Response to Stress - Nutrition Therapy

- Balance between prevention of PEM and complications of nutrition support
- Consider status prior to illness, level of injury, current metabolic changes
Response to Stress - Nutrition Therapy

• Assessment
  • Many standard measures not valid or reliable
  • Family members important source of information
  • Measured weight and visceral protein status may be affected by fluid balance
  • Indirect calorimetry most accurate for estimating energy requirements
Response to Stress - Nutrition Therapy

- Assessment
  - Energy estimates - equations
    - Mifflin-St. Jeor or Harris-Benedict
    - Use stress and injury factors
    - Initial caloric goals: 25-35 kcal/kg
  - Protein
    - 1.2-1.5 g protein/kg
    - “Permissive underfeeding”
    - 14 kcal/kg, 1.2 g protein/kg
**Table 25.4**

Calculation of Energy and Protein Requirements: Activity and Stress Factors for Hypermetabolic Conditions

To calculate total energy requirements for the hospitalized patient:

\[ \text{REE (Resting Energy Expenditure)} \times \text{Activity Factor} \times \text{Injury Factor} \]

**Harris Benedict Equation**

- **REE for females** = \( 655.1 + 9.6 \, W + 1.9 \, H - 4.7 \, A \)
- **REE for males** = \( 66.5 + 13.8 \, W + 5.0 \, H - 6.8 \, A \)

\([W = \text{weight in kg}; H = \text{height in cm}; A = \text{age in years}]\)

**Mifflin-St. Jeor Equation**

- **Females**: \( 10 \, W + 6.25 \, Ht - 5 \, \text{Age} - 161 \)
- **Males**: \( 10 \, W + 6.25 \, Ht - 5 \, \text{Age} + 5 \)

\([W = \text{weight in Kg}; Ht = \text{height in cm}; \text{and Age} = \text{age in years}]\)

<table>
<thead>
<tr>
<th><strong>Activity Factors</strong></th>
<th><strong>Average Injury Factors</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Out of bed 1.2</td>
<td>Surgery 1.0—1.3</td>
</tr>
<tr>
<td>Confined to bed 1.1</td>
<td>Infection 1.0—1.4</td>
</tr>
<tr>
<td></td>
<td>Skeletal trauma 1.2—1.4</td>
</tr>
<tr>
<td></td>
<td>Head Injury 1.5</td>
</tr>
</tbody>
</table>

**Protein Requirements**

- RDA 0.8 g protein/kg
- Minor surgery 1—1.1 g protein/kg
- Major surgery 1.2—1.5 g protein/kg
- Burn 1.5—2.0 g protein/kg

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Response to Stress - Nutrition Therapy

- Interventions
  - Oral preferred route
  - Early initiation of nutrition support with specific dg
  - First consider enteral
  - Specialty formulas available
Critical Care Nutrition Support ICU

Patient Resuscitated

NO

Continue Resuscitation
Consider: Hypo-caloric PN (if gut not accessible for nutrition support > 5 days)

YES

Control for Hyperglycemia

Stress Gastritis Prophylaxis Protocol

NO

PN

YES

Gut Works

Open Abdomen/
Large wounds
Nutritional Supp.
(Vit, C, A, Zinc)

Formula for specific Disease Process

NO

Route to GI:
NG/NJ
PEG/PEJ

YES

Combination Therapy:
PN + LRTF
(Transition to EN)

NO

Nutritional Assessment: Critical Care Patient
1. Visceral Proteins: Pre-albumin, CRP q wk
2. Nitrogen Balance qwk
3. Kcal reg. PN/EN > 2 weeks

YES

Formula for specific Disease Process

EN

Gastric Residual Volume Protocol

PN: Parenteral Nutrition
EN: Enteral Nutrition
NG/NJ: Nasogastric/Nasojejunal
PEG/PEJ: Percutaneous Endoscopic Gastrostomy/ Percutaneous Endoscopic Jejunostomy

