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Bonny received a Veterinary Technology Degree from Harcum College, Pennsylvania (USA) and started her career as an EVN at the University of Pennsylvania's New Bolton Center, specialising in medical nursing. Bonny married and moved to Britain in 1991, settling in Newmarket where she was head nurse at Rossdale and Partners in Newmarket, for 12 years, specialising in equine critical care nursing.

She regularly teaches and mentors equine veterinary nursing students while focusing on equine critical care, wound management and neonatology. At present Bonny is on the BVNA Executive Advisory Board and was president in 2008-09. She also served as a Vet Tech in the 2012 London Olympics and Paralympics.

Understanding the normal neonatal foal

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ABSTRACT: The neonatal period is the time when the foal adapts to extrauterine life. During this challenging time the client and veterinary professional need to be familiar with the normal differences and changes that happen to the healthy foal. This article will provide some insight into the physiological and physical characteristics unique to the equine neonate.

The first few hours of a foal's life are its most precarious. After a gestation period of 320-360 days, the parturition process is rapid and complex, with the foal entering the world physiologically independent from the dam. This means that a great many adaptations must take place for the transition to be successful.

Physiological adaptations

Thermoregulation

The neonate is highly susceptible to heat loss owing to its thin hair coat and high surface area:volume ratio. The newborn foal maintains its body temperature between 37-39°C, initially through shivering to generate heat, and then from the metabolism of ingested colostrum and milk.

Weak or premature foals are particularly prone to heat loss because of poor energy reserves and minimal body insulation, made worse if they have a lower energy intake.

Cardiovascular system

The *foramen ovale* in the foetal heart is located between both atria and allows blood to flow from the right to the left atria. This gap closes at birth and is responsible for the pressure decrease in the pulmonary circulation, as lungs inflate for the first time.

The *ductus arteriosus* is a short vessel that shunts blood away from the lungs and returns it to the aorta. This vessel closes about 24 hours after birth, and during this time a murmur of varying intensity can be heard at the left heart base. It is considered abnormal if the murmur persists for more than four days, when it is described as a *patent ductus arteriosus*.

Respiratory system

When the foal leaves the mare's birth canal, its chest is compressed, pushing the amniotic fluid out of the lungs, bronchi and trachea. This is followed by the first gasp of air which aids in expanding the alveoli and removing the remaining amniotic fluid. Foals have a higher metabolic rate than adults, so respiratory rates are significantly increased (**Table 1**).

Their pliable ribcage, an advantage during parturition, now requires careful handling, as it is easy to impede respiration and fracture ribs at the costochondral junction (**Figure 1**).

Gastrointestinal system

Faecal meconium is formed during gestation and should be passed within four hours of birth (**Figure 2**).

A large handful of dark black/brown 'pebbly' matter is expelled, comprising glandular secretions, swallowed amniotic

Table 1. Heart and respiratory rates of neonatal foals

Foal's age	Heart rate (bpm)	Respiratory rate (rpm)
1 minute	60-80	Irregular (gaspings), 60-80
<2 hour	120-150	40-60
12 hour	80-120	30-40
24 hour	80-100	30

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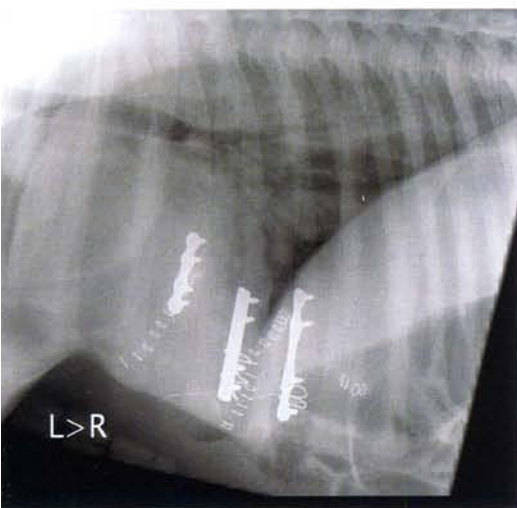


Figure 1. Repair of fractured ribs using internal fixation

fluid and cellular debris. It is believed that late-term foals produce more meconium.

Musculoskeletal system

A newborn foal's long appendicular bones are well ossified and developed, already approximately 70 per cent of the length they will be in adulthood. Because they are non-weight bearing *in utero*, there is a degree of tendon and ligament laxity evident at birth. This is normal and in most cases improves in the first few days or weeks of life when the foal ambulates.

