

# ENHANCING INTESTINAL REHABILITATION IN SBS-IF

## Enhancing Intestinal Rehabilitation in SBS-IF Strategies for Collaborative Care



Jointly sponsored by **pcme** & **Rockpointe**

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- Nutrition Support Clinical Specialist, 1991-2013
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- Staff Pharmacist, 1974-1985
- Certified Diabetes Educator, 1990-2012
- Board Certified Nutrition Support Pharmacist since 1994

### **Case Study**

- A 40-year-old male is referred for evaluation of short bowel syndrome (SBS)
  - Over the past 12 years, he has had several intestinal resections due to Crohn's disease
  - He is sustained on parenteral nutrition (PN) after multiple hospital admits for dehydration due to severe diarrhea
  - His weight is 20 lbs below his usual; appears cachectic
  - He takes some Imodium to control the diarrhea, but it does not seem to help
  - He was told to avoid dairy products

### **Why These Patients Are Worthy of Our Time and Care**

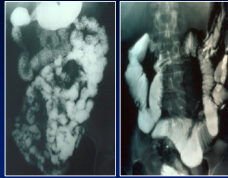
- Risks are great:
  - Central line-related
  - PN-related
  - Altered bowel anatomy-related
  - Increased mortality
- Other important effects:
  - Quality of life
    - Loss of sleep
    - Equipment "appendages"
    - "Not normal"
    - Morbidity/mortality
  - Financial
    - Out of pocket
    - Health care

Tarleton S, DiBaise JK. Short Bowel Syndrome. In: The A.S.P.E.N. Adult Nutrition Support Core Curriculum, 2nd Edition; 2012:511-522.  
Berghofer P et al. Clin Nutr 2013;32:789-796.

# ENHANCING INTESTINAL REHABILITATION IN SBS-IF

## What Defines Short Bowel Syndrome?

- Wide-ranging small bowel length
  - 300 to 800 cm
- Tremendous functional reserve
  - Problems when >75% removed
  - Entire colon equivalent to 50-60 cm SB length
- <200 cm small bowel remaining



Tarleton S, DiBaise JK. Short Bowel Syndrome. In: The A.S.P.E.N. Adult Nutrition Support Core Curriculum, 2nd Edition; 2012:511-522.

## Etiology of SBS in Adults

- Postoperative (24%)
  - Bariatric surgery
- Radiation enteritis/tumors (24%)
- Mesenteric ischemic events (22%)
- Crohn's disease (17%)
- Trauma (8%)
- Other (7%)

Dabney A et al. Am J Surg. 2004;188:792-795.

## SBS Bowel Anatomy Types



- Rapid transit
- Acid hypersecretion
- Poor adaptation
- Large fluid losses
- Malabsorption
- Worst prognosis
- <100 cm



- Rapid transit
- Poor adaptation
- B12 and bile salt malabsorption
- Variable calorie and fluid absorption
- <65 cm



- Adequate absorption until about 75% resected
- Good adaptation
- Slower transit
- Uncommon; best prognosis
- <30 cm

Tarleton S, DiBaise JK. Short Bowel Syndrome. In: The A.S.P.E.N. Adult Nutrition Support Core Curriculum, 2nd Edition; 2012:511-522. Feldman; Sleisenger & Fordtran's Gastrointestinal and Liver Disease, 7th Edition; Figure 92-1, page 1908; 2002. Elsevier.

## Treatment Goals in SBS

- Maintain adequate nutrition and growth
- Prevent and correct nutritional deficiencies
- Prevent and correct bowel- and treatment-related complications
- Improve quality of life
- Restore enteral autonomy if possible

Tarleton S, DiBaise JK. Short Bowel Syndrome. In: The A.S.P.E.N. Adult Nutrition Support Core Curriculum, 2nd Edition; 2012:511-522.

## Where to Begin?

## Initial Assessment

- Determine bowel anatomy
  - Past medical and surgical history
- Weight loss history
- 24hr urine and stool or ostomy output
- Treatment history
- Medical complications

Tarleton S, DiBaise JK. Short Bowel Syndrome. In: The A.S.P.E.N. Adult Nutrition Support Core Curriculum, 2nd Edition; 2012:511-522.

