Sepsis Learning Collaborative:
Evidence-based Approaches to Sepsis Resuscitation
Sepsis Resuscitation in Medically Complex Patients
Presenters

Dr. Nathan Shapiro

Dr. Laurence Dubensky
Evidence Based Approaches to Sepsis Resuscitation

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Disclosures

• Industry Research Grants
  – Cheetah Medical, Thermo-Fisher, Astute, Rapid Pathogen Screening

• NIH Funding Acknowledgements:
  • 1R01 HL09175701A1 and 1R01HL091757 (PI Shapiro - NHLBI)
  • 1RO1 HL101382 (PI Bennet-Guerrero and Stowell – NHLBI)
EARLY GOAL-DIRECTED THERAPY IN THE TREATMENT OF SEVERE SEPSIS AND SEPTIC SHOCK

EMANUEL RIVERS, M.D., M.P.H., BRYANT NGUYEN, M.D., SUZANNE HAVSTAD, M.A., JULIE RESSLER, B.S., ALEXANDRIA MUZZIN, B.S., BERNHARD KNOBLICH, M.D., EDWARD PETERSON, PH.D., AND MICHAEL TOMLANOVICH, M.D., FOR THE EARLY GOAL-DIRECTED THERAPY COLLABORATIVE GROUP*

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>STANDARD THERAPY (N=133)</th>
<th>EARLY GOAL-DIRECTED THERAPY (N=130)</th>
<th>RELATIVE RISK (95% CI)</th>
<th>P VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-hospital mortality‡</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All patients</td>
<td>59 (46.5)</td>
<td>38 (30.5)</td>
<td>0.58 (0.38–0.87)</td>
<td>0.009</td>
</tr>
<tr>
<td>Patients with severe sepsis</td>
<td>19 (30.0)</td>
<td>9 (14.9)</td>
<td>0.46 (0.21–1.03)</td>
<td>0.06</td>
</tr>
<tr>
<td>Patients with septic shock</td>
<td>40 (56.8)</td>
<td>29 (42.3)</td>
<td>0.60 (0.36–0.98)</td>
<td>0.04</td>
</tr>
<tr>
<td>Patients with sepsis syndrome</td>
<td>44 (45.4)</td>
<td>35 (35.1)</td>
<td>0.66 (0.42–1.04)</td>
<td>0.07</td>
</tr>
<tr>
<td>28-Day mortality‡</td>
<td>61 (49.2)</td>
<td>40 (33.3)</td>
<td>0.58 (0.39–0.87)</td>
<td>0.01</td>
</tr>
<tr>
<td>60-Day mortality‡</td>
<td>70 (56.9)</td>
<td>50 (44.3)</td>
<td>0.67 (0.46–0.96)</td>
<td>0.03</td>
</tr>
</tbody>
</table>

• Early, protocolized resuscitation to targeted physiologic endpoints
• Facilitates early, aggressive resuscitation

## Single Center EGDT Studies

<table>
<thead>
<tr>
<th>Site</th>
<th>Author</th>
<th>n</th>
<th>design</th>
<th>Protocol</th>
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</thead>
<tbody>
<tr>
<td>Henry Ford</td>
<td>Rivers</td>
<td>263</td>
<td>Random</td>
<td>EGDT ONLY</td>
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<tr>
<td>Cooper</td>
<td>Trzeciak</td>
<td>38</td>
<td>Hist Control</td>
<td>YES</td>
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<tr>
<td>BIDMC</td>
<td>Shapiro</td>
<td>130</td>
<td>Hist Control</td>
<td>YES</td>
</tr>
<tr>
<td>Barnes</td>
<td>Micek</td>
<td>120</td>
<td>Prosp obs</td>
<td>YES</td>
</tr>
<tr>
<td>Carolinas</td>
<td>Jones</td>
<td>157</td>
<td>Prosp obs</td>
<td>YES</td>
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</table>

Fluids - Initial

<table>
<thead>
<tr>
<th>Location</th>
<th>Standard</th>
<th>Protocol</th>
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</thead>
<tbody>
<tr>
<td>Henry Ford</td>
<td>3.5</td>
<td>5</td>
</tr>
<tr>
<td>Cooper</td>
<td>3.5</td>
<td>5.7</td>
</tr>
<tr>
<td>BIDMC</td>
<td>2.9</td>
<td>4.1</td>
</tr>
<tr>
<td>Barnes-Jewish</td>
<td>2.8</td>
<td>3.8</td>
</tr>
<tr>
<td>Carolina</td>
<td>2.5</td>
<td>4.7</td>
</tr>
</tbody>
</table>

