Speed is Life: Rapid Source Control in Septic Shock

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Relationship of SIRS, Sepsis and Infection

- Infection
- Sepsis
  - Severe sepsis
  - Septic shock
- SIRS
  - Burns
  - Pancreatitis
  - Trauma
  - Post-pump syndrome
Sepsis and Septic Shock: An Intensivist’s Immunologic View

van der Poll T, van Deventer SJH. Infect Dis Clin N Am
Sepsis and Septic Shock: An Intensivist’s Immunologic View

Infection → SIRS → CARS → RECOVERY

Time

van der Poll T, van Deventer SJH. Infect Dis Clin N Am
Sepsis and Septic Shock: An ID/Microbiologic View

- Microbial load
- Toxic burden
- Inflammatory response
- Cellular dysfunction/tissue injury

TIME
Shock is a syndrome resulting from depression of many functions, but in which reduction of the effective circulating volume and blood pressure are of basic importance, and in which impairment of circulation steadily progresses until it eventuates in a state of irreversible circulatory failure.
The Golden Hour

• Traumatic/hemorrhagic shock
  – Address the source of hemorrhage

• Cardiogenic shock
  – Thrombolyse/angioplasty source of ischemia

• Obstructive shock
  – Thrombolyse/embolectomize source of obstruction
An Injury Paradigm of Septic Shock: The Golden Hours

- Microbial load
- Inflammatory response
- Toxic burden
- Cellular dysfunction/tissue injury

TIME

Shock Threshold

DEATH
• The speed of clearance of the microbial pathogen is **the critical determinant of outcome in septic shock**
An Injury Paradigm of Sepsis and Septic Shock

- Microbial load
- Inflammatory response
- Toxic burden
- Cellular dysfunction/tissue injury
- TIME

Antimicrobial therapy

Shock Threshold
An Injury Paradigm of Sepsis and Septic Shock

- Microbial load
- Inflammatory response
- Toxic burden
- Cellular dysfunction/tissue injury

TIME

earlier antimicrobial therapy

Shock Threshold
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Cumulative Initiation of Effective Antimicrobial Therapy and Survival in Septic Shock

### Mortality Risk with Increasing Delays in Initiation of Effective Antimicrobial Therapy

<table>
<thead>
<tr>
<th>Time (hrs)</th>
<th>Odds Ratio of Death (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1.99</td>
<td>1</td>
</tr>
<tr>
<td>2-2.99</td>
<td>1</td>
</tr>
<tr>
<td>3-3.99</td>
<td>1</td>
</tr>
<tr>
<td>4-4.99</td>
<td>1</td>
</tr>
<tr>
<td>5-5.99</td>
<td>1</td>
</tr>
<tr>
<td>6-8.99</td>
<td>1</td>
</tr>
<tr>
<td>9-11.99</td>
<td>1</td>
</tr>
<tr>
<td>12-23.99</td>
<td>1</td>
</tr>
<tr>
<td>24-35.99</td>
<td>1</td>
</tr>
<tr>
<td>&gt; 36</td>
<td>1</td>
</tr>
</tbody>
</table>

An Injury Paradigm of Sepsis and Septic Shock

- Microbial load
- Inflammatory response
- Toxic burden
- Cellular dysfunction/tissue injury

TIME

Antimicrobial therapy + Source control

Shock Threshold
Source control - introduction

Source control

Oldest part of the treatment of infections

« Ubi pus ibi evacua »

In 2012 most attention goes to

- Antibiotic therapy
- Adjuvant strategies
- Organ support

Role of source control

underappreciated
Source control: rationale

• Poor scientific basis
  ➔ No controlled randomized trials
  ➔ Evidence from descriptive studies with increased mortality in non operatively managed patients or in patients in who (surgical) source control could not be achieved or when it was delayed.
  ➔ Level 2b (at best)
Source control: rationale

Table 3. Mortality differences after relaparotomy for persisting abdominal sepsis according to the preoperative APACHE II score.

<table>
<thead>
<tr>
<th>APACHE II score</th>
<th>Relaparotomy ≤48 hr (%)</th>
<th>Relaparotomy &gt;48 hr (%)</th>
<th>Significance (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤10</td>
<td>0</td>
<td>25</td>
<td>0.09</td>
</tr>
<tr>
<td>11–15</td>
<td>0</td>
<td>33</td>
<td>0.02</td>
</tr>
<tr>
<td>16–20</td>
<td>0</td>
<td>78</td>
<td>0.002</td>
</tr>
<tr>
<td>21–25</td>
<td>57</td>
<td>100</td>
<td>0.02</td>
</tr>
<tr>
<td>≥26</td>
<td>79</td>
<td>94</td>
<td>0.2</td>
</tr>
<tr>
<td>Overall</td>
<td>28</td>
<td>77</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

## Source control: rationale

<table>
<thead>
<tr>
<th></th>
<th>OR</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failed clearance of abdomen</td>
<td>76.92</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Age</td>
<td>1.13</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Unconsciousness</td>
<td>11.76</td>
<td>0.013</td>
</tr>
</tbody>
</table>

### Mortality

<table>
<thead>
<tr>
<th>Source Control</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate source control</td>
<td>12/67</td>
</tr>
<tr>
<td>Delayed source control</td>
<td>9/21</td>
</tr>
<tr>
<td>No source control</td>
<td>8/8</td>
</tr>
</tbody>
</table>

Necrotizing Fasciitis Source Control and Survival

Wong et al, J Bone Jt Surg 2003
Clinical Infections in Septic Shock (n=2731)

- UTI 10.7%
- Other 5.3%
- Pneumonia 37.2%
- IAI 29.3%
- SST 7.2%
- BSI 4.4%
- CVC 3.7%
- Disseminated infection 2.2%

Kumar et al, CCM. 2006:34:1589-96.
90-Day survival and cumulative fraction receiving source control stratified by time to source control.
Mortality Risk with Increasing Delays in Implementation of Source Control in Septic Shock
Survival and Rapidity of Source Control

![Graph showing survival rates over different delays in source control with 2 categories: Community and Academic. The x-axis represents source control delay (hrs) ranging from 3 to 15, and the y-axis represents survival (%) ranging from 25 to 85. The graph shows data points for both categories with red diamonds for Community and yellow squares for Academic.]
Source Control Delays

- Stabilization?
- Convenience?
### Source Control/Antimicrobial Interaction and Survival in Septic Shock

<table>
<thead>
<tr>
<th>Source Control Initiation Post-Shock</th>
<th>Antimicrobial Initiation Post-Shock</th>
</tr>
</thead>
</table>
| < 6 h                               | < 3 h  
92% (n=75)  
70.3% (n=37)  
44.4% (n=63) |
| 6-24 h                              | 3-6 h  
80.0% (n=60)  
46.0% (n=50)  
19.0% (n=94) |
| > 24 h                              | > 6 h  
69.0% (n=29)  
36.0% (n=25)  
13.0% (n=100) |