# ENHANCING INTESTINAL REHABILITATION IN SBS-IF

## SBS Diet "Code" – More Like Guidelines

| Factor        | Colon Present   | Colon Absent  |
|---------------|---|---|
| Meals/ snacks | • 5-6 smaller meals/d   | • 6+ small meals/d  |
| Fluids        | • ORS and/or hypotonic  | • ORS/ high sodium fluids (90mEq/L or >) may be required<br>• In some, fluid restriction may be necessary |
| Carbohydrates | • 50%-60% of energy intake as complex CHO<br>• Limit simple sugars (foods/fluids) | • 40%-50% of energy intake as complex CHO<br>• Limit simple sugars (foods/fluids)                         |
| Fat           | • 20%-30% of energy intake<br>• Ensure adequate (esp. essential fatty acids)      | • 30%-40% of energy intake or as tolerated<br>• Ensure adequate (esp. essential fatty acids)              |
| Protein       | • 20%-30% of energy intake  | • 20%-30% of energy intake  |
| Fiber         | • 5 to 10 g/day soluble fiber   | • ? fiber   |
| Oxalate       | • Limit   | • No restriction  |
| Salt          | • Usual intake  | • Increased salt intake   |

Byrne TA et al. *Nutr Clin Pract*. 2000;15:306-311.  
 Nightingale JMD et al. *Gut*. 1992;33:759-761.  
 Parrish CR. *A Patient's Guide to Managing a Short Bowel*. 2nd ed. Newark, DE: Growth, Inc; 2013:1-65 (www.shortbowelsupport.com).

## Practical Suggestions

- Chew foods well
- Smaller, frequent meals, ↓ simple sugars
  - Start with their usual and tailor it – prior 3-day diet record
  - Tell them what they CAN eat
- Lactose restriction?
- Low FODMAP/ Avoid sugar alcohols?
- Diet for SBS available @ [www.ginutrition.virginia.edu](http://www.ginutrition.virginia.edu)
  - Under Patient Education Materials link

Parrish CR. *A Patient's Guide to Managing a Short Bowel*. 2nd ed. Newark, DE: Growth, Inc; 2013:1-65 (www.shortbowelsupport.com).  
 Martens P et al. *Nutrition*. 1997;13:13-16.  
 Jappsen PB et al. *Gut*. 1998;43:478-483.

## Fluids/Hydration

- Separate solids from liquids
  - Take small amounts of fluids with meals
  - Sip more between meals
- Avoid hypertonic/hypotonic fluids such as:
  - Water, tea, coffee
  - Fruit juices/drinks
  - Alcohol
  - Sport drinks
  - Sodas
  - Sweetened liquid nutritional supplements

Spiller RC et al. *Gut*. 1997;28:681-687.  
 Newton CR et al. *J Royal Soc Med*. 1985;78:27-34.

## Oral Rehydration Solutions

- Are not for everybody...
- Start with 500-1000 mL/d
  - If they won't drink 1 L, they won't drink 3
- Sipping is better than gulping
  - Maximize mL of ORS per cm of small bowel
- Try ice cubes/popsicles
- Via nocturnal feeding tube
- Commercial and ORT-like recipes
  - In: *A Patient's Guide to Managing a Short Bowel*

Parrish CR. *A Patient's Guide to Managing a Short Bowel*. 2nd ed. Newark, DE: Growth, Inc; 2013:1-65 (www.shortbowelsupport.com).  
 Naeth J et al. *Nutr Rev*. 2004;62:221-231.  
 Nightingale JMD et al. *Gut*. 1992;33:759-761.  
 Alis AN et al. *Am J Gastroenterol*. 2009;104:2596-2604.

