

Surgical Management of Intestinal Failure



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Definition

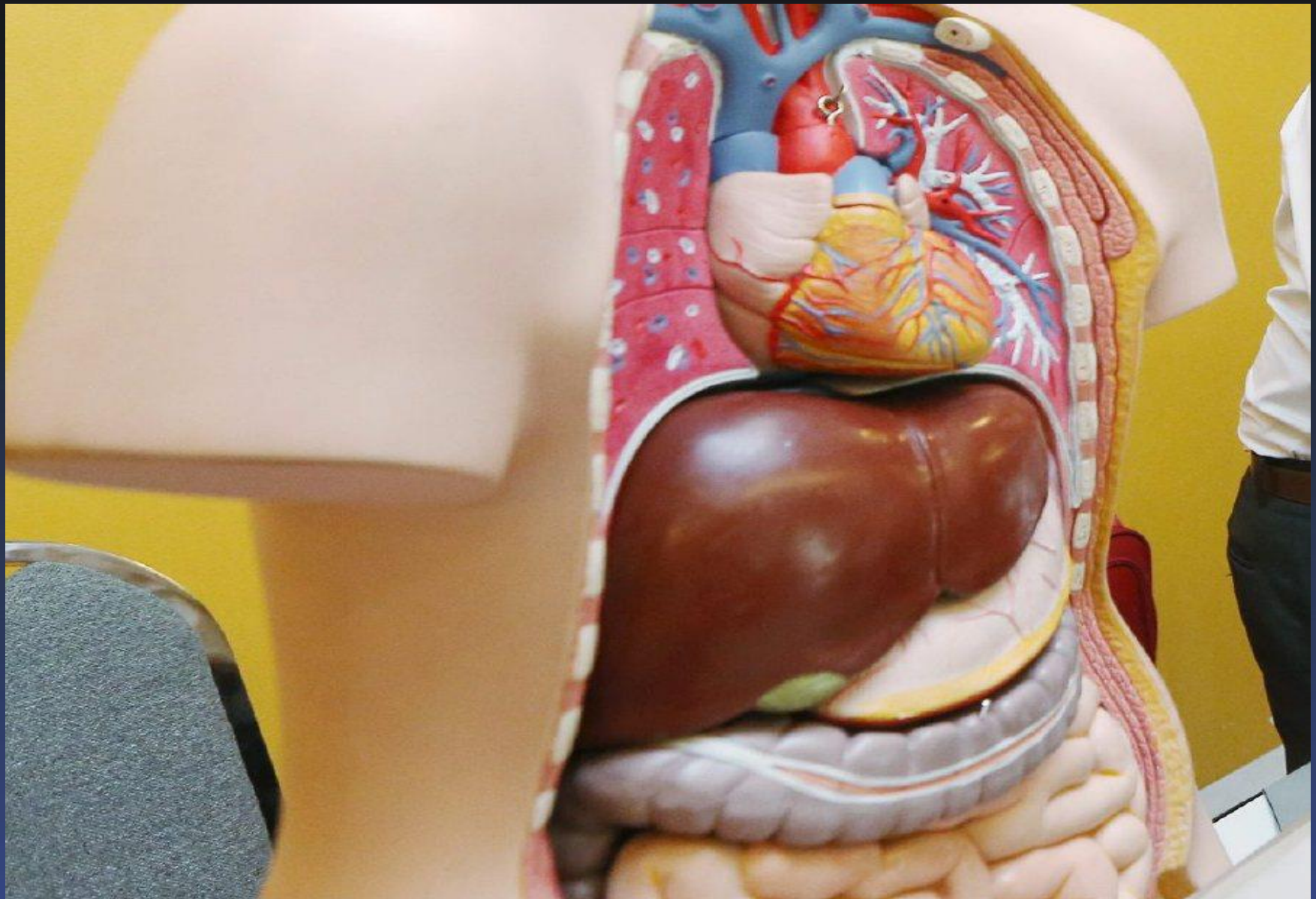
- ▶ Reduction in the functioning gut mass below the minimal amount necessary for adequate digestion and absorption of food

Fleming CR and Remington M. Nutrition and the surgical patient. 1981

- ▶ Failure of the intestinal tract to maintain adequate hydration and electrolyte balance in the absence of artificial fluid and electrolyte support

Nightingale JMD. Intestinal failure; 2001





Intestinal Failure (IF) may have various degrees of severity and duration:

- ▶ According to the duration:
- ▶ Acute (reversible within 6 months)
- ▶ Chronic (longer than 6 months, and even permanent)



