

Problems of the Neonatal Foal
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Birth Asphyxia

- Apnea (unresponsive) or dyspnea
- Sternal recumbency and vigorous rubbing
- Nasotracheal tube, Ambu® bag, O₂ supply
- Mouth-nose resuscitation
- Central respiratory center stimulant
e.g. Dopram® (doxapram hydrochloride)
Inject 1 to 2 ml IV or into tongue

Treatment: Respiratory Support

- Nasotracheal tube (45 cm length, 9 mm OD)
- Check balloon
- Lubricate well
- Extend head and neck
- Secure in place with gauze or tape
- Attach Ambu® bag and oxygen (5L/min)
- Maintain 20 breaths/min (smoothly!)

Critical Care: Equipment

Emergency Drugs

- Prednisolone sodium succinate (corticosteroid)
Solu Delta Cortef®
One vial (10 ml; 500 mg) IV fast
- Epinephrine (potent cardiac stimulant)
1 mL doses of 1:1000 epinephrine
Inject IV, into umbilicus, intracardiac
- Valium® (diazepam) *^CIV if seizing
1 ml dose of 5 mg/m diazepam IV
*** Write dosages on bottles***

Scheduled Examination by Veterinarian

12 to 18 hours after birth

- Thorough physical examination
- Draw blood and perform a SNAP® test
- Digital palpation of rectum
- Treat umbilicus again
- Examine the mare and placenta (normally passed in <3h; concern after 8h)

Diseases of the Newborn Foal

1. Prematurity / Dysmaturity
2. Dummy foal (perinatal asphyxia syndrome)
3. Meconium impaction
4. Ruptured bladder
5. Failure of passive transfer / septicemia
6. Neonatal isoerythrolysis

1. Prematurity / Dysmaturity

- Premature if < 320 days (n: 345 days), but depends upon the foal's expected gestation
- Dysmature when correct date, but immature
- Causes:
 - Uterus: placentitis, placental insufficiency
 - Foal: congenital defects
 - Stress (colic surgery)
- Fescue toxicosis and dysmaturity

Fescue Toxicosis

- Common problem in Tennessee
- Exposure to endophytes in fescue grass or hay
- Ergot alkaloids - dopamine (inhibitory) agonists
- Inhibit fetal ACTH (delay parturition)
- Inhibit prolactin causing agalactia
- Remove from pasture and hay 2 months before
- Domperidone (blocks dopamine receptors) PO
14 days prior to foaling

Acute Respiratory Distress Syndrome (ARDS)

- Fetal cortisol stimulates conversion of pneumocytes from type I (90%) to type II (10%)
- Type II pneumocytes produce surfactant
- Surfactant reduces surface tension
- Alveoli collapse (atelectasis) without surfactant
- Reduced ventilation (hypercapnia and respiratory acidosis) and hypoxemia

Clinical Features

- Premature foals are small, but dysmature foals can be normal or large in size
- Silky hair coat, pliable ears, entropion, and tendon laxity
- Angular limb deformities
- *Strong initially, but decline between 24 and 48 hours of age*

Diagnostic Test Results

- Hypoglycemia
- Leucopenia (< 5,000 WBC/ μ L)
- Low neutrophil to lymphocyte (N:L) ratio (< 2)
- Incomplete ossification of small carpal and tarsal bones
- Hypercapnia and hypoxemia if ARDS

Management

- Provide colostrum or plasma
- Caffeine to stimulate respiratory centers
10 mg/kg PO loading, 2.5 mg/kg as needed
- Nasal oxygen 5L/min if hypoxemic ($\text{PaO}_2 < 65$ mmHg)
- Severe hypercapnia ($\text{PaCO}_2 > 70$ mmHg) warrants mechanical ventilation

Importance of Recognizing Acidosis

- Decrease in blood pH (acidemia)
- Slows metabolic functions
- Causes **weakness and depression**
- Foal ceases to nurse
- Becomes hypoglycemic and weaker
- Failure of passive transfer

2. Dummy Foal Syndrome

- Nomenclature:
 - Perinatal asphyxia syndrome (PAS)
 - Hypoxic-ischemic encephalopathy (HIE)
 - Neonatal maladjustment syndrome (NMS)
 - Barkers, wanderers, and dummies
- Deprived of oxygen *in utero* or during delivery
- Present with **NEUROLOGIC SIGNS**
 - Severe: recumbent, opisthotonus, seizures
 - Mild: wandering, nursing walls, blind

