Decreasing Sepsis Mortality at the University of Colorado Hospital

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Disclaimer

• None of the presenters today have any financial interests in any medication or product listed in the following presentation.
Objectives

By the end of this presentation, Nurses will be able to;

• Describe at least one reason why early identification and treatment of Sepsis is important.
• Differentiate between SIRS, Sepsis, Severe Sepsis and Septic Shock.
• List four SIRS Criteria.
• State the three interventions that can be ordered and performed quickly that have been shown to decrease mortality in Severe Sepsis.
• Explain how the MET team can be utilized to improve outcomes in Sepsis.
Case Study

Your patient is a 62 year old man who was transferred to your unit status post bowel resection for metastatic cancer. His wife calls you to the room because the patient is complaining of abdominal pain.

- At this point would you suspect is wrong?
- What information do you need?
Importance of early identification and treatment of Sepsis

- What types of infections do your patients commonly experience?
- Can they die from this infection?
Importance of early identification and treatment of Sepsis

Patient’s don’t die from infections, they die from SEPSIS!
Importance of early identification and treatment of Sepsis

- Sepsis is the 10th leading cause of death in the United States.¹
- It is the leading cause of death in non-coronary Intensive Care Units.²
- Based on UCH’s current statistics, of the patients who develop Sepsis, 18% will die.

Through simple interventions we can save more lives.

Importance of early identification and treatment of Sepsis

Early identification and treatment has been shown to be most effective in decreasing mortality.

“Early and aggressive fluid loading appeared to be a key intervention that led to the decrease in mortality”

Importance of early identification and treatment of Sepsis

Early identification and treatment has been shown to be most effective in decreasing mortality.

“The speed with which appropriate antimicrobials are initiated after the onset of hypotension in patients with septic shock is one of the critical determinants in their survival. Survival dropped approximately 7.5% per hour delay over the first 6 hours”³

SIRS, Sepsis, Severe Sepsis and Septic Shock

First, it is important to understand the difference between SIRS, Sepsis, Severe Sepsis and Septic Shock

- **SIRS** = Systemic Inflammatory Response Syndrome
- **Sepsis** = Infection plus systemic manifestations of infection.  
  
- **Severe Sepsis** = Sepsis plus sepsis-induced organ dysfunction or tissue hypoperfusion.  
- **Septic Shock** = Sepsis-induced hypotension persisting despite adequate fluid resuscitation.  

What is SIRS?

Systemic Inflammatory Response Syndrome (SIRS) is a self-defense mechanism. “Inflammation is the body's response to nonspecific insults that arise from chemical, traumatic, or infectious stimuli. The inflammatory cascade is a complex process that involves humoral and cellular responses, complement, and cytokine cascades…If homeostasis is not restored, a significant systemic reaction occurs. The cytokine release leads to destruction rather than protection.”

SIRS, Sepsis, Severe Sepsis and Septic Shock

What are SIRS Criteria?

SIRS can be identified by the following criteria;

- Heart Rate > 90
- Respiratory Rate > 20
- Temperature >38.3 or <36°C
- WBC count >12 or <4
- % bands >10
What are Bands?

Bands are immature neutrophils just released by the bone marrow into the bloodstream. Neutrophils are the body's primary response to bacterial infections or stress.

Though our lab does not list Bands separately, it does list the percentage of neutrophils.

Neutrophils % normal range is 39.7-72.1
SIRS, Sepsis, Severe Sepsis and Septic Shock

Sepsis is defined as “infection plus systemic manifestations of infection”. 4

– Systemic manifestation of infection are SIRS Criteria.

Sepsis = Infection + ≥ 2 SIRS Criteria

SIRS, Sepsis, Severe Sepsis and Septic Shock

Severe Sepsis is defined as Sepsis plus sepsis-induced organ dysfunction or tissue hypoperfusion. 4

What does sepsis induced organ dysfunction or tissue hypoperfusion look like?

SIRS, Sepsis, Severe Sepsis and Septic Shock

Sepsis induced organ dysfunction could present as any of the following:

- SpO2 <90 or new pulmonary infiltrates
- Cool/mottled extremities
- ↓ UOP or ↑ Creatinine
- SBP < 90 or MAP < 60
- Lactate ≥ 4
- Changes in mental status
- Platelet count < 100K
- Ileus
- ↑ Bilirubin or ALT
- ↑ PT/PTT

SIRS, Sepsis, Severe Sepsis and Septic Shock

Septic Shock is defined as Sepsis-induced hypotension persisting despite adequate fluid resuscitation. 4

What is “adequate fluid resuscitation”?

