Sepsis Wave II

Sepsis 2017: “What’s the problem? What’s the solution?”
Engaging Nurses in Sepsis Identification and Early Measures
Presenters

Gina Carbino, BSN, RN, CEN, CPEN, CCRN, PCCN, SANE-A

David Gaieski, MD
Sepsis 2017:
“What’s the problem?
What’s the solution?”

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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
Outline

• A Case
• Epidemiology of Sepsis
• Need for Early Recognition:
  – SIRS, Lactate, qSOFA
• Protocolized Care
• Conclusions
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

SIRS Criteria—1st Definition:
- 2 SIRS: T=100.5; RR=21

SIRS Criteria—2nd Definition:
- 1 SIRS: RR=21

qSOFA Criteria:
- 0 qSOFA points
Typical sepsis patient

• 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”—infection + organ dysfunction
• What does this mean?
• Why is this important?
Epidemiology of Sepsis
Why is this so Important?

- A patient a minute presents to a US ED
- 750,000 cases/yr of severe sepsis in USA
- 215,000 deaths/yr directly related to sepsis
- Tenth leading cause of death in USA
- Rate of sepsis cases is increasing faster than the population
- 37% of severe sepsis patients come through the ED

Wang et al. CCM. 2007
Angus et al. CCM. 2001
Underestimate?

- “Benchmarking the incidence and mortality of severe sepsis in the United States”
- NIS: Nationally representative sample
- 4 previously validated capture techniques (Angus, Wang, Dobrovskii, Martin)
- All utilize ICD 9 codes (+/- sepsis codes)
- Annual incidence and mortality from severe sepsis
Figure 2a: Incidence of Severe Sepsis by Method Over 6-year Period\(^1\)

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

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

1 95% CI < 1%.
New Definitions
Sepsis-3

• **Sepsis** is now defined as *life-threatening organ dysfunction caused by a dysregulated host response to infection*
  • No more SIRS!
  • No more Severe Sepsis!
  • Septic shock now requires administration of vasopressors AND lactate > 2 mmol/L
  • Usefulness still to be determined
Getting Started
<table>
<thead>
<tr>
<th>Time</th>
<th>UnAtt</th>
<th>PT</th>
<th>Gender</th>
<th>Complaint</th>
<th>C</th>
<th>Age</th>
<th>BP</th>
<th>Temp</th>
<th>Pulse</th>
<th>O2Set</th>
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<td>13:43</td>
<td>51</td>
<td></td>
<td>Male</td>
<td>N/A</td>
<td>2</td>
<td>56 Years</td>
<td>157/100</td>
<td>97.9</td>
<td>99</td>
<td>14</td>
<td>14</td>
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<tr>
<td>13:59</td>
<td>64</td>
<td></td>
<td>Male</td>
<td>CP</td>
<td>2</td>
<td>51 Years</td>
<td>153/90</td>
<td>96.4</td>
<td>108</td>
<td>98</td>
<td>14</td>
<td>14</td>
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<tr>
<td>14:22</td>
<td>10</td>
<td></td>
<td>Female</td>
<td>N/A</td>
<td>2</td>
<td>77 Years</td>
<td>197/89</td>
<td>96.4</td>
<td>87</td>
<td>14</td>
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</tr>
<tr>
<td>14:28</td>
<td>33</td>
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<td>Female</td>
<td>N/A</td>
<td>2</td>
<td>77 Years</td>
<td>128/49</td>
<td>98.1</td>
<td>81</td>
<td>14</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>15:27</td>
<td>17</td>
<td></td>
<td>Female</td>
<td>N/A</td>
<td>2</td>
<td>20 Years</td>
<td>128/77</td>
<td>98.8</td>
<td>72</td>
<td>99</td>
<td>14</td>
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</tr>
<tr>
<td>15:34</td>
<td>11</td>
<td></td>
<td>Female</td>
<td>N/A</td>
<td>2</td>
<td>21 Years</td>
<td>117/81</td>
<td>98.5</td>
<td>86</td>
<td>14</td>
<td>14</td>
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</tr>
<tr>
<td>12:55</td>
<td>163</td>
<td></td>
<td>Female</td>
<td>HyperG</td>
<td>3</td>
<td>57 Years</td>
<td>172/89</td>
<td>99.1</td>
<td>94</td>
<td>14</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>13:02</td>
<td>72</td>
<td></td>
<td>Female</td>
<td>N/A</td>
<td>3</td>
<td>18 Years</td>
<td>113/68</td>
<td>98.7</td>
<td>70</td>
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<td>14</td>
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<tr>
<td>15:20</td>
<td>23</td>
<td></td>
<td>Male</td>
<td>HA</td>
<td>3</td>
<td>59 Years</td>
<td>138/93</td>
<td>99.7</td>
<td>80</td>
<td>14</td>
<td>14</td>
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<td>15:41</td>
<td>5</td>
<td></td>
<td>Female</td>
<td>GYN</td>
<td>3</td>
<td>28 Years</td>
<td>117/81</td>
<td>101.6</td>
<td>105</td>
<td>14</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>15:44</td>
<td>1</td>
<td></td>
<td>Female</td>
<td>Dizzy</td>
<td>3</td>
<td>29 Years</td>
<td>135/99</td>
<td>96.8</td>
<td>82</td>
<td>14</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>14:52</td>
<td>54</td>
<td></td>
<td>Male</td>
<td>Pain, Back</td>
<td>4</td>
<td>53 Years</td>
<td>147/97</td>
<td>97.9</td>
<td>85</td>
<td>14</td>
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<td></td>
</tr>
</tbody>
</table>