## When to Consider Enteral?

- Feed as high up as possible (i.e. stomach)
- Lower osmolality, polymeric (not elemental), some MCT-containing tube feeding
- Infuse via pump to decrease nutrient load per cm bowel
- If bile salt deficient, try lower fat semi-elemental
- Give some fiber if colon segment remaining

Levy E et al. *Br J Surg*. 1988;75:549-553.  
 McIntyre PB et al. *Gastroenterology*. 1986;91:25-33.  
 Joly F et al. *Gastroenterology*. 2009;135:224-31.  
 Botasani I et al. *Scand J Gastroenterol*. 1989;21:391-396.  
 Cosnes J et al. *Gastroenterol Clin Biol*. 1980;4:695-699.  
 DiBaise JK et al. *J Clin Gastroenterol*. 2007;41:647-656.

## Optimizing GI Function – Interventions

- Medications – FRONT LINE
  - Considerations
    - Medication malabsorption
    - Timing in relation to meals
    - Availability at the patient's pharmacy
    - Always consider the dosage form

Titus R et al. *Nutr Clin Pract*. 2013;28:429-436.

## Antisecretory Agents

- Massive enterectomy associated with transient (6-12 mo) hypergastrinemia and hypersecretion
  - H2RA (IV)
  - PPI (oral)
- Octreotide
  - subQ
  - IV

Cortot A et al. *N Engl J Med.* 1979;300:79-80.

## Discussion Points

- Net secretor vs osmotic diarrhea
  - How do you distinguish between the two?
- How much bowel do you need to utilize a PPI?
  - Dose
  - Form
  - Establishing efficacy?
  - When to go to IV route?
- When would one consider octreotide?

## Antidiarrheal Use

- ↓ motility, ↑ contact time, ↑ absorption
  - Loperamide: minimal side effects; OTC
    - 2 to 4 mg every 6-8 hours
  - Diphenoxylate / atropine
    - 1 to 2 tablets every 6-8 hours

King RFGJ et al. *Aust N Z J Surg.* 882:52:121-124.

## Discussion Points

- Are either more effective in patients with or without a colon?
- Any benefit to use both at the same time?
- What is the treatment endpoint?
- What if a patient does not have an ileum – can loperamide still be utilized?
- How many days before moving to narcotics?

## Narcotics

- Codeine phosphate
  - 30 to 60 mg every 6-8 hours (vs prn)
- Opium tincture
  - 5 to 20 drops (0.25 mL to 1.25 mL) every 6-8 hours (vs prn)
  - (Note – 5 drops = 0.25 mL = 2.5 mg morphine)
  - Safer to dose in mL vs drops

Baker ML et al. *Colorectal Dis.* 2011;13:191-197.  
King RF et al. *Aust N Z J Surg.* 1982;52:121-124.  
Newton CR. *Gut.* 1978;19:377-383.

## Discussion Points

- Issues with narcotics:
  - "I don't like to use narcotics" (patient or clinician)
    - Addiction potential
    - Are there any that are more addictive than others?
    - Other issues such as higher risk for being stolen?
    - Is this a higher risk than parenteral nutrition?
  - Pharmacogenetic issues of codeine
  - Requires monthly prescription
  - Prescriptions cannot be faxed/mailed
  - DEA concerns
  - What about using Paregoric
  - Oxycodone, or other narcotics?

## Other Therapies – Indications?

- Clonidine
- Bile salt binders
  - Not for use in patients without a colon
- Bile salt replacers
- Pancreatic enzymes
- Probiotics

McDoniel K et al. *JPEN J Parenter Enteral Nutr.* 2004;29:265-268.  
Buchman AL et al. *JPEN J Parenter Enteral Nutr.* 2006;30:467-491.  
Nehra V et al. *Am J Gastroenterol.* 2001;96:1494-1498.  
O'Keefe SJ et al. *Gastroenterology.* 1994;107:379-388.

## Antimicrobial Use in SBS

- Small bowel bacterial overgrowth
- Multifactorial pathophysiology
- Variety of potential clinical consequences
  - May interfere with PN weaning and predispose to bacterial translocation
  - May be beneficial in CHO salvage
- Unique diagnostic challenge
  - Small bowel aspirate best test (?)
- Antibiotic therapy first line
  - Improved gas-related symptoms, reduction in stool output and/or weight gain



DiBaise JK et al. *Clin Gastroenterol Hepatol.* 2006;4:11-20.

