“SEPSIS: FROM LAST TO FIRST”

"Severe Sepsis and Septic Shock
Early Recognition and Treatment"

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Disclosure

PIMC participated in the 2011 Institute for HealthCare Improvement (IHI), “Sepsis Detection and Initial Management” Expedition. Several slides in this presentation contain material from the IHI Expedition presentations.

Objectives

- Sepsis introduction and overview
- Study Group development
- Education commitment
- Tools and checklists
- Strategies for success
- Data and data sharing
Sepsis Alliance Video

Sepsis Statistics

- 10th Leading Cause of Death in US
- 750,000 new cases in US Annually
- Severe Sepsis: 30%-50% mortality
- Septic Shock: 50%-60% mortality
- Approximately 1,300 deaths worldwide daily
- More than 500 deaths from severe sepsis daily in US
- $17 Billion spent annually

Severe Sepsis v. other Priorities

<table>
<thead>
<tr>
<th>Care Priorities</th>
<th>US Incidence</th>
<th># of Deaths</th>
<th>Mortality Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEVERE SEPSIS</td>
<td>751,000</td>
<td>215,000</td>
<td>29%</td>
</tr>
<tr>
<td>AMI</td>
<td>900,000</td>
<td>225,000</td>
<td>25%</td>
</tr>
<tr>
<td>STROKE</td>
<td>700,000</td>
<td>163,500</td>
<td>23%</td>
</tr>
<tr>
<td>TRAUMA (MVA)</td>
<td>2.9 million</td>
<td>42,643</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

Sources: ACC/AHA, AHA, National Highway Safety Administration, Motor Vehicle crash data and CMI of Case Medical
Time Sensitive Interventions

- STEMI/AMI – “Code 54”
  - Focus on the timely return of blood flow to the affected areas of the heart
- STROKE – “Code Brain”
  - The sooner treatment begins, the better are one’s chances of survival without disability.
- Trauma – “The Golden Hour”
  - Requires immediate response and medical care “on the scene”
  - Patients typically transferred to a qualified trauma center.
- Severe Sepsis/Septic Shock – Time sensitive
  - Early Recognition
  - Rapid administration of fluids and antibiotics

Source: IHI
Surviving Sepsis Campaign

- International effort developed by MDs
- Evidenced based guidelines to improve diagnosis and treatment of sepsis
- Screening high risk patients, blood cultures IV fluids, ABX
- Improve patient outcomes, decrease mortality

Inter-Disciplinary Approach

- Chief Medical Officer
- ED Medical Director
- ICU Medical Director
- Sepsis Program Manager
- Clinical Pharmacist
- Lab Director
- Nursing Administration
- Education
- PI Department
- Clinical Documentation Specialist
- Respiratory Department
- Medical Record Coder
6 Hour Sepsis Bundle

- Serum lactate
- Blood cultures prior to antibiotic administration
- Broad-spectrum antibiotics (within 3 hours of ED admission or 1 hour non-ED admission)
- If hypotensive and/or serum lactate>4:
  - Fluid resuscitation (20-40 ml/kg with minimum of 20)
  - Vasopressors
- CVP/SvO2 measures
- Inotropes and/or PRBC's

24 Hour Management Bundle

- Low dose steroid for septic shock
- Glucose control:
  - Maintain a median glucose level >70 and <150 over the 1st 24 hours
- Ventilator Pressure:
  - IPPV<30 on ventilated patients over the 1st 24 hours
Why is the Diagnosis so Difficult?

- No single criteria makes the diagnosis (unlike new ST elevation on EKG, or new onset focal neurological exam)
- Changing patient status during presentation
- Diagnosis not black and white but, gray
- Patient may look good but, crash two hours later
- Many physicians prefer an observation period before reacting and lose the critical window of opportunity

Source: IHI

What we did in 2011!

