The project described is supported by Funding Opportunity Number 1C1CMS330975-01-00 from the U.S. Department of Health and Human Services, Centers for Medicare and Medicaid Services. The contents of these slides are solely the responsibility of the authors and do not necessarily represent the official views of the U.S. Department of Health and Human Services or any of its agencies. The research presented here was conducted by Houston Methodist. Findings might or might not be consistent with or confirmed by the independent evaluation contractor.
No Disclosures to Report
Objectives

• Compare and contrast the outcomes between an evidenced based clinical pathway versus a mobile sepsis team in early identification of sepsis in a large academic medical center

• Describe the utilization of inpatient mobile sepsis team and how they affect hospital length of stay, morbidity, and mortality in a large academic center
Sepsis

- 11th leading cause of death in the U.S.
- 10th leading cause of death for patients 65 and older
- Leading cause of death in non-coronary ICU units
- In 2011, 3rd most common reason for hospitalization
- Annual aggregate hospital costs of $20.3 billion
- Mortality average nationwide 28-50%

- HMH sepsis mortality reached a high of 36% in 2009
An Uncontrolled Inflammatory Response

Infection VS. Uncontrolled Infection

- Local inflammation
- Local vasodilatation & increased blood flow
- Edema from increased permeability of microvasculature

Generalized Inflammation migrating to healthy tissue
Sepsis Continuum

- INFECTION
- SEPSIS
- SEVERE SEPSIS
- SEPTIC SHOCK
ProCESS trial

A Randomized Trial of Protocol-Based Care for Early Septic Shock

The ProCESS Investigators*

- Large RCT
- 1341 patients
- Multiple tertiary care centers in the US
ProCESS trial

A Cumulative In-Hospital Mortality to 60 Days

- Protocol-based EGDT
- Protocol-based standard therapy
- Usual care

<table>
<thead>
<tr>
<th>Days</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>10</td>
<td>1.2</td>
</tr>
<tr>
<td>20</td>
<td>3.0</td>
</tr>
<tr>
<td>30</td>
<td>5.0</td>
</tr>
<tr>
<td>40</td>
<td>7.0</td>
</tr>
<tr>
<td>50</td>
<td>9.0</td>
</tr>
<tr>
<td>60</td>
<td>11.0</td>
</tr>
</tbody>
</table>

P = 0.52 by log-rank test

No. at Risk
- Protocol-based EGDT: 439, 373, 356, 348, 347, 347, 347
- Protocol-based standard therapy: 446, 389, 376, 368, 366, 366, 365
- Usual care: 456, 396, 376, 371, 371, 371, 370

B Cumulative Mortality to 1 Yr

- Protocol-based EGDT
- Protocol-based standard therapy
- Usual care

<table>
<thead>
<tr>
<th>Days</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>60</td>
<td>1.0</td>
</tr>
<tr>
<td>120</td>
<td>3.0</td>
</tr>
<tr>
<td>180</td>
<td>5.0</td>
</tr>
<tr>
<td>240</td>
<td>7.0</td>
</tr>
<tr>
<td>300</td>
<td>9.0</td>
</tr>
<tr>
<td>365</td>
<td>11.0</td>
</tr>
</tbody>
</table>

P = 0.70 by log-rank test, 90 days
P = 0.92 by log-rank test, 1 yr

No. at Risk
- Protocol-based EGDT: 439, 289, 217, 194, 175, 156, 145
- Protocol-based standard therapy: 446, 308, 212, 196, 179, 158, 142
- Usual care: 456, 285, 211, 199, 181, 164, 139
Conclusion

• “In a multicenter trial conducted in the tertiary care setting, protocol-based resuscitation of patients in whom septic shock was diagnosed in the emergency department did not improve outcomes”
Other trials

- ARISE trial (2014) – large RCT in Australia
- Conclusion –
  - “In critically ill patients presenting to the emergency department with early septic shock, EGDT did not reduce all-cause mortality at 90 days” (ARISE trial)

- ProMISE (2015) – large RCT in Europe
- Conclusion –
  - “In patients with septic shock who were identified early and received intravenous antibiotics and adequate fluid resuscitation, hemodynamic management according to a strict EGDT protocol did not lead to an improvement in outcome”
Mortality Escalates along the Sepsis Continuum: A Clear Trend Exists

Sepsis Mortality Continuum

The Best Opportunity for Safe and Effective Intervention is Here!

- SIRS: 5%
- Sepsis: 10%
- Severe Sepsis: 25%
- Septic Shock: 60%

Sepsis Category

(%) Mortality
What have we learned?

- Early Recognition
- Early Intervention
- Improved Survival
4 work teams were created
- Education/ Awareness Team
- Resuscitation Team
- Measurement Team
- Screening Implementation Team
Screening Implementation Team

• Scheduled routine screening on pilot floor and SICU

• ED Screen, high risk conditions identified

• NP “Sepsis Team” screening
  – High risk patient population
  – Early Goal Directed Therapy
• Initially the sepsis team
  – Acute Care Nurse Practitioners
  – 2 NPs covering 6-7 days/week
  – 12 noon to 12 midnight
  – Focus patient population
Validation of a Screening Tool for the Early Identification of Sepsis

Laura J. Moore, MD, Stephen L. Jones, MD, Laura A. Kreiner, MD, Bruce McKinley, PhD, Joseph F. Sucher, MD, S. Rob Todd, MD, Krista L. Turner, MD, Alicia Valdivia, RN, and Frederick A. Moore, MD