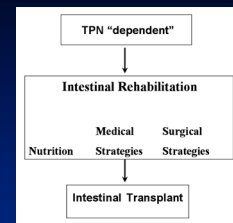
## Case Study Continued

- He was determined to have about 90 cm of jejunum and half his colon; multiple micronutrient deficiencies also found
- Stool output was 3000 mL+ per day
- Urine output was ~ 890 mL per day
- PN was initiated, as were dietary/fluid modifications and aggressive use of antidiarrheals
  - Weight increased back to near his usual and previously identified micronutrient deficiencies were corrected
- Attempts to wean his PN stalled out at 5 nights/week

**What should we do now?**

## Problem with Current Approaches

- PN still frequently necessary
  - Does not enhance bowel function
  - Costly (>\$100K/yr)
  - Reduced quality of life
  - 1-2 hospitalizations annually/patient



## Risk Factors for Permanent Intestinal Failure

- Remnant bowel length
  - ≤ 100 cm end-jejunostomy
  - ≤ 65 cm jejunocolic anastomosis
  - ≤ 30 cm jejunoleocolic anastomosis
- Residual disease in remnant bowel
- Absence of colon
- Time on PN
  - ≥ 2 yrs adults; ≥ 4 yrs children
- Degree to which adaptation has occurred
- Age
- Nutritional status

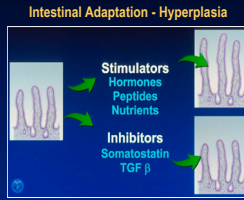
Messing et al. *Gastroenterology.* 1999;117:1043-1049.  
Crann et al. *Gastroenterology.* 2009;119:1496-1505.  
Jeppesen et al. *Best Pract Res Clin Gastro.* 2003;17:1041-1054.

## Enter: Trophic Factors

# ENHANCING INTESTINAL REHABILITATION IN SBS-IF

## Trophic Factors

- Facilitate intestinal adaptation
  - Morphological and functional
  - Ileum > Colon > Jejunum
  - Begins immediately after surgery and continues for 2-3 years
  - Variety of stimulators of adaptation



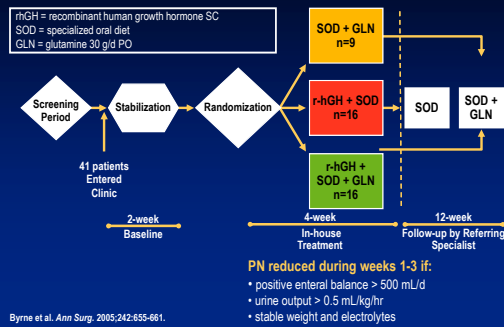
Matarese LE, Abu-Elmagd K. *Expert Opin Pharmacother.* 2005;10:1741-1745D.

## PN Weaning – Trophic Factors

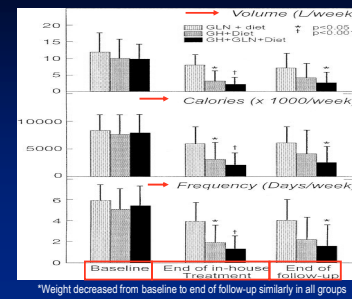
- FDA approval of rhGH (Zorbtive; Serono Inc.) in December 2003
  - Adults on PN to aid weaning together with optimized diet ± oral glutamine
- FDA approval of teduglutide (Gattex; NPS Pharm.) in December 2012
  - Adults on parenteral support

www.fda.gov.

## Combination Therapy in SBS Randomized, Controlled Trial Design



## RCT of r-hGH, Glutamine, and Specialized Oral Diet



## Growth Hormone in SBS

- Conflicting findings of this therapy in short-term, randomized, controlled, cross-over studies
  - ? Benefit mainly due to diet
  - ? Weight gain due to fluid retention
  - ? Maintain benefit long-term
- Methodological differences among studies limit definite conclusion regarding benefit of this therapy

Wales P et al. *Cochrane Database Syst Rev.* 2010;6:CD006321. doi: 10.1002/14651858.CD006321.pub2.