Types of Intestinal Failure

Type 1

SHORT TERM

Self-limiting
intestinal failure

Type 2

MEDIUM TERM

Significant &
prolonged PN
support
(>28 days)

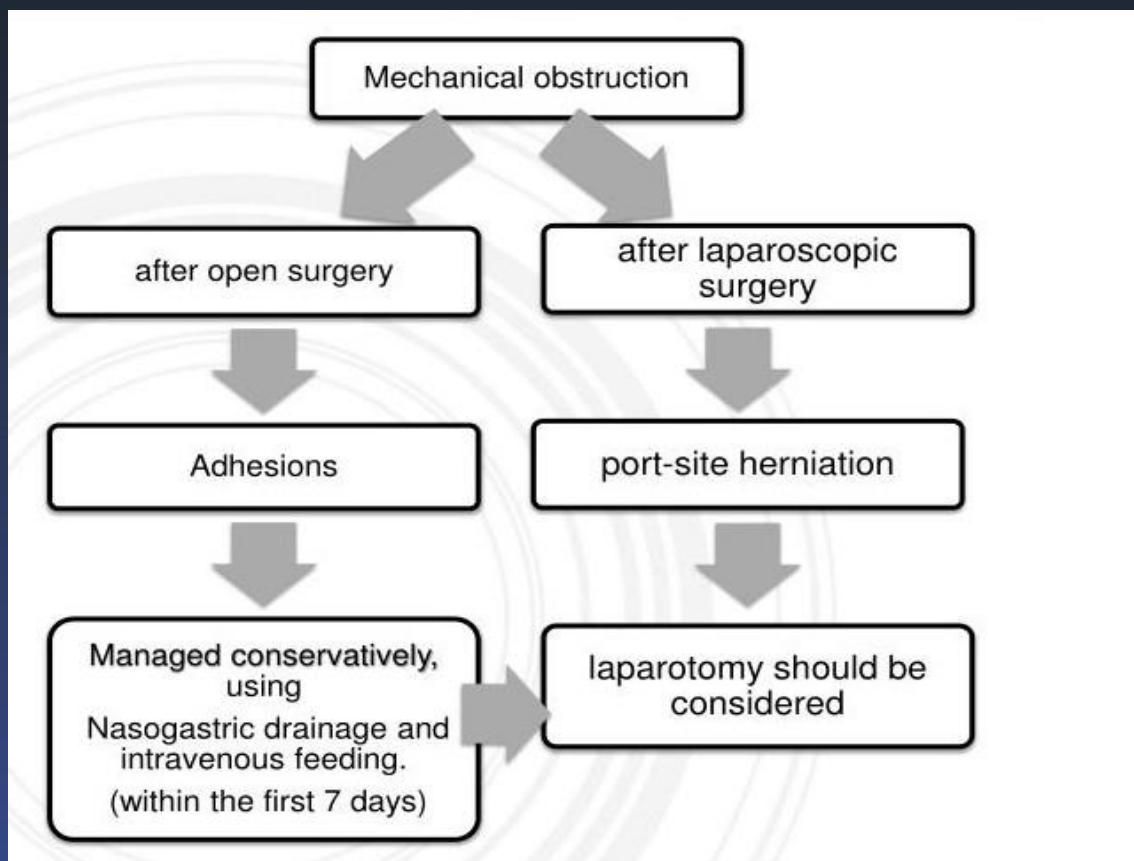
Type 3

LONG TERM

Chronic IF
(long term PN
support)

Type I Intestinal Failure

► Postoperative I Obstruction



Postoperative I Obstruction

- ▶ Patients who require re-laparotomy can be extremely challenging
 - ▶ abdominal cavity can be hostile
 - ▶ inadvertent intestinal injury, even if recognized is associated with a high incidence of abdominal sepsis, intestinal fistulation → type II intestinal failure



Type I Intestinal Failure

- ▶ **Postoperative ileus**
- ▶ The average duration of ileus after major abdominal surgery varies depending on what part of the digestive system affected
 - ▶ Small Intestine 0 to 24 hours
 - ▶ The stomach 24 to 48 hours
 - ▶ The colon 48 to 72 hours



Pathogenesis of POI Is Multifactorial

Sympathetic Nervous System

Inhibitory neural reflexes

Disorganized electrical activity

Excessive IV fluids
Intestinal edema

Multiple Pathways

proinflammatory Mediators

Macrophage and neutrophil infiltration, IL-1, tumor necrosis factor, IL-6

Pharmacologic
Exogenous opioids

IL = interleukin

There Are Numerous Risk Factors for POI



Senagore AJ. Am J Health-Syst Pharm. 2007;64(suppl 13):S3-S7.

