Sepsis Review

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Objectives

- Discuss the Updated International Guidelines
- Discuss how you can make a difference
- Review the ED pilot project
Cookeville Regional Medical Center

- 247 Bed Community Hospital (Non-Teaching)
- Regional referral center in the heart of the Upper Cumberland in middle Tennessee
CRMC Sepsis Initiative

- Go live ICU/CVICU ED and Rapid Response September 2009
- Go live Hospital Wide October 2010
- Cost Savings per patient
- Mortality Decrease = Lives Saved!!!

Cookeville Regional Medical Center Reduces Sepsis Mortality and Costs

Cookeville Regional Medical Center, a 247-bed regional referral center serving the Upper Cumberland area of Tennessee, has responded to the sepsis health crisis by launching a successful program to improve the early identification and treatment of sepsis. The initiative is being led by Angela Craig, APN, MS, clinical nurse specialist in critical care, in partnership with the Edwards HCP Solutions Sepsis Management Program. HCP Solutions provides expert advice in clinical process improvements.

Results of Cookeville Regional Medical Center’s Sepsis Management Program*

- Mortality rate dropped more than 66% to 24%
- Average LOS in the ICU was reduced from 8.61 to 6.50 days
- Costs for septic shock patients were reduced by an average of $3,409 per case

* September 2009 through March 2011
Sepsis Disease Specific Certification
CRMC March 2015
(First in State of TN)
Severe Sepsis: A Significant Healthcare Challenge

- Major cause of morbidity and mortality worldwide
  - Leading cause of death in noncoronary ICU (US)\(^1\)
  - 10th leading cause of death overall (US)\(^2*\)

- In the US, more than 700 patients die of severe sepsis daily (1.6 million new cases per year)

* Based on data for septicemia
† Reflects hospital-wide cases of severe sepsis as defined by infection in the presence of organ dysfunction


**AHRQ Healthcare cost & Utilization Project October 2011**
80% of sepsis begins outside the hospital
7 out of 10 patients with sepsis had recently used health services or had chronic dx requiring frequent care
4 types of infections most connected to sepsis; lung, urinary tract, skin and gut
HCP: think sepsis & act fast
Sepsis Definitions
Sepsis (Severe Sepsis) and septic shock are medical emergencies, and we recommend that treatment and resuscitation begin immediately.
2016

New Definitions

SEPSIS

toxic response
shock
inflammation

DRG 871
drug

#1 cause of ICU deaths
time sensitivity
blood chemicals

SIRS
debra
infection
organ failure

DRG 870
drug

No dedicated drug tx
difficult
diagnosis

reimbursement

mortality

50%
unnecessary

Severe

parasite

dependent LOS

dependent

dependent
2016 Guideline Definitions

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

- Septic Shock: a subset of sepsis with circulatory and cellular/metabolic dysfunction associated with a higher risk of mortality
Keep doing what you are doing and consider measuring q-SOFA and SOFA scores in addition to current practice to assess high risk of death until CMS changes or large prospective studies are performed.
The SOFA score is an illness-severity score which may be used to predict the mortality of any critically ill patient.

qSOFA was also designed to predict mortality <“badness”> within the context of a cohort of patients with suspected infection.

Thus, qSOFA and SOFA are predictors of mortality; they are not tests of early sepsis at risk to progress to organ failure.

qSOFA will inevitably be misunderstood to be a “sepsis screen.”
The definitions are mortality predictors, not screening definitions for early identification

- CMS definitions and core measures have NOT changed
- ICD-10 has NOT changed
- No pathway to implement at our current institutions – how would a transition happen?
Core Measure
Sepsis Definitions
Definitions

- Sepsis: infection plus 2 or more SIRS
- Severe Sepsis: infection plus 2 or more SIRS plus new organ dysfunction
- Septic Shock: severe sepsis with a lactic acid greater than or equal to 4mmol/L OR continued hypotension (systolic BP<90 or 40mmHg decrease from their baseline) after initial fluid bolus (30ml/kg)
International Guidelines for Management of Sepsis and Septic Shock & CMS Core Measure
Discuss the latest guidelines for severe sepsis and septic shock
- published March 2017 SCCM
### TABLE 3. Comparison of 2016 Grading Terminology with Previous Alphanumeric Descriptors

<table>
<thead>
<tr>
<th></th>
<th>2016 Descriptor</th>
<th>2012 Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strength</strong></td>
<td>Strong</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Weak</td>
<td>2</td>
</tr>
<tr>
<td><strong>Quality</strong></td>
<td>High</td>
<td>A</td>
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<td></td>
<td>Moderate</td>
<td>B</td>
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<td>Low</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>Very Low</td>
<td>D</td>
</tr>
<tr>
<td><strong>Ungraded strong recommendation</strong></td>
<td><strong>Best Practice Statement</strong></td>
<td><strong>Ungraded</strong></td>
</tr>
</tbody>
</table>
### TABLE 2. Factors Determining Strong vs. Weak Recommendation

<table>
<thead>
<tr>
<th>What Should Be Considered</th>
<th>Recommended Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>High or moderate evidence</td>
<td>The higher the quality of evidence, the more likely a strong recommendation</td>
</tr>
<tr>
<td><em>(Is there high- or moderate-quality evidence?)</em></td>
<td></td>
</tr>
<tr>
<td>Certainty about the balance of benefits vs. harms and burdens</td>
<td>The larger the difference between the desirable and undesirable consequences and the certainty around that difference, the more likely a strong recommendation. The smaller the net benefit and the lower the certainty for that benefit, the more likely a weak recommendation.</td>
</tr>
<tr>
<td><em>(Is there certainty?)</em></td>
<td></td>
</tr>
<tr>
<td>Certainty in, or similar, values</td>
<td>The more certainty or similarity in values and preferences, the more likely a strong recommendation.</td>
</tr>
<tr>
<td><em>(Is there certainty or similarity?)</em></td>
<td></td>
</tr>
<tr>
<td>Resource implications</td>
<td>The lower the cost of an intervention compared to the alternative and other costs related to the decision (i.e., fewer resources consumed), the more likely a strong recommendation.</td>
</tr>
<tr>
<td><em>(Are resources worth expected benefits?)</em></td>
<td></td>
</tr>
</tbody>
</table>
Surviving Sepsis Campaign

TO BE COMPLETED WITHIN 3 HOURS:

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.

TO BE COMPLETED WITHIN 6 HOURS:

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.
TABLE 1
DOCUMENT REASSESSMENT OF VOLUME STATUS AND TISSUE PERFUSION WITH:

EITHER:
• Repeat focused exam (after initial fluid resuscitation) including vital signs, cardiopulmonary, capillary refill, pulse, and skin findings.

OR TWO OF THE FOLLOWING:
• Measure CVP.
• Measure ScvO².
• Perform bedside cardiovascular ultrasound.
• Perform dynamic assessment of fluid responsiveness with passive leg raise or fluid challenge.

@2016 Society of Critical Care Medicine, European Society of Intensive Care Medicine. www.survivingsepsis.org
CMS Bundle summary:

- **3-hour bundle:**
  - **Severe Sepsis**
    1. Initial lactate level (NP)
    2. Blood culture prior to antibiotics (NP)
    3. Broad spectrum antibiotic
    4. 30ml/kg crystalloid fluid

  NP = Nursing Protocol

- **6-hour bundle:**
  - **Severe Sepsis**
    1. Repeat lactate level (NP)
      - If initial LA > 2.0
  - **Septic Shock**
    1. Vasopressor if hypotension persist
    2. Volume status and tissue perfusion reassessment if hypotension persist
Repeat volume status and tissue Assessment (one of two ways):

A. Focused exam documented by **Provider (Midlevels included)** and which includes **ALL** the following:

- Vital signs (includes all: BP, Pulse, Resp., Temp)
- Cardiopulmonary exam (heart and lung)
- Capillary refill evaluation
- Peripheral pulse evaluation
- Skin examination

OR
Volume Status/Tissue Assessment Continued:

B. Any two of the following:
   ◦ Central venous pressure measurement
     • Can see in Nursing Notes
   ◦ Central venous oxygen measurement
     • Can see in Nursing Notes
   ◦ Bedside Cardiovascular Ultrasound
     • Time and Date of Bedside Cardiovascular Ultrasound
     • Does NOT have to be always done at the bedside
       ◦ Echo, TEE, Doppler echocardiogram etc.
   ◦ Passive Leg Raise (PLR) or Fluid Challenge
     • Time and Date of PLR
     • Time and Date of Fluid challenge
Sample Progress Note

SEVERE SEPSIS / SEPTIC SHOCK PROGRESS NOTE

**DATE / TIME**

1. Patient’s known or suspected infection: ________________________________

(If there is no known or suspected infection stop documentation on this form)

2. Check all that apply to your patient (2 or More Selected Proceed to Question 3)
   - Temperature greater than 38.5°C (101.3°F) or Less than 36°C (96.8°F)
   - Heart Rate greater than 90 bpm
   - Respiratory Rate greater than 20
   - WBC count > 12,000 or < 4000 or <10% bands

3. Organ dysfunction criteria present? (1 or more Selected Proceed to Bundle)
   (Different from baseline)
   - Cardiovascular: SBP < 90 or MAP < 65 or a SBP decrease of more than 40 points
   - Renal: urine output less than 0.5ml/kg/hr for 2 hours or creatinine greater than 2
   - Metabolic: lactate > 2 mmol/L
   - Hematologic: platelets < 100,000, INR > 1.5, or a PTT>60 seconds
   - Hepatic: Bilirubin > 2mg/dl

   Patient will NOT proceed to bundle due to patient/decision maker refusal of blood draw, fluid or antibiotic administration.

**Bundle**

**TO BE COMPLETED WITHIN 3 HOURS:**
- Initial Lactate Level: ___________________ Result (if not complete please order)
- Blood Cultures x’s 2 obtained (check box if cultures were obtained)
- Broad Spectrum antibiotic ordered (check box if broad spectrum were ordered)
- 30 ml/kg crystalloid for hypotension (SBP <90, or decrease by >40 mm HG, or MAP <65) or lactate >4mmol/L
  - (check box if this was ordered)

**TO BE COMPLETED WITHIN 6 HOURS:**
- Repeat Lactic Acid if initial lactate elevated > 2: ___________________ (check box if this was ordered)
- Levophed (check box if ordered)
- For persistent hypotension after initial fluid administration (SBP <90, or decrease by >40 mm HG, or MAP <65) or if initial lactate was >4 mmol/L*
  - re-assess volume status and tissue perfusion (see page 2 of form).

*Reassessment of volume status and tissue perfusion can be completed by performing a focused assessment or through documentation of any two of the following: CVP, SCVO2, Bedside cardiovascular ultrasound, Passive Leg Raise, or Fluid Challenge (see page 2 of form).

**Date / Time**

- Vital Signs:
  - BP MAP Pulse RR Temp
- Cardiopulmonary Exam:
  - Heart
  - Lungs
  - Capillary Refill: ________ seconds
  - Peripheral Pulse Evaluation:
    - Dorsalis Pedis ________ Posterior Tibial
- Skin Examination: ________ Skin Color:
  - OR TWO OF THE FOLLOWING:
    - CVP measurement after fluid bolus: ________ CVP prior to fluid bolus: ________
    - SCVO2 measurement after fluid bolus: ________ SCVO2 after fluid bolus: ________
- Bedside cardiovascular ultrasound:
  - Assessment of fluid responsiveness with passive leg raise (PLR) or fluid challenge
    - SBP / MAP increased with PLR
    - Pre PLR SBP / MAP ________ Post PLR SBP / MAP ________
    - Stroke volume increased with PLR
    - Pre PLR Stroke Volume ________ Post PLR Stroke Volume ________
    - SBP / MAP increased with Fluid Challenge
    - Pre fluid challenge SBP / MAP ________ Post fluid challenge SBP / MAP ________
    - Stroke volume increased with fluid challenge
  - Pre Fluid Challenge Stroke Volume ________ Post Fluid Challenge Stroke Volume ________

**Notes:**

**DEFINITION**

Sepsis defined as: Known or suspected infection, 2 or more signs of SIRS.
Severe Sepsis defined as: Known or suspected infection, 2 or more signs of SIRS, and organ dysfunction.
Septic Shock defined as: Known or suspected infection with 2 or more signs of SIRS, organ dysfunction, and hypotension which is defined as systolic SBP less than 90mmHg or MAP less than 60 or 40mmHg decrease in SBP from baseline after a 30ml/kg fluid bolus

OK

Persistent hypotension defined as: In the one hour following administration of crystalloid fluids, one single blood pressure reading of either SBP <90, or MAP <65, or a decrease in systolic blood pressure by >40 mmHg from the last previously recorded SBP considered normal for that specific patient.

Time Zero defined as: The date/time on which the last criterion was met to establish the presence of severe sepsis or septic shock. If all are present on arrival to ED then times zero is ED triage time.
<table>
<thead>
<tr>
<th><strong>SURVIVING SEPSIS CAMPAIGN RECOMMENDATION HIGHLIGHTS</strong></th>
<th>2012</th>
<th>2016</th>
</tr>
</thead>
</table>
| **SEPSIS DEFINITION** | Systemic manifestation of infection + suspected infection  
Severe sepsis: sepsis + organ dysfunction | Life threatening organ dysfunction caused by dysregulated response to infection  
No severe sepsis category |
| **INITIAL RESUSCITATION** | at least 30 cc/kg in first 3 hours  
Crystalloid fluid (no recommendations on 0.9% NaCl vs balanced solution)  
Albumin if patients require “substantial” fluids (weak) | Use dynamic resuscitation markers (passive leg raise)  
Target MAP of 65mmHg  
Reassess hemodynamic status to guide resuscitation  
Normalize lactate |
| **VASOPRESSORS** | Protocolized care including  
CVP  
ScVO2  
Normalize lactate | target MAP of 65 mmHg  
1. Norepinephrine  
2. Epinephrine if not at target MAP OR vasopressin to reduce norepinephrine requirement  
3. Avoid dopamine in most patients |
| **STEROIDS** | Only indicated for patients with septic shock refractory to adequate fluids and vasopressors |
| **ANTIBIOTICS** | One or more antibiotics active against presumed pathogen  
Combination therapy (double coverage) for neutropenic patients and pseudomonas | Initial broad spectrum antibiotics (ex: vancomycin + piperacillin-tazobactam)  
Against combined therapy (i.e. do not double cover pseudomonas)  
May use procalcitonin to guide de-escalation |
| **SOURCE CONTROL** | Achieve within 12 hours, if feasible | Achieve as soon as medically and logically feasible |
| **VENTILATOR** | 6 cc/kg tidal volume  
prone patients with severe ARDS (P/F <150 in 2017 guidelines) | Against high frequency oscillatory ventilation (HFOV)  
Unable to make recommendation on noninvasive ventilation |

SSC Guidelines

A: Initial Resuscitation

1. Sepsis and septic shock are medical emergencies, and we recommend that treatment and resuscitation begin immediately (BPS)

2. We recommend that, in the resuscitation from sepsis-induced hypoperfusion, at least 30mL/kg of IV crystalloid fluid be given within the first 3 hours (strong recommendation, low quality of evidence)
A: Initial Resuscitation

3. We recommend that, following initial fluid resuscitation, additional fluids be guided by frequent reassessment of hemodynamic status (BPS)

4. We recommend further hemodynamic assessment (such as assessing cardiac function) to determine the type of shock if the clinical examination does not lead to a clear diagnosis (BPS)
5. We suggest that dynamic over static variables be used to predict fluid responsiveness, where available (weak recommendation, low quality of evidence).

6. We recommend an initial target mean arterial pressure (MAP) of 65mmHg in patients with septic shock requiring vasopressors (strong recommendation, moderate quality of evidence).
NICE Protocol

Stroke Volume (SV) Optimization

Monitor Stroke Volume

200-250 mL Fluid Challenge over 5-10 minutes
OR
Passive Leg Raise (PLR) over 1-2 minutes

SV Increase > 10%

YES

SV Reduction > 10%

NO

Monitor SV for clinical signs of fluid loss

For more information contact: Angela Craig APN, MS, CCNS
Clinical Nurse Specialist ICU (931) 783-5035 or Email: acraig@crmchealth.org
SSC Guidelines

A: Initial Resuscitation

7. We suggest guiding resuscitation to normalize lactate in patients with elevated lactate levels as a marker of tissue hypoperfusion (weak recommendation, low quality of evidence)

Other Items:
*Use of CVP alone to guide fluid resuscitation can no longer be justified because the ability to predict a response to a fluid challenge when the CVP is within a relatively normal range is limited
SSC Guidelines

A: Initial Resuscitation

Other Items:
* Serum lactate is not a direct measure of tissue perfusion. Increases in the serum lactate level may represent tissue hypoxia, accelerated aerobic glycolysis driven by excess beta adrenergic stimulation, or other causes (liver failure)
Application of Fluid Resuscitation in Adult Septic Shock

Sepsis-induced hypotension or lactate ≥ 4 mmol/L
(Based on SSC bundle and CMS threshold)

No high flow oxygen and No ESRD on dialysis or CHF

- Rapid infusion of 30 ml/kg Crystalloid*

Pneumonia or ALI with high flow oxygen requirements

- Not intubated/mechanically ventilated
- Consider intubation/mechanical ventilation to facilitate 30 ml/kg crystalloid *
- Intubated/mechanically ventilated
- Rapid infusion of 30 ml/kg crystalloid *

ESRD on hemodialysis or CHF

- Total of 30 ml/kg crystalloid* with frequent reassessment of oxygenation

*Administer 30 ml/kg crystalloid within first 3 hours

Considerations post 30ml/kg crystalloid infusion

1. Continue to balance fluid resuscitation and vasopressor dose with attention to maintain tissue perfusion and minimize interstitial edema
2. Implement some combination of the list below to aid in further resuscitation choices that may include additional fluid or inotrope therapy
   - blood pressure/heart rate response,
   - urine output,
   - cardiothoracic ultrasound,
   - CVP, ScvO2,
   - pulse pressure variation
   - lactate clearance/normalization or
   - dynamic measurement such as response of flow to fluid bolus or passive leg raising
3. Consider albumin fluid resuscitation, when large volumes of crystalloid are required to maintain intravascular volume.
Can Lactate Clearance Be Used As a Resuscitation Endpoint?

SSC Guidelines

B. Screening

- We recommend that hospitals and hospital systems have a performance improvement program for sepsis, including sepsis screening for acutely ill, high-risk patients (BPS)
**Why Do You Need to Have a Screening Process?**

- **TIME IS TISSUE!!**
  - Similar to polytrauma, AMI, or stroke, the speed and appropriateness of therapy administered in the initial hours after severe sepsis develops are likely to influence outcomes.¹
- To screen effectively, it must be part of the nurses’ daily routines—i.e., part of admission and shift assessment.
- Must define a process for what to do with the results of the screen.

If you don’t screen you will miss patients that may have benefited from the interventions.

COOKEVILLE REGIONAL MEDICAL CENTER
ADULT SEPSIS SCREENING TOOL & PROTOCOL

☐ Within 36 hours post op Surgery Pt
☐ Within 48 hours post op CVOR Pt
1. Patient has known or suspected new infection?

then proceed to question 2

2. Check all that apply to your patient
☐ Temperature greater than 38°C (100.4°F) or Less than 36°C (96.8°F)
☐ Heart Rate greater than 90 bpm
☐ Respiratory Rate greater than 20 bpm or PaCO2 less than 32 mmHg
☐ WBC count greater than 12,000 mm³ or WBC count less than 4000 mm³ or Greater than 10% bands

3. Are any of the following NEW organ dysfunction criteria present? (Different from baseline)
☐ Respiratory: increased oxygen requirements
☐ Cardiovascular: SBP less than 90 or MAP less than 65 or on vasopressor
☐ Renal: urine output less than 0.5mL/kg/hr, creatinine greater than 2
☐ Metabolic: lactate greater than or equal to 4 mmol/L

If question 1 is yes and question 2 has less than 2 boxes checked = a negative screen (SIRS criteria may be less if immunocompromised or on beta blockers)
If question 1 is yes and question 2 has 2 checked and question 3 has no boxes checked = negative for severe sepsis but positive for sepsis
If question 1 is yes and question 2 has 2 or more boxes checked and question 3 has 1 or more boxes checked then obtain/report the following:

☐ Lactic acid STAT (result) Date Time
☐ Blood cultures x 2 STAT PERIPHERALLY (Only if not done in prior 48 hrs)
☐ Notify physician of results STAT

Discuss with physician if hypotensive, or lactic acid greater than or equal to 4 to start 30mL/kg fluid bolus

Negative screen
☐ Positive screen sepsis (patient has known/suspected infection and 2 or more SIRS criteria)
☐ Positive screen for severe sepsis (Patient has known or suspected infection, 2 or more signs of SIRS and 1 or greater organ affected unrelated to primary pathology) physician notified (Nurse to fill out Form 1135 PRN).
☐ Positive screen for septic shock (patient has known or suspected infection, 2 or more signs of SIRS and hypotension after fluid bolus or lactic acid greater than or equal to 4) physician notified, (obtain order for adult septic shock orders, and transfer to ICU,) (Nurse to fill out Form 1135 PRN).

Provider ____________________________ notified, Date: ________ Time: __________
Nurse Signature ____________________________ Date: ________ Time: __________
ED Adult Severe Sepsis/Septic Shock Screening Tool

For patients with DOCUMENTED OR SUSPECTED INFECTION, ABDOMINAL PAIN OR ALTERED MENTAL STATUS

Start Time: __________ Nurse: __________

Assess the following for SIRS (check all that apply)

- Core temperature: __________ (greater than 38°C (greater than 100.4°F) OR __________ (less than 36°C (less than 96.8°F)
- Elevated heart rate: __________ beats/min
- Respiratory rate: __________ breaths/min OR __________ PaCO2 less than 32 mm Hg or mechanical ventilation for acute respiratory process

1 SIRS Present

- Obtain CBC with auto diff
- WBC greater than 12,000 or less than 4,000 or greater than 10% bands

1 SIRS Present

- Obtain lactic acid: Result: __________ Time: __________
- Obtain Blood Cultures (BC) x 2 Peripherally STAT.
- If patient hypotensive (SBP less than 90, MAP less than 65, or SBP drop of 40 mmHg) then notify provider for order for 30mL/kg fluid bolus

Order Given: __________ Yes: __________ No: __________

Bolus start time: __________ Amount: __________ mL

- Notify ICU of possible Severe Sepsis/Septic Shock Patient admit.

2 SIRS are present:

- Obtain lactic acid: Result: __________ Time: __________
- Obtain Blood Cultures (BC) x 2 Peripherally STAT.
- If patient hypotensive (SBP less than 90, MAP less than 65, or SBP drop of 40 mmHg) then notify provider for order for 30mL/kg fluid bolus

Order Given: __________ Yes: __________ No: __________

Bolus start time: __________ Amount: __________ mL

- Notify ICU of possible Severe Sepsis/Septic Shock Patient admit.

Pt. positive for Severe Sepsis (has known or suspected infection + 2 or more SIRS and organ dysfunction)*. Monitor IV access standard, obtain lactate in 2 hrs of lactate greater than 2 then every 8 hrs, and consider step-down bed for closer BP monitoring and fluid management

Time: __________

If yes or no initiate Severe Sepsis/Septic Shock Progress Note

Form 200-497 (orange)

Pt. positive for Septic Shock - Pt. still hypotensive after fluid bolus or on pressors OR lactic acid is > or = to 4

Time Zero* (time of arrival)

*Time Zero is when the clock starts for our goals

Screening Tool Completed at __________

by __________ RN

PATIENT ID STICKER

*Organ Dysfunction Criteria Present? (different from baseline)

- Respiratory: RRTs increased or oxygen requirements
- Cardiovascular: SBP less than 90 OR MAP less than 65 or on vasopressor
- Renal: urine output less than 0.5mL/kg/hr, creatinine greater than 2
- Metabolic: lactate greater than 2mmol/L
- Hematologic: platelets less than 100,000; INR greater than 1.5
- Hepatic: Serum total bilirubin greater than or equal to 3mg/dL

CNs: altered consciousness (not related to primary neuro pathology)

Form ER-31 (Rev. 8/16)
# Cookeville Regional Medical Center

## Severe Sepsis/Septic Shock Clinical Pathway

**Pathway**

### Clinical Pathway Details

**Room #:** [Blank]

**Admission Date:** [Blank]

**Time:** [Blank]

**PLEASE COMPLETE THE FOLLOWING:**

- **Time Zero:** Date: [Blank] Time: [Blank]
- **Time:** [Blank]
- **Time:** [Blank]
- **Time:** [Blank]

**Patient Location:** [Blank]

**In-House:** [Blank]

**Outside Facility:** [Blank]

**Admitting Area:** [Blank]

**Discharge Status:** [Blank]

**Alive:** [Blank]

**Expired:** [Blank]

### Severe Sepsis

**Defined as:**

- Known or suspected infection.
- 2 or more signs of SIRS, and organ dysfunction.

**Septic Shock Defined as:**

- Known or suspected infection with 2 or more signs of SIRS, organ dysfunction, and hypotension which is defined as systolic BP < 90mmHg or MAP less than 65 or 40mmHg decrease in SBP from baseline after a 30mL/kg fluid bolus or known or suspected infection with 2 or more signs of SIRS, organ dysfunction, and hypoperfusion evidenced by a lactate level greater than or equal to 4.

### 0-1 Hours

<table>
<thead>
<tr>
<th>Date</th>
<th>0-1 Hours to</th>
<th>ED Provider (If positive screen in ED)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes No Sepsis Resuscitation Algorithm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes No Blood Culture(s) X 2 Peripherally</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes No Other Cultures: Sputum Wound</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes No Establish IV access</td>
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<tr>
<td></td>
<td></td>
<td><strong>LACTATE</strong> Patient weight in kg</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Volume patient received (Goal 30mL/Kg)</strong></td>
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<td></td>
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<td><strong>Source Control</strong></td>
</tr>
</tbody>
</table>

### 1-4 Hours

**Refer to Severe Sepsis Resuscitation Algorithm**

- Yes No LA 2,3,9 (Was norepinephrine within 2 hours goal is to normalize LA)
- Initial LA Time: [Blank]
- 2 hours later if elevated (2x) [Blank]
- Yes No Was initial lactate greater than or equal to 4 mmol/L?
- Yes No Was patient hypotensive after initial fluid bolus?
- If above 2 questions both are NO STOP this form and continue reviewing every shift and PRN. If either question YES. Continue with the rest of the Sepsis Shock portion of this form.

**Yes No Central Line placed**

- **Type:** Phlebot PCC Jug/SCI TL Fem TL
- **Date:** [Blank]
- **Time:** [Blank]

**In patients with acute lung injury or ARDS:**

- Is total volume of fluid of ideal body weight in first 24 hours?
- Yes No

**All Mechanically Ventilated Patients:**

- Are the static or plateau inspiratory pressures less than 30cmH2O in first 24 hours?
- Yes No

**APRV**

- Yes No

**Oscillator Vent**

- Yes No

### 6-24 Hours

**Yes No** Patient on vasopressor at greater than 6 hours

**Yes No** Considered Hydrocortisone if vasopressor unresponsive

**Yes No** Vasopressor considered for refractory septic shock?

**Blood Glucose:** chart all bloods between hours 6-24 (If patients glucose greater than 180 obtain orders for insulin drip) Goal < 180 mg/dL

**Time:** [Blank]

**Value:** [Blank]

**Time:** [Blank]

**Value:** [Blank]

**Time:** [Blank]

**Value:** [Blank]

**In patients with acute lung injury or ARDS:**

- Is total volume of fluid of ideal body weight in first 24 hours?
- Yes No

**All Mechanically Ventilated Patients:**

- Are the static or plateau inspiratory pressures less than 30cmH2O in first 24 hours?
- Yes No

**APRV**

- Yes No

**Oscillator Vent**

- Yes No

**Goal directed therapy to achieve increased O2 delivery:**

- CVP 8-12 mmHg (non-vented) 12-15 mmHg (vented)
- MAP greater than or equal to 65
- ScvO2 greater than or equal to 70%
- Blood glucose less than 180 mg/dL
- Urine output greater than 0.5 mL/kg/hour

### Time Zero

**Time Zero = ED Arrival Time OR Direct Admit Arrival to Critical Care**

**Patient Identified on inpatient unit - follow below algorithm**

1. **Suspected/Known Infection**
   - (may be less if immunocompromised or on beta blockers)
2. **Organ Dysfunction**
3. **Organ Dysfunction of Hypotension 1 hour after fluid bolus started OR lactic acid > 4 to 6 (whichever comes first)**
   - (If no fluid given time zero = 1 hour after onset of hypotension, if on pressors - this counts for hypotension)

### SEPTIC SHOCK

**SEPTIC SHOCK**

**PATHWAY**

**DATE/TIME OF POSITIVE SCREEN**

**SIRS:** T: [Blank] RR: [Blank] WBC: [Blank]

**PATTERN ID STICKER**

**WHITE COPY - CHART**

**YELLOW COPY - ICU CNS**

Form 1112-PRN (Rev. 7/16)
C: Diagnosis

- We recommend that appropriate routine microbiologic cultures (including blood) be obtained before starting antimicrobial therapy in patients with suspected sepsis or septic shock if doing so results in no substantial delay in the start of antimicrobials (BPS)

- Remarks: Appropriate routine microbiologic cultures always include at least two sets of blood cultures (aerobic and anaerobic)
D. Antimicrobial Therapy

1. We recommend that administration of IV antimicrobials be initiated as soon as possible after recognition and within one hour for both sepsis and septic shock (strong recommendation, moderate quality of evidence; grade applies to both conditions)

2. We recommend empiric broad-spectrum therapy with one or more antimicrobials for patients presenting with sepsis or septic shock to cover all likely pathogens (including bacterial and potentially fungal or viral coverage) (strong recommendation, moderate quality of evidence)
3. We recommend that empiric antimicrobial therapy be narrowed once pathogen identification and sensitivities are established and/or adequate clinical improvement is noted (BPS)

4. We recommend against sustained antimicrobial prophylaxis in patients with severe inflammatory states of noninfectious origin (e.g., severe pancreatitis, burn injury) (BPS)
SSC Guidelines

D. Antimicrobial Therapy

5. We recommend that dosing strategies of antimicrobials be optimized based on accepted pharmacokinetic/pharmacodynamic principles and specific drug properties in patients with sepsis or septic shock (BPS)

6. We suggest empiric combination therapy (using at least two antibiotics of different antimicrobial classes) aimed at the most likely bacterial pathogen(s) for the initial management of septic shock (weak recommendation, low quality of evidence)
<table>
<thead>
<tr>
<th><strong>TABLE 6. Important Terminology for Antimicrobial Recommendations</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Empiric therapy</strong></td>
</tr>
<tr>
<td>Initial therapy started in the absence of definitive microbiologic pathogen identification. Empiric therapy may be mono-, combination, or broad-spectrum, and/or multidrug in nature.</td>
</tr>
<tr>
<td><strong>Targeted/definitive therapy</strong></td>
</tr>
<tr>
<td>Therapy targeted to a specific pathogen (usually after microbiologic identification). Targeted/definitive therapy may be mono- or combination, but is not intended to be broad-spectrum.</td>
</tr>
<tr>
<td><strong>Broad-spectrum therapy</strong></td>
</tr>
<tr>
<td>The use of one or more antimicrobial agents with the specific intent of broadening the range of potential pathogens covered, usually during empiric therapy (e.g., piperacillin/tazobactam, vancomycin, and anidulafungin; each is used to cover a different group of pathogens). Broad-spectrum therapy is typically empiric since the usual purpose is to ensure antimicrobial coverage with at least one drug when there is uncertainty about the possible pathogen. On occasion, broad-spectrum therapy may be continued into the targeted/definitive therapy phase if multiple pathogens are isolated.</td>
</tr>
<tr>
<td><strong>Multidrug therapy</strong></td>
</tr>
<tr>
<td>Therapy with multiple antimicrobials to deliver broad-spectrum therapy (i.e., to broaden coverage) for empiric therapy (i.e., where pathogen is unknown) or to potentially accelerate pathogen clearance (combination therapy) with respect to a specific pathogen(s) where the pathogen(s) is known or suspected (i.e., for both targeted or empiric therapy). This term therefore includes combination therapy.</td>
</tr>
<tr>
<td><strong>Combination therapy</strong></td>
</tr>
<tr>
<td>The use of multiple antibiotics (usually of different mechanistic classes) with the specific intent of covering the known or suspected pathogen(s) with more than one antibiotic (e.g., piperacillin/tazobactam and an aminoglycoside or fluoroquinolone for gram-negative pathogens) to accelerate pathogen clearance rather than to broaden antimicrobial coverage. Other proposed applications of combination therapy include inhibition of bacterial toxin production (e.g., clindamycin with β-lactams for streptococcal toxic shock) or potential immune modulatory effects (macrolides with a β-lactam for pneumococcal pneumonia).</td>
</tr>
</tbody>
</table>
7. We suggest that combination therapy not be routinely used for ongoing treatment of most other serious infections, including bacteremia and sepsis without shock (weak recommendation, low quality of evidence)
   Remarks: This does not preclude the use of multidrug therapy to broaden antimicrobial activity

8. We recommend against combination therapy for the routine treatment of neutropenic sepsis/bacteremia (strong recommendation, moderate quality of evidence)
9. If combination therapy is initially used for septic shock we recommend de-escalation with discontinuation of combination therapy within the first few days in response to clinical improvement and/or evidence of infection resolution. This applies to both targeted (for culture positive infections) and empiric (for culture-negative infections) combination therapy (BPS)
SSC Guidelines

D. Antimicrobial Therapy

10. We suggest that an antimicrobial treatment duration of 7 to 10 days is adequate for most serious infections associated with sepsis and septic shock (weak recommendation, low quality of evidence)

11. We suggest that longer courses are appropriate in patients who have a slow clinical response, undrainable foci of infection, bacteremia with S aureus, some fungal and viral infections or immunologic deficiencies, including neutropenia. (weak recommendation, low quality of evidence)
D. Antimicrobial Therapy

12. We suggest that shorter courses are appropriate in some patients, particularly those with rapid clinical resolution following effective source control of intra-abdominal or urinary sepsis and those with anatomically uncomplicated pyelonephritis (weak recommendation, low quality of evidence).

13. We recommend daily assessment for de-escalation of antimicrobial therapy in patients with sepsis and septic shock (BPS).
SSC Guidelines

D. Antimicrobial Therapy

14. We suggest that measurement of procalcitonin levels can be used to support shortening the duration of antimicrobial therapy in sepsis patients (weak recommendation, low quality of evidence)

15. We suggest that procalcitonin levels can be used to support the discontinuation of empiric antibiotics in patients who initially appeared to have sepsis, but subsequently have limited clinical evidence of infection (weak recommendation, low quality of evidence)
E. Source Control

1. We recommend that a specific anatomical diagnosis of infection requiring emergent source control be identified or excluded as rapidly as possible in patients with sepsis or septic shock, and that any required source control intervention be implemented as soon as medically and logistically practical after the diagnosis is made (BPS).

2. We recommend prompt removal of intravascular access devices that are a possible source of sepsis or septic shock after other vascular access has been established (BPS).
1. We recommend that a fluid challenge technique be applied where fluid administration is continued as long as hemodynamic factors continue to improve (BPS).

2. We recommend crystalloids as the fluid of choice for initial resuscitation and subsequent intravascular volume replacement in patients with sepsis and septic shock (strong recommendation, moderate quality of evidence).
F. Fluid Therapy

3. We suggest using either balanced crystalloids or saline for fluid resuscitation of patients with sepsis or septic shock (weak evidence, low quality of evidence)

4. We suggest using albumin in addition to crystalloids for initial resuscitation and subsequent intravascular volume replacement in patients with sepsis and septic shock when patients require substantial amounts of crystalloids (weak recommendation, low quality of evidence)
5. We recommend against using hydroxyethyl starches with sepsis or septic shock (strong recommendation, high quality of evidence)

6. We suggest using crystalloids over gelatins (synthetic colloids) when resuscitating patients with sepsis or septic shock (weak recommendation, low quality of evidence)
SSC Guidelines

G. Vasoactive Medications

1. We recommend norepinephrine as the first choice vasopressor (strong recommendation, moderate quality of evidence)

2. We suggest adding either vasopressin (up to 0.03 U/min) (weak recommendation, moderate quality of evidence) or epinephrine (weak recommendation, low quality of evidence) to norepinephrine with the intent of raising MAP to target, or adding vasopressin (up to 0.03 U/min) (weak recommendation, moderate quality of evidence) to decrease norepinephrine dosage
3. We suggest using dopamine as an alternative vasopressor agent to norepinephrine only in highly selected patients (e.g., patients with low risk of tachyarrhythmias and absolute or relative bradycardia) (weak recommendation, low quality of evidence)

4. We recommend against using low-dose dopamine for renal protection (strong recommendation, high quality of evidence)
5. We suggest using dobutamine in patients who show evidence of persistent hypoperfusion despite adequate fluid loading and the use of vasopressor agents (weak recommendation, low quality of evidence).

Remarks: If initiated, vasopressors dosing should be titrated to an end point reflecting perfusion, and the agent reduced or discontinued in the face of worsening hypotension or arrhythmias.
6. We suggest that all patients requiring vasopressors have an arterial catheter placed as soon as practical if resources are available (weak recommendation, very low quality of evidence)
6. We suggest against using IV hydrocortisone to treat septic shock patients if adequate fluid resuscitation and vasopressor therapy are able to restore hemodynamic stability. If this is not achievable, we suggest IV hydrocortisone at a dose of 200mg per day (weak recommendation, low quality of evidence).
I. Blood Products

1. We recommend that RBC transfusion occur only when hemoglobin concentration decreases to <7.0g/dL in adults in the absence of extenuating circumstances, such as myocardial ischemia, severe hypoxemia, or acute hemorrhage (strong recommendation, high quality of evidence)

2. We recommend against the use of erythropoietin for treatment of anemia associated with sepsis (strong recommendation, moderate quality of evidence)
SSC Guidelines

I. Blood Products

3. We suggest against the use of fresh frozen plasma to correct clotting abnormalities in the absence of bleeding or planned invasive procedures (weak recommendation, very low quality of evidence)

4. We suggest prophylactic platelet transfusion when counts are $<10,000/mm^3$ in the absence of apparent bleeding and when counts are $<20,000/mm^3$ if the patient has a significant risk of bleeding. Higher platelet counts $\geq 50,000/mm^3$ are advised for active bleeding surgery, or invasive procedures (weak recommendation, very low quality of evidence)
SSC Guidelines

J. Immunoglobulins
K. Blood Purification
L. Anticoagulants
M. Mechanical Ventilation
N. Sedation and Analgesia
O. Glucose Control
P. Renal Replacement Therapy
Q. Bicarbonate Therapy
R. Venous Thromboembolism Prophylaxis
SSC Guidelines

S. Stress Ulcer Prophylaxis
T. Nutrition
U. Setting Goals of Care
References:


Guidelines are available
Go to the Surviving Sepsis Campaign Website and look under the tab Guidelines. There will be a link there.
Emergency Room Opportunities
Have you even considered monitoring hemodynamics as early as in the Emergency Dept. or on a Rapid Response Call?
Hyperdynamic phase produces increased CO and decreased peripheral resistance (SVR)
- Hypotension
- Tachycardia
- Bounding pulse
- Warm, well perfused extremities
- Skin flushed, moist

Hypodynamic phase characterized by decreased CO & increased peripheral resistance (SVR)
- Hypotensive
- Tachycardia
- Narrow, thread pulse
- Cold, poorly perfused extremities
- Skin pale, dry

Non-Invasive Finger Cuff Effective in monitoring patients in the hyperdynamic phase of sepsis

Goal Directed Therapy (GDT) Protocol

ClearSight (Finger Cuff) versus FloTrac (Arterial Line)

Inclusion Criteria (ClearSight & FloTrac)
- SIRS/Severe Sepsis/Septic Shock
- Difficult to determine intravascular volume (heart failure, renal failure)
- Determination of hemodynamic optimization (i.e., volume, inotrope, vasodilator)

ClearSight
- Mild or moderate peripheral vasoconstriction*
- No high-dose vasopressors (typically Levophed or Dopamine > 7)*
- No mechanical obstruction to the hand or arm

FloTrac
- Existing arterial line
- Severe peripheral vasoconstriction, secondary to high-dose vasopressors (typically Levophed or Dopamine > 7)*
- Mechanical obstruction to the hand or arm

Other CO/SV Measurement
- VADs (i.e., Impella)
- IABP
- Severe, persistent arrhythmias
- Severe, persistent peripheral vasoconstriction or arterial spasm that dampen the arterial waveform
- Swan Ganz catheter in place

* If Clear Sight in place prior to peripheral vasoconstriction or high dose vasopressors, continuation with use of this device is acceptable
**Stroke Volume (SV) Optimization**

- **Monitor Stroke Volume**
- **200-250 mL Fluid Challenge over 5-10 minutes** OR **Passive Leg Raise (PLR) over 1-2 minutes**
- **SV Increase > 10%**
- **SV Reduction > 10%**
- **Monitor SV for clinical signs of fluid loss**

For more information contact: Angela Craig APN, MS, CCNS Clinical Nurse Specialist ICU (931) 783 5035 or Email: acraig@crmchealth.org
<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>NORMAL RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO (Cardiac Output)</td>
<td>4.0-8.0 L/Min</td>
</tr>
<tr>
<td>CI (Cardiac Index)</td>
<td>2.5-4.0 L/Min/m²</td>
</tr>
<tr>
<td>SV (Stroke Volume)</td>
<td>60-100 mL/beat</td>
</tr>
<tr>
<td>SVI (Stroke Volume Index)</td>
<td>33-47 mL/beat/m²</td>
</tr>
<tr>
<td>SVR (Systemic Vascular Resistance)</td>
<td>800-1200 dynes – sec/cm⁻⁵</td>
</tr>
<tr>
<td>SVRI (Systemic Vascular Resistance Index)</td>
<td>1970-2390 dynes – sec/cm⁻⁵/m²</td>
</tr>
<tr>
<td>SVV (Stroke Volume Variation)</td>
<td>&lt; 13%</td>
</tr>
</tbody>
</table>

**Frank-Starling Curve**

Stroke Volume

- Increase fluid when ΔSV < 10%
- Continue fluid when ΔSV > 10%
- Discontinue fluid when ΔSV < 10%

Increasing SV with fluid until the plateau of the Frank-Starling Curve is reached has been shown to improve the outcome of high-risk surgery patients.