## Growth Hormone Adverse Effects

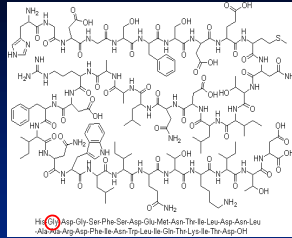
- Fluid retention (peripheral edema)
- Arthralgias
- Carpal tunnel
- Hyperglycemia
- Nausea
- Injection site reactions
- Intracranial hypertension
- Hypersensitivity reaction
- Acute pancreatitis

Matarese LE, Abu-Elmagd K. *Expert Opin Pharmacother.* 2005;10:1741-1745D.  
Wales P et al. *Cochrane Database Syst Rev.* 2010;6:CD006321. doi: 10.1002/14651858.CD006321.pub2.

# ENHANCING INTESTINAL REHABILITATION IN SBS-IF

## Glucagon-like Peptide 2 and Teduglutide

- Secreted from L-cells of distal ileum/prox colon
- GLP-2 analogue
  - Substitute glycine for alanine at position 2
- Resistant to degradation by dipeptidyl peptidase-4 (DPP-4)
  - Longer half-life of 2-3 hrs vs 7 min



## Randomized, Controlled Trial of Teduglutide in PN-Dependent SBS

83 PN-dependent SBS patients

0-8 weeks  
Optimize PN (0-8 wks)

4-8 weeks

Stabilize PN

24 weeks

Placebo (n=16)

Teduglutide 0.05 mg/kg/d (n=35)

Teduglutide 0.1 mg/kg/d (n=32)

Results

6% PN  
31% AEs

\*46% PN  
\*LBM 820g ↑

\*Citr +10.9 ↑  
37% AEs

25% PN  
\*LBM 1530g ↑

\*Citr +15.7 ↑  
34% AEs

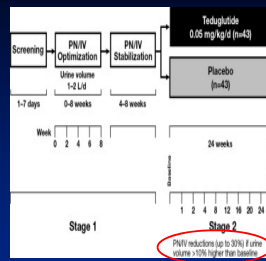
### Endpoints

- PN: %patients achieving PN reduction > 20% weekly needs b/w wks 20-24
- Lean body mass
- Plasma citrulline
- Adverse events

Adapted from Jeppesen PB et al. Gut. 2011;60:902-914.

## Teduglutide Confirmatory Study

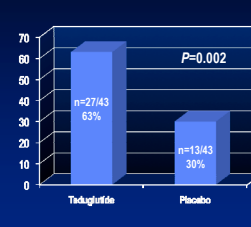
- Multinational, multicenter, RDBPCT
- Similar design as prior study except only single dose teduglutide (0.05 mg/kg/d) vs placebo
- More aggressive PN/IVF weaning protocol
- % patients achieving 20 to 100% PN volume reduction by week 20-24



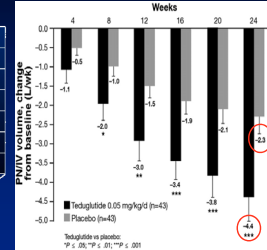
Jeppesen PB et al. Gastroenterology. 2012 Dec;143:1473-1481.

## Teduglutide #2 – Main Results

### Responder Rate



### Reduction in PN/IV Volume



Jeppesen PB et al. Gastroenterology. 2012;143:1473-1481.

## Teduglutide – Adverse Events and Precautions

- Increased AEs with teduglutide
  - Abdominal pain (31% vs 23%)
  - Nausea (29% vs. 19%)
  - Stomal complication (24% vs 7%)
  - Abdominal distension (21% vs 2%)
  - Peripheral edema (17% vs 5%)
  - Injection site reactions
  - Headaches
- Precautions
  - Risk for acceleration of neoplastic growth
  - Colonoscopy before treatment and 1 year later
  - Intestinal obstruction
  - Pancreaticobiliary disease
    - Labs before and every 6 months
  - Fluid overload
  - Potential to increase concomitant drug absorption
  - Reduce dose in mod-severe CKD