– 20-30 ml/kg over 30 minutes

• Ex: 180 lb man = 82 kg x 20 ml = 1640 ml over 30 min

Interventions proven to decrease Sepsis mortality

In 2001 experts estimated that sepsis “mortality figures range from 20-50% depending on condition severity and end organ failure”.  

Interventions proven to decrease Sepsis mortality

“In 2004, an international group of experts in the diagnosis and management of infection and sepsis, published the first internationally accepted guidelines that the bedside clinician could use to improve outcomes in severe sepsis and septic shock.”

These guidelines are known as the Surviving Sepsis Campaign Guidelines

Interventions proven to decrease Sepsis mortality

The Surviving Sepsis Campaign (SSC) joined with the Institute of Healthcare Improvement (IHI) to develop the Severe Sepsis Bundle’s based on the SSC Guidelines. The 2 bundles are;

- Sepsis Resuscitation Bundle
- Sepsis Management Bundle

Surviving Sepsis Campaign Website found at http://www.survivingsepsis.com/implement/bundles
Interventions proven to decrease Sepsis mortality

Sepsis Resuscitation Bundle: The goal is to perform all indicated tasks 100% of the time within the first 6 hours of identification of severe sepsis. The tasks are:

1. Draw Lactate
2. Draw Blood cultures
3. Administer Antibiotics
4. Administer Fluid and/or vasopressors
5. Measure CVP and ScvO2/SvO2 monitoring

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Interventions proven to decrease Sepsis mortality

Sepsis Resuscitation Bundle: *The goal is to perform all indicated tasks 100% of the time within the first 6 hours of identification of severe sepsis. The tasks are:*

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Most important 3 interventions to remember

Surviving Sepsis Campaign Website found at http://www.survivingsepsis.com/implement/bundles
Interventions proven to decrease Sepsis mortality

Sepsis Resuscitation Bundle:
1) Measure Serum Lactate

Lactate is a product of anaerobic metabolism. When a cell does not get enough oxygen, either because of respiratory failure or decreased blood flow from clots, the cell switches from aerobic metabolism to anaerobic metabolism. When the lactate level rises above normal (which is 2), this indicates that the cells are being stressed. Though lactate can rise for many reasons (such as too much skiing) it should be a concerning sign warranting further investigation.

Surviving Sepsis Campaign Website found at http://www.survivingsepsis.com/implement/bundles
Interventions proven to decrease Sepsis mortality

Sepsis Resuscitation Bundle:
2) Obtain blood cultures prior to antibiotic administration

It is important to give the patient antibiotics as soon as possible, but cultures of any suspected infection must be drawn prior to antibiotics. These cultures could include blood, sputum, urine and wound.

Surviving Sepsis Campaign Website found at http://www.survivingsepsis.com/implement/bundles
Interventions proven to decrease Sepsis mortality

Sepsis Resuscitation Bundle:
3) Administer broad-spectrum antibiotic, within 3 hrs of ED admission and within 1 hour of non-ED admission.

Surviving Sepsis Campaign Website found at http://www.survivingsepsis.com/implement/bundles
Interventions proven to decrease Sepsis mortality

Sepsis Resuscitation Bundle:

4) In the event of hypotension and/or a serum lactate > 4 mmol/L
   - Deliver an initial minimum of 20 ml/kg of crystalloid or an equivalent
   - Apply vasopressors for hypotension not responding to initial fluid resuscitation to maintain mean arterial pressure (MAP) > 65 mm Hg

Surviving Sepsis Campaign Website found at http://www.survivingsepsis.com/implement/bundles
Interventions proven to decrease Sepsis mortality

Sepsis Resuscitation Bundle:

5) In the event of **persistent** hypotension despite fluid resuscitation (septic shock) and/or lactate > 4 mmol/L

- Achieve a central venous pressure (CVP) of > 8 mm Hg
- Achieve a central venous oxygen saturation (ScvO2) > 70 % or mixed venous oxygen saturation (SvO2) > 65 %

Surviving Sepsis Campaign Website found at http://www.survivingsepsis.com/implement/bundles
Interventions proven to decrease Sepsis mortality

Sepsis Management Bundle: Efforts to accomplish these goals should begin immediately, but these items may be completed within 24 hours of presentation for patients with severe sepsis or septic shock.

