AW Sepsis Update Orders Standardization

Updated
June 19, 2018

As we continue our journey toward becoming One Ascension Wisconsin, standardization of practices across the state is necessary to ensure the highest level of care is provided to all patients regardless of location.

Use of the standard problem-specific order sets is key to compliance with best practice standards.

We need providers to use the sepsis orders whenever possible. Please let us know if there are barriers.
Goals: Sepsis Care Standardization

• **Improve care for patients with sepsis & septic shock through**
  o Implementation of sepsis care protocols consistent with national guidelines
  o Use of Ascension WI standard order sets, leveraging phases of care in
    • ED
    • Inpatient
  o Implementation of Ascension-National source-specific recommendations for antibiotics & labs
    • Ensure appropriate source-specific antibiotic coverage & critical diagnostics
    • Minimize antimicrobial resistance

• **Provide efficient, goal-directed quality care though implementation of nursing clinical & patient pathways**
Sepsis Definitions

Sepsis: life-threatening organ dysfunction caused by a dysregulated host response to infection

“Presence of infection/concern for suspected infection with evidence of systemic inflammatory response or life-threatening organ dysfunction which can be characterized by an acute change of ≥ 2 points in the patient’s SOFA score”

SOFA score ≥ 2 associated with > 10% mortality risk

- qSOFA: Hypotension Systolic BP < 100 mmHg
  - Altered Mental Status
  - Tachypnea > 22/min

- qSOFA score: ≥ 2 criteria suggests a greater risk of poor outcome
  (comparing to STEMI 8.1% mortality risk)
Sepsis Definitions

Septic shock: “Sepsis characterized by unresponsive hypotension and lactic acidosis (serum lactate > 2 mmol/L) requiring vasopressor therapy to maintain MAP > 65 mmHg, despite adequate fluid resuscitation”
  o Mortality in this group > 40%

Sepsis & SIRS? (Systemic Inflammatory Response Syndrome)
• “Nonspecific SIRS criteria such as pyrexia or neutrophilia will continue to aid in the general diagnosis of infection
• However, SIRS may simply reflect an appropriate host response that is frequently adaptive
• Sepsis involves organ dysfunction, indicating a pathobiology more complex than infection plus an accompanying inflammatory response alone” (“severe sepsis” no longer part of the sepsis consensus definitions/although still part of CMS core measure definitions)
Lay Definitions of Sepsis

Sepsis: “A life-threatening condition that arises when the body’s response to infection injures its own tissues”

How do we screen for sepsis?

• “There are, as yet, no simple and unambiguous clinical criteria or biological, imaging, or laboratory features that uniquely identify a septic patient
• Neither qSOFA nor SOFA is intended to be a stand-alone definition of sepsis *(they are an indication of mortality risk)*
• The task force wishes to stress that SIRS criteria may still remain useful for the identification of infection”
Evidence & Quality Metrics

CMS Sepsis Core Measures (SEP-1)

Opportunities to improve core-measure compliance

- SEP-1 contains 63 interventions for completion within 3 & 6 hr. timeframes
- National average of compliance approximately 50% (meeting all measures for patients)
  - AW sites are at, above & below this national target, and most below the AW target of 60%
Key to Treating Sepsis Effectively: **Early Identification**

(most patients present via the ED)

- **Screening for sepsis: Do you suspect infection?**

- **Suspicion of infection is key to the start of successful care delivery**
  - Be suspicious: Hard to predict the future, MD can do final assessment
  - Presenting problems can be unclear & masquerade as other problems. Examples of presenting complaints
    - Abdominal pain: Might only be abdominal issues, but be alert for perforated bowel, ischemic gut or c. difficile (have resulted in fatal sepsis)
    - Altered mental status / unresponsive / PNB: Many sepsis patients present only with this initial complaint
    - Dialysis patients: Unless clear alternate cause like missed dialysis, be suspicious of possible line infection
    - Difficulty breathing: Could be pneumonia, influenza or symptom of multi-system involvement
    - Falls: Why did they fall? Elderly don’t always show signs of UTI, fall could be the presenting complaint
    - Fever / chills / rigors: Present in many cases of sepsis & definitely alert to an infection
    - Nausea / vomiting / diarrhea: Might not be sepsis, but some present with these vague complaints attributed to other causes
    - Syncope: Might be cardiac, but because of dehydration could be related to sepsis
    - **Obvious infections can cause sepsis / systemic involvement:**
      - Pneumonia
      - UTI / Urinary obstruction
      - Meningitis: Suspicion of bacterial meningitis is critical concern
      - Wounds (diabetic, chronic ulcers, necrotizing fasciitis)

---

1. We recommend that hospitals and hospital systems have a performance improvement program for sepsis, including sepsis screening for acutely ill, high-risk patients (BPS).

