EARLY SEPSIS WARNINGS AND THE USE OF RAPID RESPONSE TEAMS

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OBJECTIVES

Describe tools available to assess hospitalized patients at risk for deterioration

Discuss outcomes associated with the use of rapid response teams (RRT) to recognize and respond to sepsis
Sepsis is an life threatening, dysregulated, exaggerated physiologic response to infection which leads to organ dysfunction.

>750,000 patients suffer with sepsis each year in the United States\(^1\)
- \(
\approx 200,000\) patients die annually from sepsis in the US\(^1\)
- \(383,000\) receive ICU care\(^2\)
- \(130,000\) are on mechanical ventilation\(^2\)

Inpatient mortality varies 20-40% depending on serenity of illness and co-morbidities.

Sepsis leads to poor outcomes when treatment is delayed or inadequate.
SEPSIS

Estimated cost of care per case $22,000 with total costs estimated >16.7 billion annually\(^1\)

Most expensive condition billed to Medicare in 2011, $20 billion\(^2\)

\(^1\) Critical Care medicine 2001 Vol 29(7): 1303-1310
\(^2\) 2010:statistical brief #146
RAPID RESPONSE TEAMS (RRT)

Specialized teams are called to review hospitalized patients who are demonstrating signs of clinical instability.

Can be trained to assess for sepsis as the cause of instability and intervene with protocols and physician assistance.
SEPSIS CALLS & RRTS

Sepsis and SIRS make up between 20-75% of in patient calls depending on study methods and criteria

Use of RRT could theoretically improve sepsis outcomes by early detection of patients who are deteriorating and administrating timely antibiotics

Several studies show many of the patients RRT respond to are already on antibiotics, but antibiotics are modified or changed to appropriate antibiotics 30%-50% of the time

RRT can be used initiate sepsis protocols and to administer volume resuscitation
USE OF EARLY WARNS

Patients have increased mortality with sepsis:
- If they have Lactic acid > 4 mmol/L and admitted to floor bed or IMU bed
- Delay in interventions: cultures, antibiotics, fluid boluses

Early identification with early antibiotic administration is one of the best metrics to lower mortality

Sepsis Management: (things we can ask RRT to do)
- Early detection
- Prompt recognition
- Acquisition of cultures
- Source control
- Early administration of appropriate antibiotics
- Timely resuscitation of organ dysfunction
Figure 1. Cumulative effective antimicrobial initiation following onset of septic shock-associated hypotension and associated survival. The x-axis represents time (hrs) following first documentation of septic shock-associated hypotension. Black bars represent the fraction of patients surviving to hospital discharge for effective therapy initiated within the given time interval. The gray bars represent the cumulative fraction of patients having received effective antimicrobials at any given time point.
ED Door-to-Antibiotic Time and Long-term Mortality in Sepsis

Ithan D. Peltan, MD; Samuel M. Brown, MD; Joseph R. Bledsoe, MD; Jeffrey Sorensen, MStat; Matthew H. Samore, MD; Todd L. Allen, MD; and Catherine L. Hough, MD
ER STUDY

Retrospective cohort study
Non-trauma adult ED patient with clinical sepsis
4 hospitals in Utah from 2013-2017
10,811 eligible patients
Measured time to antibiotic administration
Median time to antibiotic therapy 166 mins with 1 year mortality 19%
Each 1 hour increase in time to antibiotics associated with 10% increased adjusted odds of death at 1 year
1.1% per hour increase in risk-adjusted absolute mortality

Pelton et al, CHEST May 2019: 938-946
Managing sepsis: Electronic recognition, rapid response teams, and standardized care save lives☆☆☆☆☆☆

Faheem W. Guirgis, MD a,∗, Lisa Jones, MD b, Rhemar Esma, MD c, Alice Weiss, RN c, Kaitlin McCurdy, MD d, Jason Ferreira, PharmD e, Christina Cannon, MD a, Laura McLauchlin, DNP f, Carmen Smotherman, MS g, Dale F. Kraemer, PhD g, Cynthia Gerdik, DNP, MBA h, Kendall Webb, MD a, Jin Ra, MD i, Frederick A. Moore, MD j, Kelly Gray-Eurom, MD, MMM a
Implemented a hospital-wide program which included an electronic health record (HER) sepsis recognition tool, education, standardized management bundles and designated team responders including RRT for inpatients.

Retrospective review of all patients treated at UF Health Jacksonville for sepsis from Oct 1, 2013 to Nov 10, 2015.

12 months “before”: and 12 months “after” phase.

