Best Practice:
Severe Sepsis & Septic Shock

BEACON Multidisciplinary Collaborative Meeting
Ron Elkin MD
April 17, 2012
elkin.ron@gmail.com
What you need to know
Mortality Benefits of Early Goal-Directed Therapy

**STANDARD THERAPY**
Therapy at clinicians’ discretion, critical care consultation
- CVP ≥ 8 – 12 mm Hg
- MAP ≥ 65 mm Hg
- Urine output ≥ 0.5 ml/kg/hr

**EGDT**
Fluids at specified rate; pressors, inotropes, ventilation if needed
- CVP ≥ 8 – 12 mm Hg
- MAP ≥ 65 mm Hg
- Urine output ≥ 0.5 ml/kg/hr
- ScvO2 ≥ 70%

46%  30%
## Annual Burden
Severe Sepsis & Septic Shock

<table>
<thead>
<tr>
<th></th>
<th>USA</th>
<th>CPMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases</td>
<td>751k</td>
<td>600</td>
</tr>
<tr>
<td>Deaths</td>
<td>215k</td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td>$16.7 B</td>
<td></td>
</tr>
<tr>
<td>ICU (%)</td>
<td></td>
<td>50-66%</td>
</tr>
</tbody>
</table>
SSC Mortality - Admission Dx

N = 15022 (165 sites)

*p < 0.01 compared to site quarter 1

37% Jan 2005

30.8% Mar 2008
Sutter Health Mortality - ICD9
By Qtr 2008 - 2010

39.1%
30.4%
SSC Bundle Compliance

![Graph showing SSC Bundle Compliance over Site Quarters. The graph indicates a steady increase in compliance, with a particular focus on the 31.3% compliance rate highlighted.](image-url)
Why?
Improved Outcomes Associated With Early Resuscitation in Septic Shock: Do We Need to Resuscitate the Patient or the Physician?

Aileen Kirby and Brahm Goldstein (OHS)  
Pediatrics 2003; 112; 976
We Act Immediately!

• Troponin Elevation

• Acute Neurologic Deficits
A Curious Paralysis...

• Lactate elevation: shock
• Lactate elevation predicts...
  cost, LOS, MOF, mortality
• Lactate clearance predicts
  mortality benefit
  sepsis, circulatory dis, ICU population *(AJRCCM 2010)*
Lactate Elevation

- Report?
- Ignore?
- Rationalize?
- Observe for clinical deterioration?
- Hydrate & repeat?
- Base decision on other findings?

BP is OK
patient looks good
not septic
Evidence Stratification by Quality

EXPERT Opinion is...

• LOWEST
  USPSTF – Level III
  NHS – Level D
  “Clinical judgment...”
Effect of Clinical Judgment on Mortality in Severe Sepsis

**STANDARD THERAPY**
Therapy at clinicians’ discretion, critical care consultation
- CVP > 8 – 12 mm Hg
- MAP > 65 mm Hg
- Urine output > 0.5 ml/kg/hr

**EGDT**
Fluids at specified rate; pressors, inotropes, ventilation if needed
- CVP > 8 – 12 mm Hg
- MAP > 65 mm Hg
- Urine output > 0.5 ml/kg/hr
- ScvO2 > 70%
Pivotal downturn in ability to live independently
Clinical hubris
Diagnostic uncertainty
Regulatory apathy
Silo thinking
Unappreciated morbidity

CVP-line Avoidance Strategies
CVP-line Avoidance Strategy:

BP okay
BP

*poor* resuscitation trigger & goal
Mortality Risk of Nonsustained Hypotension

3 x

Sepsis: 10% v 3.6%  Marchik MR; Int Care Med 2009
All Comers: 8% v 3%  Jones AE; Chest 2006

Suggests ICU admission preferable
UNRELIABILITY of BP & HR to evaluate cardiac output...

- 61 ED trauma & 163 critically ill postop ICU pts
- BP maintained despite decreasing flow until compensatory mechanisms were overwhelmed

• Conclusion: Blood flow cannot be inferred from BP & HR until extreme hypotension occurs!
CRYPTIC SHOCK
MAP > 100, Lactate > 4 mMol/L (16% of pts)

Mortality %

- 0
- 10
- 20
- 30
- 40
- 50
- 60
- 70

Hosp 30 Day 60 Day

n = 23 n = 25

Standard EGDT
PROBLEMS WITH BLOOD PRESSURE

• Wrong goal
  macrocirculation
• Wrong limits
• Wrong methods
• Wrong A-line site

• Tissue perfusion
  microcirculation
• Individual guidelines
• Both sides; manual
• Femoral superior
Lactate: dehydration
Lactate:

kidney or liver disease
Blood lactate in critically ill patients with liver disease.

