Short Gut Round Table: Anatomy

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Disclosure Information

I do not have any financial relationship or affiliation with any company that could be perceived as a conflict of interest related to the content of this presentation.

Objectives

- Identify normal pediatric intestinal anatomy.
- Describe the impact of loss of ileum, jejunum, colon and ileocecal valve on long term outcomes of Short-Gut.
- Describe the structural changes associated with adaptation.
- Describe the microbiome of Short Bowel Syndrome (SBS).
Pediatric Intestinal Anatomy

- In infants, the length of the small intestine is 124 cm at the start of the third trimester of gestation and approximately 200 cm at term.
- Jejunum is the proximal two-fifths of the small intestine, and ileum is the distal three-fifths.
- Adult small intestine length is approximately 480 cm.

Intestinal Anatomy

Implications of Surgical Resection

Jejunal Resection
Ileal Resection
Ileocecal valve
Colonic resection
Adaptation

After intestinal resection remaining bowel goes through adaptive changes to enhance absorptive capacity.

The Short – Gut Microbiome

- Increased bacteria in small intestines in children with short-gut.
- Implications of bacterial overgrowth: malabsorption, inflammatory response damages absorptive surface, bacteria compete for Vitamin B12.

References


Short Gut Round Table: Intraoperative Considerations

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Objectives

• The participant will identify common surgical interventions performed for patients with Short Gut Syndrome.
• The participant will understand basic surgical principles used in treatment of patients with Short Gut Syndrome.
• The participant will identify appropriate intraoperative considerations for patients with Short Gut Syndrome.
Intestinal Resection

Severity of short gut syndrome (SGS) depends on the length and function of the bowel left after surgical resection. Studies indicate that at least 40 cm of functional small intestine are required to wean a patient off of total parenteral nutrition (TPN).

Patients who require ileal or jejunal resection have a higher mortality than patients who require colonic resection. The ileum has the greatest adaptive capacity and can increase its absorptive capacity. Patients who undergo jejunal resection and retain their ileum are better able to absorb nutrients compared to patients who undergo ileal resection and retain their jejunum.

Historically, it was considered critical to retain the ileocecal valve in order to wean patients off TPN, but recent studies show that the length and functional capacity of the ileum are more important factors than the presence of the ileocecal valve.

Operative Management of SGS

- Venous Access (Central Venous Line, Broviac Catheter, etc.)
- Gastrostomy Tube
- Serial Transverse Enteroplasty (STEP) Procedure
- Bianchi Procedure (LILT)
- Small Bowel Transplantation

Venous Access

Due to the need for long-term TPN use, SGS patients typically require some form of long-term vascular access. A pediatric general surgeon will place a broviac catheter in a central vessel. This procedure is performed in the operating room with the patient under general anesthesia.

The surgeon may use an ultrasound to view the selected vessel, and then after sterile prep and drape will access the selected vessel using an introducer needle, place a guidewire, followed by a dilator and an introducer sheath. The surgeon selects an area on the chest wall and tunnels the catheter under the skin so that the accessible lumen will exit through that selected area. The implantable end of the catheter will then be placed in the vessel and the skin incisions will be closed.

A protective dressing, such as a CHG impregnated tegaderm may be placed over the exit site.
Venous Access

Risks of broviac catheter placement include central line infections and sepsis, as well as blood clot formation.

The risk of infection can be reduced by placing a central line with the fewest number of lumens possible, such as a single-lumen broviac. In addition, the family must be educated regarding proper access technique and basic aseptic technique, such as handwashing.

Families should also be educated regarding the signs of infection, such as redness or drainage at the incision site.

Gastrostomy Tube

The gastrostomy tube (G-tube) may be placed to provide enteric access.

This is especially helpful in patients with oral aversion or associated anomalies, such as a history of tracheoesophageal fistula or cleft lip/palate.

G-tubes can be placed using endoscopy if the patient has no history of abdominal surgery. However, as there is a history of abdominal surgery in SGS patients, the G-tube should be placed using either the standard open surgical technique or with laparoscopic visualization.

STEP Procedure

In STEP (serial transverse enteroplasty), the bowel is dilated and then partially transected (cut) at certain points, creating a zigzag pattern to the bowel that results in lengthening of the surface area available for digestion.
Bianchi Procedure (LILT)

The Bianchi Procedure is a surgical alternative to STEP, utilizing longitudinal intestinal lengthening and tapering (LILT) as the mechanism to increase absorptive surface area.

