Nutritional Considerations in High Risk Gastrointestinal Conditions

Douglas L. Nguyen, MD
Assistant Clinical Professor of Medicine
University of California, Irvine Medical Center
Director of the Inflammatory Bowel Disease Program
VA Long Beach Healthcare System

Presented on December 1, 2016

Financial Support for this presentation was provided by Nestlé Health Science. The views expressed herein are those of the presenter and do not necessarily represent Nestlé’s views. The material herein is accurate as of the date it was presented, and is for educational purposes only and is not intended as a substitute for medical advice. Reproduction or distribution of these materials is prohibited. Copyright 2016 Nestlé. All rights reserved.

Learning Objectives

Understand the pathophysiology of nutrient absorption in the normal gastrointestinal tract

Recognize common nutritional deficiencies in high risk gastrointestinal conditions

Identify strategies to prevent nutritional deficiencies in high risk gastrointestinal conditions
Patient’s History

- Frequency of stool output
- Degree of unintentional weight loss
- Any history of prior surgery
- Excessive flatus or abdominal distension
- History of oil drops separated from stool mass
- Functional capacity
- Self-perception of nutrition and health status
- Dietary intake
Nutrition-Focused Physical Exam

- Loss of subcutaneous fat
- Muscle wasting
- Ankle edema
- Sacral edema
- Ascites
- Functional capacity
- Micronutrient deficiencies

Anthropometric Measures

- Body Mass Index
- Weight and Height data
- Recent weight history
- Mid-arm circumference
- Calf circumference
- Triceps skin fold

Severity of Illness

- Stress factors
- Presence of acute disease
- Albumin
- Pre-albumin
- Lymphocyte count
Testing for Malabsorption

- Fat Malabsorption
  - Qualitative Fecal Fat
  - 72-hour Fat on 100g/fat intake
- Carbohydrate Malabsorption
  - D-xylene test
  - Breath testing (lactose)
- Protein Malabsorption
  - Fecal Alpha-1 antitrypsin

Additional Testing

- Measurements of specific micronutrient deficiencies
- Tests for bacterial overgrowth
- Test for pancreatic insufficiency (fecal elastase)
- Wireless capsule endoscopy
- Colonoscopy
- Cross-sectional imaging (ultrasound, CT scan)

Case Based Review of Nutritional Challenges in Common GI Conditions
The Crohn’s Patient

- 24 year male with 5-year history of ileocolonic Crohn’s disease on infliximab therapy
- Presents to the Emergency Department for evaluation of right lower quadrant abdominal pain
- CT scan: Right lower quadrant abscess.

What additional laboratory testing or clinical information would you like to gather?

- Reports weight loss of 25 pounds in the last 5 months because of abdominal pain and strict food restriction to reduce symptoms
- Subsequently underwent percutaneous drainage of abscess but is planned for surgery after his nutritional status is optimized

Macronutrient Requirements

- BMI as starting point for daily energy requirement
- Recommend protein intake is 1.2-2.0 g/kg actual weight
- If patient’s BMI >30, use ideal body weight

<table>
<thead>
<tr>
<th>BMI</th>
<th>Energy Requirement kcal/kg/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;15</td>
<td>23-45</td>
</tr>
<tr>
<td>15-19</td>
<td>31-35</td>
</tr>
<tr>
<td>20-29</td>
<td>26-30</td>
</tr>
<tr>
<td>&gt;30</td>
<td>15-25</td>
</tr>
</tbody>
</table>

Nguyen CG, *IBD*, 2008
Pre-operative Nutritional Optimization

<table>
<thead>
<tr>
<th>Study and Setting</th>
<th>Events</th>
<th>Total</th>
<th>Total</th>
<th>Odds Ratio</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nguyen DL 2015</td>
<td>5</td>
<td>39</td>
<td>42</td>
<td>0.12</td>
<td>0.09</td>
</tr>
<tr>
<td>Lachman et al.</td>
<td>10</td>
<td>58</td>
<td>68</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Li et al. 2013</td>
<td>50</td>
<td>274</td>
<td>324</td>
<td>0.57</td>
<td>0.57</td>
</tr>
<tr>
<td>Total</td>
<td>65</td>
<td>374</td>
<td>439</td>
<td>0.57</td>
<td>0.57</td>
</tr>
</tbody>
</table>

*Note: OR = 0.57 (95% CI: 0.37-0.88)*

**NUTRITION PEARL**

In Crohn’s patients with poor nutritional status, pre-operative nutritional optimization (oral supplementation, enteral, or parenteral) should be done to improve post-operative outcomes.

