Sepsis in 2016: “Every Patient: Anytime, Anywhere”

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Disclosures

• Bard Medical Division—research funding to investigate temperature burden in patients with severe sepsis
• No other relevant sepsis-related disclosures
• Epidemiology of Sepsis
• A Case
• Need for Early Recognition:
  • SIRS, qSOFA, Lactate
• Modern Protocolized Care
• Conclusions
Epidemiology of Sepsis
Figure 2a: Incidence of Severe Sepsis by Method Over 6-year Period

1 95% CI < 1% of total for all data points and cannot be represented graphically.

STOPPING SEPSIS
Saving Lives in Pennsylvania

Gaieski et al. CCM, 2013
Figure 2b: In-hospital Case Fatality of Severe Sepsis by Method$^1$

1. 95% CI < 1%.
A Case: Initial Presentation
Case Vignette

• 54 year-old male w/ PMHx of HTN, PAF, HL
• Brought to ED by wife in private car
• Chief complaint: abdominal pain
  • Began 3 days ago after eating dinner
  • Stuttering since then
  • More severe/constant ≈ 6 hours before ED arrival
• 2 days of nausea
• 1 episode of vomiting 4 hours ago
• T=101.5°F, 4 hours prior, treated w/ APAP
• Registration: 11:10; Triage: 11:25
Case Vignette

• Allergies: NKDA
• Meds: ASA, metoprolol, amlodipine, statin
• Triage VS:
  • T°, 100.5° F
  • BP, 128/78 mm Hg
  • HR, 88 beats per minute
  • RR, 21 breaths per minute
  • O₂ sat, 96% on RA
  • Pain, 6/10
  • GCS: 15

• Triaged as ESI 3 patient—abdominal pain
• To waiting room along with 15 other patients
Challenge of sepsis patients

• This is a typical potential sepsis patient
  • Presumed infection (likely intra-abdominal process) + inflammatory response (fever, tachypnea)

• Challenge for clinicians:
  • How sick is he?
  • Does he have a time-sensitive infection?
  • How aggressive does his treatment need to be?

• On initial presentation:
  • no obvious signs of end organ dysfunction
  • Does not obviously have sepsis
  • What does this mean?
Need for Early Recognition
### Recognition

#### Emergency Department = 36

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<th>PT</th>
<th>Gender</th>
<th>Complaint</th>
<th>C</th>
<th>Age</th>
<th>BP</th>
<th>Temp</th>
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<td>20 Years</td>
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<td>Sr Thrt</td>
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<td>21 Years</td>
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<td>53 Years</td>
<td>147/97</td>
<td>97.9</td>
<td>65</td>
<td>14</td>
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**STOPPING SEPSIS**

Saving Lives in Pennsylvania
SIRS: Systemic Inflammatory Response Syndrome

- How helpful are the SIRS criteria?
87.9% SIRS-positive
12.1% SIRS-negative

Kaukonen et al. NEJM, 2015
qSOFA

• Proposed bedside screen for high risk patients
• Analyzes 3 organ systems without lab values
  • CNS, Pulmonary, Circulatory
• 3 criteria:
  • CNS: Altered mental status (GCS < 15)
  • Pulmonary: RR > 22
  • Circulatory: SBP < 100
• Mortality associated with criteria:
  • 0=<1%; 1=2-3%; 2=8%; 3=>20%
• If qSOFA ≥ 2 → high risk patient
  • overall mortality of 10%
  • Increased likelihood of spending ≥ 3 days in ICU
Our patient: No Protocol—1st Outcome

• 11:30: Patient waits to be seen
• 13:12: Treatment Room: Reassessment
• Repeat VS:
  • T°, 99.5° F
  • BP, 88/58 mm Hg
  • HR, 108 beats per minute
  • RR, 23 breaths per minute
  • O₂ sat, 93% on RA
  • Pain, 6/10
  • GCS: 14 (confused)

• Sepsis patients are dynamic, tenuous

STOPPING SEPSIS
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Our patient: Lactate Protocol

• Easily obtainable data to clarify urgency?
  • What if serum lactate is 1.4 mmol/L?
  • What if it is 4.1 mmol/L?
• How would this inform “safety of waiting in triage?”
• EMR algorithm utilizes CC + VS to generate an automatic order for a serum lactate
• 11:40: Drawn by EMT 10 minutes after triage
• Sent to the critical care laboratory for analysis
Utilizing Lactate

SIRS criteria and systolic blood pressure $\leq 90$ mm Hg or lactate $\geq 4$ mmol/liter

Rivers et al. NEJM, 2001
Mikkelsen et al. CCM, 2009
ED Lactate in Severe Sepsis

Normotensive

Mortality (%)

Lactate (mmol/L)

