

Initial Assessment of the Critical Neonate

Compromised Foal

A photograph of a brown foal with white markings on its face and legs, lying on a bed of straw. The foal is positioned in the center-right of the frame, facing towards the bottom right. Its body is oriented horizontally, with its head down. The straw bedding is a mix of yellow and brown tones, creating a textured background. The lighting is somewhat dim, suggesting an indoor or shaded outdoor environment. The overall appearance of the foal is one of weakness or illness, consistent with the text '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

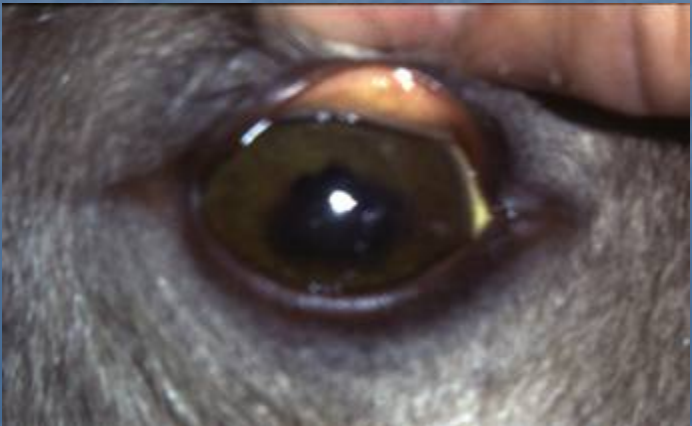


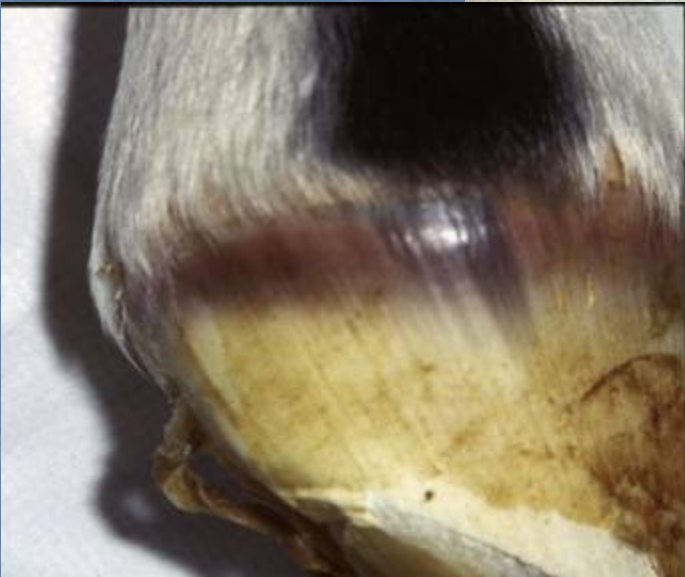






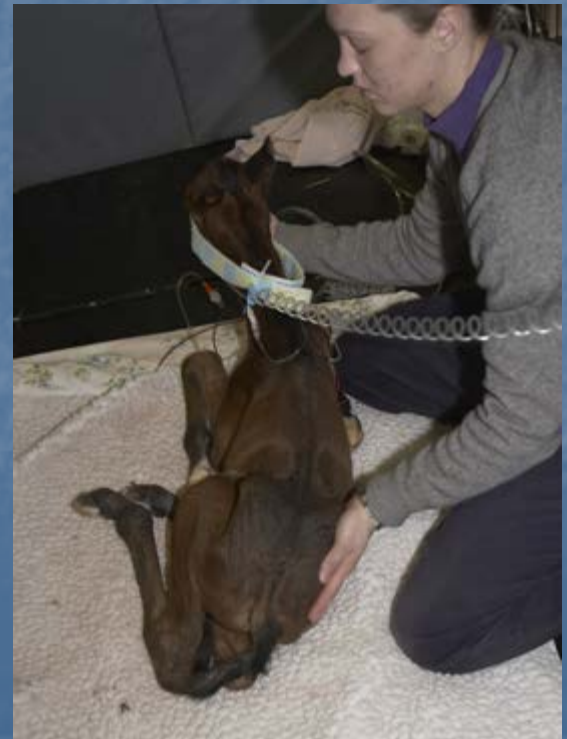






Body Condition

- 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

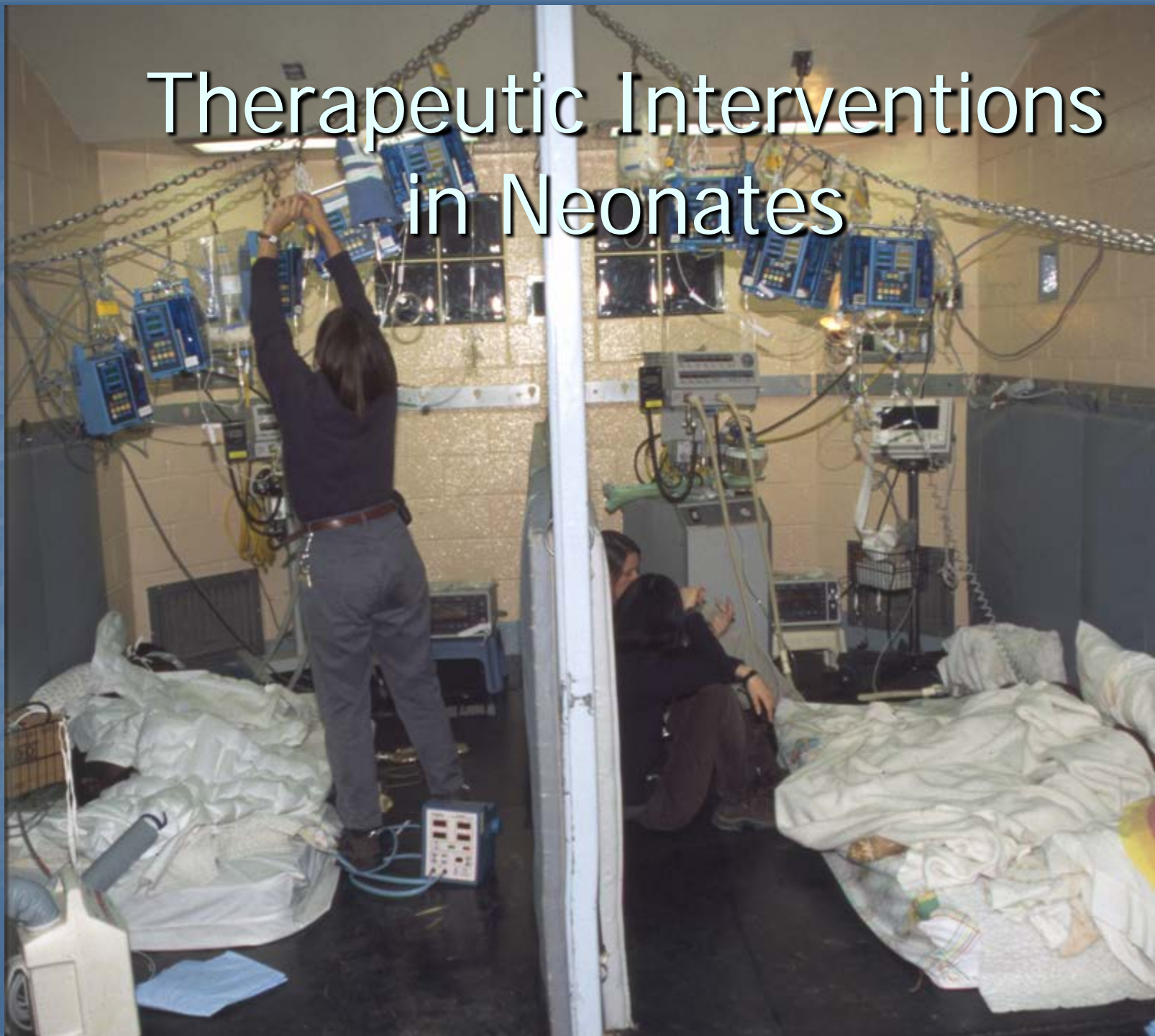
- Important parameters
 - Strength
 - Muscle tone
 - Hypertonus or hypotonus
 - Responsiveness
 - Hyperresponsive or hyporesponsive
 - Level of arousal
 - Somnolence
 - Hyperactive or hyperkinetic
 - Behavior
 - Respiratory patterns
 - Periodic apnea
 - Cluster breathing
 - Apneustic breathing
 - Ataxic 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
 - $Pa_{O_2} < 60$ torr
 - $SaO_2 < 90\%$
 - Goal
 - Pa_{O_2} 80 - 110 torr
 - $SaO_2 > 92\%$
 - 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 boluses 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 ml/kg/day for each kg above 20 kg



Thermogenesis

- 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
 - MgSO_4
 - 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
 - P_{aO_2}
 - Blood glucose
 - Perfusion
 - Core temperature is > 100 F
 - Borborygmi present
 - Meconium is being passed



Oral Nutrition



Oral Nutrition

What should be fed?



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