**Severe Sepsis/Septic Shock Mortality by ICU**

<table>
<thead>
<tr>
<th></th>
<th>SICU</th>
<th>CVICU</th>
<th>MICU</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>35%</td>
<td>21%</td>
<td>38%</td>
</tr>
<tr>
<td>2007</td>
<td>23%</td>
<td>24%</td>
<td>37%</td>
</tr>
</tbody>
</table>

*Article in* The Journal of trauma · June 2009

DOI: 10.1097/TA.0b013e3181a3ac4b · Source: PubMed
Recognize the Signs

Tachycardia
Hyperthermia/Hypothermia
Elevated/Low WBC Count
Tachypnea

**Acute Change in Mental Status**

These vital signs may seem easy to spot, but are often overlooked!
• APN Interventions
  – Screening tool: SIRS screening tool developed by a surgical intensivist
  – Nine hundred and fifty-nine general non-ICU patients were screened to validate the screening tool
    • 99.9% sensitivity
    • 95.9% specificity
    • High negative predictive value
  – Screening and protocol initiation on one unit and SICU
HMH Sepsis Team

Goals

- HR < 100 bpm
- SBP > 90mmHg or MAP > 70 mmHg
- RR < 20
- Temperature normalized
- Lactic acid < 1.5 mmol/L
- Urine output > 0.5 ml/hr/kg
- Source control
- Return to baseline mentation
• Early Goal Directed Therapy
  – Fluid resuscitation
    • Fluid challenge should be titrated to BP, HR and CO
    • Fluid requirements may be as much as 3.5 liters
  – Labs and diagnostic tests
    • Lactic acid: trend until normalized
    • Bedside testing with iStat for lactic acid levels
  – Pan Culture
    • Blood cultures, urine, sputum, wounds, viral and stool cultures as indicated
  – Antibiotics
    • Initiate within 1 hour of recognition of sepsis
NP collaborate with care teams to facilitate rapid identification and care of the septic patient

NPs can initiate sepsis workup and appropriate tests and diagnostics prior to physician involvement
  – Especially helpful with critically ill patients when time is of the essence
  – And during the typical non-working time periods, such as nights, weekends and holidays

Sepsis core measure experts
Now the NP lead team is called the Emergency Response Team
  – 10 NPs
  – Coverage is 2 NPs in house 24/7
Respond to all sepsis consults/screens, all rapid responses, and code blues in the hospital, except in ICU
As of 2015:
  – Current mortality rate is 12.2%
  – 1000 lives have been saved since 2009
  – $19 Million dollars saved
Participants through 12/31/2015
(Preliminary Results - Acute Care Only)

Total Screens: 816,371

Total # of Patients Screened: 71,299

24,808 NP evals
8,528 patients

5,154 Professionals Trained @HMH

Acute Care Participants Since Go Live

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Length of Stay (HMH)</td>
<td>6 days</td>
</tr>
<tr>
<td>Average Length of Stay (Community Acute Care)</td>
<td>3.9 days</td>
</tr>
<tr>
<td>Average Number of Screens per Patient (per day)</td>
<td>11.4 (1.9/day)</td>
</tr>
</tbody>
</table>

Total Positive Screens: 22,582 (2.8%)

Total Positive Screens with Evaluation: 24,808 (3.0%)

Evaluation/Intervention Rate: 109%

91% of Sepsis Cases Were Screened at least Once
2008-2015 Sepsis Mortality – Trend

Data Source: HMH – MIDAS as of 03/07/2016

HM – System Quality Outcomes and Service Line Analytics Dept. (BRA)
2012-2015 SEPSIS MORTALITY – TREND

Sepsis Associated Mortality Reduced 66% from baseline Facility-Wide And sustained for 12 months

Data Source: HMH – MIDAS as of 03/07/2016
HM – System Quality Outcomes and Service Line Analytics Dept. (BRA)
Ongoing Education

• Training of NPs, RNs and PCAs
  – E-Learning
  – Team based sepsis simulation using interactive simulation manikins and modules

• NPs as second level providers
  – E-learning
  – Simulation lab scenarios

• NPs as second level providers for early recognition and interventions for any patient with a score of 4 or greater
### Ongoing Education

<table>
<thead>
<tr>
<th>Courses</th>
<th>Houston Methodist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bedside Nurse Training (In-Person)</td>
<td>2,227</td>
</tr>
<tr>
<td>Bedside Nurse Training (Online)</td>
<td>2,409</td>
</tr>
<tr>
<td>Bedside Module – 1 CE</td>
<td>278</td>
</tr>
<tr>
<td>Second Level Responder</td>
<td>162</td>
</tr>
<tr>
<td>New Simulation Scenarios Second Level</td>
<td>0</td>
</tr>
<tr>
<td>Second Level Refresher</td>
<td>29</td>
</tr>
<tr>
<td>Train the Trainer</td>
<td>33</td>
</tr>
<tr>
<td>Train the Trainer: Second Level</td>
<td>16</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>5,154</strong></td>
</tr>
</tbody>
</table>
1. Which criteria does not affect the sepsis score
   a) Heart rate
   b) Blood pressure
   c) Temperature
   d) Respiratory rate

2. Houston Methodist Hospital has decreased sepsis associated mortality by 66% from 2009 to 2015.
   a. True
   b. False
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References