Senagore AJ, et al. Surgery. 2007;142:478-486.

Management Options for POI

Nonpharmacologic Options

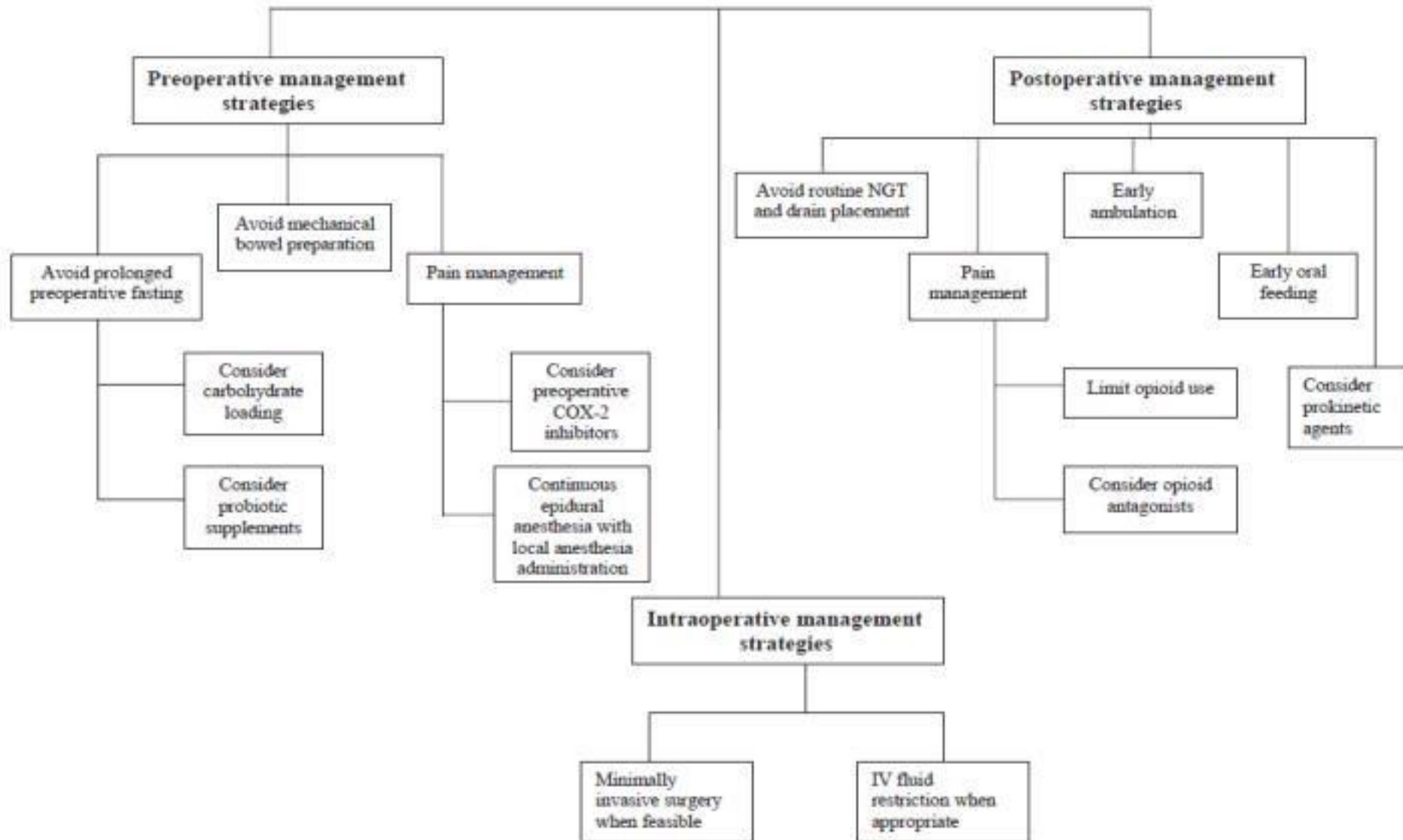
Management	Potential Mechanism	Impact on Bowel Function, Length of Stay
NG tube	Gastric/small bowel decompression	<u>Removal</u> of NG tube associated with earlier return of bowel function, reduction in pulmonary complications, shorter length of stay
Early feeding (including sham feeding)	Stimulates GI motility by eliciting reflex response and stimulating release of hormonal factors	Some studies report a reduction in POI with early feeding, meta-analyses suggest a modest (non-significant) reduction in length of stay
Early ambulation	Possible mechanical stimulation; possible stimulation of intestinal function	No effect on duration of POI; beneficial for prevention of lower extremity thromboembolism
Laparoscopic surgery	Decreased opiate requirements, decreased pain, less abdominal wall trauma, less intestinal manipulation	Earlier passage of flatus, earlier bowel movement, shortened length of stay

