Neonatal Foals-When Should I Refer???

Introduction

• Numerous advances exist in intensive medical care of the equine neonate in the past 25 years
• Significant need for initial or on-farm assessment and medical care
• Intensive care facilities are not available in many areas of the country
• Some situations the risk of nosocomial diseases in facilities with high patient density

Introduction

• Predominant conditions requiring medical attention
  • Perinatal Asphyxia Syndrome and complications
  • Resuscitation
  • Sepsis
  • Colic
Introduction

- Certain immune conditions
- Congenital defects
- Variety of orthopedic conditions

Review-History...

- As with most situations in medicine
- Accurate history is vital in management of a sick neonatal foal
- Vital information should include
  - Gestational age
  - Expected due date to determine if foal is full term
  - Delivery observed?

History

- Any difficulties with parturition?
- Any illness in dam prior to parturition?
- Placental abnormalities?
History

- Placenta - if you can get the client to save the placenta for you to look at.
- Evidence of placental edema or meconium staining would be considered risk factors for perinatal asphyxia
- Foaling history of mare if she’s not a maiden
  - Prior premature placental separation
  - Prior dystocias
  - Evidence of neonatal isoerythrolysis
  - Congenital defects

Review

- 5 minutes - lift head, alert, sternal, suck reflex
- 1-2 hours - stand
- 2-4 hours - nurse
- 12 hours - feeding pattern established
- HR 60-80 BPM at birth
- Rises to 100 at 1 hour
- 80-120 BPM 12 hours

Physical Examination

- What is mental status of foal
- Attached to mare?
- Nursing well?
- Stand unassisted?
- Strength of foal?
Neurologic Status

• Neurologic Status
  – Awake
  – Somnolent
  – Stuporous
  – Comatose
• Seizures
  • Focal
  • Generalized
    – Duration
    – Status

Mucous Membranes

• Mucous membranes
  – Pale
  – Cyanotic
  – Icterus
  – Petechiation

Sepsis???

• Petechia
• Ecchymosis
• Vulva
• Ears
• Gums
Respiratory Rate

- Respiratory System
- Auscultation
- Palpation for fx ribs
- Ultrasound
- Radiographs

Respiratory System

- Pneumonia on u/s
- Aspiration Pneumonia
- Pneumonia
- Atelectasis

Cardiovascular System

- Mucous membrane color and refill
- Auscultation
- Heart rate
- Murmur or Arrhythmia
- Pulse Quality
- Map > 60 mm Hg
Thermoregulation

• Normal foals should be able to thermoregulate

• 1 minute post foaling temperature should be 99-100 F

• 12 hours post foaling, temperature should be 100-101 F

• If a foal is below 100 or above 102 suspect a problem!

Umbilicus

• Palpate normally

• U/S findings
  – Stump < 1 cm
  – Vessels < 0.5 cm
  – Urachus

• Potential problems
  • Infection
  • Hernia
  • Patent Urachus
  • Urachal Rupture

Urinary Tract

• Intact bladder
  • Can rupture during parturition
  • Colts more likely than fillies
GL-Tract

- Meconium
- Diarrhea
- Abdominal Distention-Atresia coli

Reproduction Tract

- Scrotal Herna
- Inguinal Hernia
  - Congenital
  - Ruptured tunic

Ophthalmology

- Entropion
- Corneal Ulcers
- Periocular Trauma
  - Congenital
- Cataracts
**Musculoskeletal**

- Flexural deformities
- Joint Effusion
- Angular limb deformities

**Maturity/Dysmaturity**

- Floppy ears
- Tendon Laxity
- Silky Hair Coat
- Lack of ossification of carpal and tarsal bones

**PCV**

- PCV
  - Normally 34-44% at birth
  - Decreases over the first week
  - If >45% when born, indicates in utero hypoxia
- Anemia
  - Neonatal isoerythrolysis
  - Blood loss
Hematology

• Leukocytosis
• Neutrophilia/neutropenia
• Band neutrophils
• Lymphopenia
• Fibrinogen
  — Should be < 200 g/dl if greater possible in utero infection

Biochemistry Panel

• Normal
  • Alkaline phosphatase up to 2835 IU/L
  • Phosphate
  • Bilirubin
    — May be has high as 5.5 mg/dl if stays elevated after a few days consider sepsis

• Abnormal
  • Elevated creatinine consider placent al insufficiency
  • Elevated BUN- catabolism for in utero starvation
  • Lactate-watch trend

Common Presenting Complaints

• General weakness
• Inability to stand
• Failure to suckle
• Variety of neurologic abnormalities
• Convulsions
• Colic
• Abdominal distention
Management of Generalized Weakness

- The first step in evaluation of a foal with generalized weakness is to look for an infectious condition.
- Bacterial sepsis or viral disease.