2. Notably, sepsis screening has been associated with decreased mortality in several studies.
Suspicion of Infection

**Overwhelming?**
- Everyone doesn't have sepsis
- But, you need to be alert to those who might
- **Key screening insights**
  - Always be alert that sepsis might be present with an infection
  - Always be alert that new organ dysfunction might be caused by sepsis

**What can make it easier?**
- Targeted screening & auto-alerts
- EPIC - Inpatient: “Best-Practice Alerts”
- Cerner: Sepsis “Discern Alerts”
Cerner: Discern Notifications

Notify the physician if alerted & concern for infection (or other pt. concerns)

- Alerts will fire to any nurse who has a relationship assigned
  - RN completes screening tool
  - Notify MD if sepsis screen is positive or other pt. concerns

- Note: In the ED, the Sepsis Alert fires to the tracking board
  - Provider completes sepsis screening tool
Cerner: Sepsis Screening Tool

- If no infection suspected: sign & done unless other patient concerns
- If infection suspected: When box checked, most vitals & labs pre-populate, as well as electronic guess of screening result.
  - Change any criteria with which you disagree
  - Document name of provider notified / notify of any positive screen
  - Screening should be done within 15"
Don’t have access to an electronic Sepsis Screening tool? Here is a paper example

Sepsis-induced organ dysfunction may be occult;
• therefore, its presence should be considered in any patient presenting with infection
• Conversely, unrecognized infection may be the cause of new-onset organ dysfunction.
• Any unexplained organ dysfunction should thus raise the possibility of underlying infection.¹

When in doubt: Screen the patient & notify the provider

---

<table>
<thead>
<tr>
<th>Sepsis Screening Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Infection: Is the patient’s history suggestive of a new infection?</td>
</tr>
<tr>
<td>□ Pneumonia, empyema</td>
</tr>
<tr>
<td>□ Urinary tract infection</td>
</tr>
<tr>
<td>□ Acute abdominal infection</td>
</tr>
<tr>
<td>□ Bone/joint infection</td>
</tr>
<tr>
<td>□ Wound infection</td>
</tr>
<tr>
<td>□ Endocarditis</td>
</tr>
<tr>
<td>□ Skin/soft tissue infection</td>
</tr>
<tr>
<td>□ Meningitis</td>
</tr>
<tr>
<td>□ Other: __________________________</td>
</tr>
</tbody>
</table>

| 2. SIRS Criteria (Systemic Inflammatory Response Syndrome Criteria): Are any of the following signs & symptoms of infection both present and new to the patient? Note: Laboratory values may have been obtained for inpatients but may not be available pre-hospital |
| □ Hypertension ≥ 120 mm Hg or Mean Arterial Pressure (MAP) < 65 mm Hg |
| □ Tachycardia > 90 bpm |
| □ Hyperthermia ≥ 38°C (100.4°F) |
| □ Leukocytosis (WBC > 12,000/mL) |
| □ Leukopenia (WBC < 4000/mL) |
| □ Tachypnea > 20 b/min |
| □ Tachycardia > 90 b/min |
| □ PaCO₂ > 32 mm Hg |
| □ PaO₂/FiO₂ < 300 |
| □ Platelet count < 100,000 |
| □ Coagulopathy (INR > 1.5 or aPTT > 60 sec) for patients not on warfarin |
| □ Lactate > 2 mmol/L |
| □ qSOFA score = Suspected Infection: 2 Tachycardia >22/min, Systolic BP > 100 mmHg, Altered Mental Status (qSOFA > 2 reflects increased mortality risk) |
| □ Yes No |

3. Signs of Organ Dysfunction: Are any of the following organ dysfunction criteria present (excluding chronic conditions): |
| □ Dystolic BP < 50 mm Hg or Mean Arterial Pressure (MAP) < 65 mm Hg |
| □ Dystolic BP decrease > 20 mm Hg from baseline |
| □ Acute respiratory failure (new non-invasive ventilation [BIPAP], invasive ventilation) |
| □ Creatinine > 2 mg/dL or Urine Output < 0.5 mL/kg/hour for > 2 hours |
| □ Bilirubin > 2 mg/dL |
| □ Platelet count < 100,000 |
| □ Coagulopathy (INR > 1.5 or aPTT > 60 sec) for patients not on warfarin |
| □ Lactate > 2 mmol/L |
| □ qSOFA score = Suspected Infection: 2 Tachycardia >22/min, Systolic BP > 100 mmHg, Altered Mental Status (qSOFA > 2 reflects increased mortality risk) |
| □ Yes No |

4. Screening Completed by __________________________ |
Date __________ Time ________ (screening completed) |
| □ RN □ MD |

5. Physician: Date __________ Time ________ Signature __________________________ |

Sepsis Screening Tool by ASCENSION
Sepsis Resuscitation 3-hr. Targets

SEPSIS PATHWAY
ENDPOINTS / TARGETS FOR RESUSCITATION
3 & 6 HOUR TARGETS (version 1 4/9/18)

START (Time) ________ (ED/Sepsis triage time or time symptoms evident)
Search for source, source control, antibiotics, volume resuscitation

3-Hour Goal Time ________
6-Hour Goal Time ________

Resuscitation Bundle: 3-Hour Bundle Goal
To be accomplished within an hour if possible, but at least within 3 hours

