Dietary and Medical Management of SBS:
The Long and Short of It

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SBS: A Complex and Life-Threatening Disorder

A debilitating, complex disorder that may be life-threatening\(^1,2\)

Results in the inability to maintain fluid and nutrient balances through a normal diet\(^2\)

Typically follows extensive surgical resection of the intestine\(^2,3\)

Intestinal Anatomy After Resection\textsuperscript{1,2}

Some Types of Intestinal Resections

\begin{itemize}
  \item Jejuno-ileal Anastomosis
    \begin{itemize}
      \item Usually no major clinical problems
    \end{itemize}
  \item Jejuno-colic Anastomosis
    \begin{itemize}
      \item Gradual undernutrition
      \item Absorptive capacity may be improved by adaptation
    \end{itemize}
  \item Jejunostomy
    \begin{itemize}
      \item Severe fluid and electrolyte loss
      \item Minor change in absorptive capacity over time
    \end{itemize}
\end{itemize}
Absorption Is Impacted by Function of Resected Site

Proximal Small Intestinea
- Fat
- Sugars
- Peptides/AAs
- Iron
- Folate
- Calcium
- Water
- Electrolytes

Ileum
- Bile salts
- Vitamin B12
- Water
- Electrolytes

Jejunum
- Sugars
- Peptides/AAs
- Electrolytes

Colon
- Water
- Electrolytes
- MCTs
- AAs

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a Includes duodenum and proximal jejunum
AA, amino acid; MCT, medium-chain triglyceride.

Disease Management: Parenteral Support

- Primary therapy for SBS to provide vital nutrients and fluids when oral diet or enteral feeding cannot meet patients’ nutritional needs\(^1,^2\)
  - Patients with very short intestinal remnants usually require long-term PS

- Life-saving treatment with life-threatening complications\(^2\)
  - Many complications of SBS are caused or exacerbated by PS dependency
  - PS-related complications account for 15% to 20% of all deaths among patients dependent on long-term PS

### Complications of PS-dependent SBS¹-³

<table>
<thead>
<tr>
<th>Catheter-related</th>
<th>Gastrointestinal</th>
<th>Financial</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Infection</td>
<td>▪ Central venous thrombosis</td>
<td>▪ High cost of care</td>
</tr>
<tr>
<td>▪ Loss of vascular access</td>
<td>▪ Diarrhea</td>
<td>▪ Some patients are</td>
</tr>
<tr>
<td></td>
<td>▪ Gastric hypersecretion</td>
<td>unable to work</td>
</tr>
<tr>
<td></td>
<td>▪ Small bowel intestinal bacterial overgrowth</td>
<td></td>
</tr>
<tr>
<td><strong>Liver/biliary</strong></td>
<td><strong>Kidney</strong></td>
<td><strong>Quality of life</strong></td>
</tr>
<tr>
<td>▪ Liver disease</td>
<td>▪ Gallbladder sludge/stones</td>
<td>▪ Diminished overall health</td>
</tr>
<tr>
<td>▪ Steatosis</td>
<td>▪ Nephrolithiasis</td>
<td>▪ Appearance of</td>
</tr>
<tr>
<td>▪ Cholestasis</td>
<td>▪ Chronic renal failure</td>
<td>premature aging</td>
</tr>
<tr>
<td><strong>Metabolic</strong></td>
<td><strong>Quality of life</strong></td>
<td></td>
</tr>
<tr>
<td>▪ Fluid and electrolyte abnormalities</td>
<td>▪ Depression, irritability, confusion</td>
<td></td>
</tr>
<tr>
<td>▪ D-lactic acidosis</td>
<td>▪ Reduced freedom</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Weight loss</td>
<td></td>
</tr>
<tr>
<td><strong>Bone</strong></td>
<td><strong>Financial</strong></td>
<td></td>
</tr>
<tr>
<td>▪ Metabolic bone disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Osteoporosis</td>
<td>▪ High cost of care</td>
<td></td>
</tr>
<tr>
<td>▪ Osteomalacia</td>
<td>▪ Some patients are unable to work</td>
<td></td>
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Intestinal Adaptation After Resection

A natural process to compensate for reduced functional length of the intestine after resection

- Apart from its length, the absorptive capacity of the intestine is affected by:
  - Villi, microvilli, and crypts in the intestinal mucosa, which increase surface area
  - High blood flow rate, which facilitates nutrient uptake

Disease Management: Overview\textsuperscript{1-5}

Enhance Absorption

Reduce malabsorption-related symptoms

Enable oral/enteral nutrition

PS prevents\textsuperscript{1,4}:
- Malnutrition
- Dehydration

Adjunctive medications reduce\textsuperscript{1,4,1,2}:
- Diarrhea
- Bacterial overgrowth