- Elevated only in shock: $BP < 90 + 2$ of:
  - oliguric, reduced skin perfusion, altered

- Elevation correlated with mortality
With whose currency are we gambling?
Fluid Challenge

Re-evaluate
Fluid Challenge for Elevated Troponin?
Fluid in EGDT Study

• To reach 6 hr CVP goal –
  1 to 11 L

• Fluid alone in correct amount –
  35% reached resuscitation goals

 65% did not!
Fear of Fluid
The Mother...
of Volume Overload Concerns

ESRD on HD

<table>
<thead>
<tr>
<th></th>
<th>STD</th>
<th>EGDT</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5%</td>
<td>5.2%</td>
<td></td>
</tr>
</tbody>
</table>

VENTILATED

50%  29%
MORTALITY in ESRD on HD

Mortality %

Hosp  30 Day  60 Day

Standard  EGDT
Mortality Risks

- Unresuscitated severe sepsis
  30 - 50%
- Fluid Overload
  ~ 0%
EGDT @ 10 Years

- 1 well designed RCT
- Numerous studies with benefit
- No harm or lack of benefit
- First proposed standard of care
- Criticisms - with little merit
Abstain from protocol? Please provide...

• Proof that it is ineffective,
  or

• Alternative protocol with equal or
greater mortality benefit.
DEFINITIONS

- **SEPSIS:** $\geq 2$ SIRS & infection
- **SEVERE SEPSIS:** add...
  organ dysfunction
- **SEPTIC SHOCK:** add...
  hypotension despite fluids
Conventional Screening

- Suspicion of infection? Not always
- > 2 SIRS? Not always
- Acute organ dysfunction? Always!
Improved Screening

• Suspicion of NEW infection? Y N

• Any (≥1) NEW SIRS? Y N

• Acute organ dysfunction? Y N

Notify MD for any Y
# Sepsis Screening

<table>
<thead>
<tr>
<th>SEPSIS SCREENING</th>
<th></th>
<th>Call MD or RRT for any Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Y</strong></td>
<td><strong>N</strong></td>
<td>Suspected or confirmed infection</td>
</tr>
<tr>
<td>2. <strong>Y</strong></td>
<td><strong>N</strong></td>
<td>ANY ≥ 1 new sign(s) of SIRS:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ T&gt;38°C or&lt;36°C □ HR&gt;90 □ RR&gt;20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ WBC &gt; 12K or &lt; 4K</td>
</tr>
<tr>
<td>3. <strong>Y</strong></td>
<td><strong>N</strong></td>
<td>NEW organ failure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ CNS - Unexplained acute ▲ in Mental Status</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ RESP - New sat &lt; 90% or ↑ FiO2 by &gt; 2LNC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ CV - SBP &lt; 90 or &gt; 40 mmHg below baseline</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ RENAL - ↑ Cr &gt; 0.5 or ↓ uo to 240 ml/8 hrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ PERFUSION - Skin mottling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ ENDOCRINE – Glucose &gt; 200 or &lt; 80 – x 3</td>
</tr>
</tbody>
</table>

RN Initial: _______ Time: _________
What you can do about it
Blood Pressure

- Both arms... once!
- Manual cuff
• Bedside assessment
• Lactate +
• Cultures, antibiotics, fluid
• **ICU transfer – lactate ≥ 4 or BP↓

As your patient’s advocate, are you satisfied?
THINK

as if you alone are responsible
SSC Bundle Compliance

31.3%
“A thick skin is a gift from God.”

Konrad Adenauer
Your Options

*without apology*

- Charge nurse
- Rapid response
- Nursing supervisor
- House officer
- Attending MD
- ICU MD
Fluid!

- 2 peripherals
- 2 L or 20-30 ml/kg in 1 hr
Cultures
Antibiotics
Transfer
- PULL!
Immediately...

- **Central Line - BP, lac > 4**
- Record CVP, ScvO2
- Individualize goals: VS, CVP, ScvO2
- Identify MD
- Visits Q30 min
- Orders
Immediately Report:

- Critical VS including...
- ScvO2, lactate
- Labs

Remote management
Drug Titrations...

q 20 — 30 min!
Immediate Huddle

RNs, MDs, ED, ICU, Floors

FIX it Now!
Intermountain v SSC Compliance

Bundle Compliance %

- 31.3%
- 85%

- p<0.01 compared to site quarter 1

* * * * * *
Intermountain v SSC
Mortality

37%

30.8%

9.7%
Intermountain Paradigm

- Break down barriers
- Empower Front Line
- Adopt Goals
- Align Incentives
- PDSA
CPMC
Projected Annual Savings

• 96 lives
• 2400 hosp days
• $22m in charges
Summary

- Urgent, lethal problem
- You are the front line
- Early recognition
- Look for *new organ failure*
- Early management
- Chain of command
ACKNOWLEDGEMENTS

• **MEDICAL STAFF:** ED, ICU, Dept. Of Medicine, Pulmonary Division, Committees (Executive Committee; QI for Medicine, Critical Care, & Hospital-Wide)
• **ADMINISTRATION:** Drs. Townsend, Knight, Flaum, Culver, Levin, Pont, C. Camenga, B. Tschai, P. Marshall
• **NURSING ADMINISTRATION:** D. Karner, K. Barnes, N. Hinojales, M. Blanchard, A. Bedenk, R. Symmons, C. Loffredi, T.J. Hoeft
• **LABORATORY:** R. Garcia-Kennedy, C. Owen Pleitz, D. Bowden, J. Schifffgens
• **NURSING:** M. Sullivan, M. Mattson, M. Murray
• **HIM:** P. Evans, G. Burgess