Humpty Dumpty Syndrome
Putting The Septic Patient Back Together Again

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Objectives
At the end of this session, the participant should be able to:

• Describe the microcirculatory response to sepsis including alterations in inflammation, coagulation and fibrinolysis and their correlation to multiple organ dysfunction and death.

• Review the status of the Surviving Sepsis Campaign and revised treatment guidelines and care bundles.

• Discuss strategies for infection prevention related to central venous lines, endotracheal tubes, urinary catheters and surgical incisions.

Sepsis
1 Million Cases of Sepsis Per Year
~400,000 Cases of Septic Shock Per Year
~200,000 Deaths Per Year In The US
11th Leading Cause of Death…#1 in the ICU
Causes 1 in 4 Hospital Deaths; 500 Deaths/Day
Mortality Rates 30-70% (Average ~ 50%)
Average Hospital Stay 19.5 Days
Costs Up To $29 Billion / Year > $22,000/Case

Sepsis
Confirmed Or Presumed Infection Plus 2 or more SIRS Signs:
• T > 38°C or < 35°C (> 100.4°F or < 96.8°F)
• WBC > 12,000 or < 4,000/mm³ or > 10% bands
• HR > 90 beats/min
• RR > 20 breaths/min

ACCP & SCCM DEFINITIONS
Sepsis:
Blood Infection Causing Symptoms
Severe Sepsis:
Sepsis With Hypoperfusion Responsive To Fluid Rx OR Organ Dysfunction
Septic Shock:
Severe Sepsis With Hypoperfusion AND Organ Dysfunction That Requires Vasopressor Support

Facts
• Only 2% of hospital patients dx with sepsis…caused 17% of deaths (~08)
• For every hour a patient in septic shock doesn't receive antibiotics, the risk of death by ~ 8%
• 83% of sepsis patients have it on admission…ED!
• On average hospitals identify 13.8 sepsis cases per 1000 ED visits; “low performers”…6.5 cases
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PLUS:
- Organ Dysfunctions: altered LOC, oliguria, jaundice, thrombocytopenia, hyperglycemia (without DM), hypotension…

M.O.D.S.
Multiple Organ Dysfunction Syndrome

Interesting Facts
- ____% of Americans Do Not Know The Term Sepsis
- Lack of Familiarity Greatest In
  - Seniors
  - Men
  - African-Americans

Educate Patients!
Heart Attack  Brain Attack  Sepsis Attack

Normal Response To Injury/Infection
Local Activation Of:
INFLAMMATION  COAGULATION
Managing Sepsis, © Tuggle

**INFLAM & COAG MEDIATORS**

- Neutrophils
- Macrophage
- Oxygen Radicals
- Bradykinin
- Platelet Activator
- Histamine
- Tumor Necrosis Factor
- Arachidonic Acid
- Leukotrienes
- Lipoxins
- Interleukins 1, 6, 8, 10
- Prostaglandin
- Eicosanoids
- Proteases
- Endothelin
- Thromboxane A2
- High Mobility Proteins
- Serotonin
- Nitric Oxide
- Complement...

**Sepsis**

System-Wide Stimulus

- Blood-Borne Infection & Circulating Toxins
- Overstimulation of:
  - Inflammation
  - Coagulation
- Peripheral Vasodilation
- Intra-Organ Vasosnstriction
- Hypovolemic Shock
- Myocardial Depression
- Tissue Hypoxia or Anoxia = Shock

**What’s The Best Rx For Sepsis?**

**Single Best Strategy!**

*Hand Washing/Disinfection*

**Kills 30,000 people/yr**

CLABSI Deaths

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Breast Cancer Deaths

STOP!

1. Stop Procedures When Sterility Breached!
2. Stop Unnecessary Use!
3. Stop Long-Term Use!
Before The Procedure:
Wash hands (immediately prior)
Sterilize procedure site with chloraprep/chlorhexidine
Sterile drape entire patient

During The Procedure:
Use sterile gloves
Wear a hat, mask & gown
Maintain a sterile field

After The Procedure:
Apply a sterile dressing immediately
Ask on a daily basis if line can be removed

STOP!
1. Stop Misuse of Sedatives!
2. Begin Exercise Early!
3. LIBERATE ASAP!

Mask Ventilation

Results In 20-40% Mortality
Increases Ventilator Days By 4
Increases Critical Care LOS By 4
Increases Hospital LOS By 4
Costs $40,000 More Per Case

ihi Ventilator Bundle
✓ HOB Elevation $\geq 30^\circ$
✓ Daily Sedation Vacation
✓ Daily Spontaneous Breathing Trials
✓ DVT Prophylaxis
✓ PUD Prophylaxis
✓ Daily Oral Care with Chlorhexidine

Continuous Subglottal Suction ET
Reduces VAP Risk By 45-50%
Too Low (< 20) Increases VAP Risk
Too High (? > 25 ?) Decreases Blood Flow
Check ~ q 4

CAUTI
Daily risk of bacteruria with catheterization is 3% to 10%
By day 30 = 100%

CAUTI Bundle
- Daily assessment of catheter necessity (SHEA)
- Catheter secured
- Tamper-evident seal intact
- Drain tubing is properly positioned (no dependent loops)
- Drain bag below bladder and not touching floor
- Drain bag is not overfilled
- At least daily catheter hygiene
- Smallest lumen catheter inserted

STOP!
1. Stop Inept Foley Practices!
2. Stop Unnecessary Use!
3. Stop Long-Term Use!

