Update in Nutrition Literature

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Objectives

- Review literature supporting
  - Enteral nutrition (EN) versus Parenteral Nutrition (PN)
  - When to initiate nutrition
  - Early vs. late goal nutrition
  - Immunonutrition
  - Trace Elements

- Explain EN and PN goal rates and related calculations
Metabolism in Physiologic Stress

Stressor (Infection, trauma, surgery, etc.)

Proinflammatory cytokines (IL-1, IL-6, IL-8, TNF-alpha) → SIRS → Increased oxygen and energy demand

Counterregulatory hormones (cortisol, catecholamine, glucagon) → CATABOLISM

↑ Gluconeogenesis
↑ Glycogenolysis
↑ Lipolysis
↑ Proteolysis (skeletal muscle) → Mobilization of fatty acids, proteins, glucose

Peripheral-tissue resistance to endogenous anabolic hormones → Inability to utilize energy sources → Malnutrition

Nutritional Assessment

Functional GI Tract

Yes

Enteral Nutrition

GI Function

Normal

Standard Nutrients

Compromised

Specialty Formulas

Parenteral Nutrition

GI function returns

Yes

No

Calorie Requirements

- Indirect calorimetry
  - Measures oxygen consumption and carbon dioxide production
    - Respiratory Quotient (RQ)
      - Amount of substrate use: VCO2/VO2
      - RQ > 1 = overfeeding
      - RQ <0.8 = underfeeding
  - Calculates resting energy expenditures (REE)
    - 70-90% total energy expenditure

Calorie Requirements

• **Harris Benedict Equation**
  ▫ Men: $66 + 13.75(Wt \text{ in kg}) + 5(Ht \text{ in cm}) - 6.8(\text{age})$
  ▫ Women: $65 + 9.6(Wt \text{ in kg}) + 1.8(Ht \text{ in cm}) - 4.7(\text{age})$
  ▫ Multiply by stress factor of 1.2 – 2.0

• **Weight based predictions**

<table>
<thead>
<tr>
<th>Severity of Illness</th>
<th>Calorie needs (kcal/kg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>25-30</td>
</tr>
<tr>
<td>Critically Ill</td>
<td>30-40</td>
</tr>
<tr>
<td>Major Burn</td>
<td>35-40</td>
</tr>
</tbody>
</table>

ASPEN Clinical Guidelines *JPEN* 2011;35:16-204.
Protein and Fluid Requirements

- **Total Protein**
  - 24 hour nitrogen balance
    - Nitrogen Balance = nitrogen intake - nitrogen loss
  - Weight based predictions

<table>
<thead>
<tr>
<th>Severity of Illness</th>
<th>Protein Needs (g/kg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>0.8-1</td>
</tr>
<tr>
<td>Critically Ill</td>
<td>1.5-2</td>
</tr>
<tr>
<td>Catabolic</td>
<td>1.2-2</td>
</tr>
</tbody>
</table>

- **Total Fluid Requirements**
  - 25-35 mL/kg/day

Enteral vs. Parenteral Routes

• EN is the preferred route of feeding over PN.
  - (SCCM/ASPEN Grade B)

• EN should be initiated in the critically ill patient who is unable to maintain volitional intake.

http://www.bio.davidson.edu/courses/immunology/students/spring2006/mohr/celiac.html
Enteral vs. Parenteral Routes

- Reduces infectious morbidity
  - Pneumonia and central line infections
  - Abdominal abscess in trauma patients
- Variable effect on hospital LOS
EN Calculation

1. Calculate total kcal/day
2. Calculate total protein gram/day
3. Calculate total fluid requirement/day
4. Pick EN formulation best fit for your patient
   - Convert total kcal/day into goal rate
     - Dependent on product
     - If goal rate < goal total fluid requirement supplement with water down the feeding tube or intravenous fluid
5. Calculate protein/day pt receiving with goal rate
   - Supplement with protein packets if necessary to meet goal protein gram/day
Initiating Nutrition

- EN should be started early within the first 24-48 hours following admission
  - (Grade C SCCM/ASPEN)
- EN should advance toward goal over the next 48-72 hours
  - (Grade E SCCM/ASPEN)

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Initiating Nutrition

- Early nutrition hypothesized risk
  - Suppressing autophagy
  - Increased risk for intestinal ischemia/necrosis

- EN should be withheld in the setting of hemodynamic compromise until the patient is fully resuscitated and/or stable.
  - (SCCM/ASPEN Grade E)
Initiating Nutrition

