Today’s Host

Max Cryns, Project Assistant, Institute for Healthcare Improvement (IHI), assists programming activities for hospital settings including Expeditions (2-4 month web-based educational programs), Passport memberships, and mentor hospital relations. He also supports IHI’s networking and knowledge efforts. Max is currently in the Co-Operative Education Program at Northeastern University in Boston, MA, where he majors in Business Administration with concentrations in Entrepreneurship and Marketing. He enjoys professional and collegiate sports, playing basketball, music, the beach, and trivia.
WebEx Quick Reference

- Welcome to today’s session!
- Please use chat to “All Participants” for questions
- For technology issues only, please chat to “Host”
- WebEx Technical Support: 866-569-3239
- Dial-in Info: Communicate / Join Teleconference (in menu)

When Chatting...

Please send your message to All Participants
Expedition Director

Diane Jacobsen, MPH, CPHQ, Director, Institute for Healthcare Improvement (IHI) is currently directing the CDC/IHI Antibiotic Stewardship Initiative, NSLIJ/IHI Reducing Sepsis Mortality Collaborative. Ms Jacobsen served as IHI content lead and improvement advisor for the California Healthcare-Associated Infection Prevention Initiative (CHAIPPI) and directed Expeditions on Antibiotic Stewardship, Preventing CA-UTIs, Reducing C. difficile Infections, Sepsis, Stroke Care and Patient Flow. She served as faculty for IHI’s 100,000 Lives and 5 Million Lives Campaign and directed improvement collaboratives on Sepsis Mortality, Patient Flow, Surgical Complications, Reducing Hospital Mortality Rates (HSMR) and co-directed IHI’s Spread Initiative. She is an epidemiologist with experience in quality improvement, risk management, and infection control in specialty, academic, and community hospitals. A graduate of the University of Wisconsin, she earned her master’s degree in Public Health-Epidemiology.

Today’s Agenda

- Introductions
- Debrief: Session 5 Action Period Assignment
- Considerations and Challenges with Fluid Resuscitation
- Action Period Assignment
Expedition Objectives

By the end of the Expedition participants will be able to:

- Describe the latest evidence based care for patients with severe sepsis and septic shock
- Design reliable processes to ensure that each patient receives all elements of the best possible care at each opportunity
- Identify key opportunities and test changes on medical/surgical units to improve early recognition of sepsis in a care context which has been challenging for providers

Schedule of Calls

Session 1 – Clinical Updates to the Surviving Sepsis Campaign Guidelines: The 3 Hour Resuscitation Bundle
Date: Thursday, September 12, 1:00-2:30 PM ET

Session 2 – Key Considerations for Enhancing Reliability with Antibiotic Therapy in the Emergency Department and in Inpatient Floor
Date: Thursday, September 26, 1:00-2:00 PM ET

Session 3 – Lactate and Blood Culture Collection: Getting to Results Within One Hour
Date: Thursday, October 10, 1:00-2:00 PM ET

Session 4 – Ensuring Reliable Care from the Patient Perspective
Date: Thursday, October 24, 1:00-2:00 PM ET

Session 5 – Early Recognition and Monitoring of the Sepsis Patient on the Inpatient Floor
Date: Thursday, November 7, 1:00-2:00 PM ET

Session 6 – Considerations and Challenges with Fluid Resuscitation
Date: Thursday, November 21, 1:00-2:00 PM ET
Faculty

Terry P. Clemmer, MD, Director of Critical Care Medicine, LDS Hospital, Intermountain Healthcare (IHC), is also Professor of Medicine and Adjunct Professor of Biomedical Informatics at the University of Utah School of Medicine. He is the Medical Lead over the Intermountain Medicine Clinical Program’s Critical Care Team. Dr. Clemmer is Faculty Chair for the Institute for Healthcare Improvement (IHI) Reducing Sepsis Mortality Collaborative and he previously coached several IHI Adult ICU Breakthrough Series Collaboratives, the Idealized Design of the ICU project, and the Improving Outcomes for High-Risk and Critically Ill Patients Learning and Innovation Community. He has been active with the Surviving Sepsis Campaign and in the formulation of the Sepsis Bundles. An active researcher with numerous publications, he is a recognized speaker on critical care, medical informatics, telemedicine, standardization of care, and quality improvement.