Patients with >2 SIRS alerts and a documented source of infection, AMS, SBP <90 or lactate > 3 mmol/L.
SEPSIS ALERTS

RRT consisted of a critical care RN available 24/7, on-call ICU physician, critical care pharmacist, respiratory therapist

Interventions: IV access, administering fluids & antibiotics and facilitated transfer to higher level of care

EHR had an automatic sepsis screening with adjusted MEWS-SRS

Positive predictive value >50%

Screening q 1h
- Score >5 sent page to RRT for ward patients

Sepsis: alert order set (3 hour Sepsis bundle)
- POC lactic acid
- Two sets of blood cultures
- Antibiotics recommendations
- 30 cc/kg fluid bolus
# RESULTS

<table>
<thead>
<tr>
<th>Multivariable analysis</th>
<th>Before</th>
<th>After</th>
<th>Odds ratio</th>
<th>P value</th>
<th>Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient Mortality</td>
<td>0.62</td>
<td>0.046</td>
<td>95% (0.39, 0.99)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICU LOS</td>
<td>2.13</td>
<td>1.95</td>
<td>&lt;0.001</td>
<td>95% (1.97, 2.34) (1.75, 2.06)</td>
<td></td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>11.74</td>
<td>9.92</td>
<td>&lt;0.0001</td>
<td>95% (10.9, 12.7) (9.3, 10.6)</td>
<td></td>
</tr>
<tr>
<td>Mechanical ventilation</td>
<td>0.70</td>
<td>0.007</td>
<td>95% (0.54, 0.91)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vasopressor Use</td>
<td>0.89</td>
<td>0.181</td>
<td>95% (0.75, 1.06)</td>
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</tr>
</tbody>
</table>
To review the triggering criteria for the alerts, simply go to the St. John Sepsis Agent Flowsheet. The St. John’s Sepsis Agent Flowsheet can be accessed by using the dropdown menu in the Quick View section of the EMR.

**Key Points for Successful Documentation**
- Document Vital Signs in “Real-Time”
- Dock glucometers to upload results after every patient or every 15 minutes when testing multiple patients.
- Send specimens to lab as soon as they are drawn.
- Make sure that the time the specimen is drawn, matches the time printed on the lab requisition.
- Be sure to properly position tympanic thermometers into the ear canal. If inserted improperly, a false low temperature may result.

Failure to comply with the principles stated above could lead to false-positive Sepsis Alerts or Sepsis Alerts failing to fire. Remember that you could be a “Lifesaver”.

**LET’S DECLARE WAR ON SEPSIS**
Cerner St John’s sepsis tool launched in July 2013

Uses lab data and vital sign measurement for 30 hours

**SIRS ALERT** - The patient must meet at least 3 SIRS criteria below:
- Temp (<36°C or >38.3°C)
- HR (>90 bpm)
- RR (>20 b/min)
- Glucose Level (<50 mg/dL or >180 mg/dL)
- WBC (<4 or >12 K/L)
- Bands (>10%)

**SEPSIS ALERT** - The patient must meet at least 2 SIRS criteria and 1 Organ Dysfunction criteria below:
- Lactic Acid level (>2.0)
- SBP (<90mmHg) or SBPΔ 100
- MAP (<65mmHg)
- Creatinine Level (> 2.0 mg/dL or Δ0.5 mg/dL increase)
- Total Bilirubin (≥2 mg/dL and ≤10 mg/dL)
- INR > 1.5 and not on warfarin
- Platelets <100,000 µL
NON-RAPID TRACKING TOOL

Form used to track non-Rapid response calls for Rapid Response Nurse
- Sepsis Calls
- PIVs
- Small bore feeding tube placement
- Lab draws
- Unit support
- Patient transport
- ER support

Tracks total time spent on calls
### Non-Rapid Response Nurse Tracking Tool

**Location**

**Date/Time Initiated**

**Date/Time Completed**

**Total Time**

### Tasks/Interventions

- [ ] IVY Start
- [ ] Patient Transports
- [ ] Code Blue
- [ ] Transfers to Higher Level of Care
- [ ] Moderate sedation
- [ ] Other
- [ ] Sepsis Protocol
  - (unrelated to nursing interventions)
- [ ] Education
- [ ] ER Assistance
- [ ] Audit (charts or AED Packs)
- [ ] Feeding Tube Insertion
- [ ] Direct Admission Assessment
- [ ] Other:

### Nurse Responding

- [ ] SWAT
- [ ] Pedi Transport
- [ ] Rapid Response
- [ ] Change Nurse
- [ ] Nurse Supervisor
- [ ] Other

### Children’s Unit Support

- [ ] Chart Review
- [ ] Patient Assessment
- [ ] Respiratory distress
- [ ] Abnormal EKG
- [ ] Increasing Acuity
- [ ] Fluid Resuscitation
- [ ] Help with admission
- [ ] Pediatric sepsis

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*By: Mitchell*

*Performed on: 06/30/2017, 1457 CDT*
Sepsis Risk High vs Low

SIRS Criteria
- Temperature >38.3°C or <36°C
- HR >95 bpm
- RR >22 rpm
- Glucose <50 mg/dl
- Glucose >150 mg/dl
- WBC >12 K/mm³
- WBC <4 K/mm³
- Bands >10% of WBCs
- Other

Name of Physician Contacted

Sepsis Risk Determination High
- High

Sepsis Risk Determination Low
- Low

Patient Assessment for Sepsis
- Suspect new infection
- Vital signs repaired or worse
- Worsening wound infection
- Other