<table>
<thead>
<tr>
<th>Time Met</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Serum lactate: Measured</td>
</tr>
<tr>
<td></td>
<td>Blood cultures: Obtained prior to antibiotic administration.</td>
</tr>
<tr>
<td></td>
<td>Antibiotics: Broad-spectrum antibiotics administered within 1 hour if possible (at least within 3 hrs.)</td>
</tr>
<tr>
<td></td>
<td>Fluids (for any hypotension or lactate ( \geq 4 \text{ mmol/L} )): Deliver an initial minimum of 30 mL/kg of crystalloid.</td>
</tr>
</tbody>
</table>

**Consider RRT/transfer for non-ICU patients not responding to 3-hr. bundle**
Sepsis Resuscitation 6-hr. Targets

<table>
<thead>
<tr>
<th>Time Met</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Re-measure lactate if initial lactate elevated (&gt; 2 mmol/L)</strong></td>
</tr>
<tr>
<td></td>
<td><em>(Below Interventions done in ED or ICU)</em></td>
</tr>
<tr>
<td></td>
<td><strong>Vasopressors</strong> For hypotension not responding to initial fluid resuscitation *(30 ml/kg within 3 hrs.) to maintain mean arterial pressure <em>(MAP)</em> &gt; 65 and SBP &gt; 90 mm Hg. <em>(Remaining interventions done in ED or ICU)</em></td>
</tr>
<tr>
<td></td>
<td>For persistent hypotension after fluids <em>(30 mL/kg)</em> OR lactate &gt; 4 mmol/L</td>
</tr>
<tr>
<td></td>
<td>reassess volume status and tissue perfusion by using one of the following strategies</td>
</tr>
<tr>
<td></td>
<td><strong>Strategy A</strong>: Repeat focused exam <em>(after initial fluid resuscitation)</em> by licensed independent practitioner (MD/Nurse Practitioner) including vital signs, cardiopulmonary, capillary refill, pulse, and skin findings. Use structured documentation template where available</td>
</tr>
<tr>
<td></td>
<td><strong>OR</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Strategy B</strong>: Reassessment using two of the following</td>
</tr>
<tr>
<td></td>
<td>Measure CVP <em>(goal 8-12 mmHg / fluids)</em></td>
</tr>
<tr>
<td></td>
<td>Measure ScvO2 <em>(goal &gt; 70%)</em></td>
</tr>
<tr>
<td></td>
<td>Bedside cardiovascular ultrasound</td>
</tr>
<tr>
<td></td>
<td>Dynamic assessment of fluid responsiveness with passive leg raise or fluid challenge</td>
</tr>
</tbody>
</table>

*Refer to Sepsis Guidelines for complete information [http://survivingsepsis.org/Guidelines/Pages/default.aspx](http://survivingsepsis.org/Guidelines/Pages/default.aspx)*
Infection Source-Specific Antibiotic Recommendations

• Developed at national level & reviewed in Wisconsin by Infectious Disease Physician & Pharmacy Experts
  o They looked at our local antibiotic resistance patterns, and modified national recommendations if necessary

• What you need to know about the antibiotic categories?
  o If your patient is being treated for one of the conditions, and is on different antibiotics, consult with your pharmacist & provider to ensure no treatment gaps

  o We should ask if patients still need antibiotics every day (part of rounds or MD communication)

  ❑ Example: Patient is being treated for possible MRSA sepsis
  The cultures come back, no MRSA
  Contact provider and/or pharmacy to see if full range of antibiotics are still needed
  Keeping unnecessary antibiotics: Adds resistance risk, complications risk & unnecessary costs
Pneumonia

1. Community-acquired pneumonia

2. Community-acquired pneumonia: MRSA risk factors (necrotizing pneumonia, recurrent MRSA infections, post-Influenza infection, recipient of IV antibiotics in the previous 90 days)

3. HAP/HCAP/VAP (Hospital-acquired pneumonia / Healthcare-associated pneumonia / ventilator-associated pneumonia)

4. HAP/HCAP/VAP- MRSA risk factors (necrotizing pneumonia, recurrent MRSA infections, post-Influenza infection, recipient of IV antibiotics in the previous 90 days, 10-20% Staphylococcus at institution are MRSA)

5. HAP/HCAP/VAP- high risk of MDROs

6. HAP/HCAP/VAP- high risk of MDROs AND MRSA (necrotizing pneumonia, recurrent MRSA infections, post-Influenza infection, recipient of IV antibiotics in the previous 90 days, 10-20% Staphylococcus at institution are MRSA)
NEW: Ascension National & Ascension WI
Source-specific antimicrobial guidelines - Categories

**Urinary Source**
- 7. Acute Pyelonephritis-low risk for MDROs (if in Septic Shock, use high risk)*
- 8. Acute Pyelonephritis-high risk for MDROs or in Septic Shock*

**Febrile Neutropenia**
- 9. (only one category)

**Meningitis**
- 10. Immunocompetent
- 11. Immunocompromised

**Unknown Source**
- 12. (only one category)
NEW: Ascension National & Ascension WI
Source-specific antimicrobial guidelines: Categories

**Intra-Abdominal Source**
13. Mild/Moderate community onset
15. Healthcare-associated with surgical wound infection

**Intra-Abdominal Source** (including biliary)

**Skin/Soft Tissue**
16. Non-diabetic cellulitis [**MRSA risk factors include**: cellulitis associated with penetrating trauma, history of MRSA infection/colonization, active injection drug user, residence in a crowded living condition (e.g. homeless, military, incarceration), male with a history of having sex with men, skin infection with poor response to beta lactam antibiotics, patient report of a “spider bite”]
17. Diabetic/Severe Sepsis/Septic Shock/Necrotizing Infection
Cellulitis Guidelines*

Ascension National also working on implementation of cellulitis recommendations/order sets (non-sepsis cellulitis)

Watch for a future Ascension order set for cellulitis
Antibiotics

We know that time to antibiotics (after a blood culture) is the intervention most associated to improved mortality

- Patients who require surgical intervention (source control) – obviously need that early to survive (e.g. perforated bowel, urinary obstruction, infected line, etc.)