- IHI Sepsis Expedition
- Identified barriers to success
- Initiated “small tests of change”
- Sepsis video – mandatory nursing education
- Strategic initiative for the Providence Health System

Current State

- No current real-time method to identify sepsis patients in-house
- Using specific markers in ED (blood cultures, lactic acid, ABX, fluid resuscitation)
- ED using pre-printed severe sepsis/septic shock order sets with success (not mandatory)
- Fallouts occurring in inpatient areas – days and nights
Barriers to Success

- Limited awareness of SIRS/Sepsis/Severe Sepsis/Septic Shock
- Late identification of patients
- Inconsistent participation of intensivists and internists
- Confusion regarding pre-printed order sets
- Hesitancy to use pre-printed order sets
- No RRT out-of-count to round and evaluate
- Not using any screening tool

SIRS: Systemic Inflammatory Response Syndrome
Defined by the presence of any two of the following:
- Temperature > 38 degrees C or < 36 degrees C
- Heart rate > 90 beats/minute
- Respiratory rate > 20 breaths/minute or PaCO2 < 32 mm Hg
- Leukocyte count > 12,000 or < 4,000 or > 10% bands

SIRS plus at least one organ system dysfunction:

Sepsis: SIRS plus a suspected or confirmed site of infection
Examples: Urinary tract infection, Pneumonia, Decubitus ulceration

Severe Sepsis & Septic Shock
Defined as SIRS plus at least two of the following organ system dysfunctions:
- Altered LOC (increased agitation, confusion, decreased Glasgow Coma Score)
- Renal failure/insufficiency (Creatinine > 2.0 and/or urine output < 0.5 ml/kg/hour)
- Respiratory failure (room air pulse oximetry < 92%, pO2/FiO2 < 300, need for mechanical ventilation)
- Metabolic/ hepatic/ hematologic (Lactate level > 2.0, liver enzymes > 2X upper limit of normal, Platelet count < 100k, INR > 1.5 w/o Warfarin)

Order: Lactic acid, Blood Cx prior to ABX. Early fluid (20ml/Kg) and antibiotic

Antibiotic administration: (ED < 1 hour)

Antibiotic administration: (60 < hours inpatient < 1 hour)

Septic Shock and/or Severe Sepsis w/ Lactate > 4.0
Defined as: Severe sepsis with SBP < 90 unresponsive to initial fluid resuscitation and/ or lactate level > 4.0
Order: Lactic acid, Blood Cx prior to ABX. Early fluid (20ml/Kg) and antibiotic

Antibiotic administration: (ED < 1 hour)

Use pre-printed septic shock order set for ED or inpatient
Strategies for Success

- To succeed, we must involve the frontline clinicians
- Real-time data delivered in real time to clinician is key
- Promote use of screening tool
- Constant reminders
- Continuous education
- Pre-printed orders

What Should Nursing Do?

- Enhance knowledge of pathophysiology, signs and symptoms and knowledge of treatment
- Know your patients so that early detection can occur
- Know the SIRS criteria
- Recognize the presence of sepsis
- Quickly initiate treatment measures

Education

- Continue monthly sepsis committee meetings
- Medical staff presentation
- Nursing Education: staff meetings, story board presentations
- Develop on-line sepsis education module
- Include in new orientation and annual update
- Participation in Institute for Healthcare Improvement (IHI) sepsis expedition
For Severe Sepsis
Think 2-1-1

2
Two or more signs of SIRS

1
One suspected/actual site of infection

1
One or more organs in failure identify severe sepsis

Newer Strategies

- Modified Early Warning System (MEWS)
- RRT to evaluate each call with the sepsis screening tool

Modified Early Warning System

Provide early detection & alerts for physiologic decline that might signal an impending EVENT
Failure to Rescue

- 80% of ICU patients have abnormal physiologic parameters up to 24 hours prior to transfer (Brit Med J 2001)
- 40–68% of cardiac arrests are preceded by abnormal parameters up to 12 hours before event (Resuscitate – 1999)
  - Tachypnea (58%)
  - Hyperpnea (48%)
  - Tachycardia (54%)
  - Altered mental state (46%)
  - Hypotension (46%)
  - Decreased urine output (29%)
  - Pyrexia (14%) Hypertension (9%)

MEWS patients are the sickest patients in the hospital

- Mortality is 12.4% for those with MEWS score of 5 or greater.

