Nutrition in the Patient with Ostomy or Enterocutaneous Fistula

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Considerations

- Presence & severity of pre-operative malnutrition.
- Feeding route (oro-gastric, small bowel, parenteral).
- Earliest post-op time to re-start feeding.
- Problems with fluid & electrolyte balance.
- Problems with absorption & digestion (length & health of bowel, enzyme activity).
- Presence with fistulas and/or strictures.
- Presence of chronic disorders (IBD, CHF, DM, cirrhosis, obesity)
Pre-Op Malnutrition
Pre-operative Malnutrition

• Up to 40% of patients requiring surgery are malnourished pre-op (Br Med J 1994;308:945)
• Surgical patients loose average of 5.4% of body weight during hospitalization.
• Surgery induces a hypermetabolic/catabolic state which may lead to protein-calorie malnutrition.
• Protein-calorie malnutrition (negative balance of 100 gm protein/10000 kcal) is associated with:
  – Increased risk of infections
  – Poor wound healing
  – Increased risk of decubitus ulcers
  – Increased risk of intestinal bacterial overgrowth.
Should we treat Pre-Op Malnutrition? TPN, TEN, Nothing?
Treatment of Pre-Op Malnutrition & Feeding Route

• Parenteral
Treatment of Pre-Op Malnutrition & Feeding Route

• **Parenteral**
  
  – **VA Co-Op study** *(NEJM 1991;325:525)*:
  
  – 395 undernourished pts undergoing laparotomy or non-cardiac thoracotomy.
  
  – TPN (7-15 d pre-op & 3 d post-op) vs no-TPN.
  
  – Pre-op TPN:
    
    • Increased infections (14% vs 6%) (non-infectious & infectious complications decreased only in the SEVERELY malnourished).
    
    • Caused non-significant drop in 30-d mortality (7.3 vs 4.9%).
TPN in **Severely** Malnourished Gastric & Colon Ca

- 90 patients
- > 10% weight loss
- TPN [10 d pre-op + 9 d post-op] vs no-TPN
- JPEN 2000; 24:7
Treatment of Pre-Op Malnutrition & Feeding Route

• **Parenteral**
  – Meta-analysis of 2211 critically ill or surgical patients show no effect of TPN in mortality nor morbidity. *(JAMA 1998; 280:2013)*
  – In UC & Crohn’s disease *(Gastroenterology 2001; 121:970)*:
    • TPN vs no-therapy had no effect on mortality, disease remission, nor need for surgery.
    • Bowel rest is not necessary to achieve clinical remission.
Treatment of Pre-Op Malnutrition & Feeding Route

• Enteral
TPN vs TEN in GI Cancer

- 317 patients
- Post-op TPN vs TEN
- TEN gave more cramping & abdominal distention
- Lancet 2001; 358:1487
Immunonutrition TEN vs Standard TEN in GI Cancer

- 206 patients
- TEN for 7 days pre-op
- L-arginine, RNA nucleotides, & omega-3 fatty acids (Impact) vs Standard
- Arch Surg 1999; 134:428
Treatment of Pre-Op Malnutrition & Feeding Route

• **Enteral**
  - Immunonutrition vs Standard TEN in 154 pts with GI cancer (5 d pre-op + 10 d post-op) by needle jejunostomy (Arch Surg 1999; 134: 428):
    - Immunonutrition had less infections (14% vs 27%).

- In IBD, TEN with some special formulas (Modulen) improves remission rate, but is less effective than standard medical therapy. This formula is a reasonable choice for the IBD patient with malnutrition.
Treatment of Pre-Op Malnutrition & Feeding Route

• **Conclusion**
  
  – In patients with moderate to severe malnutrition who will require ostomy due to GI cancer or IBD: *pre-operative nutrition, preferably by the enteral route, decreases morbidity and LOS.*
  
  – If TPN is the only alternative, it should be used only in patients with severe malnutrition, and in the 7-10 days pre-op period (post-op TPN increases complications).
  
  – Immunonutrition formula (Impact/ Crucial/ Traumacal) may be best choice for cancer patients (do not use in infected patients).
How soon can we restart feeding?
Earliest Time to Re-Start Feeding

• **Use of NG tube**: Cochrane Database Systematic Review of 28 RCTs for use of NGT after abdominal surgery (4198 pts) shows that no-NGT gives (Cochrane Database Syst Rev 2005 Jan 25;(1)):
  – earlier bowel function,
  – no change in rate of anastomotic leaks,
  – slight decrease in pulmonary complications, and
  – slight increase in wound infections or ventral hernia.

