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Causes of Abortion in Australia (2005-2012) – Proportion of Cases due to Equine Amnionitis and Foetal Loss (EAFL)

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1. Introduction:

EAFL was first reported to cause abortion in Australia in 2004 (Todhunter et al., 2009). Research at the University of Queensland demonstrated that the urticarial caterpillar *Ochrogaster lunifer* is able to cause abortion with the characteristic changes of EAFL in mid-late term pregnant mares (Cawdell-Smith et al. 2012). There have been no recent reports about the cause of abortion in Australia. It is assumed that the causes are similar to those reported from the UK and USA; however the proportion of losses due to EAFL has never been reported.

2. Materials and methods

The case records of all abortion investigations conducted at Scone Equine Hospital from 2005 to 2012 were reviewed. The cause of abortion was defined as

1) EHV – EHV1 or 4 nucleic acid detected by PCR and presence of characteristic histopathology with inclusion bodies;

2) Placentitis – inflammation which was most severe on the chorionic surface and may extend to the allantois, foetus, amnion and umbilical cord;

3) EAFL – inflammation which was most severe in the umbilical cord and amnion with extension to the foetus and allantois;

4) Infection unknown cause – inflammation of the foetus with no source of infection

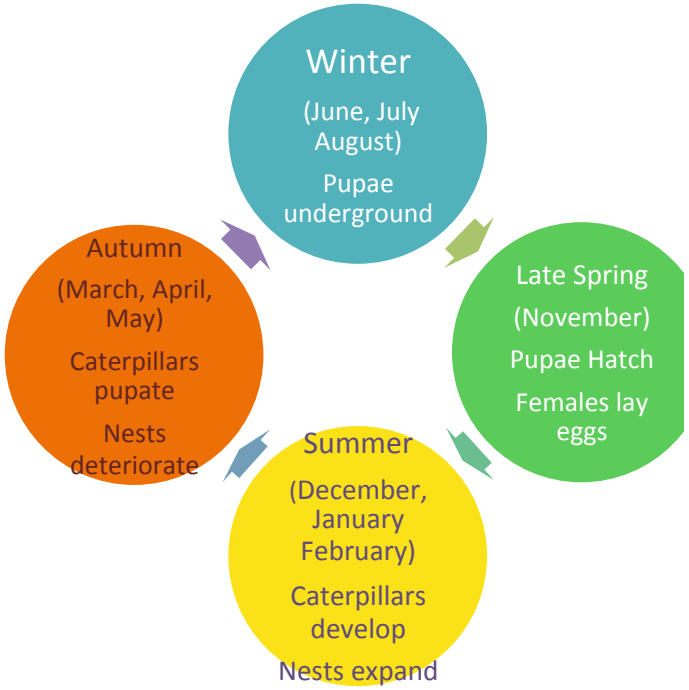
5) Poor Perfusion – autolysis of the foetus with no inflammation, mineralisation of the chorioallantois, occlusive twists of the umbilical cord may be present

6) Other – congenital abnormalities, perinatal death, contracted flexor tendons and

7) No Diagnosis – the cause of the pregnancy loss could not be determined.

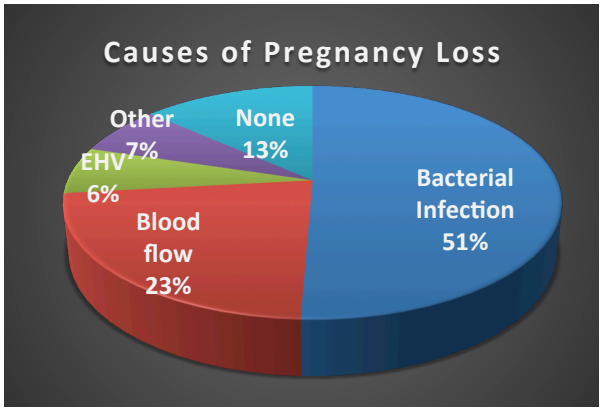
Standard tissues were collected during every post mortem (thymus, lung, liver, spleen, amnion, umbilical cord, and chorioallantois at the cervical pole and the umbilical insertion) and examined histologically by a specialist pathologist.

