foetus following partial ingestion by a predator. In other cases, maternal causes not associated with clinical illness must be suspected.

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