Minimize PS-related complications

Reduce or eliminate PS

Treatments that enhance absorptive capacity may improve disease management\textsuperscript{1,2}

Improved disease management

Disease Management: Adjunctive Medications

- May temporarily reduce symptoms but do not improve intestinal absorptive capacity
- Disadvantages include:
  - Diminished potency with extended use
  - Exacerbated malabsorption of fat-soluble vitamins and steatorrhea
  - Inhibited intestinal adaptation
  - Risk of emergence of resistant bacterial populations

Adjunctive Medications for Treatment of SBS Symptoms

<table>
<thead>
<tr>
<th>Therapeutic Class</th>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotics</td>
<td>Bacterial overgrowth</td>
</tr>
<tr>
<td>Antidiarrheals</td>
<td>Diarrhea</td>
</tr>
<tr>
<td>Antisecretory agents</td>
<td>Gastric hypersecretion, diarrhea</td>
</tr>
<tr>
<td>Bile salt binders</td>
<td>Choleretic diarrhea</td>
</tr>
<tr>
<td>Pancreatic enzymes</td>
<td>Fat malabsorption</td>
</tr>
</tbody>
</table>

Disease Management: Nutrition Therapy

- Nutrition therapy through an optimized oral diet and enteral nutrition is an essential first-line therapy in SBS
  - Small, frequent meals/tube feeding
  - Hyperphagia
  - Patient-specific diet

- In patients with SBS at a high risk of diarrhea and dehydration, proper fluid management is critical
  - Slow and continuous liquid consumption
  - Isotonic liquids, eg, oral rehydration solutions are preferred

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**Diet for SBS Based on Remnant Anatomy**

<table>
<thead>
<tr>
<th></th>
<th>Colon Present</th>
<th>Colon Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Carbohydrate</strong></td>
<td>50%-60% of energy intake</td>
<td>40%-50% of energy intake</td>
</tr>
<tr>
<td></td>
<td>Complex carbohydrates</td>
<td>Complex carbohydrates</td>
</tr>
<tr>
<td><strong>Fat</strong></td>
<td>20%-30% of energy intake</td>
<td>30%-40% of energy intake</td>
</tr>
<tr>
<td></td>
<td>Ensure adequate intake of EFAs, MCTs, and LCTs</td>
<td>Ensure adequate intake of EFAs and LCTs</td>
</tr>
<tr>
<td><strong>Protein</strong></td>
<td>20% of energy intake</td>
<td>20% of energy intake</td>
</tr>
<tr>
<td></td>
<td>High biological value</td>
<td>High biological value</td>
</tr>
<tr>
<td><strong>Fiber</strong></td>
<td>Soluble fiber for netsecretors</td>
<td>Soluble fiber for net secretors</td>
</tr>
<tr>
<td><strong>Oxalate</strong></td>
<td>Restrict</td>
<td>No restriction necessary</td>
</tr>
<tr>
<td><strong>Fluids</strong></td>
<td>ORS and/or hypotonic</td>
<td>ORS</td>
</tr>
</tbody>
</table>

EFA, essential fatty acid; LCT, long-chain triglyceride; MCT, medium-chain triglyceride; ORS, oral rehydration solution.

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The proven benefits of nutrition therapy support the importance of intestinal adaptation in SBS management\(^1\)

Nutrition therapy may not be well tolerated in patients with severe malabsorption\(^1\)

Nutrition therapy alone may not enable full adaptive potential of the intestine in all patients\(^2,3\)

Disease Management: Novel Therapies

- Novel SBS therapies aim to augment intestinal adaptation
- Prebiotic/probiotic therapy may benefit pediatric patients with SBS through improvement of intestinal adaptation and restoration of normal bacterial flora
  - Safety/efficacy of these treatments is not established in adult patients with SBS
- Hormonal therapies, such as GLP-2, and growth factors may promote intestinal adaptation and help adult patients with SBS reduce their PS needs

Summary

- A natural process of adaptation begins after intestinal resection\(^1\)
- Insufficient adaptation after resection may lead to SBS—a debilitating, life-threatening condition characterized by malabsorption\(^1,2\)
- PS, while lifesaving for some, is associated with serious complications and does not address the underlying malabsorptive state\(^3,4\)
- Therapies that promote intestinal adaptation may reduce PS requirements\(^5\)
  - Despite being very effective, nutritional therapy alone may not enable full adaptive potential of the intestine in all patients
  - Novel therapies aim to augment intestinal adaptation to supplement nutrition therapy