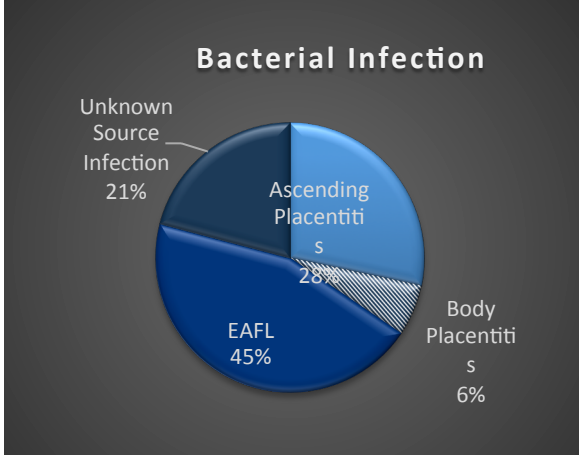
Detailed analysis of abortions that occurred on 7 farms during 2011 and 2012 was conducted. An epidemiologist and an entomologist investigated whether there was an association between losses due to EAFL and the presence of *O lunifer*. The investigation was initiated during winter 2011 when the caterpillar had pupated underground and could not be identified. Moths emerge and lay egg masses in late spring and the caterpillars develop through their larval stages during summer**.** Three farms (Intervention farms) initiated control programs that involved identification and removal of nests, and removal of pregnant mares from paddocks where nest material was found or the host tree species for *O lunifer* were present. One Intervention farm initiated trans-rectal and trans-abdominal ultrasound monitoring of all pregnant mares. Treatment with antibiotics, altrenogest and anti-inflammatory drugs was administered to mares with increased echogenicity of the amniotic fluid, thickened amnion and thickened walls of the umbilical cord. The other 4 farms (No Intervention farms) did not change management protocols for pregnant mares. Data were entered into a spread-sheet program and analysed using a statistics program (JMP 7, SAS Institute Inc, Cary NC, USA). Continuous data was assessed for normal distribution. Wilcoxin Ranks Sum Test was used to assess continuous data and Contingency analysis and Fishers Exact Test were used to assess categorical data. Significance was determined to be $p<0.05$.



3. Results and Discussion:

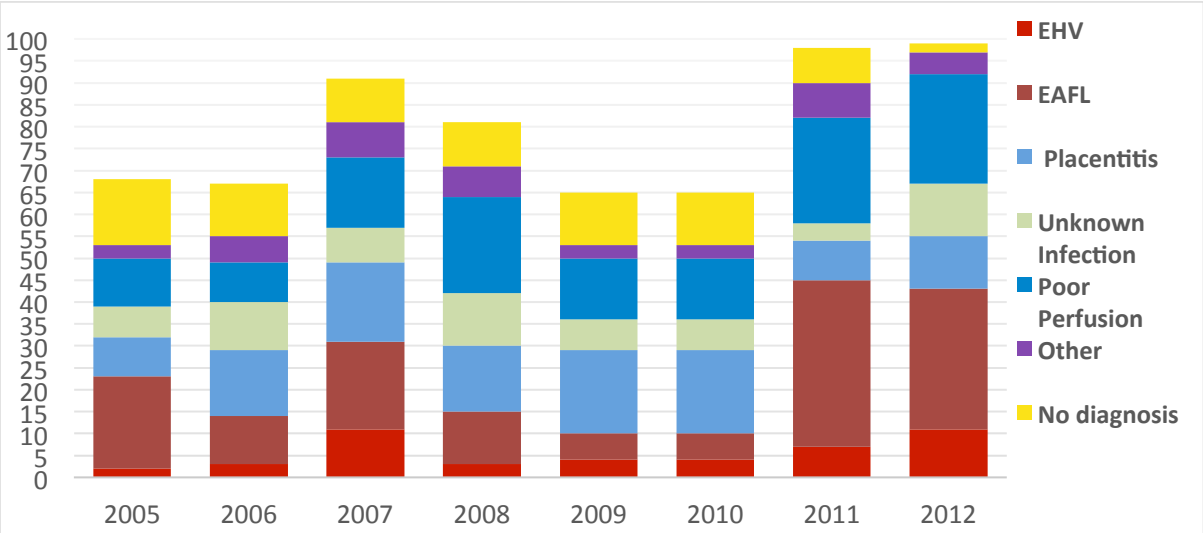
There were 642 cases of abortion investigated. The most common diagnosis was EAFL, with poor perfusion the second most common diagnosis and placentitis the third most frequent diagnosis (Figure 1). Focal placentitis of the body or horns of the chorioallanotis occurred in 18% of the cases of placentitis. Only 14% of cases were defined as ascending placentitis. Inflammation associated with bacterial infection of the foetal membranes was the cause of 325 (46%) of all abortions and a single