- But, when there are multiple antibiotics: Which do you give first?
  - Most logical answer: The antibiotic you have available now
  - If you have enough IV access sites: You can give antibiotics simultaneously
  - If you have limited IV access sites
    - Give the broad-spectrum antibiotic FIRST
    - Which is the broad-spectrum?
      - See attached “give first” reference (added to MAR when possible)
      - In general though, more common broad spectrum are
        - Cefepime
        - Ceftriaxone
        - Levofloxacin
        - Meropenem
        - Pip/Tazo (Zosyn)
  - Some antibiotics can be given IV push which can expedite antibiotic administration
“Give First” Antibiotics

- When access is limited & you have more than one antibiotic available
- See attached documents (sample below / broad-spectrum are highlighted)

<table>
<thead>
<tr>
<th>Suspected Infection Source</th>
<th>Options</th>
<th>Suspected Infection Factor</th>
<th>Recommendations: Antibiotics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Community-acquired pneumonia</td>
<td>Option A: Ceftriaxone 2g IV q24hr PLUS Azithromycin 500mg IV/PO q24hr</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1</td>
<td>Community-acquired pneumonia</td>
<td>Option B: Ceftriaxone 2g IV q24hr PLUS Doxycycline 100mg IV/PO q12hr</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Option C: <strong>Levofloxacin</strong> 750mg IV/PO q24hr (for confirmed penicillin and cephalosporin allergy)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Community-acquired pneumonia- MRSA risk factors (necrotizing pneumonia, recurrent MRSA infections, post-Influenza infection, recipient of IV antibiotics in the previous 90 days)</td>
<td>Option A: Ceftriaxone 2g IV q24hr PLUS Azithromycin 500mg IV q24hr PLUS Pharmacy-to-dose vancomycin (per institution or system protocol)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td>Option B: Ceftriaxone 2g IV q24hr PLUS Doxycycline 100mg IV q12hr PLUS Pharmacy-to-dose vancomycin (per institution or system protocol)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Option C: <strong>Levofloxacin</strong> 750mg IV q24hr (for confirmed penicillin and cephalosporin allergy) PLUS Pharmacy-to-dose vancomycin (per institution or system protocol)</td>
</tr>
</tbody>
</table>
Fluid Resuscitation: “Time is Tissue” (Normosol) Surviving Sepsis Guideline Recommendations

- Crystalloids are recommended for initial fluid resuscitation 30 mL/kg to be COMPLETED within the first 3 hrs.
- Fluid choices on sepsis orders
  - Normosol (Plasma-Lyte)
  - Lactated Ringers
  - Normal Saline

Pharmacy recommended to reserve use of 0.9% NaCl resuscitation for cases of severe hypochloremia or alkalosis. (see end for additional references)

One before-after study in all ICU patients suggested increased rates of acute kidney injury and RRT in patients managed with a chloride-liberal strategy compared to a chloride-restrictive strategy 3

Evidence from a network meta-analysis suggesting improved outcome with balanced salt solutions as compared to saline in patients with sepsis 3

<table>
<thead>
<tr>
<th>Sodium (mEq/L)</th>
<th>Normosol / Euxobic</th>
<th>Normal Saline (NS)</th>
<th>Lactated Ringers (LR)</th>
<th>Plasmalyte, Normosol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na+</td>
<td>135-145</td>
<td>154</td>
<td>130</td>
<td>140</td>
</tr>
<tr>
<td>Potassium (mEq/L)</td>
<td>3.5-5</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Calcium (mg/dL)</td>
<td>8.4-10.2</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnesium (mg/dL)</td>
<td>1.5-2.3</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chloride (mEq/L)</td>
<td>98-106</td>
<td>154</td>
<td>109</td>
<td>98</td>
</tr>
<tr>
<td>Lactate (mEq/L)</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetate (mEq/L)</td>
<td></td>
<td>27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gluconate (mEq/L)</td>
<td></td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osmolality (mOsm/L)</td>
<td>285</td>
<td>308</td>
<td>274</td>
<td>295</td>
</tr>
<tr>
<td>Strong Ion Difference (SID)</td>
<td>0</td>
<td>28</td>
<td>49</td>
<td></td>
</tr>
</tbody>
</table>

If hypotensive or lactate > 4 mmol/L
How much fluid is enough for resuscitation

Risks for both under & over resuscitating the patient

• Use a strategy for assessing volume responsiveness

ACEP DART Tool Recommendations

- Prioritize immediate fluid resuscitation.
- Recommended fluid volume in first hour: 30mL/kg.
- A history of heart failure, liver failure, or renal failure is not a contraindication to fluid resuscitation.