Faculty

Sean R. Townsend, MD, Vice President of Quality and Safety, California Pacific Medical Center (CPMC), is also a practicing intensivist in the Division of Pulmonary and Critical Care at CPMC. Previously, he was Assistant Professor of Medicine at the University of Massachusetts and at Brown University Medical School. Dr. Townsend has been faculty advisor to IHI’s 100,000 Lives and 5 Million Lives Campaigns for the ventilator-associated pneumonia and catheter-related bloodstream infections interventions. He led IHI’s work on sepsis as part of the Improving Outcomes for High-Risk and Critically Ill Patients Learning and Innovation Community, and he is current faculty for the Reducing Sepsis Mortality Collaborative. A member of the Surviving Sepsis Campaign (SSC) executive committee, he is an author of the 2008 SSC International Guidelines on the Management of Severe Sepsis and Septic Shock and 2010 SSC Results of an International Guideline-based Performance Improvement Program Targeting Severe Sepsis.
Debrief: Session 5 Action Period Assignment

- Design a PDSA to enhance early recognition of sepsis on the inpatient floor, considering:
  - MEWS (modified early warning system)
  - Rapid Response Team/System
  - Situational awareness

Considerations and Challenges with Fluid Resuscitation
Why 30 ml/kg Predicted Body Weight Is Considered To Be Very Conservative

FACT:

- One liter of normal saline adds **275 ml** to the patient’s plasma volume
Why Do All Severe Sepsis Patients Need Volume?

- Vascular volume is lost into interstitial space do to diffuse capillary leaking from cytokine release
- Both venous and arteriolar tone is reduced & blood volume occupies a larger intravascular space than normal
- Many patients also have GI and Skin losses

Pathophysiology Septic Shock

Figure B, page 948, reproduced with permission from Dellinger RP. Cardiovascular management of septic shock. Crit Care Med 2003;31:946-955.
Does Early Aggressive Therapy Make a Difference?

Mortality Increasing with Successive Organ Failures

<table>
<thead>
<tr>
<th>Mortality Rate</th>
<th># of Organ Dysfunctions</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.2%</td>
<td>1</td>
</tr>
<tr>
<td>44.3%</td>
<td>2</td>
</tr>
<tr>
<td>64.5%</td>
<td>3</td>
</tr>
<tr>
<td>76.2%</td>
<td>4</td>
</tr>
</tbody>
</table>

The Importance of Early Goal-Directed Therapy for Sepsis Induced Hypoperfusion


Trials of late hemodynamic optimization with control group mortality > 20%

After onset of organ failure
Alia et al. 1999
Yu et al. 1998
Yu et al. 1998
Gattinoni et al. 1995
Hayes et al. 1994
Yu et al. 1993
OVERALL RESULT

Kern and Shoemaker Crit Care Med 2002
Poll Question

True or False: I should aggressively administer fluids to sepsis patients who do not have evidence of shock (lactate > 4 mmol/L nor evidence of hypotension) but who do have evidence severe sepsis (i.e., organ failure such as newly elevated creatinine)?

- True
- False

Why Is Compliance Regarding Fluid Resuscitation Low Across Hospitals?

What are OUR Barriers?
- Resistance to large volumes
- Over-reliance on patient appearance
- Technical barriers to high flow fluids
Barriers

Fear of (Heart) Failure
“I will flood the patient”

Barriers-debunked

From Rivers: % Ventilated patients

<table>
<thead>
<tr>
<th></th>
<th>Hours after start of Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-6</td>
</tr>
<tr>
<td>Standard Therapy</td>
<td>53.8%</td>
</tr>
<tr>
<td>Early Goal Directed Therapy</td>
<td>53%</td>
</tr>
<tr>
<td>P Value</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Chronic coexisting conditions--CHF:
Control  30.2%
EGDT    36.7%

Barriers

Clinical vs tissue-level disease

“I am a doctor. I can tell”