1. Consider administration of low-dose steroids for septic shock.
2. Consider administration of recombinant human activated protein C (rhAPC)
3. Maintain a median inspiratory plateau pressure (IPP) < 30 cm H2O for mechanically ventilated patients

Surviving Sepsis Campaign Website found at http://www.survivingsepsis.com/implement/bundles
Interventions proven to decrease Sepsis mortality

**Sepsis Management Bundle:**

1) Consider administration of low-dose steroids for septic shock.
   - *Patients on chronic immunosuppressive drugs (e.g. transplant patients, rheumatologic disorders)*
   - *Patients with HIV*

Surviving Sepsis Campaign Website found at http://www.survivingsepsis.com/implement/bundles
Interventions proven to decrease Sepsis mortality

Sepsis Management Bundle:

2) Administer recombinant human activated protein C (rhAPC, brand name Xigris) in accordance with a standardized ICU policy.
   - Patients with APACHE II >25, or those with evidence of ≥2 organs failing (acutely)

Surviving Sepsis Campaign Website found at http://www.survivingsepsis.com/implement/bundles
Interventions proven to decrease Sepsis mortality

_Sepsis Management Bundle:_

3) Maintain a median inspiratory plateau pressure (IPP) < 30 cm H2O for mechanically ventilated patients

Surviving Sepsis Campaign Website found at http://www.survivingsepsis.com/implement/bundles
UCH Tools available for use to improve early detection and treatment

- *UCH ICU Severe Sepsis Order Set*
- *UCH ED to ICU Communication Tool*
- *UCH Sepsis Badge Reference Cards*
- *UCH Sepsis Identification Posters*
- *Sepsis Trip Sheet*
UCH Tools available for use to improve early
detection and treatment

**UCH ICU Severe Sepsis Order Set**

+ University of Colorado Hospital

**PATIENT CARE ORDERS**

**Severe Sepsis**

<table>
<thead>
<tr>
<th>Verbal/Telephone Order received, read back &amp; verified: Date: <strong>/</strong>/__</th>
<th>Time: <strong>:</strong></th>
<th>Signature: ___________________________</th>
<th>Title ___________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attending Physician: ___________________________</td>
<td>Ordering Healthcare Provider: ___________________________</td>
<td>GME/UIP #: ___________________________</td>
<td>Pager: ___________________________</td>
</tr>
<tr>
<td>Service: ___________________________</td>
<td>Allergies: ___________________________</td>
<td>Diagnosis: ___________________________</td>
<td>Note: Admission Order Form must be completed ___________________________</td>
</tr>
</tbody>
</table>

**TESTS**

**STAT LABS** – Check computer/orders to determine what is in progress to prevent duplication/excessive phlebotomy

- [ ] Comprehensive metabolic panel
- [ ] Basic metabolic panel
- [ ] Magnesium plasma
- [ ] Phosphorus plasma
- [ ] Lactate
- [ ] CBC
- [ ] PT/INR
- [ ] PTT
- [ ] VBG
- [ ] ABG
- [ ] Urine culture and sensitivity
- [ ] Blood cultures x 2. (prior to starting antibiotic therapy)
- [ ] Sputum culture and sensitivity
- [ ] Type and screen
- [ ] Other: ___________________________

**SERIAL LABS:**

- [ ] BMP, magnesium and phosphorus every 6 hours x 3, then every 12 hours. Discontinue after 72 hours.
- [ ] Lactate every 6 hours x 3, then every 12 hours. Discontinue after 72 hours.
- [ ] VBG drawn from central line every 6 hours x 2. Discontinue after 12 hours. No VBG if Edward’s catheter in place.
- [ ] Blood glucose every ________ hours by glucometer. (Goal blood glucose is between 144 - 180 mg / dl.)
- [ ] Call MD for blood glucose greater than 180 mg / dl. for initiation of insulin therapy.
- [ ] Consider completing patient care order form: ICU Electrolyte Replacement Guideline (MED 90087).