Under and over-resuscitation of fluid is an important concern in fluid management

Bellamy Curve

- Hypoperfusion
- Organ dysfunction
- Adverse outcome
- Edema
- Organ dysfunction
- Adverse outcome

Optimal

Hypovolemic

Volume load

Overload
CMS SEP-1 Core Measure to Assess Volume Responsiveness Septic Shock

**Strategy A:** Repeat focused exam of “tissues perfusion” by licensed independent practitioner (this assessment is missed frequently) Notify provider when 30 mL/kg has infused

**Alternate Strategy (in ED/ICU):** Assess two of the following
- Measure CVP
- Measure ScvO₂ (saturation of central venous oxygen)
- Bedside cardiovascular ultrasound
  - cIVC - percentage collapsibility of the IVC
  - Mechanically ventilated patients dIVC / distensibility index
- Dynamic assessment of fluid responsiveness with passive leg raise (PLR) or fluid challenge (can be measured as non-invasive or minimally invasive stroke volume)
  - Stroke volume measured at baseline with HOB elevation
  - PLR: Raise both legs to 45° for 1-2 min
    - Δ SV >10% confirms patient is likely to respond to fluid
    - Δ SV <10% suggests patient is unlikely to respond to fluid
How do you scan/sign off 30 mL/kg fluid when bolus is more than one liter?

• Possible solution (see Cerner example attached)

• Follow your normal scanning processes as they exist today (scanning patient, fluid)
  o Scan all bags of fluid included in the 30 mL/kg fluid bolus
  o Address/justify dose overage/under-dose per your usual practices
  o Keep all crystalloid bags scanned as part of the bolus with the patient and administer as prescribed
    ☐ Rate no less than 15 mL/kg/hr.
    ☐ Goal to get entire 30 mL/kg bolus in within 3 hrs.
      • (ED triage time although imperfect, is the easiest way to communicate clock “start time”)
      • (Developed sepsis after in hospital - Other times to use for start time: Sepsis auto-alert? Time blood cultures were ordered? Time temp spiked or other symptoms noted?)
Guideline recommendations (ED/ICU)

- Norepinephrine: First-choice vasopressor
  - Add vasopressin (up to 0.03 U/min – constant rate) to decrease norepinephrine dosage or
  - Epinephrine to norepinephrine
  - with the intent of raising MAP to target

- Vasopressor dosing should be titrated to an end point reflecting perfusion, and the agent reduced or discontinued in the face of worsening hypotension or arrhythmias

See additional vasopressin information in the reference slides
Revised Order Sets

EPIC

• IP Sepsis/Septic Shock Admission
• ED Sepsis/Septic Shock

CERNER

• ED Sepsis Treatment
  (related subphases: Work-up, Imaging, Labs, Central line)
• Sepsis Admission
  (related subphases: Work-up, ICU subphases – shock, flotrac

Notes:
• Orders appear more streamlined in the live E.H.R. environment, i.e. collapsible order sections (Epic) & subphases (Cerner)
• Sample Epic screen print available at the end of the document/reference section
Sepsis Order Sets (Northern Areas)

**PAPER SEPSIS ORDERS**
- Available to sites by 6/20/18

**Electronic E.H.R. Build**
- Currently in build state
- Coming soon
- Goal implementation by June 30th, 2018
Future Direction / Electronic Alerts

**Epic**

**ED**
- Piloting sepsis workflow opportunities at St. Francis Hospital
- Working on Epic workflow enhancements for ED electronic alerts

**Inpatient**
- Automated Best Practice Sepsis Alerts to the nurse & physician notification continue

**Cerner**

**ED**
- Automated Sepsis Alerts firing to the ED tracking board continues
- Sepsis Screening Tool completion by the provider continues

**Inpatient**
- Automated Sepsis Discern alerts firing to the nurse continues
- Nurse notification within 15” to the Physician & completion of the Sepsis Screening tool continues
Future updates to the Orders

• Epic sites
  o New lab order requested for ScvO₂ (saturation of central venous oxygen)

• Evaluate with next review (expected in ~2-3 months) if we need to separate out orders for shock

• Evaluate pre-checks of normosol (alternate brand Plasmsa-Lyte) once stock is readily available
**ScvO₂: what is it? (ICU staff)**

- **ScvO₂**: Saturation of central venous oxygen
  - Saturation (blood gas syringe) drawn off of a *central line* (from subclavian, internal jugular or PICC line)
  - Affected by cardiac output, hemoglobin, oxygenation, and oxygen consumption,
  - It is *different* than a mixed venous saturation
    - Mixed venous saturation SvO₂ is drawn from a *pulmonary artery catheter*
  - Normal values
    - ScvO₂ > 70% (Values in high 80’s mortality risk)
    - SvO₂ 60-80 %
    - Difference can vary up to 18% in shock states
      (but 90% of the time are within 7%, ScvO₂ being higher)

- Order for continuous ScvO₂ monitoring will be added for those few sites with access to this catheter when the new lab is available in Epic
Performance Improvement

• Our team will continue to monitor performance data, look for workflow efficiencies & aim to provided the best quality care & outcomes for our patients with sepsis.