The process of information flow and action steps

- Nurse and/or RRT assesses patient and notifies MD

- AMALGA Software
- MEWS Alert
- Vital Signs
- CAMIS
### Actions of Team Members

<table>
<thead>
<tr>
<th>MEWS Score</th>
<th>Nurse Intervention / Action</th>
<th>Physician Intervention / Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>0 to 3</strong></td>
<td>Continue routine ordered Vital Signs</td>
<td>——</td>
</tr>
<tr>
<td>4</td>
<td>Charge nurse notifies primary nurse, assesses patient and takes vital signs within 15 min. documents in the EMR, notifies physician. Increase VS frequency to include O2 sat, to 1 hr x 2. Calculate MEWS score each time.</td>
<td>Responds to Nurse Call, provides patient care orders.</td>
</tr>
<tr>
<td>5</td>
<td>Activate RRT informs MD of patient status. Increase VS frequency to q 1 hr x 2, include pulse ox. If pt. remains MEWS 5 for 3 consecutive readings, request possible orders for higher level of care transfer. Consider end of life discussion as appropriate with MD and family.</td>
<td>Responds to Nurse Call, assesses pt., orders for patient care interventions, considers higher level of care, and/or end of life discussions if appropriate.</td>
</tr>
</tbody>
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#### 2012 Rapid Response

- **MEWS** implemented and **RRT** implemented as part of the response process

<table>
<thead>
<tr>
<th>Month</th>
<th>Number of Calls or Transfers</th>
<th>Mortality Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>F</td>
<td>4</td>
<td>0.00%</td>
</tr>
<tr>
<td>M</td>
<td>10</td>
<td>0.00%</td>
</tr>
<tr>
<td>A</td>
<td>30</td>
<td>0.00%</td>
</tr>
<tr>
<td>M</td>
<td>60</td>
<td>0.00%</td>
</tr>
<tr>
<td>J</td>
<td>60</td>
<td>0.00%</td>
</tr>
<tr>
<td>J</td>
<td>90</td>
<td>0.00%</td>
</tr>
<tr>
<td>A</td>
<td>120</td>
<td>0.00%</td>
</tr>
<tr>
<td>S</td>
<td>150</td>
<td>0.00%</td>
</tr>
<tr>
<td>O</td>
<td>180</td>
<td>0.00%</td>
</tr>
<tr>
<td>N</td>
<td>210</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

- **Number of Rapid Response Calls**
- **Number of Transfers to Higher Level of Care**
- **Green (Mortality Rate)**

#### RRT Responsibilities

- **Initiate Sepsis Protocol**
  - Sepsis panel (blood cultures x2 from two different sites; CBC with differential, CMP, serum lactate and PT/INR)
  - Obtain sputum for culture – do not hold ABX if unable to obtain specimen
  - Obtain urine for culture - do not hold ABX if unable to obtain specimen
  - Obtain wound culture if applicable
  - Obtain appropriate ABX order – must be started within one hour of identifying severe sepsis/septic shock
  - Chest x-ray
  - Administer normal saline 500 ml IV bolus, then 100ml/hour
  - Consider transfer to higher level of care
Severe Sepsis is an Emergency
TIME IS TISSUE!

Each hour of delay over 6 hours was associated with a 7.6% decrease in survival.

From IHI slide deck presentation

Early Antibiotics


Criteria
Inclusion: Population is limited to patients having only severe sepsis or septic shock (995.92 and 785.52) as principal and/or secondary dx.
• Patient must be an inpatient adult (>17 years of age).
• Patients who are DNR and patients that are on comfort measures and not in IP Hospice status

Exclusion: Discharge Status
• Discharged/Transferred to other facilities.
• Left Against Medical Advice. Inpatient Hospice.
**Documentation Reminders for Appropriate Coding**

- Cannot guess, “connect the dots” or make diagnoses based on signs & symptoms
- Cannot code effectively without complete and timely D/C Summaries
  - List all significant diagnoses
  - Consistency with bulk of medical record
- Physicians must document their thought process
  - A condition is code-able even if uncertainty exists, as long as it is being treated and/or otherwise affects the hospitalization
- “Continuity, consistency, and congruency” are very helpful
  - Continue to document when issue is “resolved”
  - Document as “present on admission” - coding requirement
  - Admitting doctors agree with consultants/partners and include agreement in his/her documentation – even with weekend coverage!