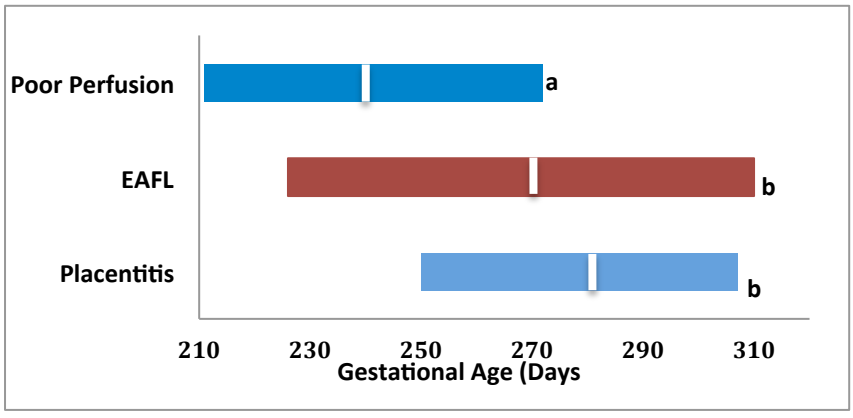


significant bacterial isolate was identified in 60% of these cases.

The number of cases of abortion investigated and the proportion in each diagnostic category differed each year however small numbers of cases in some categories precluded statistical analysis

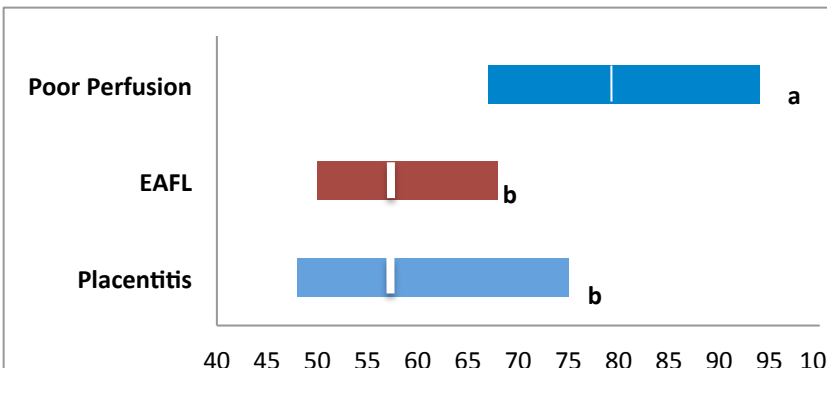


The proportion of abortions caused by EAFL differed significantly between years, with the lowest proportion of 9% in 2009 and 2010 and the highest of 39% in 2011 ($p<0.001$). The relative risk for EAFL in 2011 compared with 2009 was 4.2 (95% CI 1.9 – 9.5) and compared with 2010 was 4.1 (95% CI 1.9-8.6).