- Post-hoc analysis of the EPaNIC trial

- No randomized, prospective trials confirming zero nutrition on days 0-7 of ICU stay

Early Trophic vs. Goal EN

- Trophic vs. Full-Energy Enteral Nutrition in Mechanically Ventilated Patients with ARDS
  - Single center, open label, randomized
  - 200 patients mechanically ventilated ≥72 hours
    - Trophic vs. goal-directed nutrition in first 6 days

Early Trophic vs. Goal EN

• Initial Trophic vs. Full Enteral Feeding in Patients with Acute Lung Injury (EDEN)
  ▫ 1000 patients, 44 hospitals
  ▫ Prospective RCT enrolled patients mechanically ventilated ≥ 48 hours with ALI
  ▫ 400 kcal/day vs. 1300 kcal/day

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Trophic Feeding (n=508)</th>
<th>Full Feeding (n=492)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilator-free days, no. (95% CI)</td>
<td>14.9 (13.9-15.8)</td>
<td>15.0 (14.1-15.9)</td>
<td>0.89</td>
</tr>
<tr>
<td>ICU-free days, no. (95% CI)</td>
<td>14/4 (13.4-15.3)</td>
<td>14.7 (13.8-15.6)</td>
<td>0.67</td>
</tr>
<tr>
<td>60-day mortality, no. (%) [95% CI]</td>
<td>118 (23.2)[96-29.9]</td>
<td>109 (22.2)[18.5-25.8]</td>
<td>0.77</td>
</tr>
</tbody>
</table>
Early Trophic vs. Goal EN

- Avoid mandatory full caloric feeding in the first week but rather suggest low dose feeding (e.g., 500 calories per day), advancing only as tolerated
  - (SCC Grade 2B)
What if EN can’t get to goal?

- Consider initiating PN if unable to meet energy requirements after 7-10 days with EN
  - (SCCM/ASPEN Grade E)

- In patients who cannot meet energy requirements by day two should be supplemented with PN at a level, but no exceeding goal
  - (ESPEN Grade C)

ASPEN Clinical Guidelines *JPEN* 2011;35:16-204.
## PN Macronutrient Calculations

<table>
<thead>
<tr>
<th>Substrate</th>
<th>% Total kcal/day</th>
<th>Kcal Supplied</th>
<th>Base Solution Source</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dextrose</strong></td>
<td>50-60%</td>
<td>3.4 kcal/gram dextrose</td>
<td>Dextrose 70% Injection (70 g/100 ml)</td>
<td>Carbohydrate tolerance ranges from 2-7 mg/kg/min Not to exceed 7 g/kg/day</td>
</tr>
<tr>
<td>(Carbohydrate)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Amino Acids</strong></td>
<td>10-20%</td>
<td>4 kcal/gram protein</td>
<td>Aminosyn II 15% (15 g/100ml)</td>
<td>6.25 grams protein per gram nitrogen</td>
</tr>
<tr>
<td>(Protein)</td>
<td>(1.5-2.5 g/kg/day)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lipid</strong></td>
<td>20-30%</td>
<td>9 kcal/gram fat</td>
<td>Liposyn III 30% (30 g/100 ml)</td>
<td>Not to exceed 30% of total kcals or 1.5 g/kg/day</td>
</tr>
<tr>
<td>(Fat)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PN Macronutrient Calculations

1. Calculate Total kcal/day requirement
   ▫ 25-35 kcal/kg/day
2. Calculate total grams protein/day requirement
   ▫ 1.5-2 g/kg/day
3. Convert grams protein/day to kcal protein
   ▫ 4 kcal/gram protein
4. Determine proportion of remainder kcal dedicated to dextrose (50-60%)
   ▫ Total kcal/day × 0.5-0.6 = kcal dextrose
5. Determine remaining amount of kcals = kcals lipid
   ▫ Total kcals/day – protein kcals – dextrose kcals = kcals lipid
PN Macronutrient Calculations

6. Convert kcal dextrose into grams
   ▫ 3.4 kcal/gram

7. Convert kcal lipid into grams
   ▫ 9 kcal/gram

8. Calculate fluid requirement
   ▫ 25 mL/kg/day ÷ 24 hours/day = goal rate mL/hr

9. Calculate macronutrient concentrations (g/L)
   ▫ Grams protein/total daily fluid requirement
   ▫ Grams dextrose/total daily fluid requirement
   ▫ Grams lipid/total daily fluid requirement

● Other considerations
   ▫ Estimate electrolyte requirements (or use standards)
   ▫ Begin slow, titrate to goal over 2-3 days
   ▫ Monitor for ability to transition to enteral or regular diet
What if we can’t get to goal?

