Initial Assessment of the Critical Neonate

Compromised Foal
Critical 48 hours

- < 48 Hr old
  - 70-80% of admissions
- 84% survive
  - 70% fatal cases < 48 hr old
Neonatal Problems

- Fetal Distress/Maladaptation
- Trauma/Anemia
- Sepsis/Infection
- Congenital Malformation
Neonatal Problems

- Rarely one problem
  - Combination of problems
  - Varying severities
- Wide array of possibilities
  - But predictable course
Goals

- Identify underlying problem
- Identify disrupted vital organ functions
- Therapeutic interventions
  - Support normal organ functions
  - Control infection
Initial Assessment

- Is there evidence of sepsis?
- Is cardiovascular support necessary?
- Is respiratory support required?
- What level of metabolic support is necessary?
  - Will enteral nutrition/fluid maintenance be possible?
  - Is intravenous fluid therapy necessary?
  - Is continuous rate dextrose infusion necessary?
  - Is parenteral nutrition necessary?
- Control behavioral abnormalities
- Will assisted thermoregulation be necessary?
- Will renal support be necessary?
- Requirements for other specific supportive care
Physical Examination

- Cardiovascular examination
- Mucous membrane
- Body condition
- Musculoskeletal problems
- Abdominal palpation
- Nervous system evaluation
Cardiovascular Examination

- Evaluating perfusion
- Evaluating volemia
  - Volemia vs hydration
  - Dehydration rare
  - Hypovolemia common
Cardiovascular Examination

- Assess effectiveness of perfusion
  - Cold extremities as blood is shunted centrally
    - Do not treat with active warming
  - Depressed mental status
  - Decreased borborygmi
  - Decreased urine production
- Pulse assessment
  - Pulse quality
  - Arterial tone
  - Arterial fill
- Blood Pressure
- Unreliable signs
  - Dry oral membranes
  - Capillary refill time
  - Skin turgor
Body Condition

- Thin to emaciated
  - IUGR
  - Fetal SIRS (FIRS)
- Prematurity
- Post maturity
Musculoskeletal problems

- Fractured ribs
- Other musculoskeletal abnormalities
  - Fractures
  - Gastrocnemius disruption
  - Contracture
  - Laxity
Abdominal Palpation

- Internal umbilical remnants
  - Umbilical triad (2 arteries and urachus)
  - Hemorrhage
  - Omphalitis
- Urinary bladder
  - Bladder size
  - Luminal and bladder wall hematomas
- Intestines
  - Retained meconium
  - Thickened intestinal wall
  - Pneumatosis intestinalis
  - Intussusceptions
- Kidneys
- Liver - Hepatomegaly
- Body wall defects
  - Inguinal or umbilical hernias
  - Other body wall defects
Central Nervous System

- Important parameters
  - Strength
  - Muscle tone
    - Hypertonus or hypotonus
  - Responsiveness
    - Hyperresponsive or hyporesponsive
  - Level of arousal
    - Somnolence
    - Hyperactive or hyperkinetic
- Behavior
  - Respiratory patterns
    - Periodic apnea
    - Cluster breathing
    - Apneustic breathing
    - Ataxic breathing
- Seizures
- Abnormal vocalization
- Careful physical
  - Detect major dysfunction
  - Seriousness
- Dynamic monitoring
  - Serial physical evaluation
  - Laboratory analysis
    - Stall side
      - Serial blood glucose levels
      - Serial lactate levels
    - Sophisticated
      - Arterial blood gas
      - Blood electrolyte
      - Lactate levels
Therapeutic Interventions in Neonates
Resuscitation of the Seriously Compromised Foal

- Rapid intervention
- Intensive intervention
- On Farm
- At referral center
  - Rapid transport
    - In a car
  - Short travel time
    - < 2 hours – don’t treat - send
    - > 2 hours – begin treatment
Resuscitation on the Farm

- Delay in transportation
- Delay in decision making
- Lack of referral center availability
- Economic constraints
- Level of care on farm depends on
  - Environment/Facilities available
  - Experience/Energy of the help
  - Time constraints on the clinician
  - Availability of equipment
Resuscitation of the Seriously Compromised Foal

- Treat sepsis
- Insure tissue perfusion
  - Fluid therapy
- Respiratory support
- Stabilize blood glucose
- Deliver cerebral support
  - Control seizures
- Aid thermogenesis
- Correct metabolic abnormalities
- Spare renal work
- Deliver nutrition
  - Oral/Parenteral
- Give general supportive care
Treat Sepsis

- Plasma transfusion therapy
- Antimicrobial
  - Based on likely sensitivity
  - Community isolates vs. nosocomial isolates
- Avoid
  - Commonly used antimicrobials
  - Toxic effects
Community Acquired Isolates

- 22% *E coli*
- 19% *Enterococcus*
- 19% *Pantoea agglomerans*
- 5% *Klebsiella*
- 5% *Streptococcus*
- Others
  - *Acinetobacter*, *Aeromonas*, *Alpha Strep*
  - *Burkholderia*, *Listeria*, *Mannheimia*
  - *Comamonas*, *Salmonella*, *Staphylococcus*
- 60% Gram-negative and 40% Gram-positive
Nosocomial Bacterial Isolates

