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PRACTICAL APPROACH TO THE SICK NEONATE

The key to success with the newborn foal is to understand what is normal and to immediately act upon anything that deviates from this as time is of the essence if sick foals are to be saved. The key therefore revolves around ATTENTION TO DETAIL. Minor changes in behaviour can be warning signs of impending illness and the sooner treatment is started, the more likely there will be a positive outcome. The normal gestation of a horse is between 320-340 days but can be significantly more or slightly less than this. Immediately after birth, the cardiorespiratory system must adapt to extra-uterine life.

Breathing

Spontaneous breathing should begin within 1 minute of birth, although many foals attempt to breathe as soon as the chest has passed through the pelvis. Whilst adaptations to extra-uterine life occur, respiratory rates are normally >60 breaths per minute but should decrease to 30-40 breaths per minute within a few hours. The foal may appear slightly blue at birth, but should resolve within a few minutes.

Cardiovascular system

The heart of a normal newborn foal should have a regular rhythm and the rate should be greater than 60 beats per minute after the first minute. Occasionally rhythm disturbances can be auscultated but should resolve within 15 minutes after birth. Murmurs may be heard in the first week of life, but should resolve beyond this time. A continuous or systolic murmur may be heard for the first few days after birth in the third or fourth left intercostal space and is due to a patent ductus arteriosus. Other systolic murmurs, thought to be flow murmurs, may also be auscultated. Murmurs that persist beyond the first week of age, those that are loud (>3/6), or associated with clinical signs should be further investigated. Mucous membranes should become moist and pink within a few minutes of birth.

Normal responsiveness

Foals are usually unresponsive whilst in the birth canal. As the foal is born, it should possess a righting and withdrawal reflex. Menace response is absent at birth and has

a learned component and as such may not be present until 7-10 days. Thus, it should not be used to assess vision. Foals should have a strong suck reflex within 10 minutes of birth. However, try not to allow foals to suck fingers as they ingest organisms present on human skin, which can be pathogenic. Within 1 hour of birth, foals show evidence of being aware of auditory stimulation evidenced by movement of their ears. Eyes are angled slightly ventromedially at birth (similar to what would be seen in lightly anaesthetised small animals) and the eye angle gradually becomes more dorsomedial over the next month.

Foals should attempt to stand within 20 minutes of birth and most can stand unaided by 1 hour. They should then be steady enough and driven to nurse by 2 hours. Some foals will pass their meconium (first faeces) shortly after standing, but other will not defaecate until they have consumed colostrum approximately 3-4 hours after birth. Urination is more variable - fillies usually urinate before colts.

Foal resuscitation

For foals with difficulties, it is important to recognise and institute appropriate resuscitation procedures speedily. A scoring system (modified Apgar) has been developed as a guide to help effectively implement resuscitation and estimate the level of fetal compromise. A combined score of the four parameters of less than 3 should initiate cardiopulmonary resuscitation. If the score is between 4-6, then the foal should be closely monitored as it is suggestive of some degree of asphyxia.

The priority in resuscitation of the newborn foal, assuming that there are no other life threatening abnormalities present, is to establish an airway (A) and breathing (B) pattern. The upper airway should be cleared of membranes or any fluid. If the airway is suctioned, it should be performed with care. Tactile stimulation (stimulating the nose or ear) can be attempted initially. If this is not successful, then ventilation should begin. Usually the two options available at birth are mouth-to-snout resuscitation or the use of an Ambu bag. Evidence suggests that room air is as good, if not preferred to, 100% oxygen. Respiratory rate should be 10-15 breaths per minute.

If the foal's heart rate does not increase with ventilatory support, then chest compressions should be initiated. The recommended rate is 100-120 beats per minute for a minimum of 2 minute cycles. The foal should be placed in right lateral recumbency on a hard surface. The clinician should then place the hands over the widest point of the thorax dorsally and aim to compress the chest to about 1/3rd of the chest depth with each compression. As a small proportion of foals are born with rib fractures, it is prudent to try and rule-out their presence prior to beginning chest compressions. The key to the success of chest compressions is to not keep pausing to assess efficacy. If possible, efficacy of chest compressions generating cardiac output can be assessed with the presence of pupillary light responses. If the animal is intubated in a hospital, adequate cardiac output generated by chest compressions can be identified if end-tidal carbon dioxide is $>20\text{mmHg}$.

Drugs should be administered if a cardiac rhythm is not present within one minute of initiating chest compressions. Intravenous epinephrine is the drug of choice and should be administered at a 'low dose' (0.01–0.02 mg/kg). It can be repeated every 2–3 min during compressions. Atropine and doxapram are not recommended.

Foals at birth should be dried and placed in dry bedding. They ideally should not be in very cold environments, but equally should NOT be actively warmed. Being cool can have advantages as it reduces the metabolic requirements of the brain, heart and other tissues.