Barriers-debunked

- Ability to predict hemodynamics
  - Survey administered pre-PA catheterization

<table>
<thead>
<tr>
<th>Variable</th>
<th>N measured</th>
<th>% correct prediction of range of actual value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wedge Pressure</td>
<td>102</td>
<td>30%</td>
</tr>
<tr>
<td>Cardiac Output</td>
<td>97</td>
<td>51%</td>
</tr>
<tr>
<td>SVR</td>
<td>88</td>
<td>44%</td>
</tr>
<tr>
<td>R Atrial Pressure</td>
<td>98</td>
<td>55%</td>
</tr>
</tbody>
</table>
Barriers-debunked

- Ability to predict tissue metabolism
  - Physical findings compared to physiologic data

<table>
<thead>
<tr>
<th>Cap Refill &lt;2s, mottling, cool extremities</th>
<th>Sv02&lt;60%</th>
<th>Sv02&gt;60%</th>
</tr>
</thead>
<tbody>
<tr>
<td>All 3 present</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>All 3 absent</td>
<td>55</td>
<td>329</td>
</tr>
<tr>
<td></td>
<td>Sensitivity 8%</td>
<td>Specificity 99%</td>
</tr>
</tbody>
</table>

Barriers-debunked

- Ability to predict Mortality in infected pts
  - Systolic BP ≥ 90 still have ↑ lactate and mortality

ICM 2007 Vol 33: 1892-1899
**Cryptic Septic Shock**

Lactate > 4 mMol/L & MBP > 100 mmHg

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**Donnino et al. Chest 2003 124: 90S**

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**Barriers-debunked**

In the original EGDT (Rivers) study:
- EGDT patients had statistically the same HR, Urine output, and CVP ~ 12mm at 7-72 hours, but:

<table>
<thead>
<tr>
<th>Patients with septic shock</th>
<th>Mortality</th>
<th>Cv02</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGDT</td>
<td>42% mortality</td>
<td>70%</td>
</tr>
<tr>
<td>Standard therapies</td>
<td>56% mortality</td>
<td>65%</td>
</tr>
</tbody>
</table>

**NEJM 2001 Vol 345: 1368-13779**
Poll Question

- Fill in The Blank: Staff and physician bottlenecks prevent administration of adequate fluids in my hospital to “high risk” patients (such as small patients, renal failure patients, elderly patients, and CHF patients) ____ percent of the time.
  - >80%
  - 60-80%
  - 40-60%
  - 20-40%
  - <20%

Barriers

- Fluid administration
  - “Hang a liter”
Barriers-overcome

- 30 cc/kg in a 70 kg patient is about 2 liters
- IV pumps often limited at 500-1000 CC hour
- Likewise, “wide-open” gravity bag may be too slow
  - Rapid infusers have a place in care of these patients
  - Pressure bags can be used on to obtain adequate volume in 15 minutes
  - BEWARE of air embolism if no detector on infuser
  - Narrowest point (ie small catheter) will be rate limiting.

Fluid Resuscitation

“the early, hypovolemic, hypodynamic phase of (SEVERE) sepsis is treated by providing appropriate, high volume fluid resuscitation… crystalloid solutions (6 to 10 L) are usually required during the initial resuscitation”

Crit Care Med 1999;27:639-660
A Reminder….

Resistance = 1/ r^4, therefore small increases in catheter size dramatically increase flow!

<table>
<thead>
<tr>
<th>Gauge</th>
<th>Length</th>
<th>Flow Rate</th>
<th>Minutes/Liter</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>0.75&quot;</td>
<td>17 mL/min</td>
<td>60</td>
</tr>
<tr>
<td>22</td>
<td>1.00&quot;</td>
<td>28 mL/min</td>
<td>35</td>
</tr>
<tr>
<td>20</td>
<td>1.88&quot;</td>
<td>42 mL/min</td>
<td>25</td>
</tr>
<tr>
<td>18</td>
<td>1.88&quot;</td>
<td>79 mL/min</td>
<td>12.5</td>
</tr>
<tr>
<td>16</td>
<td>1.88&quot;</td>
<td>147 mL/min</td>
<td>6.8</td>
</tr>
<tr>
<td>16</td>
<td>3.25&quot;</td>
<td>127 mL/min</td>
<td>7.8</td>
</tr>
<tr>
<td>16</td>
<td>5.25&quot;</td>
<td>108 mL/min</td>
<td>9.2</td>
</tr>
<tr>
<td>14</td>
<td>1.88&quot;</td>
<td>277 mL/min</td>
<td>3.6</td>
</tr>
<tr>
<td>14</td>
<td>3.25&quot;</td>
<td>249 mL/min</td>
<td>4.0</td>
</tr>
<tr>
<td>14</td>
<td>5.25&quot;</td>
<td>219 mL/min</td>
<td>4.5</td>
</tr>
<tr>
<td>12</td>
<td>3.00&quot;</td>
<td>449 mL/min</td>
<td>2.2</td>
</tr>
<tr>
<td>10</td>
<td>3.00&quot;</td>
<td>609 mL/min</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Then: Build order sets based on Height with IBW built in
Poll Question