Risks of STEP / LILT

These procedures can lead to formation of intestinal strictures as well as small bowel obstruction (SBO) secondary to adhesions. With each additional abdominal surgery, these risks increase and can lead to additional loss of small bowel. Due to these risks, if the patient's nutritional needs are being adequately managed with TPN and without complications such as liver dysfunction or major vascular access issues, surgeons may often recommend avoiding procedures such as STEP or LILT.

Small Bowel Transplantation

In some cases, small bowel transplantation (SBT) can be performed, but as with any transplant procedure, there are specific criteria that must be met. The patient will be immunosuppressed and will be at risk for transplant rejection as well as lymphoproliferative disease. Because of the mixed results of this procedure, SBT is limited to SGS patients who have severe advanced liver disease or major vascular access problems.
Intraoperative Considerations

Considerations for the nurse in surgery are variable, depending on the surgery being performed, but the following issues are often found with SGS patients:

- Difficult vascular access
- Poor skin integrity due to malnutrition
- Low body weight contributing to hypothermia
- Blood loss during lengthy abdominal surgeries
- Liver dysfunction r/t long-term TPN use

Enteral Feeding in Children With Intestinal Failure: Physiologic background, Current Evidence, and Recommendations for Clinicians

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Disclosure Information

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Objectives

Discuss the physiologic background for enteral feeding in the neonate.
Describe the current evidence related to enteral nutrition management in children with intestinal failure.
List several recommendations for clinicians in the management of enteral feeds in the child with intestinal failure.
Discuss the implications for children and their families who are technology dependent and transitioning across health care settings.

Pathophysiologic Basis for Enteral Feeding Tolerance

- Poor functional capacity
- Dysmotility
- Abnormal enterocyte function and structure
- Preservation of the colon is crucial

Phases of Nutritional Treatment

- Phase 1: Acute phase - Immediately after resection
  - Severe diarrhea, loss of macronutrients, fluid and electrolytes
  - Fluid resuscitation and PN
  - Early enteral feeds promote adaptation (start slowly with small volumes)
- Phase 2: May last several weeks to months.
  - Provide enteral and parenteral nutrition
  - Early promotion of oral feeds
  - Onset of liver disease may impair adaptation process
- Phase 3: Adaptation phase - Highly variable
  - PN weaning
  - Close monitoring of intestinal transit, clinical conditions
  - Preservation of weight gain and growth velocity
## Timing of Initiation and Advancement
**Review of Current Literature and Expert Opinion**

- Evidence not overly compelling most recommendations are based on expert opinion.
- Two studies found that initiation of small volume feeds 12 hours after abdominal surgery resulted in earlier advancement to full feeds and shorter length of stay over controls. (Level 1).
- A few reports suggest a slow advancement of continuous feeds at 1mL/hour/day (Level 4).
- Others recommend advancing using stool output, pH and absence of fecal reducing substance as a guide. (Level 4).

## Assessment Parameters
**When increasing volumes**

- **Emesis**
  - No more than 3 episodes per day or 20% of daily intake.
- **Stool**
  - Quantity and consistency, pH and sugar reduction in stools.
- PN should not be decreased isocalorically.

## Continuous vs Bolus

- No level 1 or 2 evidence to suggest that bolus feeds are better tolerated than continues.
- Various experts recommend continuous feeds which are thought to enhance enteral absorption by maximizing the saturation of carrier proteins and increasing intestinal function (Level 4).
- Despite the fact that bolus feeds are more physiologic, Goulet et al., found that they were less well tolerated than continuous feeds.
Type of Enteral Nutrition

- Breast milk
  - High levels of nucleotides, immunoglobulin A, and Leucocytes thought to support the neonates immune system.
  - Contains glutamine and growth factors such as HGH and epidermal growth factor which possibly promote adaptation.
  - May be associated with shorter duration of PN (Level 3).
  - One report recommends oligometric formula when breast milk is not available (Level 4).
  - A few experts recommend a polymeric formula after 12 months (Level 4).
  - One randomized control trial showed no difference in absorption between oligometric and polymeric formula.