• Early Parenteral Nutrition Completing Enteral Nutrition in Adult Critically Ill Patients (EPaNIC)
  ▫ Prospective multicenter (7 ICU) RCT
  ▫ Patients with NRS ≥ 3 not chronically malnourished
    • Early - 20% dextrose + EN+PN at day 3 for full caloric goal
    • Late - 5% dextrose + EN regardless of caloric goal until day 7

• Primary end point
  ▫ Duration of dependency on intensive care (# ICU days)
  ▫ Time to discharge from the ICU

## EPaNiC

<table>
<thead>
<tr>
<th>Variable</th>
<th>Late-Initiation Group (N = 2328)</th>
<th>Early-Initiation Group (N = 2312)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Safety outcome</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vital status — no. (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharged live from ICU within 8 days</td>
<td>1750 (75.2)</td>
<td>1658 (71.7)</td>
<td>0.007</td>
</tr>
<tr>
<td>Death</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In ICU</td>
<td>141 (6.1)</td>
<td>146 (6.3)</td>
<td>0.76</td>
</tr>
<tr>
<td>In hospital</td>
<td>242 (10.4)</td>
<td>251 (10.9)</td>
<td>0.63</td>
</tr>
<tr>
<td>Within 90 days after enrollment†</td>
<td>257 (11.2)</td>
<td>255 (11.2)</td>
<td>1.00</td>
</tr>
<tr>
<td>Nutrition-related complication — no. (%)</td>
<td>423 (18.2)</td>
<td>434 (18.8)</td>
<td>0.62</td>
</tr>
<tr>
<td>Hypoglycemia during intervention — no. (%)‡</td>
<td>81 (3.5)</td>
<td>45 (1.9)</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Primary outcome</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration of stay in ICU§</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (interquartile range) — days</td>
<td>3 (2–7)</td>
<td>4 (2–9)</td>
<td>0.02</td>
</tr>
<tr>
<td>Duration &gt;3 days — no. (%)</td>
<td>1117 (48.0)</td>
<td>1185 (51.3)</td>
<td>0.02</td>
</tr>
<tr>
<td>Hazard ratio (95% CI) for time to discharge alive from ICU</td>
<td>1.06 (1.00–1.13)</td>
<td>0.04</td>
<td></td>
</tr>
</tbody>
</table>

# EPaNIC

## Secondary outcome

<table>
<thead>
<tr>
<th>New infection — no. (%)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Any</td>
<td>531 (22.8)</td>
<td>605 (26.2)</td>
<td>0.008</td>
</tr>
<tr>
<td>Airway or lung</td>
<td>381 (16.4)</td>
<td>447 (19.3)</td>
<td>0.009</td>
</tr>
<tr>
<td>Bloodstream</td>
<td>142 (6.1)</td>
<td>174 (7.5)</td>
<td>0.05</td>
</tr>
<tr>
<td>Wound</td>
<td>64 (2.7)</td>
<td>98 (4.2)</td>
<td>0.006</td>
</tr>
<tr>
<td>Urinary tract</td>
<td>60 (2.6)</td>
<td>72 (3.1)</td>
<td>0.28</td>
</tr>
</tbody>
</table>

## Inflammation

<table>
<thead>
<tr>
<th>Median peak C-reactive protein level during ICU stay (interquartile range) — mg/liter</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>190.6 (100.8–263.2)</td>
<td>159.7 (84.3–243.5)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>

## Mechanical ventilation

<table>
<thead>
<tr>
<th>Median duration (interquartile range) — days</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2 (1–5)</td>
<td>2 (1–5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration &gt;2 days — no. (%)</td>
<td>846 (36.3)</td>
<td>930 (40.2)</td>
<td>0.006</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hazard ratio (95% CI) for time to definitive weaning from ventilation</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.06 (0.99–1.12)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tracheostomy — no. (%)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>134 (5.8)</td>
<td>162 (7.0)</td>
<td></td>
<td>0.08</td>
</tr>
</tbody>
</table>

Immunonutrition

- Nutrition that includes immune enhancing compounds
- AKA Neutraceuticals
  - Arginine
    - Essential amino acid (5.4% diet)
    - Effects in wound healing, high nitrogen balance
  - Nucleotides
    - Serve as catalysis, transfer of energy, and replication of rapidly dividing cells
    - 1-2 grams/day (animal protein, peas, yeast, beans, milk)
  - Glutamine
  - Omega-3 polyunsaturated fatty acids
    - Eicosapentaenoic acid (EPA)
    - Docosahexaenoic acid (DHA)

