Editorials

Progress in identifying the aetiologies of infectious foal diarrhoea

GASTROINTESTINAL DISEASE IS the most common cause of sickness in foals (Baldwin, Cooper, Vanderwall and Erb 1991); however, it is only recently that field studies have been conducted to determine the causes of infectious diarrhoea outbreaks. The investigation reported by Browning *et al* (p 405) documents the importance of rotavirus as a cause of foal diarrhoea in the U.K. and Ireland, and also raises the question of the role of *Aeromonas hydrophila* in gastroenteritis. Similar studies in the United States have shown that rotavirus is a predominant cause of enteritis in foals (Conner and Darlington 1980; Dwyer *et al* 1990). The virus was the topic of a recent international workshop to address the current knowledge and future research needs (*Rotavirus Workshop Proceedings* 1989). Rotavirus can cause disease without being an opportunist or secondary pathogen (Higgins *et al* 1988) and is species specific under natural conditions. Studies of serotypes in the United States indicate that serotype 3 predominates (Hardy *et al* 1991). This also has been confirmed with rotavirus isolates from the U.K. and Ireland (Snodgrass 1991) and Japan (Imagawa *et al* 1991); however, low numbers of other rotavirus serotypes were detected in both studies, and 23/70 isolates were untypable (Snodgrass 1991).

Several questions remain about the natural history of rotavirus enteritis and other causes of foal diarrhoea. How many serotypes exist, and how do the local intestinal and systemic immunity interact to protect against disease? Does rotavirus play a role in the gastric ulcer syndrome of foals? The onset of hot humid weather has preceded reported outbreaks (Baldwin, Cooper and Higgins 1990; Dwyer, unpublished data). Can weather conditions influence virus dissemination or is it stress on the foals that predisposes them to infection and subsequent disease? Could the high number of foals on farms during April and May cause 'stress' in foals making them more susceptible to infectious diarrhoea? Or does a true carrier state exist in mares and/or foals, in which case the large number of animals present in the midst of the foaling season merely increases the chances of healthy foals contacting the virus from asymptomatic shedders.

Salmonellosis has long been considered a significant pathogen of horses and a variety of serotypes have been reported to cause outbreaks of enteritis in the United States, Great Britain, Australia and Japan: *S.*

typhimurium, *S. agona*, and *S. saint-paul* (Powell *et al* 1988). In recent prevalence studies, *Salmonella* was only rarely detected in faeces of diarrhoeic foals (Traub-Dargatz *et al* 1988; Baldwin *et al* 1990; Dwyer *et al* 1990; Browning *et al* p 00). However, serious outbreaks of salmonellosis causing diarrhoea and mortality in foals still occur (Madigan *et al* 1990).

A point to consider is that in the study by Browning's group and in an earlier study by Dwyer *et al* (1990), only 50 per cent of diarrhoeic cases were diagnosed as caused by a specific aetiological agent. Although this may seem a low figure, a similar percentage was identified in diarrhoeic cases among infants and adults (Centers for Disease Control, 1990). Other agents have been associated with foal diarrhoea, but due to diagnostic constraints are only rarely reported. These include parvovirus, coronavirus, *Bacteroides fragilis* and toxigenic clostridial organisms. Ongoing questions also revolve around the pathogenicity of *E. coli* (Hart *et al* 1991) and cryptosporidia.

Initial studies on the use of rotavirus vaccine in mares prior to foaling have shown the production of anti-rotavirus antibody in colostrum (Browning *et al* 1991; Plateau, Collobert and Zientara 1991). Bovine colostrum products fed to piglets have been shown to be protective against rotavirus diarrhoea when piglets were challenged subsequently with virus (Bridger and Brown 1981), and this form of passive immunity may be a rational means of preventing disease among foals. Although vaccination of mares and supplemental passive immunity in foals show promise in the prevention of rotavirus diarrhoea, efficacy under field conditions remains unknown. Until a proven product is available commercially the prevention and control of infectious diarrhoea rests with the fundamentals of rigorous disinfection, hygiene and sound management practices. The success of these techniques under field conditions has been documented (Traub-Dargatz *et al* 1998; Baldwin *et al* 1990; Dwyer 1991). A vaccine by itself will not erase rotavirus from the list of yearly problems encountered on studfarms.

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EQUINE VETERINARY JOURNAL

Equine vet. J. (1991) **23** (6) 398-399

Blood gas and acid-base status - art, science and relevance

DETERMINATION OF BLOOD gas and acid-base status is one of the main tools used for assessing respiratory function in both clinical and research investigations. It is most notably of value during anaesthesia, in the diagnosis of cardiovascular and respiratory disease, metabolic disturbance, care of the newborn foal and in physiological research.

Blood gas measurement consists of estimating the tension, or partial pressure of oxygen and carbon dioxide (PO_2 and PCO_2 , respectively). The partial pressure of each gas gives a guide to blood gas content and therefore an indication of the state of respiratory gas exchange. Although blood oxygen content provides more information about oxygen supply than partial pressure, the latter is easier to measure. With an estimate of oxygen partial pressure and knowledge of the oxygen-haemoglobin

dissociation curve, the adequacy of blood oxygenation can be assessed.

Measurement of blood gas and acid-base status has obvious clinical applications. However, there are a number of drawbacks. Arterial and/or mixed venous (pulmonary artery) samples are required for interpretable results and neither is straightforward to take as a routine clinical procedure, except in the anaesthetised horse or foal. In the case of research investigations, access to an artery may be provided by surgical relocation of, for example, the carotid artery.

One of the major impediments to the regular use of blood gas measurements is the cost of equipment and the need for regular maintenance. Historically, blood gas analysers have been seen as temperamental and mysterious. To a certain extent this perception persists, although the