Emergency Department = 36
Rapid Care = 4
Waiting Room
Need for Early Recognition

SIRS criteria and systolic blood pressure ≤ 90 mm Hg or lactate ≥ 4 mmol/liter
Systemic Inflammatory Response Syndrome (SIRS) Criteria
SIRS Criteria

• Criteria:
  – T < 96.8° F or > 100.4° F
  – HR > 90 beats/min
  – RR > 20 breaths/min
  – WBC < 4,000/mm³ > 12,000/mm³, or > 10% bands

Bone et al. Chest. 1992
SIRS, Severe Sepsis

- Historically => very sensitive; but not specific
- Shapiro => neither sensitive nor specific
- 3102 pts, suspect infection (blood Cx drawn)
  - 34% of severe sepsis pts didn’t meet SIRS criteria
  - 24% of septic shock pts didn’t meet SIRS criteria
- Need other methods

Shapiro et al. Ann EM. 2006
• 172 ICUs in Australia, New Zealand
• 109,663 severe sepsis patients
  – 87.9% SIRS-positive
  – 12.1% SIRS-negative
• “The need for two or more SIRS criteria…excluded one in eight otherwise similar patients with infection, organ failure, and substantial mortality…”

Kaukonen et al. NEJM. 2015
A Unadjusted Annual Mortality

- SIRS-positive sepsis
- SIRS-negative sepsis

Patients Who Died (%)

Kaukonen et al. NEJM. 2015
quick Sequential Organ Failure Assessment (qSOFA)
qSOFA

- SBP < 100 mmHg
- RR > 22 breaths per minute
- Change in mental status: GCS < 14
- In a large administrative dataset, AUC better than SIRS
- Mortality associated with criteria (0=<1%; 1=2-3%; 2=8%; 3=>20%)
- “Sepsis” meets ≥ 2 criteria, overall mortality of 10%, likelihood of ≥ 3 days in ICU
tqSOFA

<table>
<thead>
<tr>
<th>Age (yr)</th>
<th>Triage qSOFA&lt;2 (n=2337)</th>
<th>Triage qSOFA≥2 (n=508)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>53% (1243)</td>
<td>51% (261)</td>
<td>ns</td>
</tr>
<tr>
<td>Time to Antibiotics (min) (n=2796)</td>
<td>197 ± 162</td>
<td>125 ± 114</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Total IVF (mL) (n=2746)</td>
<td>2405 ± 1732</td>
<td>2750 ± 1857</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Mortality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In hospital (n=2845)</td>
<td>11.7% (273)</td>
<td>26.4% (134)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>28 days (n=2459)</td>
<td>15.2% (308)</td>
<td>36.6% (159)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>ICU Admission, (Y)</td>
<td>70.7% (1651)</td>
<td>78.2% (397)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Intubated (ED), (Y)</td>
<td>5.6% (130)</td>
<td>21.0% (106)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>ALI (SF ratio&lt;452), (Y)</td>
<td>53.6% (1252)</td>
<td>77.8% (395)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Vasopressor(s), (Y)</td>
<td>5.6% (131)</td>
<td>14.4% (73)</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

- tqSOFA≥2 for In-hospital mortality:
- Sens= 33%; Spec= 87%
- AUC, tqSOFA: 0.57 (95% CI: 0.55-0.59)