SURVIVING SEPSIS CAMPAIGN CARE BUNDLES

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

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 arterial hypotension despite volume resuscitation (septic shock) or initial lactate ≥ 4 mmol/L (36 mg/dL):
   - Measure central venous pressure (CVP)*
   - Measure central venous oxygen saturation (ScvO₂)*
7) Remeasure lactate if initial lactate was elevated
3 EGDT Validation Trials

- ProCESS (United States)
- ARISE (Australia)
- ProMISe (England)
3 EGDT Validation Trials

**ProCESS**


**ARISE**


**ProMISE**

Mortality Rates for EGDT Trials

- **Rivers**
  - Usual Care: 31%
  - EGDT: 47%

- **ProCESS**
  - Usual Care: 19%
  - EGDT: 21%

- **ARISE**
  - Usual Care: 15%
  - EGDT: 16%

- **Promise**
  - Usual Care: 25%
  - EGDT: 26%
Intravenous Fluids in Triad Trials

Intravenous Fluids in Triad Trials
Pre-Enrollment + 6 Hours

<table>
<thead>
<tr>
<th></th>
<th>ARISE - Usual Care</th>
<th>ARISE - EGDT</th>
<th>ProCESS - Usual Care</th>
<th>ProCESS - EGDT</th>
<th>Promise - Usual Care</th>
<th>Promise - EGDT</th>
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</thead>
<tbody>
<tr>
<td>0-6 fluids</td>
<td>2.6</td>
<td>2.5</td>
<td>2.1</td>
<td>2.3</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>pre-fluids</td>
<td>1.7</td>
<td>2.0</td>
<td>2.3</td>
<td>2.8</td>
<td>1.8</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Legend:
- Red: 0-6 fluids
- Blue: pre-fluids
All Fluids Over 72 hours

6-72 hr fluids
- ARISE - Usual Care: 8.7
- ARISE - EGDT: 8.8
- ProCESS - Usual Care: 8.7
- ProCESS - EGDT: 9.5
- Promise - Usual Care: 7.8
- Promise - Usual Care: 7.6

0-6 fluids
- ARISE - Usual Care: 4.4
- ARISE - EGDT: 4.3
- ProCESS - Usual Care: 4.4
- ProCESS - EGDT: 4.5
- Promise - Usual Care: 4.0
- Promise - Usual Care: 3.6

Pre-fluids
- ARISE - Usual Care: 1.7
- ARISE - EGDT: 2.0
- ProCESS - Usual Care: 2.3
- ProCESS - EGDT: 2.8
- Promise - Usual Care: 1.8
- Promise - Usual Care: 2.0
Vasopressor Administration

<table>
<thead>
<tr>
<th>Study</th>
<th>EGDT</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rivers</td>
<td>27.4</td>
<td>30.3</td>
</tr>
<tr>
<td>ProCESS</td>
<td>54.9</td>
<td>52.2</td>
</tr>
<tr>
<td>ARISE</td>
<td>66.6</td>
<td>57.8</td>
</tr>
<tr>
<td>ProMISE</td>
<td>53.3</td>
<td>46.6</td>
</tr>
</tbody>
</table>
Other Processes of Care

Mortality Rates for EGDT Trials

- **Rivers**: 47% (Usual Care), 31% (EGDT)
- **ProCESS**: 19% (Usual Care), 21% (EGDT)
- **ARISE**: 15% (Usual Care), 16% (EGDT)
- **Promise**: 25% (Usual Care), 26% (EGDT)
Implications of EGDT triad trials

Backdrop: All patients received
- Early Identification
- Aggressive Fluid Resuscitation (about 4-5 liters in first 6 hours)
- Early antibiotics (>97% all groups)
- Other care elements provided

1. A team based EGDT protocol or empiric structured protocol was not beneficial
2. Systematic Screening and Aggressive treatment is needed to reproduce these findings
Question: How much fluids should we give a patient with Severe Sepsis during the initial phases?
The Pendulum is Swinging

