Feeding the Critically Ill Patient

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Vasopressor Equivalents

\[
\text{[norepinephrine (mcg/min)]} + \\
\text{[dopamine (mcg/kg/min) ÷ 2]} + \\
\text{[epinephrine (mcg/min)]} + \\
\text{[phenylephrine (mcg/min) ÷ 10]}
\]

Norepinephrine Equivalents (NEE)

Disclosure

- I do not have a vested interest in or affiliation with any corporate organization offering financial support or grant monies for this continuing education activity, or any affiliation with an organization whose philosophy could potentially bias my presentation.

Background

- An estimated 40% of all critically ill patients suffer from malnutrition
  - Stress hypermetabolism coupled with chronic wasting
  - Impaired immune function
  - Impaired ventilatory drive
  - Increased morbidity and mortality

- Expert recommendations advocate for the initiation of feeds within 24 to 48 hours of intensive care unit (ICU) admission
  - Enteral nutrition preferred over parenteral nutrition

- Feeding hemodynamically unstable critically ill patients with a vasopressor requirement remains a debated clinical question
  - Literature suggests safety and tolerability with noradrenaline equivalents
    - 12.5 micrograms per minute or less

Tolerability of the enhanced protein-energy provision (PEP uP) protocol for enteral nutrition in critically ill patients receiving intravenous vasopressor therapy

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PEPuP Protocol

- “The Enhanced Protein-Energy Provision via the Enteral Route in Critically Ill Patients”
- Novel protocol for provision of enteral nutrition involving:
  - Daily volume based goals (versus hourly target rates)
  - Initiating gastric motility agents
  - Protein supplementation
  - Liberalizing gastric residual volume threshold
- Published data from trials in 18 ICUs in the United States and Canada
  - Safety and efficiency for increasing protein and caloric intake in critically ill patients
Study Objectives

- Primary objective:
  - Determine the tolerability of PEPuP in critically ill patients receiving intravenous vasopressor support

- Secondary objectives:
  - Define patient-specific factors associated with enteral nutrition intolerance, including specific vasopressor agents and dosing ranges
  - Evaluate ICU mortality

Inclusion and Exclusion Criteria

Inclusion:
- Adult patients ≥ 18 years of age
- Medicine or Surgical/Trauma Intensive Care admission at Palmetto Health Richland
- Initiated on PEP uP protocol (“volume-based enteral feeds”)

Exclusion:
- Requirement for Total Parenteral Nutrition (TPN) prior to PEP uP initiation
- Enteral nutrition (EN) initiated outside of PEP uP protocol (i.e. “trickle feeds”)

Tolerability

• Tolerability is defined as the absence of all of the following:
  - Gastric residuals > 300mL, in addition to:
  - Episodes of emesis
  - Positive Kidneys, Ureters, and Bladder X-Ray (KUB) findings or abdominal computed tomography (CT) suggestive of ileus, bowel ischemia, or bowel perforation as determined by the radiologist
  - Definitive ileus, bowel ischemia, or bowel perforation determined by the treating physician

Patient Identification

- Patients with PEPuP orders (N=406)
  - Tolerable (N=47)
  - Intolerable (N=3)

- Patients Excluded (N=16)
  - TPN (N=3)
  - Inappropriate Unit (N=4)
  - EN not initiated (N=9)

Methods

- Single-center, retrospective, observational cohort
  - Institutional Review Board Approved

- Information Technology generated patient list
  - December 1, 2013 to October 1, 2014
  - Patients identified for screening via random number generator

- Statistical Analysis
  - Descriptive statistics
  - Chi Square, Student’s t-test
  - Generalized Linear Mixed Model

Baseline Characteristics

<table>
<thead>
<tr>
<th>Baseline Characteristic (N=50)</th>
<th>Tolerable (N=47)</th>
<th>Intolerable (N=3)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, Median (IQR)</td>
<td>58 (34.5)</td>
<td>58 (17.5)</td>
<td>0.252</td>
</tr>
<tr>
<td>Male gender, N (%)</td>
<td>33 (70.2)</td>
<td>3 (100)</td>
<td>0.550</td>
</tr>
<tr>
<td>Admission Weight in kg, Median (IQR)</td>
<td>83 (33)</td>
<td>114 (37.5)</td>
<td>0.055</td>
</tr>
<tr>
<td>APACHE II Score, Median (IQR)</td>
<td>15 (10)</td>
<td>14 (11.5)</td>
<td>0.854</td>
</tr>
<tr>
<td>Admission to STICU, N (%)</td>
<td>34 (72.3)</td>
<td>3 (100)</td>
<td>0.558</td>
</tr>
<tr>
<td>ICU Length of Stay, Median (IQR)</td>
<td>7.9 (18.5)</td>
<td>18.5 (9.4)</td>
<td>0.048</td>
</tr>
<tr>
<td>Death during ICU stay, N (%)</td>
<td>3 (6.4)</td>
<td>0 (0)</td>
<td>&gt;0.99</td>
</tr>
<tr>
<td>Tube Feed Volume Goal (mL/24 hours), Median (IQR)</td>
<td>1440 (240)</td>
<td>1440 (60)</td>
<td>0.380</td>
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</tbody>
</table>
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<th>Intolerable (N=3)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheduled Pain Management, N (%)</td>
<td>41 (87.2)</td>
<td>3 (100)</td>
<td>&gt;0.99</td>
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<tr>
<td>Scheduled Bowel Regimen, N (%)</td>
<td>43 (91.5)</td>
<td>3 (100)</td>
<td>&gt;0.99</td>
</tr>
<tr>
<td>Motility Agent, N (%)</td>
<td>4 (8.5)</td>
<td>0 (0)</td>
<td>0.162</td>
</tr>
<tr>
<td>Hydrocortisone, N (%)</td>
<td>2 (4.3)</td>
<td>0 (0)</td>
<td>&gt;0.99</td>
</tr>
<tr>
<td>Vasopressin, N (%)</td>
<td>5 (10.6)</td>
<td>1 (33.3)</td>
<td>&gt;0.99</td>
</tr>
</tbody>
</table>

Vasopressor Use

<table>
<thead>
<tr>
<th>Vasopressor Use (N=12)</th>
<th>Tolerable (N=9)</th>
<th>Intolerable (N=3)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norepinephrine, N (%)</td>
<td>8 (88.9)</td>
<td>2 (66.7)</td>
<td>0.098</td>
</tr>
<tr>
<td>Phenylephrine, N (%)</td>
<td>6 (66.7)</td>
<td>1 (33.3)</td>
<td>0.37</td>
</tr>
<tr>
<td>Dopamine, N(%)</td>
<td>1 (11.1)</td>
<td>0 (0)</td>
<td>&gt;0.99</td>
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<tr>
<td>Epinephrine, N(%)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>&gt;0.99</td>
</tr>
<tr>
<td>Norepinephrine Equivalents (NEE), median (IQR)</td>
<td>8 (9.75)</td>
<td>9 (19)</td>
<td></td>
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Preliminary Conclusions and Further Research

- Preliminary data suggests tolerance of aggressive enteral nutrition via the PEP uP protocol
  - Low preliminary incidence of intolerance (6%)
- Data collection is on-going
  - Evaluate patient-specific factors with enteral nutrition intolerance
  - Evaluate MICU and STICU populations individually