**IVS/MEDICATIONS**

- [ ] Dispensing by non-proprietary name under formulary system is permitted, unless checked here: □

**IV FLUIDS**
UCH Tools available for use to improve early detection and treatment

**UCH ED to ICU Communication Tool**

**Patient Label**

**ED to ICU SEPSIS COMMUNICATION TOOL**

**SEPSIS GOALS**

- Blood cultures before antibiotics
- Antibiotics ASAP within 3 hours of ED arrival or 1 hour of non-ED admission
- Initial fluid bolus of 20mL/kg and repeat x1 if no response to first bolus
- Continue fluid boluses to goal CVP ≥ 8 for non-intubated patients (≥ 12 for intubated patients)
- Vasopressors (Leophrad) for MAP < 65 despite fluid boluses

Time patient arrived to ED: _____________
Time patient transferred to ICU: ___________

Check box if action completed:
- 2 Sets of Blood Cultures drawn: Time drawn: _____________
- Urine Cultures sent: Time drawn: _____________
- Respiratory Cultures sent: Time drawn: _____________
- Other cultures sent: source: Time drawn: _____________
- Lactate sent

Antibiotics given:

[Logo: University of Colorado Hospital]
UCH Tools available for use to improve early detection and treatment

**UCH Sepsis Badge Reference Cards**

### SEPSIS EARLY RECOGNITION

1. **Does the patient have ≥ 2 SIRS criteria?**
   - Yes
   - No

2. **History suggestive of new infection?**
   - Yes
   - No

3. **History suggestive of new infection?**
   - Yes
   - No

4. **Does the patient have signs of organ dysfunction?**
   - Yes
   - No

5. **Suspected severe sepsis?**
   - Yes
   - No

### SEPSIS EARLY TREATMENT

**Per Physician Order**

1. **Does the patient have ≥ 2 SIRS criteria?**
   - Yes
   - No

2. **Infection suspected or can’t be ruled out?**
   - Yes
   - No

   - If Yes to both suspect SEPSIS

   - If Yes suspect SEVERE SEPSIS

   - If Yes suspect SEPTIC SHOCK

3. **Does the patient have hypotension or lactate >4mmol/L?**

   - Yes
   - No

   - If Yes suspect SEVERE SEPSIS

   - Call the MET or request ICU bed ASAP

   - Deliver 20 mL/kg of crystalloid and an equivalent rapid infusion (goal rate 500 mL Q 15 min)

   - Use caution in patients with ESLD or CHF

4. **Does the patient have persistent hypotension or lactate >4mmol/L despite above fluid resuscitation?**

   - Yes
   - No

   - If Yes suspect SEPTIC SHOCK

   - Call MET and anticipate ICU transfer in order to initiate ICU severe Sepsis Order Set
SEPSIS EARLY RECOGNITION

1. Does the patient have ≥2 Systemic Inflammatory Response Syndrome (SIRS) criteria?

2. Is the patient’s history suggestive of a new infection?

THINK SEPSIS

√ Lactate

3. Does the patient have signs of organ dysfunction?

4. Continued ↓ BP despite ≥1.5L IVF

SEVERE SEPSIS

SEPTIC SHOCK

SIRS CRITERIA
- HR > 90
- RR > 20
- Temp > 38.3 or < 36°C
- WBC > 12 or < 4
- 2 or more

SOURCES OF INFECTION
- Pneumonia
- UTI
- Acute Abdomen
- Meningitis
- Skins/soft tissue
- Bone/joint
- Wound
- Central line catheter
- Endocarditis
- Implantable device
- Other

SIGNS OF ORGAN DYSFUNCTION
- SpO2 < 90 or new pulmonary infiltrates
- Cool/mottled extremities
- ↓ UOP or ↑ Creatinine
- SBP < 90 or MAP < 60
- Lactate ≥ 4
- Ileus
- Δ in MS
- ↑ Bili or ALT
- Pt < 100K
- ↑ PT/PTT
SEPSIS EARLY TREATMENT
Per Physician Orders

1. Does the patient have ≥ 2 SIRS criteria? □ No □ Yes
2. Infection suspected or can’t be ruled out? □ No □ Yes

If Yes to both suspect SEPSIS

- Consider MET consult if indicated
- Send lactate level
- Obtain pan cultures prior to antibiotic administration
- Administer broad spectrum antibiotic (within 1 hour of non-ED admission)

3. Does the patient have hypotension or lactate ≥ 4 mmol/L?

If Yes suspect SEVERE SEPSIS

- Call the MET or request ICU bed ASAP
- Deliver 20 mL/kg of crystalloid or an equivalent rapid infusion (goal rate 500 mL Q 15 min)
  Use caution in patients with ESLD or CHF

4. Does the patient have persistent hypotension or Lactate ≥ 4 mmol/L despite above fluid resuscitation?

If Yes suspect SEPTIC SHOCK

- Call MET and anticipate ICU transfer in order to initiate ICU Severe Sepsis Order Set.