Nguyen DL, Digestive Disease Week, 2015

---

Back to the Patient

- Six months after undergoing an ileocectomy for a fibrostenotic stricture, the patient complains of:
  - Paresthesia in the hands and feet
  - Recurrent kidney stones
  - Persistent diarrhea with fat droplets

What additional laboratory testing or clinical information would you like to gather?

- Patient had approximately 180cm of distal terminal ileum resected

- The patient inquires about nutritional therapy to reduce his reporting symptoms.
Key Findings

- Hemoglobin: 9.8 (Normal 13-17)
- MCV: 110 (Normal 80-96)
- Vitamin B12: 178 (Normal 200-900 pg/ml)
- Methylmalonic acid: 6.2 (Normal 0.4-2 µmol/L)
- Colonoscopy at 6 months post-operatively showed active ulcerations at the ileocolonic anastomosis

Vitamin B12 Absorption

1. Pepsin breaks down B12 from foods
2. Stomach produces R-protein and IF
3. B12 binds to R protein
4. Pancreas releases enzymes to break R-B12 complex
5. B12 binds IF
6. Vitamin B12 absorbs in distal ileum

In Crohn’s patients with extensive ileal resection or inflammation, consider sublingual or intramuscular injection of Vitamin B12
**Enterohepatic Circulation**

- **Liver**
- **Small Intestines**
- **Colon**

- **>100 cm ileal resection** → fatty acid diarrhea
- **<100 cm ileal resection** → bile acid diarrhea

**In Crohn’s patients with >100 cm ileal resection, consider a low fat diet (20% total calories) and consider medium chain fatty acid replacement.**

**Recurring Kidney Stones**

- **Fat Malabsorption**
  - Free fatty acids in small bowel
  - Normally Calcium binds Oxalate

- **Calcium binds free fatty acids** → Increased absorption of oxalate in colon → Oxalate Stones

**NUTRITION PEARL**

In Crohn’s patients with recurrent calcium oxalate stones, consider high calcium, low-fat, low oxalate diet.
Half-Elemental Diet

**Takagi, Aliment Pharmacol Ther, 2006**

- Half-ED
- Control

**Rate of Recurrence**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Rate of Reduction**

Approx 50%

Enteral Nutrition As Augmentative Therapy

**Nguyen DL, Therapeutic Advances in GI, 2015**

<table>
<thead>
<tr>
<th>Study</th>
<th>Enrollment</th>
<th>Events</th>
<th>Total</th>
<th>Events</th>
<th>Total</th>
<th>Rate of Recurrence</th>
<th>Rate of Recurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE</td>
<td>40</td>
<td>38</td>
<td>40</td>
<td>36</td>
<td>40</td>
<td>37.8%</td>
<td>34.5%</td>
</tr>
<tr>
<td>TE</td>
<td>20</td>
<td>17</td>
<td>20</td>
<td>14</td>
<td>20</td>
<td>50.0%</td>
<td>37.5%</td>
</tr>
<tr>
<td>TE</td>
<td>10</td>
<td>8</td>
<td>10</td>
<td>6</td>
<td>10</td>
<td>75.0%</td>
<td>50.0%</td>
</tr>
<tr>
<td>TE</td>
<td>50</td>
<td>45</td>
<td>50</td>
<td>40</td>
<td>50</td>
<td>58.0%</td>
<td>40.0%</td>
</tr>
<tr>
<td>TE</td>
<td>20</td>
<td>16</td>
<td>20</td>
<td>12</td>
<td>20</td>
<td>70.0%</td>
<td>50.0%</td>
</tr>
</tbody>
</table>

**Total EN Events**

260

**Total Control Events**

65

**Post-Operative Maintenance Therapy**

**Yamamoto, Aliment Pharmacol Ther, 2007**

**Clinical Recurrence at 1 Year**

- EN Group
- Control Group

**Endoscopic Recurrence at 1 Year**

- EN Group
- Control Group
In Crohn’s patients, half-elemental diet and enteral nutrition supplementation can be considered to augment response to medical therapy and reduces disease recurrence.

The Gastric Bypass Patient

- 30 year old female with morbid obesity status-post Roux-en-Y gastric bypass 4 weeks ago
- Lost 30 pounds to date
- Poor oral intake with nausea/vomiting at home
- Admitted for altered mental status and hypotension with fever

What additional laboratory testing or clinical information would you like to gather?