Weakness-Sepsis

- If suspicious of sepsis, a broad spectrum antimicrobial combination may be indicated.
- Consideration of the leukocyte count is important.
- Can be indicative of sepsis.

Sepsis

- Consider referral if the foal is septic.
- If you are considering referral, don’t start antimicrobials so a blood culture can be performed at the referral center.
- Consider giving fluids and anti-inflammatories (if creatinine is ok) if foal is hypotensive prior to transport.
Sepsis

- Depending upon time-frame you may also consider administration of plasma. Plasma will help with blood pressure and endotoxemia.
- Hetastarch can also be used easily in the field since crystalloids alone may not help perfusion as much as crystalloid and colloids together.

Generalized weakness

- Another very common cause of weakness is hypoglycemia
- This can be tested easily in the field with a hand held glucometer
- Place an IV catheter (typically I use an over the wire) in foals
- Administer dextrose containing solutions (5%-10% depending upon the blood glucose values)

Generalized Weakness

- Serial monitoring of blood glucose concentrations is typically warranted in sick foals
- They tend to get hypoglycemic easily if they are septic
Weakness

- All weak foals should also be closely examined for evidence of trauma from parturition
- Especially rib fractures as a cause of weakness and inability to stand
- Palpation of the ribs especially near the costochondral junctions should be routine

Weakness

- Some times the fracture is not palpable on the first day after birth, but later becomes detectable because of displacement of fracture ends

Weakness

- Ultrasound examination of the ribs is also a good way to pick up fractures that may not be palpable
- Many foals with rib fractures are also tachypneic from pain or trauma.
Rib Fractures

• Some rib fractures require sx however, many will heal well on their own
• The foal should be confined to a stall for 2-3 weeks and sedated if too active so as not to displace the fracture ends.
• If painful, flunixin meglumine can be utilized to control pain.

Perinatal Asphyxia

• If features of the history or physical examination indicate the potential for perinatal asphyxia
• Prophylactic treatment of the foal may be indicated
• Foals at risk may nor may not have clinical signs such as
  – Loss of affinity for mare
  – Failure to suckle
  – Seizures

PAS

• Various agents have been evaluated in research of the mechanism of injury from PAS
• Some agents MOA is antagonism of the glutamate (NMDA) receptors or disruption of the oxidant injury pathways by inhibition of xanthine oxidase
PAS

- Agents used are:
  - Allopurinol PO
  - Thiamine IV
  - Vitamin E IV or PO
  - DMSO IV
  - Vitamin C IV
  - MgSO₄
- All IV drugs are placed in 1 liter of fluid and given as initial fluid bolus

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Function</th>
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<tbody>
<tr>
<td>MgSO₄</td>
<td>40 mg/kg to 2g/50 kg</td>
<td>NMDA-receptor blockade</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>100 mg/kg to 5 g/50 kg</td>
<td>NMDA-receptor blockade, antioxidant</td>
</tr>
<tr>
<td>Allopurinol</td>
<td>44 mg/kg to 2.4 g/50 kg PO</td>
<td>Xanthine oxidase inhibition, prevention of free radical formation</td>
</tr>
<tr>
<td>Thiamine</td>
<td>10 mg/kg to 500 mg/50 kg</td>
<td>Supports cerebral energy metabolism</td>
</tr>
<tr>
<td>DMSO</td>
<td>0.5 to 1.0 g/kg to 50 g/ml/50 kg</td>
<td>Free radical scavenger</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>Parenteral: 68 IU/50 kg or 5000 IU SID</td>
<td>Prevention of membrane oxidative injury</td>
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PAS