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<table>
<thead>
<tr>
<th>Formula/Manufacturer/Basic Nutrition Information</th>
<th>Carbohydrate Source</th>
<th>Protein Source</th>
<th>Lipid Source</th>
<th>Rationale for Metabolic Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pivot© (Ross)</td>
<td>46% (corn syrup solids)</td>
<td>25% partially hydrolyzed sodium caseinate, whey protein hydrolysate</td>
<td>Structured lipid (interesterified sardine oil and medium chain triglycerides), soy oil, canola oil</td>
<td>Arginine—13 g/L; glutamine (inherent): 6.5 g/L; omega-3 fatty acids (EPA, 2.6 g/L; DHA: 1.3 g/L); fructooligosaccharides (FOS) and increased antioxidants</td>
</tr>
<tr>
<td>Caloric Density: 1.5 kcal/mL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osmolality: 595 mOsm/kg water</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crucial© (Nestle)</td>
<td>36% (maltodextrin)</td>
<td>25% (hydrolyzed casein with added amino acid fortification)</td>
<td>Marine oil, MCT, and soybean oil</td>
<td>n6:n3 ratio of 1.5:1; fortified with arginine, vitamin C, A, zinc and beta-carotene</td>
</tr>
<tr>
<td>Caloric Density: 1.5 kcal/mL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osmolality: 375 mOsm/kg water</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact© (Novartis)</td>
<td>53% (hydrolyzed cornstarch)</td>
<td>22% (sodium and calcium caseinates, L-arginine 12.5 g/L)</td>
<td>25% (palm kernel oil, sunflower oil, menhaden oil)</td>
<td>EPA/DHA: 1.7 g/L; n-6 : n-3 ratio: 1.4:1.0; fortified with arginine—also available with added fiber</td>
</tr>
<tr>
<td>Caloric Density: 1.0 kcal/mL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osmolality: 375 mOsm/kg water</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact Glutamine© (Novartis)</td>
<td>46% (maltodextrin)</td>
<td>24% (wheat protein hydrolysate, free amino acids, sodium caseinate)</td>
<td>30% (palm kernel oil, menhaden oil, sunflower oil)</td>
<td>Glutamine: 15 g/L; L-arginine: 16.3 g/L; dietary nucleotides: 1.6 g/L; n-6:n-3 ratio: 1.4:1.0; added probiotic with soy and hydrolyzed guar gum</td>
</tr>
<tr>
<td>Caloric Density: 1.3 kcal/mL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osmolality: 630 mOsm/kg water</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Periative© (Ross)</td>
<td>55% (corn maltodextrin)</td>
<td>20.5% (partially hydrolyzed sodium caseinate, hydrolyzed lactalbumin)</td>
<td>Canola oil, MCT</td>
<td>.6 g of FOS/8 fl oz (6.5 g/L and 9.8 g/1,500 mL); fortification with arginine</td>
</tr>
<tr>
<td>Caloric Density: 1.3 kcal/mL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osmolality: 460 mOsm/kg water</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Response to Stress - Nutrition Therapy

- Interventions
  - Supplemental nutrients to consider:
    - Arginine, glutamine
    - Branched-chain amino acids: isoleucine, leucine, valine
    - Omega-3 fatty acids
    - Modify type of lipid; menhaden oil, marine oil, structured lipids
    - Sources of fiber
    - Probiotics, prebiotics, synbiotics
Response to Stress - Nutrition Therapy

- Interventions
- Complications of enteral include
  - Hyperglycemia
  - Electrolyte imbalances
  - Aspiration
  - Mechanical complications
Response to Stress - Nutrition Therapy

- Interventions
  - Total parenteral nutrition (TPN)
    - Reserved for NPO status, if enteral access not viable or unable to meet needs (volume)
    - Hyperglycemia most critical concern
    - Other concerns: catheter occlusion, infection, hypertriglyceridemia, intestinal atrophy, electrolyte disturbances, refeeding syndrome
Burns

- Tissue injury caused by exposure to heat, chemicals, radiation, or electricity

- Depth of wound and body surface are used to classify
  - Superficial
  - Superficial partial thickness
  - Deep partial thickness
  - Full thickness
  - See Table 25.6
<table>
<thead>
<tr>
<th>Classification</th>
<th>Cause</th>
<th>Appearance</th>
<th>Sensation</th>
<th>Healing Time</th>
<th>Scarring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial</td>
<td>Ultraviolet light, very short flash (flame exposure)</td>
<td>Dry and red; blanches with pressure</td>
<td>Painful</td>
<td>3 to 6 days</td>
<td>None</td>
</tr>
<tr>
<td>Superficial partial-thickness</td>
<td>Scald (spill or splash), short flash</td>
<td>Blisters; moist, red and weeping; blanches with pressure</td>
<td>Painful to air and temperature</td>
<td>7 to 20 days</td>
<td>Unusual; potential pigmentary changes</td>
</tr>
<tr>
<td>Deep partial-thickness</td>
<td>Scald (spill), flame, oil, grease</td>
<td>Blisters (easily unroofed); wet or waxy dry; variable color (patchy to cheesy white to red); does not blanch with pressure</td>
<td>Perceptive of pressure only</td>
<td>More than 21 days</td>
<td>Severe (hypertrophic) risk of contracture</td>
</tr>
<tr>
<td>Full-thickness burn</td>
<td>Scald (immersion), flame, steam, oil, grease, chemical, high-voltage electricity</td>
<td>Waxy white to leathery gray to charred and black; dry and inelastic; does not blanch with pressure</td>
<td>Deep pressure only</td>
<td>Never (if the burn affects more than 2% of the total surface area of the body)</td>
<td>Very severe risk of contracture</td>
</tr>
</tbody>
</table>
Burns