Gaieski et al. Unpublished data
qSOFA

<table>
<thead>
<tr>
<th>qSOFA&lt;2 (n=1478)</th>
<th>qSOFA&gt;=2 (n=1362)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>54.8 ± 17.7</td>
<td>60.0 ± 17.6</td>
</tr>
<tr>
<td>Male</td>
<td>54.3% (802)</td>
<td>51.4% (700)</td>
</tr>
<tr>
<td>Time to Antibiotics (min) (n=2791)</td>
<td>204 ± 167</td>
<td>162 ± 141</td>
</tr>
<tr>
<td>Total IVF (mL) (n=2763)</td>
<td>2172 ± 1524</td>
<td>2785 ± 1934</td>
</tr>
<tr>
<td>Mortality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In hospital (n=2840)</td>
<td>8.5% (126)</td>
<td>20.6% (280)</td>
</tr>
<tr>
<td>28 days (n=2457)</td>
<td>11.7% (150)</td>
<td>27.1% (316)</td>
</tr>
<tr>
<td>ICU Admission, (Y) (n=2840)</td>
<td>64.7% (956)</td>
<td>80.0% (1090)</td>
</tr>
<tr>
<td>Intubated (ED), (Y) (n=2830)</td>
<td>3.4% (50)</td>
<td>13.8% (187)</td>
</tr>
<tr>
<td>ALI (SF ratio&lt;452), (Y) (n=2839)</td>
<td>45.2% (668)</td>
<td>71.5% (974)</td>
</tr>
<tr>
<td>Vasopressor(s), (Y) (n=2839)</td>
<td>2.5% (37)</td>
<td>12.3% (167)</td>
</tr>
</tbody>
</table>

- qSOFA>=2 for In-hospital mortality:
- Sens= 70%; Spec= 56%
- AUC, qSOFA: 0.56 (95% CI: 0.55-0.57)

Gaieski et al. Unpublished data
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
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 (2 or more SIRS) 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
Lactate
Utilizing Lactate

SIRS criteria and systolic blood pressure ≤ 90 mm Hg or lactate ≥ 4 mmol/liter

Liver: Cori Cycle

PDH
Thiamine
• Hypothesis
  – Lactate measured on ED presentation is associated with mortality and risk stratifies severe sepsis patients INDEPENDENT of blood pressure
• 831/856 (97%) of admitted severe sepsis pts had lactate sent
  – Median lactate = 2.9 mmol/L
  – 28 day mortality: 22.7%
• Divided into:
  – Low: ≤ 2 mmol/L
  – Medium: > 2 to ≤ 3.9 mmol/L
  – High: ≥ 4 mmol/L
• Stratified to presence or absence of refractory hypotension

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

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

Mikkelsen et al. CCM. 2009
Our Case: Changing Severity
Our Patient: Lactate Protocol

• 11:55: Lactate (15 min p sent)= 5.4 mmol/L
• Immediate 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
• Vanco, Pip-Tazo, 1\textsuperscript{st}, 70 min post-triage
Patient Vignette: Lactate Protocol

- Continue volume resuscitation (I/O: 4550/20)
- Repeat Lactate: 3.2 mmol/L
- Repeat ECHO:
  - Decreased EF 45%; IVC collapse negligible
- MAP decreased to 55 mmHg
  - A-line, L FA; CVC R IJV under US guidance
  - Started on NE and Dobut
- Surgery consulted
Our patient: Inclusive Protocol

- 11:30: “Potential sepsis protocol patient”
  - “Sepsis Alert” activated
- 11:40: 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 Criteria—Either Definition:
- 0 SIRS points

qSOFA Criteria:
- 0 qSOFA points
Our patient:
No Protocol—2\textsuperscript{nd} 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 confused
- 14:08: Wheelchair to Treatment Room
Our patient:
No Protocol—2nd Outcome

• VS unstable
• O₂ sat 86% on RA → NRB placed
• IV placed → fluid bolus started
• Lactate: 8.7 mmol/L
• Increased confusion → RSI
• Sudden cardiovascular collapse:
  – PEA; no ROSC
  – Time of death: 15:13
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
Sepsis: Anytime, Anywhere, 2017

• Huge epidemiologic burden of sepsis
• Recognition: major hurdle
  – SIRS: Helpful but not infallible
  – Lactate: Screening tool and risk stratifier
  – qSOFA → Will it be helpful? ID sicker patients
• Screen in ED, on wards for early recognition
• Recognize syndrome => start care without delay
• In 2017, “standard care” => a protocol that fits your institution’s resources
Engaging Nurses in Sepsis Identification and Early Measures

authored by: Gina Carbino, BSN, RN, CEN, CPEN, CCRN, PCCN, SANE-A
COIs
Objective:

Identify effective strategies to engage nurses in sepsis identification and early measures
More than AIDs, breast, and bowel cancer COMBINED!
Greek For ......
SEPSIS CAN BE

**Bacterial:**
- *e. coli*
- *strep*
- *staph*

**Viral:**
- viral meningitis
- influenza

**Fungal:**
- *candida*
- *PCP*

**Parasitic:**
- *malaria*
- *giardia*
SEPTIC tank = build up of waste
Sepsis Teams

Who should be on the team?

