Sepsis 2014: Emerging Trends in Managing Severe Sepsis

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What is Sepsis?

- Comes from the Greek meaning:
  - “decay” or “to putrefy.”
- Medical terms:
  - “the presence of pathogenic organisms or their toxins in the blood and tissues”
  - or “the poisoned condition resulting from the presence of pathogens or their toxins as in septicemia.”

How Does it Occur?

- Typically Bacterial in origin
  - Pneumonia
  - Cellulitis
  - UTI
  - Abdomen
  - Medical Devices
  - Procedures/Surgery
    - Basic vs. invasive
- Fungal

Where do the patients present?

- 50% in the Emergency
- Other in Hospital
  - ICU
  - Med-Surg
  - OR
Hospital Avoidance

- PPE
  - Personal Protective Equipment
- Hand washing
- CAUTI
  - Catheter Associated Urinary Tract Infection
- VAP
  - Ventilator Associated Pneumonia
- CLABSI
  - Central line-associated Bloodstream Infections

http://www.medicare.gov/hospitalcompare/search.html

Incidence of Sepsis

- Severe sepsis: 800,000 cases/year
- Septic shock: 400,000 cases/year
- Deaths from septic shock: 200,000/year

Mortality of Sepsis

- According to the US CDC, septic shock is the 13th leading cause of death in the United States, and the #1 cause of deaths in intensive care units.
Hemodynamics 101

Inflammatory Response to Infection
- Neutrophils and monocytes release cytokines (e.g., IL-6, IL-1, TNF-α)
- Bacterial, viral, fungal, or parasitic infection/endotoxin stimulation

Thrombotic Response to Infection
- Tissue factor (TF) expression
- Factor VIIIa and Factor Va activation
- Platelet aggregation and clot formation

Fibrinolytic Response to Infection
- Enhanced fibrinolysis
- Tissue plasminogen activator (tPA) and others

Endothelium
- TAFI (thrombin-activatable fibrinolysis inhibitor)
- PAI-1 (plasminogen activator inhibitor-1)
- Suppressed fibrinolysis

Hemodynamic Effect of Sepsis
- Vasodilation
- “Container” effect
- Endothelial cell destruction
- “Leakage” effect
- Neutrophil aggregation
- “Clotting” effect

Identification of Sepsis
SCCM and Surviving Sepsis Campaign
- Suspicion of infection (i.e., UTI, pneumonia, abscess, cellulitis, etc.)
  - AND
- SIRS: Two or more of the following:
  (Systemic Inflammatory Response Syndrome)
    - Temperature ≥100.4°F (38°C) or <96.8°F (36°C); Rectal temp if altered mental status
    - Heart Rate >90 bpm
    - Respiratory Rate >20/min or Mechanical Ventilation
    - Altered Mental Status (ED Specific)
    - (Leukocytosis)
**Progression of Sepsis**

**Differentiating Severe Sepsis**

**TWO OF THE FOLLOWING:**
- Temperature ≥100.4°F (38°C) or <96.8°F (36°C); Rectal temp if altered mental status
- Heart Rate >90 bpm
- Respiratory Rate >20/min or Mechanical Ventilation
- Altered Mental Status

**AND**
- SBP<100mmHg or MAP<65mmHg after initial fluid bolus
- Lactate ≥4 mmol/L

**Lactate**

- Produced when damage is done to cells
  - Lack of perfusion
  - Lack of Oxygen (anaerobic metabolism)
  - Physical damage

**Early Goal Directed Therapy**

- EGDT is an algorithmic approach of hemodynamic optimization that aims to restore the balance between oxygen supply and demand in cases of severe sepsis or septic shock within the first 6 hours of ED care.
- Early hemodynamic optimization requires the monitoring of CVP, arterial blood pressure and ScvO₂.
- Studies demonstrating the efficacy of early goal-directed therapy in the treatment of severe sepsis and septic shock have targeted central venous oxygen saturation (ScvO₂) as a key indicator of potential sepsis.
Insert CVC with ScvO2

- CVP monitoring
  - Transducer
- ScvO2 monitoring

  - Requires advanced provider to place
  - Catheter more expensive BUT saves 40,000 per patient that develops sepsis!

Sepsis Management

- Early Goal Directed Therapy
  - Quick Identification
  - Initial Labs and Fluid Resuscitation
  - Central Venous Catheterization
    1. Achieve and Maintain CVP ≥ 8 mmHg
    2. Achieve and Maintain MAP ≥ 65 mmHg
    3. Achieve and Maintain $S_cVO_2 \geq 70\%$

  Lactate clearance

Mortality and EGDT

NNT to prevent 1 event (death) = 6-8

- Standard therapy
- EGDT

Mortality (%)

- In-hospital mortality (all patients)
- 28-day mortality
- 60-day mortality


Sepsis Screening

- Absolutely crucial to Identify early
  - ED Triage
  - ICU
  - Floor
  - OR
Other Considerations

- Antibiotics in 1 Hours (Severe)
- Urine Output monitoring
- Steroids
- Glucose Control
- CRRT
- Nutrition
- DVT/Stress Ulcer Prophylaxis

Barriers to Implementation?

- Providers
  - No time to insert central line
  - Not skilled to place IJ/Subclavian
  - “I’m a physician, I know how to treat sepsis. I don’t need a fancy machine to tell me what to do.”

Other Methods of Treatment

- Arterial Line CCO
  - Mainly use Stroke Volume Variation (SVV)

• Nursing
  - Poor screening
    - Computerized Charting?
  - Lack of education
Other Methods

• Bioreactance (older bioimpedance)

Other Methods

• Thermodilution
  – Arterial
  – PA Catheter

Other Methods

• Lactate Clearance Research
  – Now a part of EGDT
  – NOT recommended as stand alone treatment
    • Flawed study - Small
    • Only ED
    • 10% clearance
    • 6 hours only
    • Only in hospital

NEJM Sepsis Trial March 2014

Much sicker patients in the Original trials
Hawthorne effect? Clinicians aware of all 3 arms
Adherence not 100% in EGDT
QUESTIONS?????

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