Neurological system

The foetus *in utero* exhibits a withdrawal reflex, which is evident when prodded. During parturition this response disappears and the foal becomes limp in the birth canal. The reflex will return once the foal's hips have passed through the mare's pelvis.

A suck reflex is often present at birth, but should definitely be observed at 20 minutes old. Once standing, the normal foal should seek the mare's udder and be nursing within three hours.

The foal will right itself into sternal recumbency within minutes of birth and will struggle to stand soon after. It should stand without assistance within one to two hours. Foals adopt a wide-based stance for balance and will be hypersensitive to sound and visual stimuli. There is cause for concern if the foal has not stood within three to four hours (Figure 3).

Urogenital system

The urachus is the part of the umbilicus that links the bladder to the foetal fluids *in utero* and allows the foal to excrete urine. It closes at birth to become the median ligament of the bladder. The two

umbilical arteries become the round ligaments of the bladder. Sometimes the urachus fails to close, causing urine to dribble from the umbilicus.

A healthy foal produces large volumes of urine owing to the large quantity of milk that is consumed. This process may be slowed in sick or premature foals. Kidney function is very sensitive and easily impaired by hypovolaemia or the administration of some medications such as non-steroidal anti-inflammatory drugs (NSAIDs).

Routine neonatal examination

A routine examination of the neonate should be carried out by a veterinary surgeon within the first 24 hours of life, ensuring:

- a thorough and systematic approach
- the vet is familiar with normal foal behaviour and has knowledge of normal parameters
- attention is paid to vague or non-specific signs that can rapidly progress to serious illness
- that a foal is not viewed as a 50kg horse – events that have little effect on the mature horse, may have a profound effect on a foal.

For physical examination:

- the foal must be restrained lightly but adequately
- do not put yourself between the mare and the foal
- take care that the chest is not compressed! Foals have a chest wall

Figure 2. A newborn foal passing meconium



Figure 3. A healthy newborn foal delivered by Caesarean section

that is extremely elastic and it is easy to impair breathing with tight restraint.

Normal newborn behaviour

Foals are best observed from outside the stable at first. Note that:

- a foal will nurse at least five times an hour
- they are naturally inquisitive and play in between nursing times
- foals interact with the mare and hide behind them when faced with a new experience
- a foal spends large amounts of time sleeping.

Physical characteristics

1. Head

It is usual practice to begin by observing the foal's head and neck:

- there should be no milk running down the nostrils, otherwise a cleft palate may be suspected
- if dried milk is seen on the foal's head, it may not be nursing enough or have an uncoordinated suck
- mucous membranes should be pink and moist, with no signs of jaundice, congestion or petechiation
- the mandible and maxilla should meet without an overbite (parrot mouth)
- eyes should be clear with a distinctly white sclera. Scleral congestion or petechial haemorrhage suggests there was trauma at birth.
 - uveitis – bacteraemia
 - entropion – eyelids inverted causing lashes to rub the cornea, potentially leading to corneal ulceration.

2. Limbs

The foal's gait should not indicate signs of ataxia or weakness fairly quickly after birth. The normal foal will often have a springy, 'choppy' gait, noticeable when it tries to keep up with the mare. Observe for signs of angular limb deformities, flexural deformities, distended joints or 'joint ill', and trauma.

3. Chest

The chest is gently palpated for signs of broken ribs – resulting from trauma at, or after, birth. Auscultation of the lungs right after birth generally reveals moist lung sounds. A meconium-stained foal at

birth can imply that aspiration of faecal material into the lungs has occurred.

4. Abdomen

Particular attention should be paid to examination of the abdomen:

- abdominal distension should not be present in the newborn foal
- normal gut signs (borborygmi) are easily heard on both sides
- meconium retention/impaction is a common condition that usually responds to enemas and medical treatment. Overdue colts are most at risk of retaining their meconium
- umbilical swelling – small umbilical hernias are common and palpable. Heat, pain and discharge may indicate an infected urachus and requires prompt systemic antibiotic to prevent the onset of a systemic infection.

Passive transfer of immunity

Foals are born immunologically naïve and receive transfer of colostrum immunoglobulins (IgG) to ensure a good immunity before they are able to manufacture their own antibodies.

The mare's placenta comprises many layers of cells, which prevent the transfer of any immunoglobulins across it into the foetal circulatory system. Thus the foal is born with the ability to recognise signs of

infection but with virtually no circulating immunoglobulins to fight against it.