Too Much Fluid

Too Little Fluid

Healthy, dynamic, adaptive balance

maladaptive

maladaptive
### Each Has Theoretical Advantages

<table>
<thead>
<tr>
<th>Liberal Fluids</th>
<th>Conservative Fluids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augment preload to increase CO and organ perfusion</td>
<td>Reduce overall fluids and positive fluid balance</td>
</tr>
<tr>
<td>Decrease vasopressor use and its detrimental effects</td>
<td>Early vasopressors to treat vasodilation</td>
</tr>
<tr>
<td>?Increase Microcirculatory Flow</td>
<td>Prevent worsening of pathologic edema (due to sepsis-induced barrier dysfunction)</td>
</tr>
<tr>
<td>Current early empiric approach</td>
<td>Observational studies of Fluid and Fluid Balance Associated with Poor Outcomes</td>
</tr>
</tbody>
</table>
Negative Fluid Balance is Associated with Better Outcomes

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Survivors Mean</th>
<th>SD</th>
<th>Total</th>
<th>Nonsurvivors Mean</th>
<th>SD</th>
<th>Total</th>
<th>Weight</th>
<th>Mean Difference IV, Random, 95% CI</th>
<th>Mean Difference IV, Random, 95% CI</th>
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<tbody>
<tr>
<td>Alsous 2000</td>
<td>0.05</td>
<td>0.4</td>
<td>16</td>
<td>2.4</td>
<td>1.7</td>
<td>20</td>
<td>6.1%</td>
<td>-2.35 [-3.12, -1.58]</td>
<td></td>
</tr>
<tr>
<td>Cordemans 2012 (CLI)</td>
<td>4.971</td>
<td>7.737</td>
<td>58</td>
<td>9.503</td>
<td>6.91</td>
<td>65</td>
<td>5.1%</td>
<td>-4.53 [-7.14, -1.93]</td>
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<tr>
<td>Cordemans 2012 (PAL)</td>
<td>3.419</td>
<td>7.842</td>
<td>70</td>
<td>6.982</td>
<td>9.875</td>
<td>44</td>
<td>4.5%</td>
<td>-3.56 [-7.01, -0.12]</td>
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<tr>
<td>Dabrowski 2014</td>
<td>-0.963</td>
<td>1.089</td>
<td>24</td>
<td>0.333</td>
<td>0.401</td>
<td>6</td>
<td>6.2%</td>
<td>-1.30 [-1.84, -0.75]</td>
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<tr>
<td>Goldstein 2005</td>
<td>0.457</td>
<td>0.403</td>
<td>60</td>
<td>0.805</td>
<td>0.858</td>
<td>56</td>
<td>6.3%</td>
<td>-0.35 [-0.59, -0.10]</td>
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<tr>
<td>Kuzkova 2006</td>
<td>0.893</td>
<td>0.668</td>
<td>16</td>
<td>1.782</td>
<td>0.75</td>
<td>15</td>
<td>6.2%</td>
<td>-0.89 [-1.39, -0.39]</td>
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<tr>
<td>Malbrain 2005</td>
<td>1.643</td>
<td>1.5</td>
<td>192</td>
<td>6.214</td>
<td>2.143</td>
<td>73</td>
<td>6.2%</td>
<td>-4.57 [-5.11, -4.04]</td>
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<tr>
<td>Malbrain 2014</td>
<td>3.862</td>
<td>6.904</td>
<td>314</td>
<td>5.994</td>
<td>7.546</td>
<td>413</td>
<td>6.1%</td>
<td>-2.13 [-3.19, -1.08]</td>
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<tr>
<td>Micek 2013</td>
<td>2.709</td>
<td>2.585</td>
<td>162</td>
<td>12.124</td>
<td>5.463</td>
<td>163</td>
<td>6.1%</td>
<td>-9.42 [-10.34, -8.49]</td>
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<tr>
<td>Murphy 2009</td>
<td>9.25</td>
<td>0.625</td>
<td>125</td>
<td>15.875</td>
<td>1.125</td>
<td>87</td>
<td>6.3%</td>
<td>-6.63 [-6.89, -6.36]</td>
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<tr>
<td>Rosenberg 2009</td>
<td>5.154</td>
<td>0.769</td>
<td>159</td>
<td>10.398</td>
<td>1.923</td>
<td>635</td>
<td>6.3%</td>
<td>-5.15 [-5.35, -4.96]</td>
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<tr>
<td>Sakr 2005</td>
<td>1.4</td>
<td>6.5</td>
<td>239</td>
<td>3.9</td>
<td>7.8</td>
<td>153</td>
<td>5.9%</td>
<td>-2.50 [-3.39, -1.01]</td>
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<td>Schuller 1991</td>
<td>0.25</td>
<td>1.6</td>
<td>43</td>
<td>2.8</td>
<td>2.8</td>
<td>26</td>
<td>6.0%</td>
<td>-1.75 [-2.93, -0.57]</td>
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<tr>
<td>Shum 2011</td>
<td>0.88</td>
<td>2.32</td>
<td>505</td>
<td>5.41</td>
<td>5.05</td>
<td>134</td>
<td>6.1%</td>
<td>-4.53 [-5.41, -3.65]</td>
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<tr>
<td>Simmons 1987</td>
<td>7.5</td>
<td>4.09</td>
<td>11</td>
<td>17.22</td>
<td>2.045</td>
<td>26</td>
<td>5.2%</td>
<td>-9.72 [-12.26, -7.18]</td>
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<tr>
<td>The RENAL Study 2012</td>
<td>-1.94</td>
<td>1.1</td>
<td>808</td>
<td>1.735</td>
<td>9.061</td>
<td>644</td>
<td>6.1%</td>
<td>3.69 [-4.73, 2.86]</td>
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<tr>
<td>Vidal 2008</td>
<td>2.1</td>
<td>3.9</td>
<td>34</td>
<td>16.1</td>
<td>6.4</td>
<td>49</td>
<td>5.4%</td>
<td>-14.00 [-16.22, -11.78]</td>
<td></td>
</tr>
</tbody>
</table>