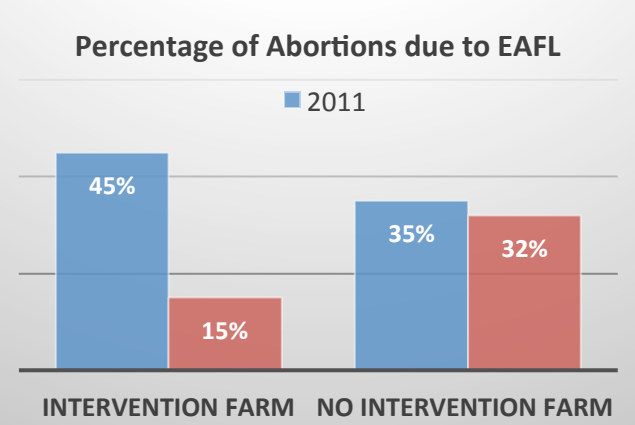
The gestational age at which poor perfusion caused abortion was less than the gestational age at which EAFL or Placentitis cause abortion (Table 2). Most abortions due to poor perfusion (75%) occurred before 272 days of gestation. At this stage of pregnancy the hind limbs become lodged in the pregnant horn and the foetus is too large to accomplish a 180 degree turn which may reduce the chance of a complete cord occlusion.

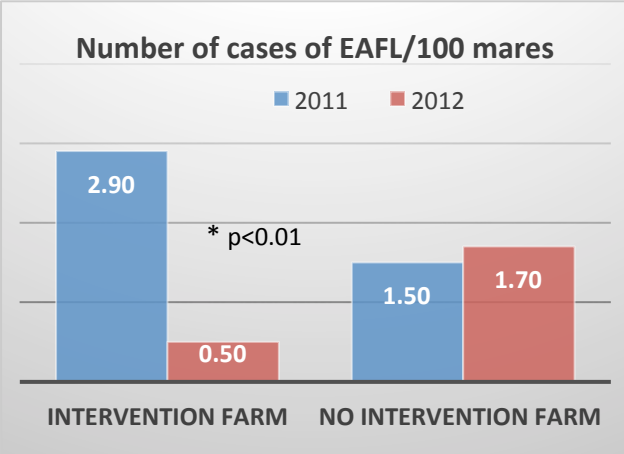
The umbilical cord length from foetuses that died due to poor perfusion was longer than the umbilical cord length of foetuses that died due to EAFL or placentitis (Table 2). The association between umbilical cord



length, placental perfusion and foetal blood flow may provide critical information about this important cause of mid-late term pregnancy loss

During 2011 and 2012 large numbers of nests were detected on several farms and in native forest during the late spring and summer (November 2011 – February 2012). Although the total number of abortions and the proportion due to EAFL on Intervention farms decreased in 2012 compared to 2011, it was not different from the No Intervention farms





During 2011, the number of cases of EAFL/100 resident mares was similar for both Intervention and No Intervention farms. However in 2012, when control measures were initiated, the number of cases of EAFL/100 resident mares was higher on No Intervention than on Intervention farm. The relative risk of a mare losing a pregnancy due to EAFL on a No Intervention farm in 2012 was 3.27 (95% CI, 1.01-10.56) compared with an Intervention farm

These data show that EAFL is an important cause of mid-late term pregnancy loss in Australia. Data on the effectiveness of risk management strategies are preliminary but indicate that control of exposure to *O. lunifer* is effective in decreasing losses due to EAFL. Control of exposure to *O. lunifer* is may be critically important to reduce mid-late term pregnancy losses in Australia and further efforts are underway to identify optimal methods for identifying and managing exposure risk on broodmare farms.

Conflict of interest

None

References:

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