Clinical Features and Management

- Mildly affected foals
 - Require feeding via nasogastric tube
 - Anti-inflammatory drugs (flunixin, DMSO)
 - Time (7 to 14 days)
 - High risk of FPT and septicemia
- Severely affected foals are seizing and require valium (diazepam) followed by phenobarbital

3. Meconium Impaction

- Commonly occurs in first 48 hours
- More common in colts (narrower pelvis)
- Most common cause of *decreased appetite* (swishing tail), *abdominal distension*, or *colic*
- Concretions of amniotic fluid (black-brown)
- Mild problem easily remedied (enema)
- Severe obstruction requiring surgery

Clinical Features and Test Results

- Digital palpation reveals meconium
- Marked distension is cause for more concern
- Gas accumulation upon US exam
- Retrograde barium to determine whether distal (enemas) or proximal (mineral oil /surgery).
Administer 20 ml/kg of 30% barium sulfate (approx. 1L) using 24-Fr Foley and gravity

Management

- Most resolve with a phosphate (Fleet®) enema
- Do not exceed two of these enemas in 12 hours (hyperphosphatemia)
- Use soapy water enemas (commercial kit or unscented Ivory® soap)
- If proximal, give mineral oil (125 to 250 mL via nasogastric tube) and repeat in 12 to 24 hours (can cause diarrhea).
- Surgery if no improvement and very distended

4. Ruptured Bladder

- Commonly occurs in first 48 hours
- Also more common in colts (narrower pelvis)
- Rupture on dorsal aspect of bladder
- Pressure during foaling
- Present with *abdominal distension, colic, or decreased appetite*
- Can continue to urinate, but lower volume
- Medical emergency because of hyperkalemia

Clinical Features and Test Results

- Ballottement of the abdomen reveals fluid
- Peritoneal fluid accumulation upon US exam
- Azotemia with hyperkalemia, hyponatremia, and hypochloremia (electrolyte profile of urine)
- Bradycardia +/- arrhythmia
- Abdominal fluid : plasma creatinine ratio > 2:1
- Catheterize bladder, instill 10 to 50 ml 10% new methylene blue; perform abdominocentesis

Other Urogenital Conditions

- Ruptured urachus
Subcutaneous edema of perineum or ventrum
Catheterize bladder or perform surgery
- Patent urachus
Urine drips from umbilicus with urination
Congenital: does not close after birth
Acquired: occurs as a result of infection
Treat with silver nitrate sticks or remove

5. Failure of Passive Transfer / Septicemia

- Most important disease of neonates
- FPT occurs because:
Mare is agalactic (fescue toxicosis)
Mastitis
Foal too weak to stand and nurse (premature, dysmature, dummy foal, injury, or deformity)
Mare refuses to allow foal to nurse (no bond)
Physical separation (foal gets out of enclosure)

Failure of Passive Transfer (FPT)

- Colostral antibodies (IgG and IgA)
- Absorbed across GI epithelium
- Peak absorption in first 8h, closed by 24h
- Require 1 to 2 L of good-excellent colostrum
- Excellent: yellow sticky, s.g.>1.070 g/ml
- Colostral IgG 4,000 to 6,100 mg/dl
- Foal's plasma IgG raised above 800 mg/dl

Most Common Causes of Septicemia

Gram negative bacteria

- *Escherichia coli*
- *Actinobacillus equuli*

- *Klebsiella* spp.
- *Enterobacter* spp.
- *Salmonella* spp.

Other Causes of Septicemia

Gram positive bacteria

- *Streptococcus equi*
- *Streptococcus zooepidemicus*

Viruses

- EHV-1 (Rhinopneumonitis)
- EVA (non-arthropod-borne togavirus)

Septicemia

- Immunocompromised
- Exposed via umbilicus, respiratory tract, gastrointestinal tract
- Bacteremia
- Gram negative bacteria
- ENDOTOXEMIA

Endotoxic Shock

- Cell wall of gram negative bacteria
e.g. *E. coli*, *Salmonella* spp.
- LIPOPOLYSACCHARIDE (LPS)
- Associated with bacteria or free in blood
- VERY potent immune system stimulant

Presentation

- Recumbent
- Cool extremities (shock)
- Hypothermic
- Tachycardic or bradycardic
- Organ failure
- Dehydrated (hemoconcentrated)
- Hypoglycemic!

