Sepsis: It’s Not the Same Old Infection Anymore

Sharon Fichera R.N., M.S.N., CNS, NNP-BC
Clinical Nurse Specialist
Newborn & Infant Critical Care
Childrens Hospital Los Angeles

Objectives

- Upon completion of this lecture the nurse will be able to
  - Define sepsis
  - Describe the inflammatory cascade
  - List risk factors for sepsis

Neonatal Sepsis

Definitions:

- a. Bacteremia – blood culture positive
- b. Sepsis/septicemia – blood culture positive and has systemic response
- c. Septic shock – blood culture positive, systemic response with cardiovascular instability

Incidence of Sepsis

- Accounts for 13 to 45% of all neonatal deaths
- Term infants 1 to 8%
- Preterm infants up to 26%
- Risk of meningitis
- Nosocomial infections

Risk Factors for Sepsis

- Prematurity
- ROM
- Chorioamnionitis
- Resuscitation
- Invasive procedures
Clinical & Laboratory Evidence of Sepsis
Changes in vital signs
Change in respiratory condition
Change in neurologic status
Feeding intolerance
Suspicion, suspicion & more suspicion

Sepsis Work Up
- Cultures
- Sites
- How much
- How often
- Other laboratory studies of interest
  - WBC
  - CRP

Bacteria
- **GRAM +**
- **COCCI**
  - Strep A, B, D
  - Pneumocci
  - SCN
  - S. Aureus
  - Group D Enterococcus

Bacteria
- **GRAM -**
- **RODS**
  - Listeria M.
  - E. Coli
  - Klebsiella
  - Citrobacter
  - Serratia
  - Pseudomonas

The Complete Blood Count
- WBC
- Hemoglobin & hematocrit
- Platelet count
- The differential

Sampling Issues CBC
- Where the sample is obtained
- Warmed vs non-warmed heels
- Stress response
- Mode of delivery
Neutrophils

- Chemotaxis
- Margination
- Diapedis
- Phagocytosis
  - Ingest
  - Destroy

Chemotaxis

- Migration of the neutrophil towards an area of tissue inflammation/damage
- As a response to bacterial toxins and chemical substances

Margination and adherence of the neutrophil to the vessel wall

Neutrophil Diapedis

Phagocytosis

- Most important function of the neutrophil
- Cell membrane surface
- Opsonization & complement
**Phagocytosis**
- Neutrophils can phagocytize 5-20 bacteria
- Surround bacteria
- Granules are thrust into the enclosed bacteria
- Cell killing

**Consequences of Sepsis**
- ARDS vs VQ mismatch
- Shock
- SIRS
  - i. Inflammatory response
  - ii. Complement cascade
  - iii. Arachidonic acid metabolites

**Inflammatory Response**
1. Vasodilation
2. Micro/cellular permeability
3. Cellular activation & adhesion
4. Coagulation

**Consequences of Sepsis**
- Decreased response to chemotaxis
- Difficulty in cell surface adhesions
- Impaired migration
- Impaired diapedesis
- Abnormalities in oxidative glucose metabolism
  - Decreased killing
  - 75% of term neutrophils respond
  - 50% of preterm neutrophils respond

**Cytokines & Mediators**
- A bioactive substance that exerts a change in body cells & tissues
- Release is triggered through TLR’s, activation of the inflammatory response and complement

**Neonatal Response**

**Inflammatory Response**
- Neutralize microorganisms & their products
- Oxygen & glucose to the site of injury
- WBC to the site of injury
- Cellular activation & adhesion promote phagocytosis
- Activation of the coagulation cascade
Cytokines & Mediators

- **TNF** – Tumor Necrosis Factor
  - Very potent, turns on the endothelium and accentuates other mediators
- **IL 1** – Interleukin 1
  - Released with TNF and acts synergistically and potentiates the cytokine response
- **PAF** – Platelet Activating Factor
  - Released when the endothelium is activated, primarily responsible for capillary leak

Sepsis Cascade

- **Bacterial Triggers**
- **Release of cytokine mediators**
- **Coagulation**
- **Neutrophil**
- **Immune**
- **Arachadonic**
- **Concentration**
- **Activation**
- **Activation**
- **Acid pathway**
- **Vasodilation**
- **Vasogenic Edema**
  - **Oxygen delivery**
  - **Tissue injury and cellular death**

Diffuse Alveolar Injury

Increased permeability
- Fluid, plasma proteins and blood cells move from the capillary to the pulmonary interstitium and into the alveoli
- Inactivated surfactant
  - Impaired production in the type II pneumocyte
  - Proteinaceous fluid inactivates the surfactant

Acute Respiratory Distress Syndrome

Consequences of Sepsis

- ARDS vs VQ mismatch
- **Shock**
- SIRS
  - i. Inflammatory response
  - ii. Complement cascade
  - iii. Arachidonic acid metabolites

Shock

- Definition: A state in which the body cannot meet the tissues demands for oxygen and substrate
  - Hypovolemia
  - Septic/maldistributive
  - Cardiogenic
Phases of Shock
- Early or compensated shock
  - Compensatory mechanisms
    - Elevation in the baseline heart rate
    - Skin signs
  - Late or decompensated shock
    - Change in neuro status, urine output,
    - Blood pressure changes
    - Irreversible shock

Systemic Inflammatory Response Sequence (SIRS)
- A systemic response to infection gone

Interleukin 10
- Potent anti-inflammatory
- Inhibits pro-inflammatory cytokine production and intracellular killing
- Enhances B cell production
- !! Lower levels in newborns

Treatment for Sepsis

Antimicrobials
- Bacteriostatic
- Bacteriocidal
- Susceptibilities
  - MIC
- Resistant strains
  - MRSA
  - VRE

Volume resuscitation

Antibiotics
- Volume resuscitation
- Immunoglobulins
- GCSF
- Inotropes
- Steroids

Antimicrobials
- Bacteriostatic
- Bacteriocidal
- Susceptibilities
  - MIC
- Resistant strains
  - MRSA
  - VRE

Treatment for Sepsis

Antimicrobials
- Bacteriostatic
- Bacteriocidal
- Susceptibilities
  - MIC
- Resistant strains
  - MRSA
  - VRE

Volume resuscitation

Antibiotics
- Volume resuscitation
- Immunoglobulins
- GCSF
- Inotropes
- Steroids
Treatment for Sepsis

- Antibiotics
- Volume resuscitation
- **Immunoglobulin**
- GCSF
- Inotropes
- Sterioids

Dopamine vs Dobutamine

References

References Cont: