Sepsis: Expert recommended care practices and protocols
Agenda

- MHA QPS Overview
  Rahul Koranne, MD, MBA
  Minnesota Hospital Association Chief Medical Officer

- Sepsis care practices and protocols – Emergency Department perspective
  David Larson, MD, FACEP
  Ridgeview Medical Center

- Sepsis care practices and protocols – Inpatient perspective
  Craig Weinert, MD, MPH
  University of Minnesota Medical Center

- MHA Resources
  Sepsis Road Map and QPS dashboard overview
  Sepsis advisory committee site visits available

- Question & Answer
Issue Identified

Expert Committee

Celebrate

Continuous Quality Improvement

Process, Outcome & Adherence Data

MHA Road Map
Sepsis mortality, claims

120 of 122 hospitals reporting a 33.6% increase from MN-HIIN baseline

All-cause, in-hospital mortality rate among sepsis patients in Minnesota HIIN hospitals

\[ y = 0.0067x + 3.7411 \]
Septic shock mortality, claims

120 of 122 hospitals reporting a 17% increase from MN-HIIN baseline

All-cause, in-hospital mortality rate among Septic Shock patients in Minnesota Hospitals

\[ y = -0.0067x + 26.398 \]
45 yr old female

- Presents to the ED with cough, chest pain and shortness of breath.
- Initial VS: T 98.3, BP 131/88 HR 140 R 24 Sat 88%
- Mental status: normal
- Chest xray: bilateral pulmonary infiltrates
- WBC 7.8 (90% PMN)
- Lactate 4.6
Chest x-ray
Objectives

- Early recognition of sepsis
- Initial management
- Appropriate disposition
Sepsis is a Time Critical Emergency
“Similar to polytrauma, acute myocardial infarction, or stroke, **early identification** and **appropriate management in the initial hours** after sepsis develops improve outcomes”
New Paradigm for Sepsis

URGENCY
In septic shock every hour delay in antibiotic administration was associated with a 7.6% decrease in survival \(\text{Kumar, Crit Care Med 2006; 34:1589}\)
Time to Treatment in Sepsis

Seymore, NEJM 376 (23), 2017
Early recognition in the ED

- **Systemic Inflammatory Response Syndrome (SIRS)**
  - 2 or more of the following
    - Fever or hypothermia (T >100.4 or < 96.8)
    - Tachycardia (HR > 90)
    - Tachypnea (RR > 20 or PaCO2 < 32)
    - Leukocytosis, leukopenia or left shift (WBC > 12,000, < 4,000 or > 10% bands)
  
- **Sepsis** – defined as SIRS as a result of infection
\textbf{Severe Sepsis:} Sepsis plus sepsis-induced organ dysfunction or tissue hypoperfusion

- Sepsis-induced hypotension: Systolic Blood pressure <90 mm Hg or MAP <70 mm Hg or SBP decrease > 40mm Hg

\textbf{Septic Shock:} Sepsis induced hypotension persisting despite adequate fluid resuscitation
Organ dysfunction in sepsis

- Altered LOC &/or Confusion
- Acute lung injury
  - RR ≥ 22/min
  - PaO2/FiO2 <400
- Liver dysfunction
  - Bilirubin > 1.2
  - INR > 1.5
- Lactate ≥ 4
- Tachycardia
- Hypotension
  - SBP ≤ 100mmHg
  - MAP < 70mmHg
- Ileus
- Peritonitis
- Pancreatitis
- Thrombocytopenia
  - Platelets < 150K
- Oliguria
  - Cr > 1.2
  - Urine output < 500 ml/d
Recognizing Sepsis Begins in Triage
Reminders

Stop Sepsis
3-100s

Pulse 100
Temp 100
Emergency Department & General Floor Sepsis Algorithm

Begin at Triage using “Adult ED Sepsis Screening Tool”

Suspected infection and 2 more SIRS criteria?

Yes

Suspected sepsis

Positive screen for sepsis

Proceed with:
- Cardiac monitor
- BP, P, RR, MAP q15 and Temp hourly until stable
- Continuous oximetry
- Oxygen to maintain SpO₂ <90%
- Establish at least 1 large bore IV line
- Obtain BC, UA/UC, CBC w/ diff, lactate

Negative screen for sepsis

No

Nursing Early Detection Tool 100-100-100

SIRS Criteria
- Temperature ≥100 or ≤96.8
- Heart Rate > 100 beats/min
- Respiratory Rate >20/SpO₂<90%
- Altered Mental Status

Notify physician and begin “Severe Sepsis/Septic Shock Screening Tool”

3-hr Bundle
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 ≥4mmol/L
Criticism of traditional definitions

- Too sensitive
  - A bad cold could be classified as sepsis
  - Routine post op patients
- Too much variability in the definition which can affect reported outcome such as mortality
Evolving Issues in Critical Care and Sepsis
The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3)
New Definitions in 2016 guidelines

- **Sepsis**
  - Life-threatening organ dysfunction due to a dysregulated host response to infection
  - Lay-term definition
    - “Sepsis is a life-threatening condition that arises when the body’s response to an infection injures its own tissues and organs”

- **Septic shock**
  - A subset of sepsis in which particularly profound circulatory, cellular, and metabolic abnormalities substantially increase mortality
Organ Dysfunction

- Can be identified as an acute change in total SOFA score of $\geq 2$
Sequential Organ Failure Assessment Score (SOFA) criteria


- SOFA assists in predicting patient mortality
- It does require a blood gas
- Not appropriate for all clinical situations, i.e. Emergency Department where early recognition is key
Welcome Sepsis-3 readers! We've also added the qSOFA Score with a summary of the new definitions and recommendations.

Note: Use the worst value in a 24-hour period for the SOFA Score.

<table>
<thead>
<tr>
<th>Partial Pressure of Oxygen</th>
<th>60 mm Hg</th>
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<tbody>
<tr>
<td>Fraction of Inhaled O2</td>
<td>40 %</td>
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<tr>
<td>Platelet Count</td>
<td>120 x10^3/µL</td>
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<tr>
<td>Glasgow Coma Scale</td>
<td>13 points</td>
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<tr>
<td>Bilirubin</td>
<td>1.2 mg/dL</td>
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</table>

**Level of Hypotension (Vasopressor Status For ≥ 1 Hr)**
- No Hypotension 0
- MAP < 70 1
- On vasopressors, dopamine < 5 µg/kg/min or dobutamine (any dose) 2
- Dopamine > 5 µg/kg/min or Epi/Norepi < 0.1 µg/kg/min 3
- Dopamine > 15 µg/kg/min or Epi/Norepi > 0.1 µg/kg/min 4

**Creatinine (or Urine Output, Use Worst Value)**
- Cr < 1.2 mg/dL (< 106 µmol/L) 0
- Cr 1.2-1.9 mg/dL (106-168 µmol/L) 1
- Cr 2.0-3.4 mg/dL (177-301 µmol/L) 2
- Cr 3.5-4.9 mg/dL (309-433 µmol/L) or Urine Output < 500 ml/day 3
- Cr > 5.0 mg/dL (> 442 µmol/L) 4

7 points
An initial SOFA score <9 predicted a mortality <33%, while an initial score >11 predicted a mortality of 95%.
Clinical criteria of Sepsis

- Attempted to differentiate Sepsis from uncomplicated infections
- Interrogated large clinical data sets of hospitalized patients with presumed infection correlating 21 different clinical and laboratory criteria with clinical outcomes
  - Mortality and ICU length of stay > 3 days
- qSOFA – simple bedside criteria to screen those with infection who are likely to have poor outcomes.
Remember qSOFA = HAT

- **H**ypotension (BP < 100)
- **A**ltered Mental Status
- **T**achypnea (RR > 22)
New Sepsis Definitions

Patient with suspected infection

qSOFA ≥ 2? (see A)

No

Sepsis still suspected?

No

Monitor clinical condition; reevaluate for possible sepsis if clinically indicated

Yes

Assess for evidence of organ dysfunction

SOFA ≥ 2? (see B)

No

Monitor clinical condition; reevaluate for possible sepsis if clinically indicated

Yes

Sepsis

Despite adequate fluid resuscitation, 1. vasopressors required to maintain MAP ≥ 65 mm Hg AND 2. serum lactate level > 2 mmol/L?