• Only 1.8% of patients develop acute gastric distention & 10% need NGT due to vomiting.
Earliest Time to Re-Start Feeding
Can we shorten it?

• In colonic surgery, the pre-op ingestion of a Maltodextrin drink decreased “first flatus” time & LOS (Colorectal Dis 2006;7: 563)

• Starting clear liquids the day after colorectal resection, was well tolerated, with only 10% needing NGT (full liquid diets are less “osmolar” and should be tolerated better) (Ann Surg 1995; 222:73)

• Feeding per-os can be initiated as soon as gastric ileus resolves. “Sitz-Marks” markers can be given pre-op and followed by KUB; once 70% are emptied, feeding can start (Hepatogastroenterol 2005; 63:775)
Problems with Fluid & Electrolyte Balance
## Intestinal Contents

### Normal Volumes and Compositions

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>Contribution</th>
<th>(Absorption)</th>
<th>Luminal Balance</th>
<th>Na (mM/L)</th>
<th>K (mM/L)</th>
<th>Cl (mM/L)</th>
<th>HCO$_3$ (mM/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral</td>
<td>2000</td>
<td>0</td>
<td>2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saliva</td>
<td>1500</td>
<td>0</td>
<td>3500</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastric</td>
<td>2500</td>
<td>0</td>
<td>6000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bile</td>
<td>500</td>
<td>0</td>
<td>6500</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pancreas</td>
<td>1500</td>
<td>0</td>
<td>8000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jejunum</td>
<td>1000</td>
<td>(5500)</td>
<td>3500</td>
<td>130</td>
<td>6</td>
<td>90</td>
<td>30</td>
</tr>
<tr>
<td>Ileum</td>
<td>0</td>
<td>(2000)</td>
<td>1500</td>
<td>140</td>
<td>8</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>Colon</td>
<td>0</td>
<td>(1300)</td>
<td>200</td>
<td>40</td>
<td>90</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Stool</td>
<td>-</td>
<td>-</td>
<td>200</td>
<td>40</td>
<td>90</td>
<td>15</td>
<td>30</td>
</tr>
</tbody>
</table>
Fluid Entering (per day)

- Oral intake: 2 L
- Salivary: 1.5 L
- Biliary: 0.5 L
- Gastric: 2.5 L
- Pancreatic: 1 L
- Intestinal: 1 L

Fluid Reabsorbed

- Small intestine: 7.0 L (max 12 L)
- Large intestine: 1.4 L (max 5 L)
Expected output by Ostomy-Level (while in oral diet)

- **Jejunum:** 3500 to 8000 mL/day
- **Ileum:** 1500 to 3000 mL/day
- **Colon:** up to 1500 mL/day
# Long-Term Hydration Outcome Related to Bowel Remnant

<table>
<thead>
<tr>
<th>Jejunum</th>
<th>Ileum</th>
<th>Colon</th>
<th>Hydration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intact</td>
<td>TI Resected</td>
<td>Intact</td>
<td>Not Needed</td>
</tr>
<tr>
<td>Resected</td>
<td>Intact</td>
<td>Intact or Resected</td>
<td>Not Needed</td>
</tr>
<tr>
<td>60-100 cm present</td>
<td>Absent</td>
<td>Intact</td>
<td>ORT</td>
</tr>
<tr>
<td>60-100 cm present</td>
<td>Absent</td>
<td>Absent</td>
<td>ORT; may need IV</td>
</tr>
</tbody>
</table>

ORT = Oral Rehydration Therapy
IV = Intravenous fluids
## Long-Term Hydration Outcome Related to Bowel Remnant

<table>
<thead>
<tr>
<th>Jejunum</th>
<th>Ileum</th>
<th>Colon</th>
<th>Hydration</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-60 cm present</td>
<td>Absent</td>
<td>Intact</td>
<td>IV; <strong>ORT</strong> may be possible</td>
</tr>
<tr>
<td>30-60 cm present</td>
<td>Absent</td>
<td>Absent</td>
<td>IV</td>
</tr>
<tr>
<td>&lt; 30 cm present</td>
<td>Absent</td>
<td>Intact or Absent</td>
<td>IV</td>
</tr>
</tbody>
</table>