Total (95% CI) 2836 2609 100.0% -4.43 [-5.83, -3.04]

Heterogeneity: Tau² = 8.09; Chi² = 1894.59, df = 16 (P < 0.000001); I² = 99%
Test for overall effect: Z = 6.23 (P < 0.000001)

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Manu L.N.G. Malbrain et al., Fluid overload, de-resuscitation, and outcomes in critically ill or injured patients

Data in support of Conservative Approach?

• Observational Studies finding Association between fluid volume/balance and Adverse Outcome
  – Confounding by Indication
  – Fluid Administration is really, really good biomarker of illness severity
  – Association does not equal causation

• FEAST trial provocative but different population/setting
Support for a Liberal Approach?

- Physiologically logical
- Historical Shifts and Mortality trends support this approach
Fluids in Usual Care
Pre- and Post- Rivers

Pre-Rivers

Post-Rivers
Mortality in Usual Care
Pre- and Post- Rivers

Pre-Rivers

Post-Rivers
Limitations and Opportunity

- Studies are Largely observational
- Well conducted trials are needed
Challenge to the EDs and ICUs

• Early Identification
• Assure “appropriate” fluid resuscitation in all patients (~ 4 liters in ED)
• Assure early/appropriate antibiotics
• Optimize other care elements
• We cannot return to Sepsis Circa 2000

Systematically in ALL patients!!!
EFFECTIVE SEPSIS RESUSCITATION IN MEDICALLY COMPLEX PATIENTS

LAURENCE DUBENSKY, MD
ASSISTANT PROGRAM DIRECTOR
RESIDENCY IN EMERGENCY MEDICINE
DISCLOSURES:

- None

DISCLAIMER:

- Expert opinion / consensus recommendations
- Actively evolving evidence
OBJECTIVES

- Address provider concerns about medically complex care:
  - Volume overload - liberal vs conservative
  - POCUS - ECHO
  - Early vasopressors in fluid restricted models

- CHF - right heart failure and pulmonary HTN
- ESRD - hemodialysis and peritoneal dialysis
- Cirrhotic / Liver disease
- Goals of Care

REFRESHER

SEP-1 measures:

**Septic Shock Bundle**

- **WITHIN 3 HOURS OF PRESENTATION**
  - Measure Serum Lactate
  - Obtain Blood Cultures prior to antibiotics
  - Administer broad spectrum antibiotics
  - Resuscitation with 30mL/kg crystalloid fluids

- **WITHIN 6 HOURS OF PRESENTATION**
  - Repeat measurement of Serum Lactate if initial is > 2.0
  - Repeat volume status and tissue perfusion assessment
  - Vasopressor administration (If hypotension after fluids)
FLUID RESPONSIVENESS