• Performance data will be shared when possible at ED, Critical Care & (local) Sepsis Committees to help us strive for continuous improvement.
Clinical Pathways
Patient Pathways

• A clinical pathway has been created and will be used to ensure that the patient’s recovery is progressing well and that any barriers are identified and addressed.
  o Sepsis Pathway will be the 3-hr. & 6-hr. Resuscitation Targets

• A patient care pathway will be given to the patient and their support person to keep them informed and engaged in their recovery
  o Since the most critical sepsis care occurs during the first 6 hrs., a time when patient unlikely to interact with the pathway document
    Sepsis Patient Education document will be in lieu of the patient pathway
Under the guidance of an Ascension WI Steering Committee, a multidisciplinary team consisting of a provider, pharmacist, and clinical nurse specialist were brought together to review best practices in the Management of Sepsis. This team also reviewed all order sets and made recommendations for standardization.
Review: Key Take away
(Screening for Sepsis, Clinical Pathway & Patient Pathway)

<table>
<thead>
<tr>
<th>Sepsis Screening Tool (Version 1.5.20.18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Infection: Is the patient’s history suggestive of a new infection?</td>
</tr>
<tr>
<td>- Pneumonia, empyema</td>
</tr>
<tr>
<td>- Bone/joint infection</td>
</tr>
<tr>
<td>- Urinary tract infection</td>
</tr>
<tr>
<td>- Wound infection</td>
</tr>
<tr>
<td>- Bloodstream catheter infection</td>
</tr>
<tr>
<td>- Acute abdominal infection</td>
</tr>
<tr>
<td>- Endocarditis</td>
</tr>
<tr>
<td>- Skin/tissue infection</td>
</tr>
<tr>
<td>- Meningitis</td>
</tr>
<tr>
<td>- Other</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SIRS Criteria (Systemic Inflammatory Response Syndrome Criteria): Are any of the following signs &amp; symptoms of infection both present and new to the patient?</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Hypothermia &gt; 36°C (96.8°F)</td>
</tr>
<tr>
<td>- Leukopenia</td>
</tr>
<tr>
<td>- Leukocytosis</td>
</tr>
<tr>
<td>- Hypotension &lt; 90 mm Hg (WBC &lt; 4000/mm³)</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Signs of Organ Dysfunction: Are any of the following organ dysfunction criteria present?</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Acute respiratory failure (new non-invasive ventilation)</td>
</tr>
<tr>
<td>- Acute renal failure</td>
</tr>
<tr>
<td>- Coagulopathy (INR &gt; 1.5 or aPTT &gt; 60 sec) for patients not on warfarin</td>
</tr>
<tr>
<td>- Lactate &gt;2 mmol/L</td>
</tr>
</tbody>
</table>

### Resuscitation Bundle: 3-Hour Bundle Goal

<table>
<thead>
<tr>
<th>Time Met</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Blood cultures: Obtained prior to antibiotic administration</td>
</tr>
<tr>
<td></td>
<td>Antibiotics: Broad-spectrum antibiotics administered within 1 hour if possible (at least within 3 hrs)</td>
</tr>
<tr>
<td></td>
<td>Fluids for any hypotension or lactate &gt; 4 mmol/L: Delivered an initial minimum of 30 mL/kg of crystalline</td>
</tr>
</tbody>
</table>

**Consider RRT/transfer for non-ICU patients not responding to 3-hr. bundle**

### Resuscitation Bundle: 6-Hour Bundle Goal

<table>
<thead>
<tr>
<th>Time Met</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**For persistent hypotension after fluids (30 mL/kg) or lactate > 4 mmol/L with volume status and tissue perfusion by using one of the following strategies**

#### Strategy A: Repeat focused exam (after initial fluid resuscitation) by licensed independent practitioner (nurse practitioner) including vital signs, capillary refill, pulse, and skin findings. Use structured documentation template where available.

#### OR

#### Strategy B: Reassessment using two of the following measures:

- MAP (90-110 mmHg; <3 fluids)
- ScvO2 (goal >70%)
- Bedside cardiovascular ultrasound
- Dynamic assessment of fluid responsiveness with passive leg raise or fluid challenge

---

**Sepsis and Your Hospital Stay**

Sepsis is a whole body response to an infection. The source of infection can be easy or hard to find. Common symptoms are: fast heart beats, rapid or labored breathing, fever, confusion, sleepiness, dehydration, and even falling down. Sepsis can affect various organs in your body. Patients with Sepsis can either be critically ill or can remain relatively stable. Sepsis can occur at any age.
Other Education Resources
Coming Soon

• MyLearning for Ascension WI: “Sepsis, Let’s Save Some Lives”
  o Available as optional learning
  o Final revisions being made to the program

• Ascension National (more info coming soon)
  o Expected toolkit availability some time in July?
  o Expected national-required education
  o Learning about this upcoming program is why we made our AW education “optional”. It may help if there are gaps before national education is ready.
What's new with sepsis?

