When Prevention Fails: The Clinical and Economic Impact of Sepsis

Introduction

- Healthcare-associated infections are one of the top 10 leading causes of death in the U.S.\(^1\) The US Centers for Disease Control and Prevention (CDC) estimates that 1.7M patients experience a hospital-acquired infection each year.

- Hospitals have invested considerable resources in methods to reduce hospital-acquired infections (HAIs) – screening, handwashing, etc. However, prevention measures often fail.

- The clinical and economic impact of an infection can be far greater if the patient becomes septic. Effective measures to prevent sepsis and to diagnose and manage these patients are critical to decrease mortality and reduce hospital costs.

\(^1\)Centers for Disease Control and Prevention (CDC), [http://www.cdc.gov/ncidod/dhqp/healthdis.html](http://www.cdc.gov/ncidod/dhqp/healthdis.html)
The Burden of Severe Sepsis

- Severe sepsis is reported in 2.26 cases per 100 hospital discharges and one in five admissions to the ICU.¹
- Of the 750,000+ severe sepsis cases each year in the US, an estimated 215,000 (28.6%) patients die.¹
- Mortality associated with severe sepsis has been reported as high as 30-50%.²

¹Angus, DC et al. Critical Care Medicine. 2001; 29:1303-1310
²Shapiro NI, et al. Critical Care Medicine, 2006; 34: 1025-1032

Sepsis: Leading cause of death in non-coronary ICUs

Angus DC et al. Critical Care Medicine. 2001
American Heart Association. Heart Disease and Stroke Statistics 2008 Update
National Center for Health Statistics
Sepsis is Costly

- Severe sepsis accounts for an estimated 40% of all ICU expenditures\(^1\), totaling $16.7B in the US alone.\(^2\)

- The average length of stay and cost per case is 19.6 days and $22,100, respectively.\(^2\)

- The cost of treating an ICU patient with sepsis is six times greater than that of treating a patient without sepsis.\(^3\)

---

Impact of Avoidable Medical Events

The Agency for Healthcare Research and Quality (AHRQ) Patient Safety Indicators were used to identify medical injuries in 7.45 million hospital discharge abstracts from 994 acute-care hospitals across 28 states in 2000.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Excess Mortality</th>
<th>Excess Length of Stay (days)</th>
<th>Excess Charges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-operative Sepsis</td>
<td>21.92%</td>
<td>10.89</td>
<td>$57,727</td>
</tr>
<tr>
<td>Post-operative Physiologic &amp; Metabolic Derangement</td>
<td>19.81%</td>
<td>8.89</td>
<td>$54,818</td>
</tr>
<tr>
<td>Post-operative Respiratory Failure</td>
<td>21.84%</td>
<td>9.08</td>
<td>$53,502</td>
</tr>
<tr>
<td>Post-operative Wound Dehiscence</td>
<td>9.63%</td>
<td>9.42</td>
<td>$40,323</td>
</tr>
<tr>
<td>Selected Infection due to Medical Care</td>
<td>4.31%</td>
<td>9.58</td>
<td>$38,656</td>
</tr>
<tr>
<td>Post-operative PE/DVT</td>
<td>6.56%</td>
<td>5.36</td>
<td>$21,709</td>
</tr>
<tr>
<td>Post-operative Hemorrhage or Hematoma</td>
<td>3.01%</td>
<td>3.94</td>
<td>$21,431</td>
</tr>
<tr>
<td>Transfusion Reaction</td>
<td>-1.04%</td>
<td>3.44</td>
<td>$18,929</td>
</tr>
<tr>
<td>Iatrogenic Pneumothorax</td>
<td>6.99%</td>
<td>4.38</td>
<td>$17,312</td>
</tr>
<tr>
<td>Post-operative Hip Fracture</td>
<td>4.52%</td>
<td>5.24</td>
<td>$13,441</td>
</tr>
<tr>
<td>Foreign Body Left During Procedure</td>
<td>2.14%</td>
<td>2.08</td>
<td>$13,315</td>
</tr>
</tbody>
</table>

Payers Recognize the Burden of Sepsis

- In 2008, CMS began withholding payment to hospitals for various “avoidable” conditions. The final list includes three (3) categories of hospital-acquired infections.
- Many large commercial payers, including Aetna, Cigna, and Wellpoint, have adopted these non-payment policies verbatim.
- The list is expected to expand in FY2010 and beyond.
- Though not implemented in FY2009, sepsis has been proposed for this list and remains under consideration for future implementation.

Finding the Solution - Surviving Sepsis Campaign

- The goal of the SSC is to increase awareness and improve outcomes in severe sepsis, leading to a 25% reduction in mortality in 5 years.
- The campaign includes evidence-based guidelines developed by a group of international experts and endorsed by 18 international organizations.

Guidelines endorsed by:
- American Assn. of Critical Care Nurses
- American College of Chest Physicians
- American College of Emergency Physicians
- Canadian Critical Care Society
- European Society of Clinical Microbiology and Infectious Diseases
- European Society of Intensive Care Medicine
- European Respiratory Society
- Indian Society of Critical Care Medicine
- International Sepsis Forum
- Japanese Association for Acute Medicine
- Japanese Society of Intensive Care Medicine
- Society of Critical Care Medicine
- Society of Hospital Medicine
- Surgical Infection Society
- World Federation of Critical Care Nurses
- World Federation of Societies of intensive and Critical Care Medicine
- German Sepsis Medicine
- Latin American Sepsis Institute
What is Early Goal Directed Therapy?