- Increase in SV by 10-15% in response to 250-500cc bolus
- Important to assess fluid tolerance and responsiveness before fluid loading
- Venous capacitance and myocardial dysfunction
- <40% of patients are fluid responders

A rational approach to fluid therapy in sepsis

P. Marik¹,* and R. Bellomo²

¹Division of Pulmonary and Critical Care Medicine, Eastern Virginia Medical School, 825 Fairfax Av, Suite 410, Norfolk, VA 23507, USA, and ²Intensive Care Unit, Austin Health, Heidelberg, Victoria, Australia
FLUID RESPONSIVENESS

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<table>
<thead>
<tr>
<th>STATIC ASSESSMENT</th>
<th>DYNAMIC ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical endpoints (HR, Cap Refill, UO)</td>
<td>Passive leg raise (PLR)</td>
</tr>
<tr>
<td>CVP</td>
<td>IVC / Lung POCUS</td>
</tr>
<tr>
<td>CXR</td>
<td>Pulse pressure variation</td>
</tr>
<tr>
<td>Lactate / SvO2</td>
<td>ECHO w/ VTI</td>
</tr>
</tbody>
</table>
HEART FAILURE & PULMONARY HTN

- Types of heart failure
  - Systolic vs diastolic
  - Left, right and biventricular
- Beside ECHO or recent ECHO is key
- Volume responsiveness
- Considerations in right heart failure and pulmonary HTN

HEART FAILURE & PHYSIOLOGY

- LV tolerates ▲ afterload but not preload
- RV tolerates ▲ preload but not afterload
  - Limited contractile reserve
  - Pulmonary hypertension
- Significantly decreased physiologic reserve
  - Off Frank-Starling curve
- Cannot ▲ CO to compensate (innate or fluid)
- Exacerbated by myocardial dysfunction in sepsis
RIGHT HEART FAILURE & PHYSIOLOGY

- ECHO guided resuscitation
- LV only pumps what it receives
- Isolated right heart failure will not show "CHF" on CXR
- Does not respond well to aggressive fluid resuscitation
- Intubation is associated with increased mortality

Annals of Emergency Medicine, Volume 66, Issue 6, 619 - 628
RHF / PAH & SEPSIS

- Fragile patient population
- Most common causes are LHF & COPD
- Exacerbated by:
  - Hypoxia
  - Acidosis (lactate / hypercarbic)
  - Excess fluid
  - Hypothermia
  - Anemia
- Unable to tolerate permissive hypercapnia or acidosis
Circle of Death!
RHF / PAH & SEPSIS

- Early vasopressors
  - Norepinephrine / Epinephrine
  - Vasopressin (pulmonary vasodilator)
    - Decrease RV afterload
  - Dobutamine in isolation should be avoided (beneficial as combo therapy)
- Avoid phenylephrine
- May add iNO (even non ventilated patients), PDEi
RHF / PAH & SEPSIS

- Down regulation of Beta receptors
- Many patients with PPM
- Able to augment CO by raising HR on PPM
- ECMO and RVAD for refractory patients
RHF / PAH & INTUBATION

- **Avoid** at all costs
- Profound hemodynamic effects
  - Loss of sympathetic tone
  - Increased thoracic pressure
  - RSI medications
- Risks weighed against hypoxia & hypercarbia
- ARDS type management but low PEEP
- NIV is the better choice
E-QUAL SEPSIS INITIATIVE

RHF / PAH: SUMMARY

- Fluids are high risk
- Early pressors / inotropes
- Avoid hypoxia, acidosis, hypothermia
- Avoid intubation
- Pulmonary vasodilators
- ECMO / RVAD
- Goals of Care Discussions
END STAGE RENAL DISEASE

- Marked increased risk for infection
  - Immunocompromised state
- Baseline fluid overload
  - Fragile volume status
- Many co-morbid/causative conditions
  - DM, HTN, CHF
- Access is often infectious source

FLUIDS & END STAGE RENAL DISEASE

- Fluid limited / restricted
- **Volume assessment** / Intravascularly volume depleted
  - fragile volume status
- **Choice of crystalloid** (NS, LR, balanced)
  - Plasmalyte / Normsol
  - Avoid large volume NS
SOURCE & END STAGE RENAL DISEASE

- Dialysis access until proven otherwise
- Source control
- May limit ability for dialysis during resuscitation
  - fragile volume status
- Blood cultures from temporary access
- All treated as Health Care Associated Infections
MISCELLANEOUS

