Nutrition Support In the Pediatric Trauma Patient

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Objectives

- Review equations for estimating energy and protein needs in critically ill pediatric patients.
- Review enteral nutrition formulas for the pediatric population.
- Review enteral nutrition guidelines/protocols for critically ill pediatric patients.
Estimating Energy Needs

- WHO
- Schofield
- DRIs
- White equation
- Indirect Calorimetry (most accurate)
Indirect Calorimetry

- Calculates resting metabolic rate & respiratory quotient by measuring whole body oxygen consumption ($V_{O_2}$) & carbon dioxide gas exchange ($V_{CO_2}$)

<table>
<thead>
<tr>
<th>RQ</th>
<th>Significance</th>
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<tbody>
<tr>
<td>&lt;0.7</td>
<td>Oxidation of ETOH, Oxidation of ketones, Carbohydrate synthesis, Measurement problem</td>
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<tr>
<td>0.7-0.75</td>
<td>Mostly lipid oxidation, possible starvation</td>
</tr>
<tr>
<td>0.85-0.95</td>
<td>Mixed substrate oxidation, adequate kcals</td>
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<tr>
<td>&gt;1.0</td>
<td>Lipogenesis, primary carbohydrate oxidation, hyperventilation, measurement problem</td>
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Enteral Nutrition

- “If the gut works use it”
- Supports components of gut barrier function
- Maintain normal gallbladder function by stimulating release of cholecystokinin (reducing risk of cholecystitis)
- Aides in the maintenance of gut-associated & mucosa-associated lymphoid tissues vital to gut-associated immune function
- Early Enteral Nutrition (within 48 hours after injury)
Gastric vs Small Bowel

**Gastric Tube (NG, OG, PEG)**
- Easily obtained
- Possible aspiration/reflux
- Patient may have delayed gastric emptying, possibly limiting ability to tolerate gastric feeds

**Small Bowel (NJ, OJ, PEJ)**
- Ideal placement is beyond the Ligament of Trietz
- Jejunal tubes obligate patient to continuous feeds
- No need to check for residuals
- May achieve goal rate in shorter time
Nutrition Pearls

- Avoid overfeeding
  - Excessive calorie intake increases CO2 burden. May make weaning from the ventilator difficult
- Adequate protein
Potential Barriers

Adequate nutrition for the critically ill pediatric patient may be impeded by:

- Fluid restrictions, concentrated enteral formula often required to meet estimated nutritional needs
- Interruption of enteral nutrition delivery for surgery, procedures, perceived intolerances, etc.
Age Specific Enteral Formulas: Infants (0-12 months)

In general resume the infant formula the patient was previously receiving. May require concentration above 20 kcals/oz. In the hospital setting liquid ready to feed infant formula is preferred over powder formula.

- Breastmilk is preferred when available
- Standard Infant formula
- Hydrolyzed Infant formula
- Free Amino Acid formula
Age Specific Enteral Formulas: Pediatric (1-13 years of age)

- Standard/Polymeric Formulas:
  - 1 kcal/ml formula, available with or without fiber
  - 1.5 kcal/ml formula, available with or without fiber

- Hydrolyzed/Semielemental Formulas:
  - 1 kcal/ml formula, available with or without fiber
  - 1.5 kcal/ml formula, available with or without fiber

- Free Amino Acid/Elemental Formulas:
  - 0.8 kcal/ml formula, no fiber
  - 1.0 kcal/ml formula, no fiber
Age Specific Enteral Formulas: (14 years old & greater)

- **Standard/Polymeric Formulas:**
  - 1 kcal/ml formula, available with or without fiber
  - 1.2 kcal/ml formula, available with or without fiber
  - 1.5 kcal/ml formula, available with or without fiber

- **Hydrolyzed/Semielemental Formulas (may be Immune Modulating Formulas):**
  - 1 kcal/ml formula, available with or without fiber
  - 1.2 kcal/ml formula, available with or without fiber
  - 1.5 kcal/ml formula, available with or without fiber

- **Free Amino Acid/Elemental Formulas:**
  - 1.0 kcal/ml formula, no fiber
Age Specific Enteral Formulas: (14 years old & greater)

- Immune Modulating Formulas (IMFs)
  - May contain arginine, glutamine, nucleotides, omega-3 fatty acids alone or in combination with each other
  - SSCM & A.S.P.E.N recommend use of IMFs in adult surgical ICU patients & medical ICU patients
Practical Approaches

- Early enteral nutrition (with 48 hours) after patient is hemodynamically stable
- Adequate energy & protein intake
- Transpyloric tube placement
- May need concentrated enteral nutrition formula
- Consult the Registered Dietitian
References

• Mazzola C et al. *Crit Care Med*. 2002; 30(11), S393-S401
• *The A.S.P.E.N Pediatric Nutrition Support Core Curriculum* 2010