• Early Goal-Directed Therapy (EGDT) is a comprehensive strategy for identifying and treating septic patients that includes:
  ✓ Identification of high-risk patients based on early pathogenesis
  ✓ Mobilization of resources for intervention
  ✓ Performance of a consensus-derived protocol to reverse early hemodynamic perturbations

• The core objectives of EGDT in sepsis management are to:
  □ Detect and treat occult global tissue hypoxia early before organ damage becomes irreversible.
  □ Achieve a systemic oxygen delivery and demand balance.

EGDT Saves Lives

<table>
<thead>
<tr>
<th></th>
<th>EGDT (n = 130)</th>
<th>Standard Therapy (n = 133)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-Hospital Mortality</td>
<td>30.5%</td>
<td>46.5%</td>
<td>0.009</td>
</tr>
<tr>
<td>28-Day Mortality</td>
<td>33.3%</td>
<td>49.2%</td>
<td>0.01</td>
</tr>
<tr>
<td>60-Day Mortality</td>
<td>44.3%</td>
<td>56.9%</td>
<td>0.03</td>
</tr>
<tr>
<td>Mean LOS (for patients who survived to hospital discharge) [days]</td>
<td>14.6</td>
<td>18.4</td>
<td>0.04</td>
</tr>
<tr>
<td>In-hospital death due to sudden cardiovascular collapse</td>
<td>10.3%</td>
<td>21.0%</td>
<td>0.02</td>
</tr>
</tbody>
</table>

EGDT Body of Evidence

Since the landmark Rivers Study in 2001, there have been over 39 international studies with consistent findings demonstrating the impact of EGDT on mortality in sepsis.

<table>
<thead>
<tr>
<th>Publication Type</th>
<th># of EGDT Studies</th>
<th>Patients</th>
<th>Relative Mortality Reduction</th>
<th>Absolute Mortality Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer-reviewed</td>
<td>11</td>
<td>1,569</td>
<td>47%</td>
<td>21%</td>
</tr>
<tr>
<td>Abstracts</td>
<td>28</td>
<td>4,429</td>
<td>45%</td>
<td>20%</td>
</tr>
<tr>
<td>Total</td>
<td>39</td>
<td>5,998</td>
<td>46%</td>
<td>20%</td>
</tr>
</tbody>
</table>


EGDT is Cost-Effective

Shorr, 2007

<table>
<thead>
<tr>
<th></th>
<th>Before EGDT</th>
<th>With EGDT</th>
<th>Change</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Total Costs</td>
<td>$21,985</td>
<td>$16,103</td>
<td>$5,882</td>
<td>0.008</td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>13 days</td>
<td>8 days</td>
<td>5 days</td>
<td>0.001</td>
</tr>
</tbody>
</table>

“...cost decreased an average of $9,346 per patient.”

Becker, 2007

Trzeciak, 2006

Median Hospital Charges

$0  $25,000  $50,000  $75,000  $100,000  $125,000  $150,000

Before EGDT With EGDT

39.2% reduction
The Joint Commission Recognizes the Value of EGDT

The Joint Commission’s Codman Award is presented for achievement in the use of process and outcomes measures to improve the quality and safety of care. The value of EGDT in Sepsis has been recognized in this award process.

**2007 AWARD WINNER: Christiana Care Health System (Delaware):**
Implementation of sepsis resuscitation and critical care management standards led to a 49.4% decrease in mortality rates (p < .0001), a 34% decrease in average length of hospital stay (p < .0002), and a 188.2% increase in the proportion of patients discharged to home (p < .0001).

**2008 AWARD WINNER: Carolinas Medical Center (North Carolina):**
Implementation of an EGDT protocol led to a 30% relative reduction in mortality of patients in the ED with suspected or confirmed sepsis.

### Potential Impact of EGDT - Example

<table>
<thead>
<tr>
<th>Hospital's Total Discharges per Year</th>
<th>Hospital Specific Data</th>
<th>20,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Number of Severe Sepsis Patients (based on 2.26% Incidence [Angus] – slide 3)</td>
<td>= Total Hospital Discharges per year x 2.26%</td>
<td>452</td>
</tr>
<tr>
<td>Estimated Severe Sepsis Patients Treated (based on 51.2% Compliance Rate(^1))</td>
<td>= Estimated Number of Severe Sepsis Patients x 51.2%</td>
<td>231</td>
</tr>
<tr>
<td>Potential Lives Saved (15.4% EGDT mortality based on 46% relative reduction in mortality rate of 28.6% [Rivers and others] – slides 11 &amp; 13)</td>
<td>= (Number of Treated Severe Sepsis patients x 28.6% - Number of Treated Severe patients x 15.4% EGDT mortality rate)</td>
<td>30</td>
</tr>
<tr>
<td>Potential Cost Reduction (based on 27% reduction [Shorr] – slide 12)</td>
<td>= Number of Treated Severe Sepsis patients x $5,882</td>
<td>$1,361,236</td>
</tr>
</tbody>
</table>

\(^1\)Nguyen, HB et al. Critical Care Medicine. 2007; 35:1105-1112
\(^2\)Angus, DC et al. Critical Care Medicine. 2003; 29:1303-1310
References


National Center for Health Statistics. Available at: www.cdc.gov/nchs/fastats/pneumonia.htm on 6/24/08.

Nguyen, HB et al., Implementation of a bundle of quality indicators for the early management of severe sepsis and septic shock is associated with decreased mortality, *Critical Care Medicine*. 2007; 35: 1105-1112