▸ Unable to use urine output as quantitative goals

▸ Be mindful of patients that produce urine
END STAGE RENAL DISEASE: SUMMARY

- Very sick population, high mortality
- Source control
- Fluid responsiveness essential
- Early vasopressors / Dobutamine
- NIV, High Flow O2 > ETT
- Consider: Avoiding NS as crystalloid (acidemia)
E-QUAL SEPSIS INITIATIVE

PERITONEAL DIALYSIS

- Intra-abdominal static fluid infections
- Tolerate more fluid
- Peritonitis
  - Get fluid sample (PD nurse)
  - Intra-abdominal antibiotics
- Skin or Catheter Infection
  - IV antibiotics
CIRRHOSIS AND LIVER DISEASE

- Marked increased risk for infection
- Chronic alcohol abuse - independent risk factor for septic shock
- Advanced disease is associated with increased risk for SBP and infection
- Advanced disease, Child-Pugh C & MELD >17 associated with increased mortality

Medicine. 2016;95(8):e2877
CIRRHOSIS / ACLD

Sepsis
- Endotoxemia
- NO
- Inflammatory cytokines
- Vasodilatation
- Organ perfusion

Cytokine-induced hepatocyte apoptosis and necrosis
ER stress blocks protein synthesis
Altered liver reserve

Acute-on-chronic liver failure

Acute renal failure
- 24–27% in SBP-unrelated sepsis\(^{29,30}\)
- 30–40% in SBP-related sepsis\(^{27,28,30}\)

Circulatory failure
- HRS
- Ischemic ATN
- Toxic ATN

Respiratory failure
- ARDS

Coagulation failure
- Tissue factor activation
- DIC

Relative adrenal insufficiency
- Vascular hypo responsiveness
- Septic encephalopathy

Death

Short-term mortality: 10–20% without organ failure,
30–50% with 1 organ failure, and 55–100% with >1 organ failure\(^{1,2,11,28-30}\)

ATN; acute tubular necrosis; ARDS, acute respiratory distress syndrome; DIC, disseminated intravascular coagulation;
ER, endoplasmic reticulum; HRS, hepatorenal syndrome; LV, left ventricle; NO, nitric oxide

Source: Clin Gastroenterol Hepatol © 2011 AGA Institute

Clin Gastroenterol Hepatol. 2011;9(9):727-738
CIRRHOSIS AND THE HEART

- Largely volume overloaded
- Cardiomyopathy: Cirrhosis - 50% (alcoholic)
- Hyperdynamic Circulatory Syndrome
- Beta-Blocker use

Hepatol Int. 2011 Sep;5(3)
CIRRHOSIS AND FLUIDS MECHANICS

- Splanchnic vasodilation
- Hypoalbumenemia
- Type of crystalloid
- Vasopressors and Inotropes

Lactic Acidosis without shock
- Use other markers for shock evaluation
- Fluid responsiveness, tolerance assessment

Found to have adrenal insufficiency or RAI more frequently than non-cirrhotics (up to 65% in sepsis)
- Role for corticosteroids

SBP should be considered early
- Antibiotics
CIRRHOSIS AND COLLOIDS

- Increased survival with colloids
  - Extrapolated from SBP
- Decreased risk for AKI and RRT
  - AKI significantly increased mortality
- No consensus on algorithm
CIRRHOSIS : SUMMARY

- Very sick population, high mortality
- Fluid responsiveness essential
- Consider colloids (improve mortality, decrease AKI/RRT)
- Consider corticosteroids
- Early vasopressors / Vasopressin (hyporesponsive)
- Consider: Variceal bleeding & Abdominal Compartment Syndrome
Exclusions

- Patients under the age of 18
- Patients with LOS greater than 120 days
- Directive for comfort measures within 3 hours of presentation of severe sepsis
- Directive for comfort measures within 6 hours of presentation of septic shock
- Transfer in from another acute care facility
- Patients with severe sepsis who expire within 3 hours of presentation
- Patients with septic shock who expire within 6 hours of presentation
- Patient/caregiver refusal for care that must be documented by provider
- Patients receiving IV antibiotics for more than 24 hours prior to presentation
QUESTIONS?

- Fluids are high risk
- Early pressors / inotropes
- Case specific, patient specific management
- Avoid intubation / Use NIV
- Goals of Care Discussions