The key factor that prevents creating and using automated protocols for the rapid administration of fluids in my hospital is:
- Nurse staffing is insufficient to manage protocols
- We’ve never done it before therefore its hard to do
- Restrictions preventing nurses from practicing outside of their scope (state laws, Joint Commission, etc.).
- Physicians are unwilling to give up autonomy/discretion
- Physicians fear intubating patients unnecessarily
- We have insufficient equipment for rapid infusion
- Other

HEIGHT TO SALINE BOLUS TABLE

<table>
<thead>
<tr>
<th>Height (Feet &amp; Inches)</th>
<th>Milliliters of Saline</th>
<th>Height in Inches</th>
<th>Height in cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>4'4&quot; – 4'7&quot;</td>
<td>1000</td>
<td>53&quot; – 55&quot;</td>
<td>132 -- 140</td>
</tr>
<tr>
<td>4'8&quot; – 4'11&quot;</td>
<td>1250</td>
<td>56&quot; – 59&quot;</td>
<td>141 -- 150</td>
</tr>
<tr>
<td>5'0&quot; – 5'2&quot;</td>
<td>1500</td>
<td>60&quot; – 62&quot;</td>
<td>151 -- 158</td>
</tr>
<tr>
<td>5'3&quot; – 5'6&quot;</td>
<td>1750</td>
<td>63&quot; – 66&quot;</td>
<td>159 -- 168</td>
</tr>
<tr>
<td>5'7&quot; – 5'10&quot;</td>
<td>2000</td>
<td>67&quot; – 70&quot;</td>
<td>169 -- 178</td>
</tr>
<tr>
<td>5'11&quot; – 6'1&quot;</td>
<td>2250</td>
<td>71&quot; – 73&quot;</td>
<td>179 -- 186</td>
</tr>
<tr>
<td>6'2&quot; – 6'5&quot;</td>
<td>2500</td>
<td>74&quot; – 77&quot;</td>
<td>187 -- 196</td>
</tr>
<tr>
<td>6'6&quot; – 6'8&quot;</td>
<td>2750</td>
<td>78&quot; – 80&quot;</td>
<td>197 -- 204</td>
</tr>
<tr>
<td>6'9&quot; – 7'0&quot;</td>
<td>3000</td>
<td>81&quot; – 84&quot;</td>
<td>205 -- 213</td>
</tr>
</tbody>
</table>
Questions?

Raise your hand

Use the Chat

Building on the Expedition Content

Suggested PDSA's to "keep the momentum going":

- Design a PDSA to ensure providing appropriate, high volume fluid resuscitation by addressing technical barriers to high flow fluids
- Expand on initial PDSAs to enhance early recognition of sepsis on the inpatient floor by expanding use of: MEWS, RRT, Situational Awareness
- Ongoing PDSAs to increase reliability with the sepsis bundle elements:
  - Lactate collection & reporting
  - Blood cultures prior to antibiotics
  - Timely antibiotics
  - Fluids
- Assess the process of care for 2-3 patients identified with sepsis in the ED and/or on the inpatient floor to identify delays/constraints and inform additional PDSAs to providing timely antibiotics (ie: timing, availability of AB, etc.)
- Other PDSA's targeting "opportunities" in your organization.

*Share your experience/learnings and request additional input on the Listserv.
Follow-up

- The Listserv will remain active:
  To use the listserv, address an email to:
  TreatingSepsis@ls.ihi.org

- Instructions to receive Continuing Education Credits will be sent with the follow-up email for today’s session
  - Please complete the instructions within 30 days

- Please take 5 minutes to complete the Expedition evaluation survey – your feedback is appreciated!

THANK YOU!