Glutamine

- Essential amino acid
  - Oxidative fuel for rapidly replicating cells
    - Enterocytes and colonocytes
    - Protective/restorative influence on the GI tract
  - 10% diet (5-9 grams of protein/day)
- Essential role in nitrogen shuttle
- Precursor component to glutathione (antioxidant)
- Stored in
  - Skeletal muscle tissue
  - Liver - constituent amino acid aids in visceral protein production
  - Kidney - substrate for renal ammonia production

Glutamine and Selenium

- Glutamine, Selenium, or both, to supplement parenteral nutrition for critically ill (SIGNET)
  - 10 Scottish ICUs, prospective randomized trial
  - 502 patients requiring ≥ 50% nutritional requirement met by parenteral nutrition and expected ICU stay ≥ 48 hours
    - Patients received either:
      - Glutamine (20.2 grams)
      - Selenium (500 mcg)
      - Combo vs. Placebo
  - Primary outcomes
    - Infections and mortality

### SIGNET

#### Trial parenteral nutrition formulations

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Individual formulations</th>
<th>Combined groups</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Glutamine (n=126)</td>
<td>Selenium (n=127)</td>
<td>Glutamine + selenium (n=124)</td>
<td>Neither (n=125)</td>
<td>Any glutamine (n=250)</td>
<td>Any non-glutamine (n=252)</td>
<td>Any selenium (n=251)</td>
</tr>
<tr>
<td>New infections*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All infections:</td>
<td>71 (56)</td>
<td>63 (50)</td>
<td>63 (51)</td>
<td>68 (54)</td>
<td>134 (54)</td>
<td>131 (52)</td>
<td>126 (50)</td>
</tr>
<tr>
<td>Odds ratio (95% CI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.07 (0.75 to 1.53)</td>
<td>0.81 (0.57 to 1.15)</td>
<td></td>
</tr>
<tr>
<td>Confirmed infections†:</td>
<td>62 (49)</td>
<td>48 (38)</td>
<td>56 (45)</td>
<td>59 (47)</td>
<td>118 (47)</td>
<td>107 (42)</td>
<td>104 (41)</td>
</tr>
<tr>
<td>Odds ratio (95% CI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.23 (0.86 to 1.76)</td>
<td>0.75 (0.52 to 1.08)</td>
<td></td>
</tr>
<tr>
<td>Mortality</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within critical care or high dependency unit:</td>
<td>46 (37)</td>
<td>42 (33)</td>
<td>42 (34)</td>
<td>38 (30)</td>
<td>88 (35)</td>
<td>80 (32)</td>
<td>84 (33)</td>
</tr>
<tr>
<td>Odds ratio (95% CI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.17 (0.80 to 1.71)</td>
<td>1.004 (0.69 to 1.47)</td>
<td></td>
</tr>
<tr>
<td>Within 6 months:</td>
<td>60 (48)</td>
<td>52 (41)</td>
<td>55 (44)</td>
<td>54 (43)</td>
<td>115 (46)</td>
<td>106 (42)</td>
<td>107 (43)</td>
</tr>
<tr>
<td>Odds ratio (95% CI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.18 (0.82 to 1.70)</td>
<td>0.89 (0.62 to 1.29)</td>
<td></td>
</tr>
</tbody>
</table>

Glutamine and Selenium

• Glutamine and Antioxidants in Critically Ill Patients

• 1223 patients in 40 ICUs
  ▫ Glutamine supplementation (0.35 g/kg/day) provided IV with enteral glutamine (30g)
  ▫ Placebo
  ▫ With and without 500mcg selenium

• Primary outcome: 28 day mortality

Table 2. Odds Ratio for Death According to Study Agent.*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Antioxidants</th>
<th>Glutamine-Specific Odds Ratio with Antioxidants (95%)</th>
<th>Overall Adjusted Odds Ratio with Antioxidants (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glutamine</td>
<td></td>
<td></td>
<td>1.09 (0.86–1.40)</td>
<td>0.48</td>
</tr>
<tr>
<td>Yes — no. of patients who died/total no. (%)</td>
<td>101/310 (32.6)</td>
<td>97/301 (32.2)</td>
<td>1.02 (0.72–1.43)</td>
<td></td>
</tr>
<tr>
<td>No — no. of patients who died/total no. (%)</td>
<td>89/307 (29.0)</td>
<td>76/300 (25.3)</td>
<td>1.20 (0.84–1.72)</td>
<td></td>
</tr>
<tr>
<td>Antioxidant-specific odds ratio with glutamine (95% CI)</td>
<td>1.18 (0.83–1.66)</td>
<td>1.40 (0.98–2.00)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall adjusted odds ratio with glutamine (95% CI)</td>
<td>1.28 (1.00–1.64)</td>
<td></td>
<td></td>
<td>0.05†</td>
</tr>
</tbody>
</table>
EPA and DHA

