Passive Transfer of Immunity

Colostrum

- Source of IgG
- Other biologically active substances
  - Other proteins
  - Immune modulators
  - Pro and anti-inflammatory substances
  - Inflammatory cells
    - Neutrophils, plasma cells
  - Trophic substances
- Role
  - Establish an immune barrier GIt
  - Targeting potential pathogens
    - Before invasion
  - Insuring GIt development

Colostral Protective Factors Tailored for the Neonate

- Defense agents in colostrum
  - Enhanced survival in the gastrointestinal tract
  - Protect without provoking inflammation
  - Inhibit inflammation
- Targeting of pathogens
  - Without collateral damage

Colostral Protective Factors Tailored for the Neonate

- Agents in colostrum
  - Alter the physiologic state of the GIt
  - Transform from fetal physiology
    - To physiology appropriate to extrauterine life
- Growth factors in colostrum
  - Favor proliferation of commensal enteric bacteria
  - Inhibit pathogens
  - Trophic factors
    - Epithelial growth and development

Colostral Transfer of Protective Factors

- GIt is the most likely portal for pathogens
  - Preventing luminal establishment of pathogens
  - Prevent proliferation of pathogens
  - Prevent invasion of pathogens
  - Protecting the neonate from sepsis

Antimicrobial Factors in Colostrum

- Proteins
  - Lactoferrin - bacteriostasis by Fe chelation
  - Lactoferricin - causing bacterial killing
  - Lysozymes – bacteriolysis
- MUCI - inhibits the binding of fimbriated *E coli*
- Lactadherdrin - binds viruses
- Oligosaccharides and glycoconjugates
  - Receptor analogues
  - Enteric pathogens and toxins
- Monoglycerides
- Fatty acids
  - Disrupt envelope viruses
  - Inactivate certain bacteria
  - Defend against *Giardia*

Antimicrobial Factors in Colostrum

- PAF-degrading enzyme
  - PAF is an important proinflammatory mediator
  - High levels in neonate
  - Protects mucosal cells from damage
- Erythropoietin
  - Protects against epithelium apoptosis
  - Trophic substance
- Epidermal Growth Factor (EGF)
  - Role in mucosal barrier function
  - Down-regulates apoptosis

Passive Transfer

- Why measure IgG levels?
  - Only measurement available
  - Surrogate for of the establishment of this immune barrier
  - Surrogate for transfer of immune competence
  - Quantity vs. quality

Failure of Passive Transfer Definition

- Failure to absorb adequate colostral antibodies
- Complete if IgG < 400 mg/dl
- Partial if IgG 400 - 800 mg/dl
- Normal transfer > 800 mg/dl
- Normal foals often have IgG > 1000 - 3000 mg/dl

Failure to Absorb IgG

- Premature lactation
  - Dripping milk before parturition
  - Poor colostral quality
- Delayed lactation
- Failure of foal to ingest adequate amounts
  - Musculoskeletal disease
  - Weakness
  - Abnormal behavior
- Other factors
  - Older mares
  - Foals born early in spring (Jan-March)
  - Breed differences
    - Arabians - highest colostral IgG levels (6.1 mg/dl)
    - Standardbreds- lowest colostral IgG levels (4 gm/dl)

Failure of Passive Transfer
Septic Foals

- Catabolize all proteins
  - IgG levels drop rapidly
  - Some used specifically
  - Most is nonspecifically catabolized
- Replaced by plasma transfusions
- Also provide other important proteins

Failure of Passive Transfer
Prevalence of Infection

- If the risk is very low
  - High false positive rate
  - Foals with FPT will remain healthy
- If the risk of infection is high
  - High false negative rate
  - Foals adequate IgG develop infections
- Has lead to current recommendation

Failure of Passive Transfer Prevention

- Colostral quality
  - Physical characteristics
    - Thick ,sticky, yellow
  - Colostrometer
    - Specific gravity >1.060
      - Brix > 23%
    - Excellent quality >1.080
      - Brix > 30%
  - Lack of correlation with results

Failure of Passive Transfer Diagnostic Tests

- DVM Rapid Test™
- Snap® Test (ELISA)
- Foal Chek ® (Latex Agglutination Test)
- ZnSO4 Turbidity Test
- Glutaraldehyde Coagulation Test
- SRID (Single Radial Immunodiffusion) Test

DVM Rapid Test™

- Anti-horse antibodies
  - Agglutination
  - Turbidimetry
- Plasma, colostrum
- Equine, camelid
- Technique currently used at NBC

Failure of Passive Transfer
Snap® Test

- ELISA
- Rapid test
- Run on whole blood/plasma
- <400, 400-800 or >800 mg/dl
- Accurate, rapid test

Failure of Passive Transfer
$ZnSO_4$ Turbidity Test

- Rapid test
- Run on serum
- Problems
  - Reagents lack stability
  - Hemolysis cause false positive results
  - Difficult to quantitate

Failure of Passive Transfer
Glutaraldehyde Coagulation Test

- Rapid (1 hr) test
- Run on serum
- Problems
  - False positives with hemolysis
  - Difficult to quantitate

Failure of Passive Transfer
SRID Test

- Single radial immunodiffusion
- Requires 24 hour test time
- Traditional "gold standard"
- Accuracy has been questioned

Failure of Passive Transfer
Treatment - Oral Therapy

- Window for oral colostrum absorbed
  - Considered "closed" after 18 hours
    - IgG may rise after this time
- Advantage of colostrum
  - Provides local immunity
  - Effective laxative
  - Contributes to health of epithelium

Failure of Passive Transfer Treatment - Oral Therapy

- Frozen equine colostrum
  - No more than 18 months old
  - Properly stored and thawed
  - 0.5 liter of >1.060
- Colostrum substitutes (lyophilized IgG)
- Bovine colostrum
  - > 4 liters
  - IgG will drop more rapidly
  - May not be as effective

Failure of Passive Transfer Treatment - Intravenous Therapy

- Fresh Plasma (random donor)
- Frozen Hyperimmune Plasma
- IgG Concentrates

Failure of Passive Transfer
Frozen Hyperimmune Plasma

- Number of commercial sources
- Hyperimmunized donors
- No anti-equine antibodies
- IgG levels > 2400 mg/dl
- Most convenient for most practitioners
- It should be stored properly
- 1 liter is enough except for septic foals

Failure of Passive Transfer
IgG Concentrates

- Endoserum ®, Promune E ®, Seramune ®
- Less expensive
- Easily stored
- Inferior to whole plasma
- Lack immunogenic factors other than IgG