These foals may also need fluid therapy and intravenous nutrition. Fluids need to be given cautiously in these scenarios as these foals are not hypovolaemic (unless they have bled). Fluid boluses may be required if the foal is obtunded, has poor peripheral pulse quality, has cold distal extremities or has other clinical signs consistent with septic or haemorrhagic shock.

Practical management of sick neonates

All sick foals are septic until proven otherwise. If these foals are treated appropriately early on in the disease process, they can have a good prognosis.

The first step with the critically ill foal is to ensure the client appreciates the severity of the condition and is emotionally and financially behind a decision to treat the foal. The next step with a moderately to severely ill foal is to move or refer the foal to an appropriate facility. This should be done promptly and is often easiest without the mare....foals can easily be transported in cars and the mare can be transported later.

Initial tests and samples that should be considered in the foal include a major body system assessment, haematology, biochemistry, urine specific gravity, blood lactate concentration, arterial blood gas assessment and IgG concentration. A central venous cannula should be placed aseptically and then three samples should be taken for blood culture over the next 4 hours. Plasma should be defrosted as required. The foal's fluid deficit should be assessed....most recumbent foals have a fluid deficit over 8% or greater. There are various ways to approach correction of a fluid deficit in the hypovolaemic patient which we will discuss. The foal should be maintained in sternal recumbency to make the work of breathing less and minimise the risk of atelectasis and intra-nasal oxygen should be provided at 5-10L/min. Intra-nasal tubes should be used with the tip of the catheter being inserted up to the level of the medial canthus. A urinary catheter and urine collection bag should be used in recumbent foals. These not only prevent urine scalding, but allow renal function and perfusion to be assessed and aid titration of fluids. Foals should produce 1-2 ml/kg/hr of urine and due to their milk based diet as this stage should produce hyposthenuric urine (USG <1.008). Once initial fluid boluses have been administered, a more conservative fluid plan can be implemented that includes the inclusion of plasma and parenteral nutrition (glucose and amino acids or glucose, amino acids and lipid with vitamins and minerals).

Recumbent, collapsed foals are unlikely to have an effective, gastro-intestinal function predisposing these animals to necrotising enterocolitis and abdominal pain due to ileus if enteral nutrition is used and the recumbency will promote the risk of aspiration if milk is administered. Once all blood cultures are collected intravenous, bacteriocidal, broad-spectrum antimicrobials should be administered. Choices would include amikacin and benzyl penicillin, ceftiofur or cefquinome. Non-steroidal anti-inflammatory drugs may also be administered; COX-2 selective drugs such as meloxicam or carprofen may be associated with fewer side effects. However renal function should be monitored

when nephrotoxic drugs are administered. If the foal is hypotensive, pressor agents or inotropes such as dobutamine or norepinephrine, may be administered by constant-rate infusion to improve blood pressure and organ function. The use of sucralfate may be beneficial in conjunction with fluids and inotropes to help improve gastric mucosal blood flow and prevent (or treat) gastric disease. Hyperglycaemia is common in these foals secondary to the disease process and provision of parenteral nutrition. As such it becomes important to control blood glucose at least below the renal threshold or the osmotic diuresis can make it challenging to maintain hydration status.

It may be prudent early in the management of these critically ill foals to perform thoracic and carpal and/or tarsal radiographs. Thoracic radiographs allow any thoracic pathology to be identified and treated as appropriate. Some foals have such severe pulmonary disease that they need mechanical ventilation, which would require referral to a specialist centre. If foals are premature or dysmature, lack of or very poor ossification of the small carpal or tarsal bones significantly reduces the likelihood that the foal will become an athlete and as such clients may choose to stop treatment.

The key to success is frequent reassessment and adaptation of the treatment plan. Foals should be kept dry and warm, but not actively heated and turned frequently. Ideally foals should be weighed daily to ensure that they are not losing body weight. Foals are at risk of thrombophlebitis and the development of septic joints so should be checked regularly for the development of these conditions as well as for decubital and corneal ulcers. Physical therapy or passive range of motion exercises should be provided.

As these foals hopefully improve, it becomes possible to reduce fluid rates and gradually wean them off parenteral nutrition and onto enteral nutrition. Whilst the foal is ill and recumbent, it is helpful for the mare to be near and able to see the foal, but physically separated from it. Milk can be stripped from the mare and stored until the foal is ready for its re-introduction. As the foal becomes stronger and copes with enteral nutrition, in many cases it is possible to re-unite the mare and foal and the foal will learn to obtain milk from the teat with help. If the mare rejects the foal, then bucket training the foal is warranted. Bottle feeding foals increases the risk of aspiration pneumonia,

but also often results in the development of an unmanageable orphan foal when it reaches adulthood.

Conclusions

In conclusion, management of the sick, equine neonate is both challenging and rewarding. Success is dependent upon prompt recognition of often very subtle abnormal clinical signs with a swift and aggressive response and treatment plan to these signs. If treated appropriately, prognosis can be good.