**ORT** = Oral Rehydration Therapy  
**IV** = Intravenous fluids
Adult Oral Rehydration Therapy (ORT) Solutions

• Needed if all SB remnant is 30-100 cm jejunum.
• Ideally should have close to 90 mEq/L of sodium, 20 mEq/L of K, and 40 gm/L of carbohydrate (sugar or rice)
  – WHO: Water 1 liter + ¾ tsp salt + ½ tsp baking soda + 1 cup orange juice + 4 Tbs of sugar.
  – Ceralyte-70 1 liter + ¼ tsp salt
  – Pedialyte 1 liter + ½ tsp salt + 1 Tbs sugar
  – Gatorade 3 glasses + 1 glass orange juice + ½ tsp salt + ½ tsp baking soda

½ tsp salt = 22 Zesta crackers       ½ tsp baking soda = 15 Zesta crackers
Problems with Absorption & Digestion
Problems with Absorption & Digestion

• **Loss of colon**
  – decreases fluid & electrolyte absorption, and prevents rescue absorption of the SCFA not absorbed by the small bowel.
  – accelerates gastric emptying.

• **Loss of IC valve**
  – accelerates SB transit, and allows bacterial overgrowth, which worsens fat, $B_{12}$, & bile salt absorption.

• **Loss of $\geq 60$ cm of TI**
  – will cause $B_{12}$ deficiency.

• **Loss of 30 to 100 cm of TI**
  – will cause bile salt malabsorption and cholerheic (colorrhelic) secretory diarrhea but no fat maldigestion (liver compensation).
Problems with Absorption & Digestion

• **Loss of more than 100 cm ileum**
  – causes bile salt deficiency with fat maldigestion & malabsorption.
  – if colon is present, colonic oxalate absorption is increased by fatty acid diarrhea, causing kidney stones.

• **Loss of ileum**
  – causes loss of “compensatory gastric emptying delay” that occurs when unabsorbed lipids reach the ileum; maldigestion & diarrhea worsen.
  – if all SB remnant is < 100 cm jejunum, will need ORT or IV fluids.

• **Short bowel syndrome**
  – causes gastric hypersecretion & acid-pH mediated inactivation of pancreatic enzymes: more diarrhea & maldigestion.
Management of Absorption & Digestion Problems
Management of Absorption & Digestion Problems

- **Poor fluid & electrolyte absorption**
  - Decrease saliva volume: belladonna
  - Slow down bowel transit: paregoric, other opiates, or loperamide.
  - Liquid drug preparations will be absorbed better; be sure they do not have sorbitol.
  - Avoid hyperosmolar feeding formulas, sodas & juices. Prefer formulas with 40% of calories as fat, low in simple carbohydrates, & with fiber, given as continuous feeding or q 2h feeding.
  - If patient has only 30-100 cm jejunum and no ileum: give ORT to support hydration.
Management of Absorption & Digestion Problems

- **Hypersecretion**
  - Control gastric secretion with liquid PPI or H2 blocker
  - Cholestyramine for ileal loss of 30-100 cm: prevents cholerheic (colorrheic) diarrhea; must use lowest effective dose to avoid bile salt depletion; not needed if colon is absent.
  - Clonidine (alfa-2 adrenergic receptor agonist) 0.2 mg BID or 0.3 mg patch decreases small bowel secretion *(JPEN 2004;28:265  JPEN 2006;30:487)*
Management of Absorption & Digestion Problems

• **Hypersecretion**
  
  – Zn supplements: Zn is loss at 12 mg/kg stool by jejunostomy or 17 mg/kg stool from ileum or colon. Zn deficiency due to diarrhea may worsen fluid loss and delay fistula healing; Zn is a K channel blocker of adenosine 3’,5’-cyclic monophosphate-mediated chlorine secretion *(Gastroenterol 2006;130:2201)*
  
  – Decrease pancreatic secretion with octreotide 100-200 mcg SQ q 8h (but worsens maldigestion, and could decrease enteroglucagon release needed to induce intestinal mucosal hyperplasia)
Management of Absorption & Digestion Problems