- Rule of “Nines” used to estimate BSA
  - Used in assessment of extent of injury, basis for fluid and medication recommendations
Burns

• Pathophysiology
  • Excessive inflammatory process
  • Rapid fluid shifts and accumulation
  • Fluid loss from wound
  • Metabolic stress; hypermetabolism, catabolism, immune, hormonal response
  • Respiratory complications
Burns

- Treatment
  - Topical agents
  - Clean, debride, dress wounds
  - Skin grafting
Burns

- Nutrition Therapy/ Implications
  - 20% body protein can be lost
  - Fluid imbalance, pain, immobility
  - Wound healing requires optimum nutrition
  - Weight fluctuations (d/t fluid shifts and resuscitation)
Burns

• Nutrition Therapy/ Assessment
  • Estimate energy using indirect calorimetry
  • Curreri equation can be used at peak of burn injury
    • Needs do not increase beyond 50-60% total body surface area burn
  • Mifflin-St. Jeor equation with injury factor 1.3-1.5
  • Energy needs increase with fever, infection, sepsis
Burns

- Nutrition Therapy/ Assessment
  - Protein 1.5-2 g protein/kg
  - Negative nitrogen balance may not be totally prevented
  - Set goal to minimize losses and promote wound healing
Burns

• Nutrition Therapy/ Interventions
  • Nutrition support - enteral
    • Early feeding associated with prevention of infections and Curling’s ulcer, and reduction in protein catabolism
    • Focus on higher protein (20-25% of kcal)
    • Supplemental arginine, glutamine, omega-3 fatty acids
  • PN if enteral cannot meet needs
Burns

- Nutrition Therapy/ Interventions
  - Nutrition support - PN
    - Avoid overfeeding, control hyperglycemia
  - Oxandrolone (anabolic steroid)
    - Used to promote protein synthesis
  - Additional vitamins, minerals, trace elements
    - Vitamins C, A, E, zinc routinely used
  - Wean from nutrition support when pt. can meet at least 60% of needs orally
TPN

Functional GI tract?  

NO

Continue TPN

Need TPN long term?  

YES

Obtain appropriate catheter for home TPN

NO

GI tract function improved?  

YES

Patient able to take PO volitionally?  

NO

EN continues or is initiated

start trophic EN at 10 to 20 ml/hr and advance EN to goal as tolerated

YES

Clear or full liquid diet

Evaluate ability to take po diet

Tolerates clears or full liquid diet?

YES

Advance to solid food

Tolerates Solid foods?

NO

WEANING TPN or EN

- reduce TPN or EN by 1/2 of goal
- TPN can be reduced by 1/2 of goal or to less than 24 hour infusion time
- EN can be cycled to 12 hour nighttime cycle to encourage appetite during the day
- follow calories counts

YES

Start Calorie counts

Wean TPN or EN off once patient consuming 1/2 to 2/3 of nutritional needs
**Surgery**

- Nutritional implications if...
  - Patient enters surgery malnourished or overnourished
  - Surgery will interrupt normal nutrition processes
  - Preoperative changes in weight, albumin, CRP
Surgery

- Clinical manifestations... depend on type of procedure
  - 12 hours pre-op NPO
  - May have nasogastric tube
  - Anesthesia may result in postop. ileus (lack of motility),
    general paralysis of GI tract
  - PO resumed with bowel sounds and gas production
Surgery

- Nutrition Implications/ Interventions
  - Post-operative metabolic stress
  - Progression for postoperative feeding individualized
    - NPO to solid foods as quickly as possible
  - Individualize energy and protein using REE and activity and injury factors
  - Nutrition support if NPO prolonged