See flowchart for additional sections.
UCH Tools available for use to improve early detection and treatment

UCH Sepsis Identification Posters

SAVE LIVES...STOP SEPSIS!

WHY?
Sepsis is a major cause of mortality and morbidity worldwide. It is often difficult to diagnose, especially in the early stages, which can lead to poor outcomes.

HOW?
Recognizing the signs of sepsis early can help prevent serious complications. Here are some signs to look out for:

- SIRS (systemic inflammatory response syndrome)
  - SIRS is a response to a variety of severe injuries.
  - Considered present when two or more of the SIRS criteria are present.

- SEPSIS
  - The systemic inflammatory response syndrome plus a known or suspected infection.

- SEVERE SEPSIS
  - Sepsis associated with organ dysfunction.
  - Hypotension and/or hypotension requiring fluid resuscitation.

- SEPTIC SHOCK
  - Sepsis with hypotension and/or hypotension despite adequate fluid resuscitation.

SIRS CRITERIA
- Does your patient have 2 or more of these signs/diagnosis?
  - HR > 90
  - RR > 20
  - Temp > 38.3°C or < 36°C
  - WBC > 12 or < 4
  - % band > 5

SOURCES OF INFECTION
- Could your patient have a new source of infection?
- Pneumonia
- Acute Abdomen
- Septicemia
- Skin/skinfold tissue
- Urinary
- Wound
- Central line catheter
- Nosocomial device

WHAT CAN BE DONE IMMEDIATELY?
- Early and aggressive fluid loading is critical to the patient's survival.
- Provide an initial fluid bolus of 20-30 ml/kg over 30 minutes.
- Reassess the fluid bolus if the patient remains hypotensive.
- Consider transferring to the ICU.
- Consider calling the MET team for assistance.

REFERENCE

You are the Key to decreasing Sepsis Mortality!
UCH Tools available for use to improve early detection and treatment

*Translating Research Into Practice (TRIP)* Sheet: Sepsis

A “TRIP” sheet will be coming out that will be posted on each unit summarizing many of the things we learned today
Utilizing the Medical Emergency Team (MET)

For Acute Care units, how would calling the Medical Emergency Team improve outcomes?
Review of Objectives

By the end of this presentation, Nurses will be able to;

• Describe why early identification and treatment of Sepsis is important.
• Differentiate between SIRS, Sepsis, Severe Sepsis and Septic Shock.
• List four SIRS Criteria.
• State the three interventions that can be ordered and performed quickly that have been shown to decrease mortality in Severe Sepsis.
• Explain how the MET team can be utilized to improve outcomes in Sepsis.
Answers to Case Study

Your patient is a 62 year old man who was transferred to your unit status post bowel resection for metastatic cancer. His wife calls you to the room because the patient is complaining of abdominal pain.

- At this point would you suspect Sepsis?
- What information do you need?
Questions?
References


8. Surviving Sepsis Campaign Website found at http://www.survivingsepsis.com/implement/bundles
Resources

- **Advances in Sepsis**: www.advancesinsepsis.com

- **Edwards Lifesciences Critical Care Education** found at http://www.edwards.com/education/cceducationmap.htm

- **International Sepsis Forum**: www.sepsisforum.org

- **Medical Simulation Corporation** Sepsis Online Course: www.medsimulation.com

- **My ICU Care**: "Sepsis: What You Should Know": www.sepsisalliance.org

- **Surviving Sepsis Campaign Website** (thru 2011) www.survivingsepsis.org
Evaluations

• Please complete the evaluation for this lecture in order to receive your CE for attendance.

• Thank you for your interest in reducing Sepsis mortality at UCH. You can make a difference.