Jeppesen PB et al. Gastroenterology. 2012;143:1473-1481.  
O'Keefe SJ et al. Clin Gastroenterol Hepatol. 2013;11:815-823.  
Physician's Desk Reference. Available at: <http://www.pdr.net/drug-summary/gattex7druglabelid=3100>. Accessed 1/15/2014

## Trophic Factors – Further Study Needed

- Long-term safety and efficacy
- Optimal patient selection
- Cost-effectiveness
- Optimal timing of administration relative to onset of SBS

# ENHANCING INTESTINAL REHABILITATION IN SBS-IF

## PN Weaning – Practical Aspects

- Stepwise approach to when and how much
  - Frequent monitoring of food/fluid intake and stool/urine output
    - Inpatient vs. outpatient (vs. outpatient intensive)
  - Meet daily calorie and fluid intake goals
  - Adjustments based on tolerance:
    - Symptoms
    - Stool/urine output
    - Electrolyte/micronutrient levels
    - Weight
    - Hydration status

D'Alaise JK et al. J Clin Gastro. 2006;40:984-998.

## “Tools” for our Patients



## More Tools

| Date | Weight | Stool/<br>Ostomy Output | Urine<br>Output |
|------|--------|-------------------------|-----------------|
|      |        |                         |                 |
|      |        |                         |                 |
|      |        |                         |                 |
|      |        |                         |                 |
|      |        |                         |                 |
|      |        |                         |                 |
|      |        |                         |                 |
|      |        |                         |                 |

## Monitoring Parenteral Nutrition: At Home

- Weekly
  - CMP, phosphorus, magnesium, bicarbonate, glucose, CBC
- Every 3-6 months
  - Trace elements
    - Zinc, copper, chromium, selenium, manganese
    - Iron
      - Ferritin (positive acute-phase reactant)
  - Essential Fatty Acid Profile
  - Stool output, physical exam, signs/symptoms

Kirby DH et al. JPEN J Parenter Enteral Nutr. 2012;36:632-644.  
Fessler TA. Pract Gastroenterol. 2005;29:44.

## Monitoring cont.

- Periodic assessment of:
  - Vitamin A (negative acute-phase reactant)
  - Vitamin E
  - Folate
  - Methylmalonic acid/B<sub>12</sub>

Kirby DH et al. JPEN J Parenter Enteral Nutr. 2012;36:632-644.

## Vitamins/Minerals: What Makes Sense

- Many recommendations in literature/texts; very little evidence
- Consider:
  - Osmotic drag from so many pills (and fluid to take them)
  - Sheer cost of the supplements
  - Time to take them all
  - Does not include patient's prescription medications!
- Add therapeutic vitamin and mineral supplement
  - Daily, twice daily—½ to 1 tab
  - Chewable, crushed, liquid form



## Vitamin D and Bone Health

- Vitamin D
  - 25 OH vitamin D/ intact PTH
    - Baseline DXA scan (bone density)
- Direct sunlight to arms and legs:
  - 5-10 minutes avg = 3000 IU D3
  - Depends on time of day, season, skin sensitivity, latitude
- Sperti lamp (D/UV Lamp)
  - [www.vitaminduv.com](http://www.vitaminduv.com)
  - Tanning beds (10 minutes, 3 x/wk x 6 months – arms and legs)
- Liquid vitamin D
  - Consider higher dose, twice-daily dose, etc

Thacher TD et al. *Mayo Clin Proc.* 2011;86:50-60.  
Dabal NS et al. *Photodermatol Photoimmunol Photomed.* 2012;28:307-311.  
Devgun MS et al. *Br J Dermatol.* 1982;107:275-284.

## Concluding Remarks

- Care of the SBS patient is time intensive
- Significant education of patient/caregiver is necessary and must be allotted for to maximize outcomes
- When embarking on an intervention, it is important to:
  - Try one thing at a time
  - Determine endpoint and how long you will give it to work
  - Move on to next intervention if it doesn't
- Monitoring is ongoing and goals can change
- We cannot expect these patients to be successful if we do not, by our actions and giving of our time, demonstrate to them that they ARE worthy of our time and intensive care

Enhancing Intestinal  
Rehabilitation in SBS-IF  
Strategies for Collaborative Care

*Thank you!*

# Enhancing Intestinal Rehabilitation in Short Bowel Syndrome–Intestinal Failure

Evaluation and management of patients with short bowel syndrome (SBS) can be challenging. This reference tool has been designed to help guide you through this complex process. Included are practical strategies to assess patients with suspected SBS-IF and subsequently manage these patients, including optimization of hydration and conventional drug therapy; parenteral nutrition (PN) protocols and weaning procedures; as well as the introduction of trophic agents into the treatment regimen to improve structural and functional intestinal integrity for optimal outcomes.