No

Septic shock

A qSOFA Variables
- Respiratory rate
- Mental status
- Systolic blood pressure

B SOFA Variables
- PaO₂/FiO₂ ratio
- Glasgow Coma Scale score
- Mean arterial pressure
- Administration of vasopressors with type and dose rate of infusion
- Serum creatinine or urine output
- Bilirubin
- Platelet count
Septic Shock Clinical Criteria

- Despite adequate fluid resuscitation, vasopressors needed to maintain MAP ≥ 65
  
  And

- Lactate > 2
### 1992 Consensus Definitions

**Sepsis**
- **2 or more SIRS criteria**
  - Temperature >38°C or <36°C
  - Pulse rate >90 beats/min
  - Respiratory rate >20 breaths/min
  - WBC count >12,000 cells/mL

**Severe sepsis**
- Sepsis + evidence of organ dysfunction
  - Neurologic: altered mental status by history or examination
  - Cardiovascular: systolic blood pressure <90 mm Hg after fluid challenge
  - Metabolic: lactate >4.0 mmol/L
  - Hematologic: platelets <100,000 cells/mL
  - Renal: creatinine >2.0 mg/dL, not known to be chronic
  - Pulmonary: respiratory rate >20 breaths/min or pulse oximetry <90%
    - on room air or <95% while breathing supplemental oxygen >4 L/min

**Septic shock**
- Sepsis + evidence of hypoperfusion
  - Vasopressor requirement
  - Hypotension after at least 2 L intravenous fluids

### SEP-3 Definitions

**Sepsis**
- **2 or more qSOFA criteria**
  - Respiratory rate >20 breaths/min
  - Systolic blood pressure <100 mm Hg
  - Altered mental status

**Septic shock**
- Vasopressor requirement to maintain mean arterial pressure >65 and serum lactate >2.0 mmol/L
Among patients with infection who died during the hospitalization, how many were detected (RED)

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<table>
<thead>
<tr>
<th>qSOFA</th>
<th>OLD “SEPSIS”</th>
<th>SEVERE SEPSIS</th>
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Henning Ann Emerg Med 2017;70:544
SIRS vs qSOFA (specificity)

Among patients who survived, how many were marked as high risk for dying (black)

Henning Ann Emerg Med 2017;70:544
Lactate as a screening tool

What does an elevated lactate mean?

- Marker of cellular/metabolic stress
- Can also occur with liver disease, catecholamine Rx, other drugs (metformin)
- Independent predictor of mortality
- Lactate > 4
  - Tissue hypoperfusion
  - “occult” sepsis/septic shock
  - Admit to ICU
Lactate

Every hospital should be able to perform a lactate with results within 30 minutes.
“If a patient is sick enough to order a blood culture, then they are sick enough to order a lactate” (Scott Davis, MD, Director of ICU SCH)

Link lactate to blood culture order
Sepsis without fever
45% Septic shock patients – afebrile

21.7% higher risk of in-hospital mortality

Absence of fever led to delayed diagnosis and treatment in the ED

Associated with older age, alcoholism, COPD, end stage liver disease
Recognizing Sepsis in older patients

- Fever may be absent
  - 13% in patients > 65 vs 4% in < 65yrs
- Lower incidence of tachycardia and hypoxemia
- Infection may not be apparent
  - More likely to have altered mental status (confusion, delerium)
  - Other non specific complaints such as weakness, falls, anorexia, incontinence

Girard, Aging and Inf Dis. 2005
Undifferentiated Shock

- Think Sepsis
- Obtain cultures and begin broad spectrum antibiotics
2016 Sepsis Guideline

“...We recommend administration of IV antibiotics as soon as possible after recognition and within 1 hour for both sepsis and septic shock (strong recommendation)...”
Initial Management: IV Fluids

- 2016 Sepsis Guideline
  - “We recommend that, in the resuscitation from sepsis induced hypoperfusion, at least 30cc/kg of IV crystalloid fluid be given within the first 3 hours (strong recommendation)”
Early treatment = improved outcomes

3 Hour Bundle
To be completed within 3 hours of time of presentation

Measure lactate level

Obtain blood cultures prior to administration of antibiotics

Administer broad spectrum antibiotics

Administer 30 ml/kg crystalloid for hypotension or lactate ≥ 4mmol/L

Early treatment = improved outcomes

6 Hour Bundle
To be completed within 6 hours of time of presentation

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

In the event of persistent hypotension after initial fluid administration (MAP < 65 mmHg) or if initial lactate was ≥ 4 mmol/L, reassess vol. status and tissue perfusion & document findings.