Diagnosis

- Hyperemic membranes or endotoxic shock
- Neutropenia, left shift (bands), toxic changes
- Positive blood culture, but negative result is meaningless

Treatment: Fluid Support

- Hypertonic saline (7.2% NaCl) for shock
4 ml/kg as a bolus (approx. 200 ml)
- Dehydration deficit
BW(kg) x percent dehydration = volume (L)
Normosol R® with dextrose
Physiological saline if hyperkalemic
- Maintenance (account for ongoing losses)
Normosol M® with dextrose

Treatment of FPT

- Colostrum via nasogastric tube if < 24h old
 - Ideally from the mare
 - One liter of excellent colostrum
 - Beware of neonatal isoerythrolysis
- Plasma (2L) if > 24 hours old or prophylactically
 - Elevated respiratory rate indicates anaphylaxis
 - Start slowly and increase rate every 5 min

Antimicrobial Combinations

- Ampicillin
 - Gram positives, some anaerobes, few gram negatives
 - 50 mg/kg IV or IM TID to QID

OR

- Penicillin
 - Gram positives and some anaerobes
 - 22,000 IU/kg IM BID (Procaine) QID (KPen)

AND

- Amikacin (Amiglyde®)
 - Gram negative aerobes
 - 25 mg/kg IV SID

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- Ceftiofur sodium (Naxcel®)
 - Used alone when renal issues or instead of ampicillin (i.e. in combination with amikacin)
 - 10 mg/kg IV (slowly; diluted) or IM BID
 - Cefotaxime sodium
 - 3rd generation cephalosporin
 - Used when renal damage or meningitis
 - 50 mg/kg IV TID to QID
 - Metronidazole
 - If anaerobe suspected
 - Clostridial hemorrhagic diarrhea
 - Aspiration pneumonia
 - 15 mg/kg PO QID or 25 mg/kg PO BID
 - Trimethoprim Sulfa
 - Only used to send foals home on (7 to 14 days)
 - 30 mg/kg PO BID

Sequelae of Septicemia

- Infected umbilical remnants
 - Umbilical vein (< 1 cm) running cranially to liver
 - Two umbilical arteries (< 1 cm) caudally to bladder
 - Urachus going to the tip of the bladder
- Septic arthritis
 - Most common in tibiotarsal and stifle joints
- Meningitis (central depression, seizures)
- Endocarditis, osteomyelitis, liver abscess

6. Neonatal Isoerythrolysis

- ICTERUS
- Intravascular and/or extravascular hemolysis
- Blood group incompatibility
- Usually second or more pregnancy for Aa⁻ or Qa⁻ mare that is bred to a Aa⁺ or Qa⁺ stallion
- Approximately 20% of Thoroughbred or Standardbred mares are Aa⁻ or Qa⁻

Pathophysiology

- SENSITIZATION: A mare that is Aa⁻ or Qa⁻ is bred to a stallion that is Aa⁺ or Qa⁺. The foal's blood is Aa⁺ or Qa⁺ and the mare comes in contact with it via placenta or delivery
- SUBSEQUENT FOALS: The mare has formed antibodies to the Aa or Qa antigens and these anti-Aa or anti-Qa antibodies enter colostrum
- NI: The foal drinks the colostrum and the anti-Aa or anti-Qa antibodies attack the foals RBCs.

Treatment

- If antibodies are **hemolysins**, intravascular hemolysis occurs: hemoglobinemia and hemoglobinuria (plus hyperbilirubinemia).
Blood transfusion often required
- If antibodies are **agglutinins**, extravascular hemolysis occurs and only hyperbilirubinemia (icterus) is seen.
Blood transfusion rarely required

Management

- Blood type mare and foal to diagnose (University of California at Davis)
- Blood type stallion before rebreeding (find Aa⁻ or Qa⁻ stallion for future breedings)
- Prevent foal from nursing colostrum and milk out mare

Note: Tyzzer's (*Clostridium piliformis*) is most likely when profound icterus seen > 7 days old