- Foals that are recumbent or unable to suckle should have an indwelling nasogastric tube placed to prevent aspiration pneumonia
- Foals that develop seizures may need intermittent anticonvulsant medication
  - Diazepam (0.04 to 0.4 mg/kg IV or 5 mg/50 kg foal)
  - Midazolam (2-5 mg/50 kg foal IV can be given IM
  - Phenobarbital 20 mg/kg IV
- Avoid acepromazine and xylazine if possible
Midazolam CRI

- Midazolam CRI: Use 100 ml bag of 0.9% Saline
- Take 10 ml out of 100 ml bag of saline
- Place 10 ml of 5 mg/ml (50 mg) midazolam injected into bag
- Creation of 0.5 mg/ml solution

- Administration at a rate of 2-6 ml/hr (1-3 mg/hr) to a 50 kg foal using a fluid pump
- Infusion rate can be altered as needed
- It can also be discontinued when desired and the foal should be alert in 1-2 hours allowing for neurologic assessment

PAS foals

- Foals that are having seizures should have a padded environment
- Head protection if possible do avoid secondary trauma during convulsions
- Foals that develop severe or recurrent seizure activity should be considered candidates for referral
Management of Colic

- Colic in foals is one of the most common reasons for evaluation of foals in the field
- Meconium impaction is a frequently the cause of colic during the neonatal period
- History of straining and failure to pass a normal volume of meconium and variable abdominal distention

- Digital palpation of the rectum and abdominal ultrasound help in confirmed diagnosis by showing firm meconium in the rectum and colonic tympany
- Solid meconium can be imaged in the large colon at times

Meconium Impactions

- Enemas have been the classic therapy for meconium impactions
- I tend to use mineral oil mixed with ivory soap and given via a Harris flush tube or a red rubber feeding tube
- USE LOTS OF LUBE!!!!
Meconium impaction

- Acetylcysteine enemas may be necessary at times
- Use 40 ml of 2% Acetylcysteine plus 160 ml warm water and 20 gm bicarbonate via foley catheter for 30 minutes
- Oral laxatives (mineral oil, mild of magnesia 30 ml PO every 6-12 hours) are also indicated
- In some foals with a huge amount of abdominal distention from colonic tympany
- Neostigmine (0.5-1.0 mg per 50 kg foal) SQ hourly for up to 3 hours can be utilized

Colic in the Neonate

- Abdominal ultrasound is an excellent tool for differentiating the causes of colic and abdominal distention
- A clinician can perform a decent diagnostic exam in the field with a 5.0-7.5 mHz linear rectal probe
- Differentiate between colonic gas distention from meconium impaction or obstructions and fluid filled small intestine
Colic in foals

- Radiographs can sometimes be helpful in colicky foals with an aboral blockage
- Barium can be used to find blockage by giving an enema and then taking radiographs
- If foal has ingested a great deal of sand, can also see well on radiograph
- Most generators can shoot through a foal

Colic in the Neonate

- Would expect to see distended fluid filled small intestine with enteritis or small intestinal obstruction
- Abdominal distention caused by free peritoneal fluid could be seen with uroperitoneum or peritonitis
- The information gained from the U/S may be vital in guiding on the farm treatment or from prompting a decision to refer.

Uroperitoneum

- Typically seen on u/s as an accumulation of echolucent fluid
- On some occasions the fluid has an echogenic appearance which makes differentiation from peritonitis difficult based on imaging alone.
- Creatinine diffuses poorly across the peritoneal lining, thus disparity in serum to peritoneal fluid ratio of at least 1:2 leads to a definitive diagnosis of uroperitoneum
Uroperitoneum

- Average case is seen from 3-7 days of age.
- Typically tear of the dorsal body wall
- Can also be caused by urachal leakage or ureters
- This is a medical emergency due to electrolyte abnormalities
- Should be referred if possible
- Care should be taken if administration of fluids due to typical hyponatremia, hyperkalemia, hypochloremia

Colic in the Neonate

- Bottom line with colic in the neonate
- You can treat in the field depending upon what the etiology is...
- Meconium impaction, sand impaction, ulcers you can treat easily in the field
- Others may seriously need to consider referral
Decision to Refer

• Not always easy
• Do you have appropriate equipment, nursing help and clinical expertise available?
• What is the clinical condition of the foal-stable or deteriorating rapidly?
• How valuable is the foal?
• How long does it take to get to the referral center?
• What needs to be done in order to prepare for travel?