0-1.9  8.7
2-3.9  16.4
> 3.9  31.8

28-day Mortality

Mikkelsen et al. CCM, 2009
ED Lactate in Severe Sepsis

Hypotensive 28-day Mortality

Mikkelsen et al.  CCM, 2009
• 11:55: Lactate (15 min p sent) = 5.4 mmol/L
• Immediately transfer to a treatment room
  • Repeat VS: no significant change
• 12:04: 2 18 gauge IVs placed
• 13:04: 3 L NSS were infused in 1 hr
• 13:10: WBC = 16.5; HCO₃⁻ = 18; Tbili = 2.7; Alk phos = 235; AST/ALT 335/284; lipase 650
Patient Vignette: Lactate Protocol

• Bedside ultrasound:
  • Gallstones
  • GBWT
  • Dilated intrahepatic ducts

• Bedside ECHO:
  • Under-filled RV
  • > 50% IVC collapse

• 13:15: Repeat VS: BP 128/82; HR 84; RR 24

• No urine output
  • Continue IVF resuscitation, close monitoring

• Antibiotics ordered; surgery consulted

Adapt resuscitation strategy to your hospital’s resources and your setting (ED, ward, clinic)
Our patient: Inclusive Protocol

• 11:30: “Potential sepsis protocol patient”
  • “Sepsis Alert” activated
• 11:40: Placed in treatment room, met by “team”
  • Immediate evaluation and treatment
• Repeat VS: No significant change
• 11:50: IVs placed, labs drawn, exam complete, fluid bolus started and US performed
• 11:55: Lactate (POC device) = 5.4 mmol/L
Our patient: Inclusive Protocol

• 12:32: Bolus complete, Labs back, US done
• 12:35: Repeat VS
  • T°, 99.5° F
  • BP, 132/76 mm Hg
  • HR, 80 beats per minute
  • RR, 18 breaths per minute
  • O₂ sat, 96% on RA
  • Pain, 2/10
  • GCS: 15
• 12:45: Repeat lactate: 3.2mmol/L
• 13:55: Antibiotics complete; surgery consulted

SIRS qSOFA Criteria:
• 0 qSOFA points
Our patient: No Protocol—2nd Outcome

- 11:30: Patient waits to be seen
- 11:52: OHCA to Resuscitation Bay
- 12:18: Trauma Code to Resuscitation Bay
- 14:00: Wife informs triage nurse “husband is confused”
- 14:08: Taken by Wheelchair to Treatment Room
Our patient: No Protocol—2nd Outcome

- VS unstable
- $O_2$ sat 86% on RA $\rightarrow$ NRB placed
- IV placed $\rightarrow$ fluid bolus started
- Lactate: 8.7 mmol/L
- Increased confusion $\rightarrow$ RSI
- Sudden cardiovascular collapse:
  - PEA; no ROSC
  - Time of death: 15:13
Modern Resuscitation: from EGDT to ProCESS, ProMISe, ARISE
The ProCESS Investigators. NEJM, 2014
Figure 2. Kaplan–Meier Survival Estimates.

Adjusted hazard ratio, 0.94 (0.79–1.11); P=0.46
P=0.63 by log-rank test

No. at Risk

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Mouncey et al, ProMISe Trial Investigators. NEJM, 2015
A Survival

![Graph showing survival probability over days since randomization for EGDT and Usual care groups.](image)

<table>
<thead>
<tr>
<th>No. at Risk</th>
<th>Days since Randomization</th>
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<td>792 677 660 646</td>
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<tr>
<td>Usual care</td>
<td>796 670 657 646</td>
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</tbody>
</table>

ARISE

The ARISE Investigators. NEJM, 2015
Patient Vignette: Lactate Protocol

- 13:15: Vancomycin and Pip-Tazo ordered
  - 13:25: 1st antibiotic started 120 minutes after triage
- MAP: 55 mmHg
- A-line placed in L femoral artery
- CVC placed in the R IJ vein w/ US guidance
- Further fluid boluses
- Repeat lactate 14:30: 2.6 mmol/L
- After 4 L NSS was infused
  - Input: 4550cc; Output 20cc
  - Started on norepinephrine

Gaieski et al. CCM, 2010
Kumar et al. CCM, 2005
Case Conclusion

- Evaluated by ESS
- Went to IR for a percutaneous drain
- E. coli in blood cultures and drainage fluid
- On NE and DOBUT for 3 days
- Clinically stabilized
- Delayed cholecystectomy
- Discharged in good condition on HD-17
  - Prevent post-sepsis neurocognitive decline
  - Prevent post-sepsis readmissions

Ortego et al. CCM, 2015
Goodwin et al. CCM, 2015
• Huge epidemiologic burden of sepsis
• Recognition: major hurdle
  • SIRS: Helpful but not infallible
  • Lactate: Screening tool and risk stratifier
  • qSOFA → Will it be helpful?
• Screen in ED, on wards for early recognition
• Recognize syndrome = start care without delay
• In 2016, “standard care” = a protocol that fits your institution’s resources
• Minimum care: ABCs, fluids, antibiotics, source control
• New definitions: new insights, new questions
• Complications of sepsis continue post-d/c
  • Post-discharge interventions to minimize neurocognitive decline
  • Follow up protocols to prevent readmission
• Details always changing
• Further research needed