The lining (epithelium) of the foal's gut contains specialised cells that enable the absorption of IgG. Maximal absorption of IgG occurs when the foal is around eight hours old, and decreases then until the cells begin to cease absorbing the IgG when the foal is 24 hours old.

This is why it is essential that the foal ingests colostrum within this time frame. The mare produces at least one litre of good quality colostrum, which contains the vital immunoglobulins, to protect the foal from infection until its own immune system is more mature.

The first few feeds are very important for adequate passive transfer of immunity.

Colostrum and IgG

- Check the colour and viscosity. Thick honey coloured colostrum is preferable. Accurate measurement for quality requires a BRIX sugar refractometer. Supplement with stored colostrum if the quality is not adequate.
- Colostrum can be stored, in clean sealed containers in the freezer for up to two years. It must be defrosted slowly and not in a microwave as the heat will denature the IgG.
- Absorption occurs best when the foal nurses the mare; with bottle-feeding and stomach tube feeding being the least effective.
- If the foal has not nursed within the first four hours of life, bottle-feed with the colostrum or administer it by stomach tube.
- Bovine colostrum may be used in an emergency if there is no other alternative; but the half-life of the antibodies will remain in circulation for only four days, as opposed to 20 days for equine colostrum.
- Interpretation of serum IgG levels
 - < 2g/l – complete failure of passive transfer
 - 2-4g/l – partial failure of passive transfer
 - 4-6g/l – adequate levels are present but it would be *preferable to have levels above 6g/l*.

If the foal's initial physical examination is not perfect and IgG levels are below 4g/l,

Figure 4.A content neonatal foal and mare



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it may be best to transfuse the foal with commercially available equine plasma and treat it as if the foal has partial failure of passive transfer.

This plasma usually raises serum IgG levels by 2g/l. It is given slowly, through an intravenous catheter and a blood giving set. To prevent anaphylaxis, the foal must be monitored closely throughout administration.

Post-partum preventive neonatal care

Enemas

Enemas are routinely given at most commercial studs to prevent and treat meconium retention. The commercial brands (Fletcher's phosphate enemas) are easy to administer and effective. Warm soapy water enemas, using mild non-bio soap flakes, are equally useful.

Treating the umbilicus

The umbilicus should be allowed to break naturally, which aids in sealing the blood vessels and urachus. Treat with 0.5% chlorhexidine solution twice daily to aid drying.

Routine neonatal foal blood sampling

On commercial thoroughbred studs, blood samples are taken on day 2 post partum allowing adequate time for passive transfer of antibodies. Besides IgG, red blood cell and haemoglobin levels will help to determine any degree of anaemia. Increased white blood cell counts will indicate the possibility of infection. Raised inflammatory proteins will detect inflammation caused by trauma or infection.

Routine antibiotics

Broad-spectrum injectable antibiotics are given on a significant number of

commercial stud farms because of the high density of mares and foals in the locality. A course is administered intramuscularly for three days as oral medications can upset the delicate balance of normal gut flora. This protocol is not a substitute for good hygiene and stable management.

Tetanus antitoxin

A single dose of 1500 IU of tetanus antitoxin will provide protection against environmental tetanus toxins for three months.

Conclusion

Owning a newborn foal can be a challenge for the inexperienced horse owner because there is much to understand about the equine perinatal period.

Veterinary nurses can play an important role in preparing the client for the much-awaited arrival of their foal, and can be on hand throughout those first few magical hours of life (Figure 4). [vni](#)

NEWS REVIEW by Jean Turner

VN students to have voting rights

BVNA senior vice-president, Louisa Baker, was delighted to announce a change to student voting rights during the recent BVNA Annual General Meeting.

After an initial enquiry from a 'student' member, the BVNA Council undertook extensive research into voting rights across the veterinary associations, and as a result decided to change its voting procedures. Student BVNA members will now be able to vote at the AGM, nominate and to vote for those full VN members standing for election onto BVNA Council.

The BVNA constitution was amended accordingly and the changes formally ratified during the AGM which took place at the BVNA Congress on Sunday 13 October in Telford.

Pet bereavement support services

When a client has to have a much-loved pet put to sleep, working out how to support the grieving owner is not always easy. Help is available from the Blue Cross with their Pet Bereavement Support Service (PBSS).

Call 0800 096 6606 or e-mail pbssmail@bluecross.org.uk. The line is open from 8.30am to 8.30 pm every day. Calls are confidential and free from a landline.

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