## I. Initial Assessment

### 1

#### Determine:

- Bowel anatomy: op note, small bowel follow through
- Weight loss history
- Presence of GI and other symptoms that may affect oral intake or fluid loss
- Potential signs/symptoms of micronutrient deficiencies
- Signs of dehydration and malnutrition
- Pertinent past medical, psychiatric and surgical history
- Education, motivation, support system and potential economic or other barriers

### 2

#### Evaluate:

- Surgical complications
  - ◆ Anastomotic strictures, chronic obstruction, enterocutaneous fistulae
- Medical complications
  - ◆ Chronic diarrhea (multiple causes, especially *Clostridium difficile* ["C. Diff."] infection)
  - ◆ Fluid/electrolyte disturbances
  - ◆ Oxalate nephropathy
  - ◆ D-lactic acidosis
  - ◆ Renal dysfunction
  - ◆ Metabolic bone disease
  - ◆ Peptic ulcer disease

### 3

#### Define treatment history:

- Diet
  - ◆ 3-day diet record
    - What and amounts of ALL food/beverages consumed
  - ◆ Supplements used (Ensure, Boost, herbals, protein, probiotics, etc.)
  - ◆ Vitamins and minerals used – dose/form
- Nutrition support history
  - ◆ Enteral and/or central venous access device
  - ◆ Formula used, route and method of administration
  - ◆ Prior complications
- Current medications – Review ALL
  - ◆ Dosing
  - ◆ Check for liquid meds (sugar alcohols)
  - ◆ Form (tab, capsule, suspension, sustained or delayed-release)
  - ◆ Include ALL over-the-counters



## II. Moving Forward

- Differentiate between osmotic vs. secretory diarrhea
  - Clinical history, 24-hour fast
- Obtain baseline data on patient's "normal regimen" (diet, IV fluids, medications, etc.):
  - Urine output
  - Stool output
  - Weight

### III. Optimizing GI Function - Interventions

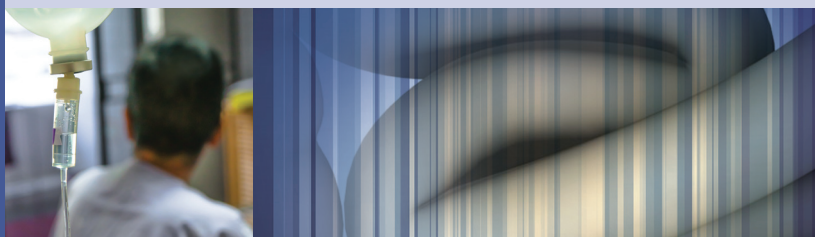
#### 1 Diet

Educate patient to:

- Chew foods well
- Take smaller, frequent meals – Tell them what they **CAN** eat.
  - ◆ Start with patient's usual (refer to 3 day written diet record, if possible) and tailor it
- Avoid simple sugars
- Consider lactose restriction
- Consider low FODMAP/ Avoid sugar alcohols
- Avoid oxalate if colon segment
- Separate solids from liquids
  - ◆ Take small amounts of fluids with meals
  - ◆ Sip more between meals
  - ◆ **Avoid** hypertonic/hypotonic fluids
  - ◆ Oral rehydration solutions