• We’re not changing any of our order sets / bundle information

• However: Surviving Sepsis Campaign has just released a bundle & guideline update

• The intent with the ONE-hr. Bundle is that great outcomes can be achieved if we begin immediate resuscitation
  • Much like stroke & heart attack where earlier intervention can make a difference to outcomes

“Time is Tissue”

“Aspirational Goals”
(Not without national controversy – especially in ED)
Thank You

If you have questions or need additional education, please contact:

• Patty Haugh: Clinical Nurse Specialist, Columbia St. Mary’s Milwaukee
• Don Lee MD: Hospitalist, Columbia St. Mary’s
• Peter DeGroot: Pharmacist, All Saints
• Anthony Zeimet DO Infectious Disease, St. Elizabeth with Kyle Piscitello Phm-D, St. Joseph’s Hospital & Jim Davis Phm-D, All Saints
• Zebuline Koran: AW Director of Nursing Practice
• Catherine Kostuch: Case Management, St. Michael’s Hospital
• Paula Gebauer: Clinical Quality Improvement Specialist
• Maciejewski, Shelley: Quality Improvement, St. Joseph’s Hospital
• Richard Shimp MD, CMO Columbia St. Mary’s
• Patricia Gedemer: Director Performance Excellence

Additional references follow this slide
References

1. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) JAMA February 23, 2016 Volume 315, Number 8 (801-810)


The baseline Sequential [Sepsis-related] Organ Failure Assessment (SOFA) score should be assumed to be zero unless the patient is known to have preexisting (acute or chronic) organ dysfunction before the onset of infection. qSOFA indicates quick SOFA; MAP, mean arterial pressure.
<table>
<thead>
<tr>
<th>Current Guidelines and Terminology</th>
<th>Sepsis</th>
<th>Septic Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991 and 2001 consensus terminology(^9,10)</td>
<td>Severe sepsis Sepsis-induced hypoperfusion</td>
<td>Septic shock(^{13})</td>
</tr>
</tbody>
</table>

### 2015 Definition

- **Sepsis is life-threatening organ dysfunction caused by a dysregulated host response to infection**
- **Septic shock is a subset of sepsis in which underlying circulatory and cellular/metabolic abnormalities are profound enough to substantially increase mortality**

### 2015 Clinical criteria

- **Suspected or documented infection and an acute increase of ≥2 SOFA points (a proxy for organ dysfunction)**
- **Sepsis\(^a\) and vasopressor therapy needed to elevate MAP ≥65 mm Hg and lactate >2 mmol/L (18 mg/dL) despite adequate fluid resuscitation\(^{13}\)**

### Recommended primary ICD codes\(^\text{a}\)

<table>
<thead>
<tr>
<th>ICD-9</th>
<th>ICD-10(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>995.92</td>
<td>R65.20</td>
</tr>
<tr>
<td>785.52</td>
<td>R65.21</td>
</tr>
</tbody>
</table>

### Framework for implementation for coding and research

1. Identify sepsis by using a clinical criterion for life-threatening organ dysfunction
2. Assess for shock criteria, using administration of vasopressors, MAP <65 mm Hg, and lactate >2 mmol/L (18 mg/dL)\(^d\)

---

Abbreviations: ICD, *International Classification of Diseases*; MAP, mean arterial pressure; SOFA, Sequential (Sepsis-related) Organ Failure Assessment.\(^{27}\)

\(^a\) Included training codes.

\(^b\) Suspected infection could be defined as the concomitant administration of oral or parenteral antibiotics and sampling of body fluid cultures (blood, urine, cerebrospinal fluid, peritoneal, etc.). For example, if the culture is obtained, the antibiotic is required to be administered within 72 hours, whereas if the antibiotic is first, the culture is required within 24 hours.\(^{12}\)

\(^c\) Considers a period as great as 48 hours before and up to 24 hours after onset of infection, although sensitivity analyses have tested windows as short as 3 hours before and 3 hours after onset of infection.\(^{12}\)

\(^d\) With the specified period around suspected infection, assess for shock criteria, using any vasopressor initiation (eg, dopamine, norepinephrine, epinephrine, vasopressin, phenylephrine), any lactate level >2 mmol/L (18 mg/dL), and mean arterial pressure <65 mm Hg. These criteria require adequate fluid resuscitation as defined by the Surviving Sepsis Campaign guidelines.\(^{4}\)
Crystalloids: Saline vs. Normosol/LR

• “A strong signal is emerging from recent large propensity-matched and cohort studies for the adverse effects that 0.9% saline has on the clinical outcome in surgical and critically ill patients when compared with balanced crystalloids. Major complications are the increased incidence of acute kidney injury and the need for renal replacement therapy, and that pathological hyperchloremia may increase postoperative mortality.” ¹

• “Healthy human volunteer studies have shown that retention of fluid in the interstitial space is greater after infusions of 0.9% saline, than after those of balanced crystalloids or 5% dextrose, and that this fluid retention is associated with reduced urine volume.” ¹

• “This comprehensive review of literature has shown that 0.9% saline is neither ‘normal’ nor ‘physiological’ and that its high chloride content leads to many pathophysiological changes, especially with regard to renal function, in both animals and healthy human volunteers. These changes are not seen after infusions with balanced crystalloids” ¹