**Systemic Inflammatory Response Syndrome (SIRS)**

Defined by the presence of two or more of the following:
1. Temperature > 38 degrees C or < 36 degrees C
2. Heart rate > 90 beats/minute
3. Respiratory rate > 20 breaths/minute or PaCO2 < 32 mm Hg
4. Leukocyte count > 12,000, < 4,000 or > 10% bands

SIRS plus a suspected or confirmed site of infection

Examples: Urinary tract infection, Pneumonia, Decubitus ulceration

**Severe Sepsis**
Defmed as: SIRS with organ system dysfunction (examples below)
- Decreased CO (increased agitation, confusion, altered mental status)
- Renal Failure (Creatinine > 2.0 and/or urine output < 0.5 ml/kg/hour)
- Respiratory Failure (Arterial oxygen saturation < 90%)
- Hypotension (PaO2/FIO2 < 300)
- Metabolic Failure (Lactate level > 4.0)
- Liver Failure ( bilirubin > 1.5 x normal, platelets < 100,000, INR > 1.5)

Order: Lactic acid, Blood Cx prior to ABX, Early fluid (20 ml/Kg) and antibiotic

**Septic Shock**

Defined As: Severe sepsis with SBP < 90 unresponsive to initial fluid resuscitation and/or lactate level > 4.0
Order: Lactic acid, Blood Cx prior to ABX, Early fluid (20 ml/Kg) and antibiotic

**Population: PRESENT ON ADMISSION (POA)**

- Patients that had a lactate ordered & resulted in 6 hrs

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12
Population: NOT PRESENT ON ADMISSION (NPOA)

Patients that had a lactate ordered & resulted in 6 hrs

Population: NPOA and POA

Blood culture done before ABX given

Population: PRESENT ON ADMISSION (POA)

Blood culture done before ABX given
2011 and 2012
Population: PRESENT ON ADMISSION (POA)

Compliance with two element bundle:
Early ABX (180 min) and fluid resuscitation

2011 and 2012
Population: NOT PRESENT ON ADMISSION (NPOA)

Compliance with two element bundle:
Early ABX (60 min) and fluid resuscitation

Six Hour Bundle Compliance 2012
Population: NPOA and POA
SEVERE SEPSIS & SEPTIC SHOCK
2 Element Bundle Compliance and Mortality - 2012
POA AND NPOA

2 element bundle = Antibiotic within 60 min for NPOA and within 180 min for POA
and fluid resuscitation (20-40 ml/kg with minimum of 20) for patients
that are hypotensive and/or serum lactate A.

NPOA Mortality
2011 v 2012

• Dashboard Analysis
  • Inpatient (NPOA) population
  • Decrease in mortality from 45.7% in 2011 to 22.4% in 2012
  • Increased use of MD order set from 11.4% in 2011 to 20.6% in 2012

SEVERE SEPSIS/SEPTIC SHOCK
O/E MORTALITY RATIO

This graph shows our ratio of actual deaths versus expected deaths related for our sepsis patients. According to our data analytics program, one would expect that our mortality rate would be higher based on the severity of our sepsis patients. We are extremely proud that our ratio has been below 1.0 consistently since May 2012.

Our low O/E rate translates to approximately 17 lives that have been saved (year-to-date through October 2012).
What to Expect in 2013

- IHI and the Surviving Sepsis campaign are currently revising the 2008 guidelines to incorporate recently published evidence.
- Within the Providence Health & Services system, we will continue to review the 6-hour bundle with an emphasis on timely antibiotic administration and fluid resuscitation.
- We are asking for a renewed commitment of our intensivists and senior leaders in the Department of Medicine to help champion our sepsis improvement efforts.
- The creation of a full-time, dedicated positions for nurses on our Rapid Response Team (RRT).
- Once we have our full-time dedicated RRT nurses in place, we will work to initiate a Code Sepsis and further improve our response.

Parting Thoughts!

- Don’t let “perfect” be the enemy of “good”!
- Persist! Persist! Persist!
- Change is slow – celebrate the small victories!
- Always keep in mind that the end goal is to save lives!

Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it’s the only thing that ever has.

Margaret Mead