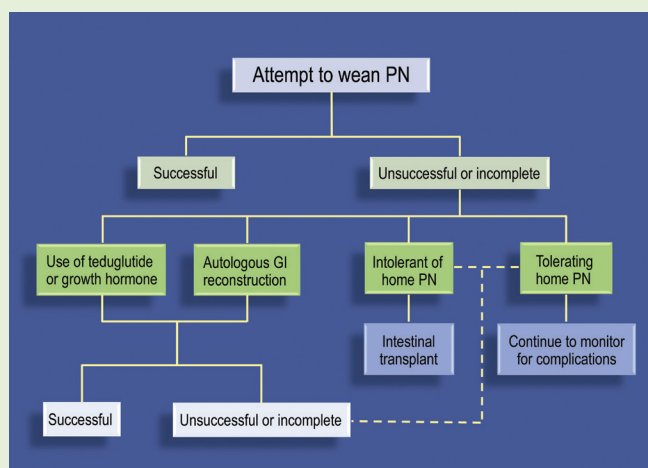
#### 2 Medications

- Considerations
  - ◆ Scheduled dosing; **NOT** "PRN"
    - Every 4, 6 or 8 hours?
  - ◆ Before, during, after meals?
  - ◆ Available at the patient's pharmacy?
  - ◆ Dosage form
- Front line
  - ◆ *Antisecretory agent*
    - Proton pump inhibitor, H2-blocker
  - ◆ *Gut slowing agents*
    - Loperamide, diphenoxylate with atropine, Paregoric, tincture of opium, codeine
  - ◆ *Other therapies*
    - Clonidine
    - Bile salt binders?
    - Bile salt replacers
    - Pancreatic enzymes?
    - Antimicrobials
    - Probiotics?
  - ◆ *Trophic agents*
    - r-hGH
    - Teduglutide



### IV. Stepwise Approach to Rehabilitate Intestinal Function in SBS Patients with Intestinal Failure

- Wean from parenteral nutrition
  - Optimize oral diet and fluids
  - Aggressive use of antisecretory and antimotility agents
  - Surgically maximize remnant bowel function if possible
  - Careful monitoring of status
  - Micronutrient monitoring and supplementation, as needed
- Meet daily calorie and fluid intake goals
- Inpatient vs. outpatient
- Frequent monitoring and adjustments based on
  - Symptoms
  - Stool/urine output
  - Electrolyte/micronutrient levels
  - Weight
  - Hydration status



### V. Resources

- UVAHS GI Nutrition Website ([www.ginutrition.virginia.edu](http://www.ginutrition.virginia.edu)) with links to:
  - Nutrition Articles in Practical Gastroenterology including:
    - ◆ Parrish CR. The Clinician's Guide to Short Bowel Syndrome. *Practical Gastroenterology*. 2005;XXIX(9):67.
- Parrish CR. *A Patient's Guide to Managing a Short Bowel*. 2nd ed. Newark, DE: Growth, Inc; 2013:1-65 ([www.shortbowelsupport.com](http://www.shortbowelsupport.com)).
- Tarleton S, DiBaise JK. Short Bowel Syndrome. In: *The A.S.P.E.N. Adult Nutrition Support Core Curriculum*, 2nd ed. American Society for Parenteral and Enteral Nutrition, Silver Spring, MD; 2012:511-522.
- DiBaise JK, Matarese LE, Messing B, et al. Strategies for parenteral nutrition weaning in adult patients with short bowel syndrome. *J Clin Gastroenterol*. 2006;40(Suppl 2):S94-S98.
- Shatnawei A, Parekh NR, Rhoda KM, et al. Intestinal failure management at the Cleveland Clinic. *Arch Surg*. 2010;145(6):521-527.
- *New SBS Pocket Guide for Patients*
  - Abbreviated version of guide above
  - Contact Maureen Stellwag at [MStellwag@npsp.com](mailto:MStellwag@npsp.com) to obtain
- Kirby DF, Corrigan ML, Speerhas RA, et al. Home parenteral nutrition tutorial. *JPEN J Parenter Enteral Nutr*. 2012;36:632.
- Kelly DG, Tappenden KA, Winkler MF. Short bowel syndrome: highlights of patient management, quality of life, and survival. *JPEN J Parenter Enteral Nutr*. 2013 Nov 18. [Epub ahead of print].
- Oley Foundation
  - <http://www.oley.org> or (800) 776-OLEY

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