Surgical Site Infections
- Clippers NOT Razors
- Single Dose Antibiotic Rx Within One Hour Of Making Incision
- Blood Sugar Control
Managing Sepsis, © Tuggle

**RED FLAG**

CDC Estimates That 70% of Hospital-Acquired Infections Are Caused By Antibiotic-Resistant Bacteria

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**STOP!**
1. MDRO!
2. De-escalate
3. Do You Really Need An Antibiotic?

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1. **1st Comprehensive Analysis**
   - Annually, > 2 million people incur antibiotic-resistant bacterial infections in the US
   - These cause more than 23,000 deaths
   - Add ~ $20 Billion in Direct Costs, and > $34 Billion in Lost Productivity Annually

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**#1**

CRE Sepsis = 50% Mortality!

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**#2**

Cephalosporins

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**#3**

Clostridium Difficile
C Diff: 6 Steps For Prevention
1. Stop Unnecessary Antibiotics
2. Test All Patients With Diarrhea On Or Within Several Months Of Antibiotic Therapy
3. Isolate Patients Immediately
4. Wear Gloves & Gowns...Hand Sanitizer Does Not Work & Hand Washing May Be Insufficient
5. Clean Room Surfaces with Bleach or Other Spore-Killing Disinfectant
6. Notify New Facility When Patient Transfers
Source: CDC, 2012

Surviving Sepsis Campaign
10 Year History

- ‘02: Barcelona Declaration (Goal 25% Mortality)
- ‘04: 1st Guidelines Published
- ‘05: Phase III: Bundles
- ‘06: NEJM Critique Due To Lilly Affiliation
- ‘08: Revised Guidelines Published
- ‘10: Mortality 20% with 30% Bundle Compliance
- ‘12: Revised Guidelines Published

TIME SENSITIVE EMERGENCIES
ACS
CVA
Trauma
Sepsis

3 Hour Initial Bundle
1. Draw A Lactate Level
2. Draw Blood Cultures
3. Administer Empiric Antibiotics Stat
4. Administer A 30 ml/kg Bolus of Saline
Screening Test For “Occult” Hypoperfusion

Patient Examples

<table>
<thead>
<tr>
<th></th>
<th>BP</th>
<th>SpO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>88/60</td>
<td>88%</td>
</tr>
<tr>
<td>#2</td>
<td>112/64</td>
<td>95%</td>
</tr>
</tbody>
</table>

Urgent Antibiotics

Initiate Within One Hour Of Obtaining Cultures
Failure To Comply = Declining Survival
Within 30 min of hypotension... Survival ___%
From 30-60 min of hypotension... Survival ___%
Over the next 5 hrs of delay... Survival falls ___%/hr


Resuscitation: Early Goal-Directed Therapy
For Shock or Lactate > 4...
Fluid Rx To Maintain:
CVP 8-12
MAP ≥ 65
UO ≥ .5/ml/kg/hr
ScvO₂ ≥ 70%
If PA Cath

Fluid Assessment

Ongoing Fluid Rx Assessed By:
- Pulse Press / Stroke Volume Variation
- Passive Leg Raising Test
- Urine Output
- Cardiac Output (Noninvasive)
- Lung Water / Function
- LV Size / Function
**Managing Sepsis**

### Venous Saturation?

![Venous Saturation Diagram](image)

- **SvO2, ScvO2**
- **Oxygen Supply**
  - SaO2, Hgb, CO
- **Oxygen Demand**
  - VO2

### Lactate Clearance vs ScvO2

Lactate Clearance ≥ 10% or ScvO2 ≥ 70%:

- No Difference in:
  - Hospital Mortality
  - Length of Stay
  - Ventilator-Free Days
  - Incidence of MODS


### Resuscitation: Early Goal-Directed Therapy


**If ScvO2 < 70%**

- √ PRBC Administration if Hct < 30%
- √ Dobutamine Infusion For ScvO2 < 70% After PRBC

**If MAP < 65**

- Vasopressors
- Norepi / Epi / Vaso

*Only if low CO, HR & low risk of dysrhythmias

### SSC Good News

- **Put the Spotlight on Sepsis**
- **Promoted Early Identification & Treatment**
- **Encouraged**
  - Early Antibiotics
  - Early Hemodynamic Resuscitation
  - Team Approach To Care

### SSC Bad News

- **Other Than Antibiotics Many Rec’s Based on Lowest Level of EBP (Grade E: uncontrolled studies, case series and expert opinion).**

- **EGDT Biggest Concern**
  - Too Much Fluid? Too Long?
  - Guidance By CVP?
  - Blood Transfusion Harmful
    - further inflammation?
    - ARDS & MODS stimuli?

### Fluid Recommendations

- **Early**: Repeated Boluses Until
  - MAP > 65 Achieved
  - Tissue Perfusion Improved **OR**
  - Signs of Cardiac Overload / Pulmonary Edema

- **Late (> 12 hrs): CONSERVATIVE!**
  - Highest Fluid Gains Had Highest Mortality
  - Negative Fluid Balance May Be Best
  - Norepi After ~ 2 Liters NS To Lower Fluid Req


• Patients with infection
• Patients on antibiotics:

**Look For:**
- Drops in UO
- Increasing FiO\textsubscript{2}
- Requirement for Fluid / Pressors
- Changes in LOC

**References**