- 23% Enterococcus
- 18% E coli
- 11% Enterobacter cloacae
- 9% Acinetobacter baumannii, Salmonella
- 7% Pantoea agglomerans, Pseudomonas
- 5% Coag neg Staphylococcus
- 4% Klebsiella pneumonia, Streptococcus
- Others
- 68% Gram-negative and 32% Gram-positive
Antimicrobial Choices

- **Community acquired infection**
  - Ambulatory patient, controlled sepsis
    - Cefuroxime
    - TMS, doxycycline
  - Critically ill neonate, uncontrolled sepsis
    - Ceftiofur Na - IV
      - 10 mg/kg IV QID
      - Continuous rate infusion (CRI)
    - Ticarcillin with clavulanic acid - IV

- **Nosocomial infection**
  - Penicillin and amikacin – IV
  - Imipenem
  - Chloramphenicol
Glucose Therapy

- All compromised neonates
  - Will benefit from glucose therapy

- Placental glucose transport
  - Equine delivers 6.8 mg/kg/min
  - Range between 4 – 8 mg/kg/min

- Neonatal liver
  - Produces similar amounts

- Glucose therapy
  - Begin 4 mg/kg/min
  - Goal of 8 mg/kg/min

- Hyperglycemia - insulin therapy
- Hypoglycemia – hypermetabolism

- Glucose boluses
  - Metabolic anarchy
  - Often more harmful than continued hypoglycemia
Respiratory Support

- Frequently hypoxemic
  - Ventilation perfusion mismatching

- Intranasal oxygen insufflation
  - $\text{PaO}_2 < 60$ torr
  - $\text{SaO}_2 < 90\%$
  - Goal
    - $\text{PaO}_2$ 80 - 110 torr
    - $\text{SaO}_2 > 92\%$
  - Nasal cannula
    - Flow rate of 6-10 lpm (2 to 15 lpm)
    - Preconditioned - water filled humidifier

- Central respiratory depression
  - Caffeine (10 mg/kg PO or PR)
  - Positive pressure ventilation
Fluid Therapy

- Hypoperfusion
  - Hypovolemia due to poor vascular tone
    - Precapillary especially
  - Almost never dehydrated
    - Hyperhydrated but hypovolemic

- Correct the hypovolemia
  - 20 ml/kg blouses over 10 to 20 minutes

- Maintenance fluids
  - 100 ml/kg/day for the 1st 10 kg weight
  - 50 ml/kg/day for the 2nd 10 kg weight
  - 25 mg/kg/day for each kg above 20 kg
Thermogenesis

- Successful resuscitation
- Active warming
  - Contraindicated early
  - Hot air blanket
Seizure Control

- Phenobarbital
  - Hypothermia
  - Hypercapnia
  - Hypotension
  - Infused over 15-20 min
  - Half-life of >200 hrs

- Phenytoin

- Others
  - Diazepam
  - Midazolam
Cerebral Support

- Maintaining cerebral perfusion
  - Fluid replacement
  - Maintaining adequate BP

- Thiamine
- Not used
  - MgSO₄
  - DMSO
  - Mannitol
Renal Function

- Neonatal distress targets
- Normal neonatal kidney
  - Fluid handling
  - Sodium regulation
- Goal - minimize renal work
  - Regulating fluid balance
  - Regulating sodium balance
- Fluid and Na overload
  - Inappropriate weight gains
  - Development of edema
- Drugs to avoid
  - Flunixin meglumine
  - Aminoglycoside antimicrobials
    - Unless blood levels are measured
Oral Nutrition

- Colostrum
  - Avoid large volumes
- Critical neonate
  - Hypoxemia, hypoperfusion
  - Hypoglycemia, hypothermia
  - Can’t support enterocytes
- Criteria for feeding
  - $Pao_2$
  - Blood glucose
  - Perfusion
  - Core temperature is $> 100$ F
  - Borborygmi present
  - Meconium is being passed
Oral Nutrition

- Trophic feeding
  - 1-2% of body wt/day
  - Stimulate normal mucosa development
  - Support nutritional needs
- Partial parenteral nutrition
  - Gradually increase volumes
  - Goal 12-15% of body weight
- Feed by weight gain

Permissive Undernutrition
Oral Nutrition
What should be fed?

- Fresh colostrum
- Trophic substances
- Bioactive proteins
- Functioning immune cells
- Immunomodulating factors
- Fresh mare's milk
- Frozen mare's milk
- Milk replacer
Ulcer Prophylaxis

Reasons not to suppress acid

- Sick neonates produced little acid
- Acid blockers have a decreased efficacy
- Gastric ulcer pathogenesis
  - Acid plays a minor role
- Acid is protective against nosocomials
  - Should not be suppressed or neutralized
- Ulcer prophylaxis not affect incidence of ulcers
- Occurrence decreasing
  - More effective supportive therapy for neonates
Summary

- Treat sepsis
- Maintain tissue perfusion
- Maintain blood glucose homeostasis
- Maintain fluid balance
- Give respiratory support
- Keep the patient warm
- Control seizures and support cerebral perfusion
- Maintain renal function
- Conservatively approach oral nutrition
- Deliver general supportive nursing care
Avoid

- Excessive fluids
- Excessive sodium
- Aggressive warming
- Large volumes oral feeding
- NSAIDs (flunixin meglumine)
- Gastric acid blocking therapy