Re-measure lactate if initial lactate is elevated

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
- Bedside cardiovascular ultrasound
- Dynamic assessment of fluid responsiveness with passive leg raise or fluid challenge

Disposition

- ICU or transfer
  - Lactate >4
  - SOFA or qSOFA > 2
  - Requiring vasopressors to maintain MAP
CAH: When to transfer?

- Lactate > 4 mmol/ml
- Unresponsive to 30ml/kg fluid (no increase in UOP or BP)

OR

2 or more of the following:

- SaO2 <90% or increase in O2 requirements
- SBP < 90 mmHg or decrease by 40 mmHg from baseline or MAP < 65 mmHg
- UOP < 30 ml/hr, increase in creatinine > .05 mg/dl from baseline or ≥ 2.0 mg/dl
- Altered mental status, GCS ≤ 12
- Platelets < 100,000, INR > 1.5, PTT > 60 secs
- Serum total bilirubin ≥ 4mg/dl or plasma total bilirubin > 2.0 mg/dl or 35 mmol/L
- Progression of symptoms despite treatment

Time to Transfer goal: < 2 hrs
45 yr old female

- Presents to the ED with cough, chest pain and shortness of breath.
- Initial VS: T 98.3, BP 131/88 HR 140 R 24 Sat 88%
- Mental status: normal
- Chest xray: bilateral lung consolidation involving all lobes.
- WBC 7.8 (90% PMN)
- Lactate 4.6
Initial management

- Screen positive for Sepsis
  - SIRS
    - Tachycardia, tachypnea, left shift
  - Severe Sepsis
    - Respiratory failure
    - Lactate > 4
  - qSOFA
    - RR, HR
Missed opportunities

- Triage level 3 (no sepsis alert)
  - No fever
- Received broad spectrum antibiotics (2hrs 20mins after arrival)
- IV NS 1000L
- Admitted to community hospital medical floor 4 hrs 43 mins after arrival
Hospital course

- Respiratory status deteriorated and hypotension (systolic 80, MAP 60) requiring intubation, pressors and transfer to ICU.
- Lactate 5.8
- Worsening respiratory failure and ARDS
- Transferred to Tertiary hospital ICU
- Discharged 2 wks later
  - Strep pneumo pneumonia
  - ARDS
Summary

- Screen for Sepsis
  - Fever may not be present
- Have a protocol
- Early antibiotics and fluid resuscitation
- Transfer to the appropriate level of care
- Have a PI process for sepsis
Recognition & Management of Sepsis – Inpatient Perspective

Craig Weinert, MD, MPH
Critical Care Physician,
Pulmonologist
University of Minnesota Medical Center
In-patient perspective

- Conceptual approach is similar to ED—screen, assess, treat quickly, follow for deterioration
  - Low threshold for abx, rare justification for avoiding full 30 ml/kg initial fluid bolus
    - Ok to use in “CKD”, “CHF” “dialysis”, “EF 35%” unless in gross volume overload
- Use LA as a marker of severity of illness needing higher level of care
- Alerts and elevated LA can help create a sense of urgency especially in “new” cases
Non-septic causes of elevated LA and SIRS

- In-patients sepsis alerts complicated by:
  - Persistent abnl VS or elevated WBC even if sepsis is being treated appropriately
  - LA > 2 even if improving
    - Surgery
    - Liver failure (cirrhosis not by itself)
    - Cardiac failure
    - Bleeding
    - Advanced cancer
    - Respiratory distress
    - All of these are also associated with infections/sepsis
  - Requires examining the pt with a “skeptical” approach
Negative consequences of repeated sepsis alerts

- Possibility of repeated fluid boluses to “make the LA better”
- Alarm fatigue (might ignore the next “alarm”)
- DNR/DNI vs palliative care vs comfort care patients
- Multiple blood draws, pressure on lab
- Increased antibiotic use (not a problem if de-escalation is followed)
System approach to make it hard to miss a sepsis case

- SIRS alerts (paper or electronic)
- Automatic or low barrier to obtaining stat lactate
- Rapid provider evaluation
- Access to order sets/bundles
- Sense of urgency (like stroke or STEMI)
- Review of process measures for sample of (or all) cases (not just deaths or transfers)
- Ongoing staff education and physician champion
Questions?