Roux-en-Y Gastric Bypass

Roux-en-Y Gastric Bypass

BEFORE

Digestive cycle

Gastric pouch

Jejunal

Duo-denum

AFTER

Intravenous

Gastric pouch

Jejunal (gastric)

Duo-denum (patent)
Wernicke Encephalopathy
- Estimated up to 30% bariatric candidates have thiamine deficiency pre-operatively
- Significant thiamine deficiency occurs in 1% as early complication in post-RYGB
- Given presentation of Wernicke Encephalopathy, needs parenteral supplementation

**Nutrition Pearl**
In post-RYGB who presents with nausea/vomiting and WE, thiamine should be given parenterally (IV or IM) for at least 7 days

**Back to the Patient**
- Patient had parenteral thiamine replacement
- CT scan was collected which showed significant small bowel ileus with an intra-abdominal abscess
- She was found to have sepsis and ARDs and was placed on mechanical ventilation → ADMIITED TO MICU

**Nutritional Risk Assessment**
  - Nutritional NRS 2002 >3
  - NUTRIC ≥ 5
- Ultrasound and CT scan may be helpful to assess muscle mass (clinical trials ongoing)
- Recommends early EN in patients within 24-48 hours in critically ill patients

McClave et al, ASPEN Guidelines, 2016
**Protein Deficiency**

- Most commonly seen in post-RYGB
  - At 2 year—13% patients
  - At 10 year—28% patients

- Most common if Roux limb >150cm

- Recommended protein intake is 1.5-2.5 g/kg/day IBW

---

**Critical Illness and Enteral Nutrition: Mortality**

<table>
<thead>
<tr>
<th>Study Title</th>
<th>Enteral Total</th>
<th>Outcome</th>
<th>Reduction in Mortality</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown et al. 2000</td>
<td>535</td>
<td>53</td>
<td>1.00</td>
<td>0.318</td>
</tr>
<tr>
<td>Reduction in Mortality:</td>
<td>446</td>
<td>43</td>
<td>1.00</td>
<td>0.935</td>
</tr>
<tr>
<td>Analysis</td>
<td>581</td>
<td>57</td>
<td>1.00</td>
<td>0.796</td>
</tr>
</tbody>
</table>

Adapted from McClave et al, ASPEN Guidelines, 2016
Critical Illness and Enteral Nutrition: Mortality

- Adapted from McClave et al, ASPEN Guidelines, 2016

**REDUCTION IN MORTALITY**

**NUTRITION PEARL**

In critically ill patients, early initiation of EN within 48 hours in high risk patients may reduce mortality.

### Peptide-Based vs. Polymeric

- **Randomized trial peptide-based vs. polymeric in ICU patients x10 days**
  - 50 subjects completed study

- **Key Findings**
  - No statistical differences in diarrhea
  - Serum albumin and fibronectin increased significantly in the peptide-based group

Heimburger DC et al, JPEN, 1997

### Peptide-Based vs. Polymeric: Abdominal Surgery

- **Retrospective study**
  - Peptide (32 pts) vs. Whole protein (40 pts)

- **Key Findings Favoring Peptide Formula**
  - Trends greater improvement in lymphocyte count, albumin, pre-albumin, and C-reactive protein
  - Reduction in LOS in ICU
  - Reduction in diarrhea and pneumonia

Liu MY et al, World J Gastroenterol, 2016
### Feeding Intolerances & Outcome

- **Retrospective, multi-center**
- **167 ICUs**
- **Over 1,800 patients**

<table>
<thead>
<tr>
<th>GI Tolerant</th>
<th>Intolerant</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 1,312</td>
<td>N = 576</td>
<td></td>
</tr>
<tr>
<td>Ventilator-Free Days (median)</td>
<td>11.3</td>
<td>2.5</td>
</tr>
<tr>
<td>ICU Stay (median, days)</td>
<td>11.3</td>
<td>14.4</td>
</tr>
<tr>
<td>60-day Morality, %</td>
<td>26.2%</td>
<td>30.8%</td>
</tr>
</tbody>
</table>

Gungabissoon et al., JPEN, 2015

### Role of Soluble Fiber

- Consider adding in fermentable soluble fiber additive if presence of diarrhea
  - Adding 10-20g fermentable fiber/day
- **Benefits**
  - Carbohydrate & fat metabolism
  - Gut motility
  - Improve stool characteristics
  - Improve nutrient absorption
  - Pre-biotic effect → Bifidobacteria & Lactobacillus
  - Improve gut barrier function

McClave et al., ASPEN Guidelines, 2016

### Pre-biotic Effect Soluble Fiber

- Observational study of 63 ICU patients with systemic inflammatory response syndrome (SIRS)
- 14 patients found to have feeding intolerance
  - Lower anaerobes including Bifidobacteria (p <0.05)
  - Patients with feeding intolerance → higher rate of bacteremia (86% vs 18%; P < .05) and greater mortality (64% vs 20%; P < .05)