• “This is the first human study to demonstrate that intravenous infusion of 0.9% saline results in reductions in renal blood flow velocity adrenal cortical tissue perfusion. This has implications for intravenous fluid therapy in perioperative and critically ill patients.” ²

• “In conclusion, we have shown that the hyperchloremic acidosis associated with a 2-L infusion of 0.9% saline has a detrimental effect on renal artery blood flow velocity and renal cortical tissue perfusion. Balanced crystalloids may, therefore, be safer than 0.9% saline in patients with existing renal disease and those at risk of developing renal dysfunction” ²
Crystalloids: Saline vs. Normosol/LR

- “Among critically ill adults with sepsis, resuscitation with balanced fluids was associated with a lower risk of in-hospital mortality.”
- “In-hospital mortality was lower following initial resuscitation with balanced versus non-balanced crystalloids among nonoperative patients admitted with early vasopressor-dependent sepsis. Mortality was progressively lower among patients receiving greater proportions of balanced crystalloids. These findings support an urgent need for definitive clinical trials, as crystalloid therapy is nearly universal and any outcomes differences between common alternatives could have a large public health impact.”
- “The implementation of a chloride-restrictive strategy in a tertiary ICU was associated with a significant decrease in the incidence of AKI and use of RRT.”
- “We conducted a before-and-after study comparing a chloride-restrictive intra-venous fluids strategy with a chloride liberal intravenous fluids strategy in a multidisciplinary tertiary ICU. We found that restricting intravenous chloride intake was associated with a significant decrease in the incidence of AKI and the use of RRT. These observations support the desirability of further clinical studies in this field.”

References:
- Should chloride-rich crystalloids remain the mainstay of fluid resuscitation to prevent ‘pre-renal’ acute kidney injury?: con Dileep N. Lobo and Sherif Awad Kidney International (2014) 86, 1096–1105
  A Randomized, Controlled, Double-Blind Crossover Study on the Effects of 2-L Infusions of 0.9% Saline and Plasma-Lyte R_148 on Renal Blood Flow Velocity and Renal Cortical Tissue Perfusion in Healthy Volunteers.
  Abeed H. Chowdhury, BSc, MRCS,* Eleanor F. Cox, PhD,† Susan T. Francis, PhD,† and Dileep N. Lobo, DM, FRCS, FACS Annals of Surgery Volume 256, Number 1, July 2012
- Association Between the Choice of IV Crystalloid and In-Hospital Mortality Among Critically Ill Adults With Sepsis Karthik Raghunathan, MD, MPH1,2; Andrew Shaw, MB, FRCA, FFICM, FCCM1; Brian Nathanson, PhD3; Til Stürmer, MD, PhD4; Alan Brookhart, PhD4; Mihaela S. Stefan, MDS; Soko Setoguchi, MD, DrPH6; Chris Beadles, MD, PhD2; Peter K. Lindenauer, MD, MSc Critical Care Medicine July 2014 • Volume 42 • Number 7
- Association Between a Chloride-Liberal vs Chloride-Restrictive Intravenous Fluid Administration Strategy and Kidney Injury in Critically Ill Adults. Nor’azim Mohd Yunos, MD, Rinaldo Bellomo, MD, FCICM, Colin Hegarty, BSc, David Story, MD, Lisa Ho, MClinPharm, Michael Bailey, PhD. JAMA, October 17, 2012—Vol 308, No. 15
Vasopressin – Adjunctive Therapy

Vasopressin used as an adjunct Vasopressor in Septic Shock not first line

• Effects usually seen in 30-45 min as an increase in MAP and decreased need for Norepinephrine

• Dose is 0.03 units/min

• Studies have shown specific patient populations (i.e. obese and those who have a genetic predisposition to be vasopressin deficient) may require dose of 0.04-0.06 units/min

• When to add?? There is no consensus at what dose of Norepinephrine should it be initiated.

• VAST trial 2008  Vasopressin started at Norepinephrine dose of 5 mcg/min; Results: There was no significant difference between the vasopressin and norepinephrine groups in the 28-day mortality rate (35.4% and 39.3%, respectively; P=0.26) or in 90-day mortality (43.9% and 49.6%, respectively; P=0.11).

• Vanderbilt Study 2016 compared starting Vasopressin at Norepinephrine doses of 10 mcg/min compared to 50 mcg/min; Results: Time to achieve goal mean arterial pressure (MAP) was shorter in the postintervention group (2.0 vs 1.3 hours; P = 0.03) in univariate analysis but not after adjusting for prespecified confounders.
Antibiotic orders are more streamlined when viewed within Epic or Cerner subphases
Special Thank You to Our Order Builders
(for this very complex order set)

**EPIC**
- Diane Roszek
- Kylee Albright
- Tuyet Vance
- Gary Swart MD
  (consulting ED provider workflow)
- The several pharmacists who proofed the medication section

**Cerner**
- Julie Kreckow
- Suzanne Wilkerson MD (Consulting provider workflow)
- Anton Salud MD
  (Critical Care Perspective)
- Rob Riepenhoff MD
  (ED provider workflow)

**Paper Order Set**
- Kate Campbell
- Anne Putzer

**Northern E.H.R. Build**
- Rebecca Hietpas