- **Loss of \( \geq 60 \text{ cm of TI} \):** B\(_{12}\) replacement by injection or transnasal (Nasocobal)
- **> 100 cm ileum loss, with colon present:** causes fatty acid diarrhea; give Calcium with food to decrease colonic oxalate absorption & prevent kidney stones.
- **30-100 cm TI loss, with colon present:** causes Bile salt malabsorption/cholerheic diarrhea; Cholestyramine
- **Bacterial overgrowth:** cycles of rifaximin, metronidazol, or quinolone.
  - **Experimental:**
    - Glutamine + growth hormone,
    - Glucagon-like peptide-2 (Teduglutide),
    - Hepatocyte growth factor,
      - IL-11,
    - Epidermal growth factor
## Long-Term Nutrition Outcome Related to Bowel Remnant

<table>
<thead>
<tr>
<th></th>
<th>Jejunum</th>
<th>Ileum</th>
<th>Colon</th>
<th>Diet &amp; Vitamins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intact</td>
<td></td>
<td>TI Resected</td>
<td>Intact</td>
<td>Regular; $B_{12}$</td>
</tr>
<tr>
<td>Resected</td>
<td></td>
<td>Intact</td>
<td>Intact or Resected</td>
<td>Regular or low fat</td>
</tr>
<tr>
<td>60-100 cm present</td>
<td>Absent</td>
<td>Absent</td>
<td>Intact</td>
<td>Diet as tolerated; $B_{12}$, Ca, Cholestyramine</td>
</tr>
<tr>
<td>60-100 cm present</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
<td>High Na Diet as tolerated; $B_{12}$</td>
</tr>
</tbody>
</table>
## Long-Term Nutrition Outcome Related to Bowel Remnant

<table>
<thead>
<tr>
<th>Jejunum</th>
<th>Ileum</th>
<th>Colon</th>
<th>Nutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-60 cm present</td>
<td>Absent</td>
<td>Intact</td>
<td>PN usually needed</td>
</tr>
<tr>
<td>30-60 cm present</td>
<td>Absent</td>
<td>Absent</td>
<td>TPN</td>
</tr>
<tr>
<td>&lt; 30 cm present</td>
<td>Absent</td>
<td>Intact or Absent</td>
<td>TPN</td>
</tr>
</tbody>
</table>
Management of Fistula
Management of Fistula

- Correct fluid & electrolyte balance
- Treat sepsis
- Drain fluid collections.
- Treat malnutrition (No Immunonutrition in septic patient)
- Control fistula output
- Treat bowel strictures distal to fistula
- In septic abdomen, may need “proximal loop jejunostomy” (ideally 80-100 cm distal to duodeno-jejunal flexure) (Ann Surg 2004;240:825, Br J Surg 2006;93:1247)
Management of Fistula

• When feasible, wedge resection of fistula with re-anastomosis is preferred to oversewing (Ann Surg 2004;240:825)

• High-pressure vacuum/ Vacuum-Assisted Closure may be a useful adjunct (Gynecol Oncol 2001;80:413, Dig Surg 2004;21:401, Surgery 2006;140:570)

• When TPN is required, changes in hydration should be treated with fluids independent of TPN.
TEN in Patients with Enteric Fistula

• 1. If bowel stricture is present, feed beyond point of stricture, or correct stricture.
• 2. If multiple fistulas are present, feed beyond most distal stricture.
• 3. When possible, use naso-enteric tube, jejunostomy, or PEG/J to deliver nutrition beyond fistula tract.
• 4. If most-distal fistula is beyond reach of PEG/J or N-J: place feeding tube through the most distal fistula. Avoid tubes with “balloon” or “large head” which can partially obstruct the lumen.
• 5. If “point of feeding” is very distal, manage bowel as in “short bowel” to improve absorption.
Presence of Chronic Disorders

• In cirrhosis or heart failure, minimize Na in diet & fluids (80 mEq/day + ostomy/fistula losses). Avoid TPN in cirrhosis.
• In Diabetes Mellitus, avoid hyperglycemia (do not overfeed, use enteral diabetic formula, ADA diet, insulin in TPN)
• Obesity: moderate caloric restriction (500 kcal deficit/day)
• IBD: if in tube feeds, consider Modulen; replace Zn & B_{12} as appropriate