**Perioperative Goal-Directed Therapy improves outcomes vs. conventional care alone**

As seen in the figure above, a U shape relationship is classically described between the amount of volume administered and the morbidity rate. Conventional fluid management, based on clinical assessment, vital signs and/or central venous pressure (CVP) monitoring, is suboptimal. Indeed, clinical studies have shown that CVP is not able to predict fluid responsiveness and that changes in blood pressure cannot be used to track changes in stroke volume (SV) or in cardiac output induced by...
EMS radio report: 54 year old Db with c/o SOB. Left below the knee amputation with ulcer. Suspected respiratory infection + possible infection to ulcer on stump

- ClearSight applied
- PLR performed raising 1 ½ legs.
- SV has a subtle rise but <10%
- IV initiated at 999. Monitoring for rise in SV with fluid bolus
- Again SV has a subtle rise but not >10%

**Interpretation:**
Respiratory infection is localized not systemic. No intravascular volume shift noted with PLR or fluid bolus. Nickle size abrasion to stump 2nd to ill fitting prosthesis. No infection to stump noted.
61 year old male with C/O SOB. Tachypnea with suspected source respiratory. Screening positive for Sepsis initiating Sepsis 3 Hour Bundle.

• Upon my arrival bundle in progress with 2L infused, continuing with 3rd liter.+ antibiotics
• LA 2.4 +WBC 21,000
• SV (82-86) increasing >10% to (102-105) with 3rd liter.
• Post 3rd liter walking to bathroom. IV infusion + ClearSight stopped.
• Upon return from bathroom drop in SV.
• Volume administration restarted.

Interpretation:
Need for 3rd liter 2nd to rise in SV >10%. Drop in SV upon return from BR signifying need for additional volume. Rise in SV upon restarting volume administration.
<table>
<thead>
<tr>
<th>Severe Sepsis/Septic Shock Summary</th>
<th>Jan'16</th>
<th>Feb'16</th>
<th>Mar'16</th>
<th>April'16</th>
<th>May'16</th>
<th>June'16</th>
<th>July'16</th>
<th>Aug’ 16</th>
<th>Sept’16</th>
<th>Oct’16</th>
<th>Nov’16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Mgt Bundle Compliance Rate:</td>
<td>59%</td>
<td>72%</td>
<td>64%</td>
<td>67%</td>
<td>60%</td>
<td>69%</td>
<td>72%</td>
<td>66%</td>
<td>70%</td>
<td>71%</td>
<td>65%</td>
</tr>
<tr>
<td>Severe Sepsis Bundle:</td>
<td></td>
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</tr>
<tr>
<td># of patients that met criteria</td>
<td>51</td>
<td>58</td>
<td>76</td>
<td>75</td>
<td>49</td>
<td>61</td>
<td>53</td>
<td>65</td>
<td>67</td>
<td>52</td>
<td>80</td>
</tr>
<tr>
<td>Initial Lactate w/in 3 hrs</td>
<td>96%</td>
<td>95%</td>
<td>97%</td>
<td>95%</td>
<td>100%</td>
<td>98%</td>
<td>97%</td>
<td>99%</td>
<td>99%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Bld C/S prior to ATB and w/in 3 hrs</td>
<td>88%</td>
<td>95%</td>
<td>96%</td>
<td>91%</td>
<td>94%</td>
<td>92%</td>
<td>94%</td>
<td>94%</td>
<td>99%</td>
<td>100%</td>
<td>95%</td>
</tr>
<tr>
<td>ATB w/in 3 hrs</td>
<td>96%</td>
<td>90%</td>
<td>93%</td>
<td>97%</td>
<td>92%</td>
<td>95%</td>
<td>96%</td>
<td>92%</td>
<td>94%</td>
<td>94%</td>
<td>91%</td>
</tr>
<tr>
<td>Repeat lactate w/in 6 hrs (if initial &gt;2)</td>
<td>83%</td>
<td>90%</td>
<td>74%</td>
<td>87%</td>
<td>88%</td>
<td>91%</td>
<td>95%</td>
<td>90%</td>
<td>98%</td>
<td>93%</td>
<td>93%</td>
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<tr>
<td>Septic Shock Bundle:</td>
<td></td>
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</tr>
<tr>
<td># of patients that met criteria</td>
<td>18</td>
<td>17</td>
<td>24</td>
<td>19</td>
<td>15</td>
<td>15</td>
<td>11</td>
<td>19</td>
<td>19</td>
<td>14</td>
<td>22</td>
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<tr>
<td>Resuscitation W/cystalloid fluid w/in 3 hrs for pt w/initial hypot</td>
<td></td>
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</tr>
<tr>
<td>Resuscitation w/cystalloid fluid w/3hrs for pt w/septic shock</td>
<td>83%</td>
<td>93%</td>
<td>83%</td>
<td>84%</td>
<td>80%</td>
<td>60%</td>
<td>73%</td>
<td>84%</td>
<td>76%</td>
<td>93%</td>
<td>94%</td>
</tr>
<tr>
<td>Vasopressors for persist. Hypotension w/in 6 hrs</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>83%</td>
<td>50%</td>
<td>100%</td>
<td>50%</td>
<td>100%</td>
<td>89%</td>
<td>100%</td>
<td>86%</td>
</tr>
<tr>
<td>Repeat volume status/ tissue perfusion assessment w/in 6 hrs</td>
<td>75%</td>
<td>75%</td>
<td>90%</td>
<td>74%</td>
<td>80%</td>
<td>87%</td>
<td>73%</td>
<td>79%</td>
<td>84%</td>
<td>57%</td>
<td>77%</td>
</tr>
<tr>
<td>Other:</td>
<td></td>
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<tr>
<td>Central line inserted for septic shock patients</td>
<td>39%</td>
<td>41%</td>
<td>67%</td>
<td>63%</td>
<td>53%</td>
<td>73%</td>
<td>64%</td>
<td>42%</td>
<td>53%</td>
<td>50%</td>
<td>55%</td>
</tr>
<tr>
<td>Survival rate for severe sepsis and septic shock patients</td>
<td>88%</td>
<td>88%</td>
<td>83%</td>
<td>88%</td>
<td>82%</td>
<td>80%</td>
<td>94%</td>
<td>95%</td>
<td>94%</td>
<td>88%</td>
<td>91%</td>
</tr>
<tr>
<td>Readmission Rate</td>
<td>0%</td>
<td>2%</td>
<td>1%</td>
<td>3%</td>
<td>8%</td>
<td>5%</td>
<td>4%</td>
<td>9%</td>
<td>4%</td>
<td>6%</td>
<td>6%</td>
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</tbody>
</table>
Questions