- qSOFA
- Sepsis definitions
- CMS vs MHA vs SSC bundles
MHA patient safety resources

http://www.survivingsepsis.org/Pages/default.aspx

http://www.sccm.org/Pages/default.aspx
Welcome to the Quality and Patient Safety Data Portal

In order to share statewide and national benchmarks, the Minnesota Hospital Association’s Quality and Patient Safety Division collects outcome data on hospital-acquired conditions (HACs). Additionally, we offer interactive roadmaps to share best practices and to help you improve quality and patient safety at your organization. Within this data portal, you will find four sections: 1) Outcome data 2) Roadmaps 3) Patient and Family Engagement (PFE) data and 4) QPS Dashboard. The following roadmaps are available on this site: Maps Culture, Behavioral Health Falls, Controlled Substance Diversion Prevention, Delirium, Falls, Medication Safety, Opioid/Anticoagulant/Hypoglycemic, Perinatal, Pressure Injury/Ulcers, SAFER from Readmissions, Septic, Surgery, Transitions, Violence Prevention and VTE. Our MHA committees will continue to list the following roadmaps: Opioid/Anticoagulant/Hypoglycemic, Safe from HAIs and Transitions. We will communicate when these are tiered and loaded into the Quality and Patient Safety Data Portal. The QPS Dashboard is currently under construction. The QPS Dashboard and the PDF versions of the roadmaps will be available on August 1, 2017.

Outcome data
Complete and review outcome measures for a select facility.
Proceed

Road Map and Process data
Work through road maps set up for continual improvement in a given area.
Proceed

PFE data
Work through PFE data.
Proceed

Reports
Access reports for both outcome and road map information.
Proceed
The facility's core strategies for the early detection and treatment of sepsis and septic shock

A process is in place to initiate a rapid response to treat patients that screen positive for sepsis, patterned after other time critical emergencies such as trauma, STEMI, or stroke.

Ongoing, annual, interdisciplinary education on early detection and treatment of sepsis and septic shock; examples include simulation exercises and grand rounds.

Current and standardized evidence based literature is provided to patients in the clinic setting to increase public awareness.

A sepsis quality improvement process is in place
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# Outcome Data Dashboard

**QPS Dashboard**  Sepsis Shock, all-cause mortality

<table>
<thead>
<tr>
<th>Measure</th>
<th>Reporting Hospitals</th>
<th>Rate</th>
<th>MHIN-Baseline</th>
<th>MHIN-Reduction</th>
<th>State Rate</th>
<th>Period(Yr-Qtr)</th>
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<tr>
<td>SSI (NQF 0753). Abdominal Hysterectomy (PS)</td>
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<td>SSI (NQF 0753). Colon Surgeries (PPS)</td>
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<td>SSI (NQF 0753). Total Knee replacement (PPS)</td>
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<td>VAF, ventilator-associated complication (VAC)</td>
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**Run Chart**

- **Rate (Average)**
- **StateRate (Average)**

Values

- 0
- 10
- 20
- 30
- 40

Periods:
- 2015-04
- 2016-01
- 2016-02
- 2016-03
- 2016-04
- 2017-01
Site Visit Invitation

Goal: Create Standardized Site Visit Template

Collaborate

Bridge/Identify opportunities in care

Share your knowledge and expertise

Leverage Subject Matter Experts

Contact: Angie Pokharel
apokharel@mnhospitals.org
SEPSIS AND SEPTIC SHOCK: EARLY IDENTIFICATION SAVES LIVES

Sepsis and septic shock can be associated with a mortality rate of up to 60 percent if not managed early. MHA has coordinated a Sepsis toolkit to facilitate the adoption of sepsis early detection tools and the three- and six-hour care bundles by hospitals of all sizes.

Download the Sepsis road map.

- Seeing Sepsis toolkit
- Seeing Sepsis Long Term Care resources
- Webinar recordings

Videos

- Early recognition of sepsis & septic shock in the ED
- Improving care for patients with sepsis & septic shock
- Patient story: St. Cloud Hospital

Webinar recordings

- Recognition and Management of Severe Sepsis and Septic Shock, June 2019
- Download the slide presentation
Question and Answer