Monitoring

- Nutritional Labs
- Vitamin Levels (every 6 months)
- Trace Elements (every 6 months)
- Growth Parameters
- Height, Weight, Upper arm circumference

Implications for Family

- Caregivers often have a strong negative initial reaction to home enteral nutrition.
- Fears of making mistakes.
- Upset over the inability to provide oral nutrition to their child.
- Let about “being trained” and more about coping with the situation.
- Training should be gradual and begin early.
- Written materials are not a good substitute when the family is alone at home.
- In home psychological and practical support needed.
- Significant lifestyle adaptation.
References


Short Gut: Central Venous Access

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Objectives

- Identify central venous catheter (CVC) complications related to short-bowel syndrome
- Determine appropriate treatment of central venous catheter (CVC) complications
- Recognize and discuss current, research-based methods for prevention of recurrent CVC complications

Central Venous Catheter Complications

- Catheter-Related Bloodstream Infections (CRBSI)
  - Common in PN dependent children with SBS
  - Predictor of increased morbidity & mortality
  - Associated with hyperbilirubinemia & cholestasis
  - ≥ 2 associated with suboptimal somatic growth

Catheter-Related Bloodstream Infection

- Diagnosis (CDC):
  - Microbiologic confirmation
  - Blood culture from CVC and peripheral vein
  - Pathogen not r/t infection at another site or ≥ 2 blood cultures, if same pathogen
  - Clinical evaluation
    - At least 1 of the following symptoms:
      - fever (≥38°C), hypothermia/ chills, hypotension, apnea, or bradycardia
CRBSI

- Contamination: Improper care of the catheter: Gram +
  - Staphylococcus Epidermidis (Coagulase-negative Staph)
  - Staphylococcus aureus
  - Candida

CRBSI

- Bacterial translocation: Migration of bacteria from GI tract: Gram-/+
  - Lack of enteral feeds: impaired microvilli
  - SBBO increases risk (loss of ICV)
  - Fecal microbiome
  - SBR: loss of GALT
  - Klebsiella pneumoniae & E. Coli
  - Enterococcus faecalis

Treatment of CRBSI

- Attempt to salvage the CVC
- Appropriate systemic IV antibiotics for pathogen
- Coagulase-negative staphylococci
Treatment of CRBSI

- Antibiotic locks (Dwell time: 4 hours to 3 days)
- Ethanol locks (Dwell time: 12 to 24 hours - silicone cath only)
  - Intraluminal colonization - Microbial biofilm
  - Adjunctive therapy with systemic antibiotics (Duration: 7 to 14 days)

- Removal of CVC for
  - Severe sepsis / hemodynamic instability
  - Endocarditis
  - Suppurative thrombophlebitis
  - Persistent bacteremia after 72 hours susceptible antimicrobial therapy
  - Fungemia (Candidemia)
  - Infections caused by Staph. aureus, Pseudomonas aeruginosa, Coag. Neg., Staph, mycobacteria, Bacillus species, Micrococcus species, or Propionibacteria
    - Antibiotic therapy 7 to 14 days following removal

Central Venous Catheter Complications

- Mechanical Failure
  - Occlusion / thrombosis
    - Cathflo-IPA (Alteplase)
      - ≤ 10kg: 0.5 mg IPA
      - > 10kg: 1-2 mg IPA
  - Damage
    - Broviac repair
    - Exchange over a guide wire
Prevention of CVC Complications

**Recommended Strategies for Preventing Recurrent Central Line–Associated Bloodstream Infections (APSA)**

- Chlorhexidine skin prep
- Chlorhexidine-impregnated sponge (Biopatch)
- Heparin and antibiotic-impregnated central venous catheters
- Ethanol and antibiotic lock therapy

(Huang et al., 2011; Jones et al., 2010; Mouw et al., 2008)

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Prevention of CVC Complications

- Zero-displacement IV needless connectors
  - Lower infection rates
  - Neutral fluid displacement- helps reduce the risk of thrombotic catheter occlusions
- Neutron® Needle-free Catheter Patency Device
  - Bi-directional silicone valve to help prevent reflux of blood
  - Silicone Seal and internal cannula-minimizes bacterial cor

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Prevention of CVC Complications

- **Education**
  - Minimize infection and mechanical complications
  - Parent/ caregiver (2)- Didactic/ interactive
  - Written materials/ Hands-on practice/ Videos
  - Confirm proficiency of CVC care prior to discharge
  - Standardized protocols
    - Catheter care and maintenance
    - Dressing care- aseptic technique
    - Flush protocols
    - Needleless cap changes
References