Equipment

• Intravenous catheters are a necessity for fluid therapy (14 or 16 gauge over-the-wire)
• Antimicrobials
• Total parenteral nutrition (especially if diarrhea)
• Fluid therapy via CRI or can bolus therapy work?
• Oxygen insufflation-available on farm?
• Feeding tube-hard to maintain on the farm

Taking Care of the Foal

• Many people are enthusiastic to help initially when a sick neonate is on the farm
• Prolonged therapy can be extremely tiresome and difficult
• Other foals and mares may get neglected due to the amount of care needed to give one critical neonate
• Foals that cannot stand need specialized nursing care round the clock
Down Foal

- Decubital ulcers develop easily and their position should be changed every 2 hours
- They can develop a patent urachus from being down
- Need frequent changing due to urination and defecation
- Need to be positioned appropriately for feeding

Subtle Changes

- There are some very good owners and caretakers
- However, many cannot see subtle clinical changes that can occur with a critically ill neonate
- The subtle changes could change the course of the outcome for the foal if it remains on the farm
- Important to emphasize to owners/caretakers how time consuming a sick foal is to take care of

Value of the foal

- The whole foal needs to be considered when making the decision to refer
- Is the foal worth a great deal financially?
- If the foal hasn’t stood and nursed can they get a rebreeding, versus spending a great deal of time and an unsure ending?
Neonatal Care

- Expensive
- Many hospital stays will be $1000.00 to 2000.00/day
- Typically hospital stays can be between 5000-10,000/hospitalization
- The cost of hospitalization and potential outcome should be discussed with the client very carefully
- Clients should understand the finances as well as the potential to sometimes end up with no foal at the end

Transportation

- Once decision is made to refer
- Things to consider....
- Will the foal survive transport to the hospital?
- If the foal hasn’t nursed, the foal should probably have a nasogastric tube passed and colostrum given at that time.
- The tube can be left in place so the foal can be fed during transport if it’s a long ride

- Does the foal need fluids to maintain hydration and blood glucose concentrations?
- Would the foal be better off transported with oxygen insufflation?
- Where is the foal going to ride in comparison to the mare?
- Can you separate the two if the foal needs treatment on the way?
Transportation

• What is the ambient outside temperature?
• Does the foal need extra blankets and insulation?
• Is the foal down and out and need some sort of padding for support?
• All these are important to consider especially if transported for over 2 hours
• If the ride is over 2 hours, feeding and intravenous fluids are warranted

Referral

• The decision to refer is made after the history, examination and discussion with the owner
• The tertiary care center should be informed in advance so they can be ready to receive the foal
• This will also allow discussion with the specialist involved if you have any questions

Referral

• Most large animal internal medicine specialists are very willing to help veterinarians in the field with suggestions and treatment options
• Typically the outcome will be better for many of the foals and owners, the quicker the decision of whether to refer is made
Bottom Line

• Foal care is a specialization
• Hence the many NICU units throughout the USA
• Even if a foal is not referred for financial or other reasons
• Don’t hesitate to call a Large Animal Internal Medicine Specialist for consultation

Case

• Foal born unattended some time last night
• Owners found in the morning
• Foal is dry
• Unable to stand on own
• Mare had a full bag
• Placenta is missing

Case

• Examination of foal
• Colt approximately 60 kg
• No meconium staining on rear
• Mucous membranes hyperemic
• No petechae or ecchymosis noted
• Sclera injected with hemorrhage around the sclera
• Ophthalmic exam-no ulcers noted, entropion noted bilateral
Case

- Heart rate is 120 bpm no arrhythmia
- Murmur noted-systolic PDA
- RR-28 irregular no abnormal lung sounds
- No rib fx palpated
- Joints all palpate normally
- Umbilicus palpates large

Case

- Foal is somnolent to stuporous
- Can assist to stand for short periods
- Suckle is lacking
- What would you do now?

U/S of umbilicus

- Stump is 2.5 cm
- L artery is 0.8 cm right artery is 0.9 cm
- Vein is 0.5 cm
- Bladder appears intact
- No excess abdominal fluid
- Kidney's appear normal
Now what?

References


Questions