• Omega-3 polyunsaturated fatty acids
  ▫ \(\alpha\)-Linolenic acid (ALA)
  ▫ *Eicosapentaenoic acid (EPA)*
  ▫ *Docosahexaenoic acid (DHA)*

• Major component of the cell membrane
  ▫ Catalyst to dilation and contraction
  ▫ Inhibition and promotion of clotting
  ▫ Cell division and growth

• Found in fish oil, rape seed (canola oil)

EPA and DHA

- No direct effect on immune system
- Competes with arachidonic acid for COX metabolism
- Indirectly affects T-cell proliferation

Arachidonic Acid

- Prostaglandin H2
- Prostacyclins and Thromboxane
- Leukotrienes

COX; Cyclooxygenase
LOX; Lypooxygenase

OMEGA Trial

- OMEGA trial, JAMA 2011
  - 272 patients within 48 hours of ALI requiring mechanical ventilation
  - Received n-3 fatty acids, gamma-linolenic acid, and antioxidants vs. control
    - Enteral nutrition provided separately
  - Primary outcome: ventilator free days
- Ended at interim analysis for futility
- Criticized for bolus delivery method of supplements

## Immunonutrition

<table>
<thead>
<tr>
<th>EN</th>
<th>kcal/mL</th>
<th>Protein g/L</th>
<th>CHO g/L</th>
<th>Fat g/L</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact ®</td>
<td>1.0</td>
<td>56</td>
<td>130</td>
<td>28</td>
<td>Immune-enhancing</td>
</tr>
<tr>
<td>Impact ® Fiber</td>
<td>1.0</td>
<td>56</td>
<td>140</td>
<td>28</td>
<td>High calorie</td>
</tr>
<tr>
<td>Impact ® Peptide1.5</td>
<td>1.5</td>
<td>94</td>
<td>140</td>
<td>63.6</td>
<td>Arginine, DHA/EPA, Dietary nucleotides</td>
</tr>
</tbody>
</table>

### Supplement Dose

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutamine (PO)</td>
<td>15 g/packet</td>
</tr>
<tr>
<td>Glutamine (IV)</td>
<td>50g/1000mL</td>
</tr>
<tr>
<td>Fish Oil Omega-3 fatty acid</td>
<td>1000mg 1-4 times daily</td>
</tr>
<tr>
<td>Arginine</td>
<td>9.2 g/packet</td>
</tr>
</tbody>
</table>

Neslie®Nutrition Products
## Trace Elements

<table>
<thead>
<tr>
<th>Amount</th>
<th>Function</th>
</tr>
</thead>
</table>
| Chromium     | 10-15 mcg  
Stimulates FFA and cholesterol synthesis; breakdown insulin |
| Copper       | 0.3-0.5 mg  
Helps form RBC; vessel, nerve, bone health                             |
| Manganese    | 60-100 mcg  
Bone formation, thyroid function, connective tissue, sex hormone, calcium absorption, CHO and fat metabolism |
| Selenium     | 20-60 mcg  
Stimulates antioxidant enzyme production, immunologic (vaccine) protection |
| Zinc         | 2.5-5 mg  
Cofactor in immune response, factor in cell division, growth, wound healing, breakdown of CHO |

- Antioxidant vitamins and trace elements *(especially selenium)* should be provided to all critically ill patients (SSCM/JPEN Grade B)
  - Vitamins provided through 10 ml Infuvite (adult MVI)
  - Trace elements provided through 1 ml Trace Elements-5

Summary

• EN has not been proven superior to PN
  ▫ Associated with fewer infectious complications
  ▫ Recommended over PN
• Nutrition should be initiated as soon as possible
  ▫ Evidence supporting trophic (non-goal) formulations for the 1st seven days of ICU stay if goal nutrition not tolerated
• PN supplementation to EN is not supported in the evidence
  ▫ Data lacking in severely malnourished patients
• Immunonutrition may have benefits in small trials, but have not been shown to effect mortality in large RCT.
Update in Nutrition Literature

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