- ED physician
- Triage nurse
- ED Nurse nurse
- Laboratory technician
- Pharmacist
- Admission/registration
- Additional team members may include:
  - Critical care medicine physician
  - ICU charge nurse
  - Infectious disease physician
Sepsis Coordinator

- The go to person in your shop on sepsis
- Serves as an in house expert on sepsis
- This person is a “sepsis” visual reminder to staff
- ROUNDING, ROUNDING, ROUNDING!
Building Templates and Protocols

• Access and download pre-made templates & make them your own or create your
• There is a ton of information
• Templates and algorithms can help make it manageable and less overwhelming

http://www.survivingsepsis.org/Resources/Pages/Protocols-and-Checklists.aspx

https://www.cdc.gov/sepsis/clinicaltools/
Screening for Sepsis

- Triage/ED
- Admission/Shift Assessment
- Interdisciplinary team rounding
- Rapid response team
Triage

- Protocol hanging in triage
- Clearly list out high risk patients
  - Immunocompromised, elderly, infants
- ESI 2 for patients with sepsis
- Triage “up” policy for sepsis
Sepsis Bundles
Badge Buddies

1) Measure lactate level.
2) Obtain blood cultures prior to administration of antibiotics.
3) Administer broad spectrum antibiotics.
4) Administer 30 ml/kg crystalloid for hypotension or lactate ≥4 mmol/L.

“Time of presentation” is defined as the time of triage in the emergency department or, if presenting from another care venue, from the earliest chart annotation consistent with all elements of severe sepsis or septic shock ascertained through chart review.

5) Apply vasopressors (for hypotension that does not respond to initial fluid resuscitation) to maintain a mean arterial pressure (MAP) ≥65 mm Hg.

6) In the event of persistent hypotension after initial fluid administration (MAP < 65 mm Hg) or if initial lactate was ≥4 mmol/L, re-assess volume status and tissue perfusion and document findings according to Table 1.

7) Re-measure lactate if initial lactate elevated.

Rounding

- Develops a personal connection with staff
- Visual reminder to screen, complete interventions, and document
- Provides an opportunity for staff to ask questions
- Provides an opportunity to ensure updated infographics and guidelines are displayed
- ROUND AS OFTEN AS POSSIBLE
Everyone loves infographics

Sepsis Binder

• Make sure it has a designated spot on every unit
• Make sure staff knows where it is located
• Place one on every unit
• Put all your organizations templates and sepsis guidelines in it
Chart

- Collect data
- Find out where your gaps are
- Find out what you are doing right
- Gather information for case reviews
Case Reviews

• Don’t just pick really bad patient outcome cases
  • Nurses want to know what they did right, too!
• Quarterly or monthly lunch and learns
  • Invite all department and disciplines
  • Helps understand patient flow and develop relationships
House Wide Education

- Inservices on sepsis, treatment protocols, & medications
  - Get pharmacy and nutrition involved
- Skills check off/competency for equipment
  - Invasive lines
  - Monitors
  - Titrating drips
  - Etc
Consistently Update

- Sepsis Binder
- Rounding
- Bright, consistent signage
- Templates
- Case reviews
Engaging Nurses in Sepsis Identification and Early Measures

Take Aways

• Sepsis Kills…. A LOT!

• Nurses are pivotal to early recognition of sepsis

• Clear, consistent signage displayed in triage, nurses desk, & physician dictation room

• Sepsis binder

• ROUND AS OFTEN AS POSSIBLE
“Never underestimate the power of a small group of committed people to change the world. In fact, it is the only thing that ever has”

–Margaret Mead
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References:

- McClellandMA. Early Identification and Treatment of Sepsis. Nursing Times; 2014
What's Next?

• Complete Sepsis Portal Activities

• Register for the May Webinar
  www.acep.org/equal

• Questions? Contact the E-QUAL team at
  equal@acep.org