Comorbidity Disease States
- Liver disease
- End Stage Renal Disease (ESRD)
- Cancer
- Sickle Cell
- Congestive Heart Failure (CHF)

Sepsis Information

Organ Dysfunction
- SBP <90 mmHg or SBP drop 40 mmHg or baseline without treatment
- MAP <65 mmHg
- SpO2<90% or increasing 0.2 needs to main stay >90%
- pH <7.3
- Lactic Acid >2.0 mmol/L
- Urea Output < than equates to 0.5 mL/kg/hr for 2 hours
- Creatinine > 2 x 50% increase from known baseline
- Platelets < 100,000/mm³
- INR >1.5
- PT >60sec
- Total Bilirubin >2 mg/dl and or equal to10 mg/dl
- Change in mental status from baseline

Interventions/Outcomes
- Fluids
- Blood cultures
- Urine culture
- Respiratory culture
- Other cultures
- Blood work
- CBC w/Diff
- Lactic acid
- Radiology orders
- New antibiotic orders
- Transfer to higher level of care
- Arterial blood gas
High vs Low determination is based on clinical judgment by the RN responding to the severe sepsis alert. Based on patient presentation, answering Low Risk will open the Comorbid Disease States, whose symptoms often mimic sepsis.
High Risk Determination will open Tab 3

Complete the Patient Assessment for Sepsis box and move to Tab 3
• RN to follow up on Sepsis orders
• Verify that orders were completed in a timely manner
• If answer no in the 0-30 minutes box, Name of provider contacted is mandatory
• If answer yes in the follow up boxes, the name of RN responding is mandatory
Total Rapid Response Calls

Total Rapid Response Calls
August 2018 - July 2019

August 2018: 357
September 2018: 335
October 2018: 386
November 2018: 308
December 2018: 287
January 2019: 343
February 2019: 231
March 2019: 285
April 2019: 306
May 2019: 345
June 2019: 282
July 2019: 362
Tasks/Interventions from Rapid Response Calls

Distinct Tasks Interventions
August 2018 through July 2019

- 26% of time Sepsis Alert
Monthly Totals of Total Sepsis Rapid Response Calls


198  189  268  228  198  218  161  186  184  230  198  262
Monthly Totals of Sepsis=Yes & Sepsis=No

Total Sepsis Calls
August 2018 - July 31, 2019

- No
- Yes
SIRS Criteria which triggered Severe Sepsis Alert

Distinct SIRS Criterion
August 2018 - July 2019

- Glucose < 50 mg/dl: 12
- Glucose > 180 mg/dl: 75
- Temp > 38.3 degrees (101 F): 139
- WBC < 4 K/cmm: 386
- Temp < 36 degrees (96.8 F): 399
- Bands > 10% of WBC’s: 683
- RR > 22 bpm: 1,041
- WBC > 12 K/cmm: 1,288
- HR > 95 bpm: 1,805
Organ Dysfunction

Organ Dysfunction Categories
August 2018 - July 2019

- PTT > 60 sec: 1
- SpO2 < 90% or increasing O2 needs to main sats < 90%: 1
- pH < 7.3: 2
- Urine Output < than equal to 0.5 mL/kg/hr for 2 hours: 2
- Platelets < 100,000/mm³: 4
- Creatinine > 2 or 50% increase from known baseline: 252
- MAP < 65 mmHg: 288
- INR > 1.5: 569
- Lactic Acid > 2.0 mmol/L: 580
- Total Bilirubin (> or equal to 2 mg/dl and < or equal to 10 mg/dl): 600
- SBP < 90 mmHg or SBP 40 mmHg < baseline without treatment: 613
Interventions/Outcomes of Sepsis = Yes

Intervention Outcomes Total
August 2019 - July 2018

- Respiratory culture: 6
- Other cultures: 11
- Arterial blood gas: 45
- CBC w/diff: 49
- Radiology orders: 54
- Urine cultures: 79
- Transfer to Higher level: 105
- New antibiotic orders: 130
- Blood cultures: 186
- Fluids: 275
- Lactic acid: 307
- No new order: 1,995
MS-DRG: 870 Septicemia or severe sepsis w/mv >96 hours or peripheral extracorporeal membrane oxygenation (ecmo),
871 Septicemia or severe sepsis w/o MV >96 hours w MCC
TAKE HOME POINTS

Sepsis mortality decreases with early recognition and treatment

Sepsis screening with early aggressive care is vital to increasing the chance of survival

Use of an automated early warning system can increase the identification of septic patients but can also lead increased false positives

Use of a RRT team to clinically assess patients at the bedside can help implement therapies such as drawing blood cultures and administering antibiotics & fluids

Ideally, these interventions will improve sepsis mortality and decrease the need for transfer to higher level of care
The number of patients who die of Sepsis in the United States is:

A. ~200
B. ~2000
C. ~20,000
D. ~200,000
E. ~2,000,000

Correct answer is D ~200,000 die in the US from sepsis every year
Using an early warning system to identify sepsis can decrease mortality

- True
- False

The answer is True. Every hospital should utilize a system to identify sepsis earlier and have a team in place to intervene.