Shimizu et al., Neurogastroenterol Motil, 2011

**NUTRITION PEARL**

In critically ill patients, adding a soluble fiber to conventional formula will reduce diarrhea and may improve outcomes

Shimizu et al., Neurogastroenterol Motil, 2011
Short Bowel Syndrome

- 58 year old male with a history of coronary artery disease and diabetes
- Six months ago, had acute superior mesenteric artery embolism with resulting 300 cm of distal small bowel and ileocecal valve resection.
- Presents to the clinic for further nutritional management

What additional laboratory testing or clinical information would you like to gather?

---

Short Bowel Syndrome

**Stage 1**
- Immediate after resection
- Initial use of total parenteral nutrition (TPN)
- Trial of oral intake and titrate as tolerated

**Stage 2**
- Intestinal adaptation process takes place
- Increase oral intake
- Wean TPN

**Stage 3**
- Maximal intestinal adaptation
- Process can take months to years
- Wean TPN

Sundaram A et al, J Clin Gastroenterol, 2002

---

Initial Determination of Intestinal Function

- Length of the intestinal resection
- Presence of the ileum and ileocecal valve
- Presence of all or part of the colon
- Continuity versus incontinuity of the intestines

DiBaise Up To Date, 2016
Management of Diarrhea

<table>
<thead>
<tr>
<th>Increased Intestinal Motility</th>
<th>Gastric Hypersecretion</th>
<th>Intestinal Bacterial Overgrowth</th>
<th>Steatorrhea</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Loperamide</td>
<td>• Proton pump inhibitors</td>
<td>• Antibiotics</td>
<td>• Pancreatic Enzyme replacement</td>
</tr>
<tr>
<td>• Diphenoxylate</td>
<td>• H2 blockers</td>
<td>• Probiotics</td>
<td>• Bile acid replacement therapy</td>
</tr>
<tr>
<td>• Codeine</td>
<td>• Octreotide</td>
<td>• Reduce anti-motility or acid reducing agents</td>
<td></td>
</tr>
<tr>
<td>• Tincture of opium</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adapted from Kumpf, Journal of Parenteral and Enteral Nutrition, May 2014

Composition of Total Parenteral Nutrition

- 20-30% Fat
- At least 1.5 - 2.5g/kg/day protein
- Daily Calories 30 kcal/kg/day
- Carbohydrates make up remaining calories
- Vitamins, Minerals, Trace Elements

Sturn A et al, Scand J Gastroenterol, 1997
McClave et al, ASPEN Guidelines, 2016

Oral Diets: Practical Advice

- Once diarrhea less than 2L/day and electrolytes stable, consider oral and enteral nutrition
- Six small solid meals per day during adaptation phase
- Nasogastric tube at night to supplement 1000kcal can be considered
- Elemental vs. Semi-elemental vs. Polymeric Formulas

NUTRITION PEARL
In patients with short bowel syndrome, once diarrhea and electrolyte requirements have been stabilized to an output of 2L/day, consider oral and enteral supplementation to promote intestinal adaptation
Luminal exposure to nutrients → Enhance intestinal adaptation

Short bowel syndrome patients only absorb 2/3 of usual energy intake, so need to increase dietary energy intake by 30% to maintain weight

Use medium-chain triglycerides to increase calories because can be absorbed by proximal small bowel

Peptide-Based Formulas

- May be better tolerated than elemental1
  - Reaches feeds faster in group with peptide-based formula vs. elemental formula (3 month vs. 5 month)
- More efficient nutrient assimilation2
  - Mean ostomy output 39cc/kg/day peptide group vs 49cc/kg/day elemental group
  - Trace elements > excretion of copper and sulfur in elemental group

In patients with short bowel syndrome, consider the use of peptide-based formulas supplementation to enhance caloric intake and improve nutrient assimilation.

<table>
<thead>
<tr>
<th>References</th>
</tr>
</thead>
</table>

Other Pharmacologic Therapies

- Glutamine
- Growth Hormone
- Teduglutide (glucagon like peptide-2 analog)
- Epidermal Growth factor

Sundaram et al, J Clin Gastro, 2002
Thank you!

Questions

Nutrition-related resources and tools are available from Nestlé Nutrition Institute: www.nestlenutrition-institute.org

Visit the New and improved MyCE site at MyCEeducation.com
Offering CE to dietitians and nurses