Management Options for POI

Pharmacologic Options

Treatment or Prevention	Potential Mechanism	Impact on Bowel Function, Length of Stay
Epidural (thoracic) anesthesia/analgesia	Inhibits sympathetic reflex at cord level; opioid-sparing analgesia	Earlier bowel movement, reduced duration of POI compared with systemic analgesic regimens
NSAIDs	Opiate-sparing analgesia, inhibits COX-mediated prostaglandin synthesis	Earlier bowel movement, earlier ambulation, no change in length of stay compared with morphine PCA
Metoclopramide	Dopamine antagonist, cholinergic agonist, prokinetic agent	No benefit on the duration of POI
Erythromycin	Motilin receptor agonist, prokinetic effect	No benefit on the duration of POI
Laxatives	Help to induce bowel movement	Limited data from small nonrandomized study suggests benefit; additional study required
Peripherally selective mu-receptor antagonists	Block enteric mu-receptors and minimize opioid effects on GI function, without impacting CNS-mediated analgesia	Clinical trials with alvimopan demonstrated reduced time to recovery of GI function, reduced time to discharge order written compared with placebo

Prevention and treatment for POI



Type II intestinal failure

- ▶ Type II failure may be self-limiting, (simple intestinal fistulation, spontaneous healing with effective nutritional and metabolic support)
 - ▶ Complications of abdominal surgery, (severe abdominal sepsis)
 - ▶ A patient malnourished following intestinal resection
 - ▶ IF result from a short bowel secondary to resection and fistula formation and/or indirect effect of sepsis on gastrointestinal function



Prevention of intestinal failure

- ▶ Anastomosis avoided in the malnourished patient, adjacent to sepsis, haemodynamically unstable patient, or ischemic bowel
- ▶ In cases of significant resection/fistula formation, accurate intra-operative measurement of the length of the remaining bowel should be attempted to aid subsequent planning (Level 5)



Prevention of intestinal failure

- ▶ IF surgery, should be discouraged within 12 weeks, and preferably postponed until 24 weeks
- ▶ Open abdomen should not have planned reconstructive surgery until the abdomen has softened and re-epithelialized
- ▶ Re-laparotomy should be taken with the involvement of a second specialized consultant not involved with the case at the time of the original operation (Level 4)



Management of acute intestinal failure: A position paper from the European Society for Clinical Nutrition and Metabolism (ESPEN) Special Interest Group



Stanislaw Klek^{a,*}, Alastair Forbes^b, Simon Gabe^c, Mette Holst^d, Geert Wanten^e, Øivind Irtun^{f,g}, Steven Olde Damink^h, Marina Panisic-Sekeljicⁱ, Rosa Burgos Pelaez^j, Loris Pironi^k, Annika Reintam Blaser^{l,d}, Henrik Højgaard Rasmussen^d, Stéphane M. Schneider^m, Ronan Thibaultⁿ, Ruben G.J. Visschers^h, Jonathan Shaffer^o



Fig. 1. Multidisciplinary management of type II AIF.



Adult Conditions Causing Type 3 Intestinal Failure

- ▶ Short bowel syndrome following extensive surgeries secondary to mesenteric ischemia
- ▶ IBD such as Crohn's disease
- ▶ Small bowel tumors such as Gardner's syndrome (familial colorectal polyposis)
- ▶ Tumors of the mesenteric root and retroperitoneum (desmoid tumor)



IF in inflammatory bowel disease

- ▶ Rare in MUC
- ▶ IF in patients with CD
 - ▶ Complications of surgery for intra-abdominal sepsis,
 - ▶ Extensive primary small bowel disease impairing nutrient absorption
 - ▶ Uncomplicated sequential resection leading to a shortened small bowel



IF in inflammatory bowel disease

- IF in patients with CD 20 years after first resection is 8.5%
- Predisposing factors to type 3 IF in CD
 - Younger age at diagnosis and (at first operation)
 - Stricturing disease
 - Family history of IBD
 - CD susceptibility gene nucleotide containing protein 2 (NOD2) is associated with IF



Strategies for managing Type 3 IF

- Growth hormone to enhance intestinal adaptation and absorption and reducing PN requirements
 - Effects not sustained and patients revert to pretreatment states relatively quickly

Seguy D, et al, Am J Clin Nutr. 2014

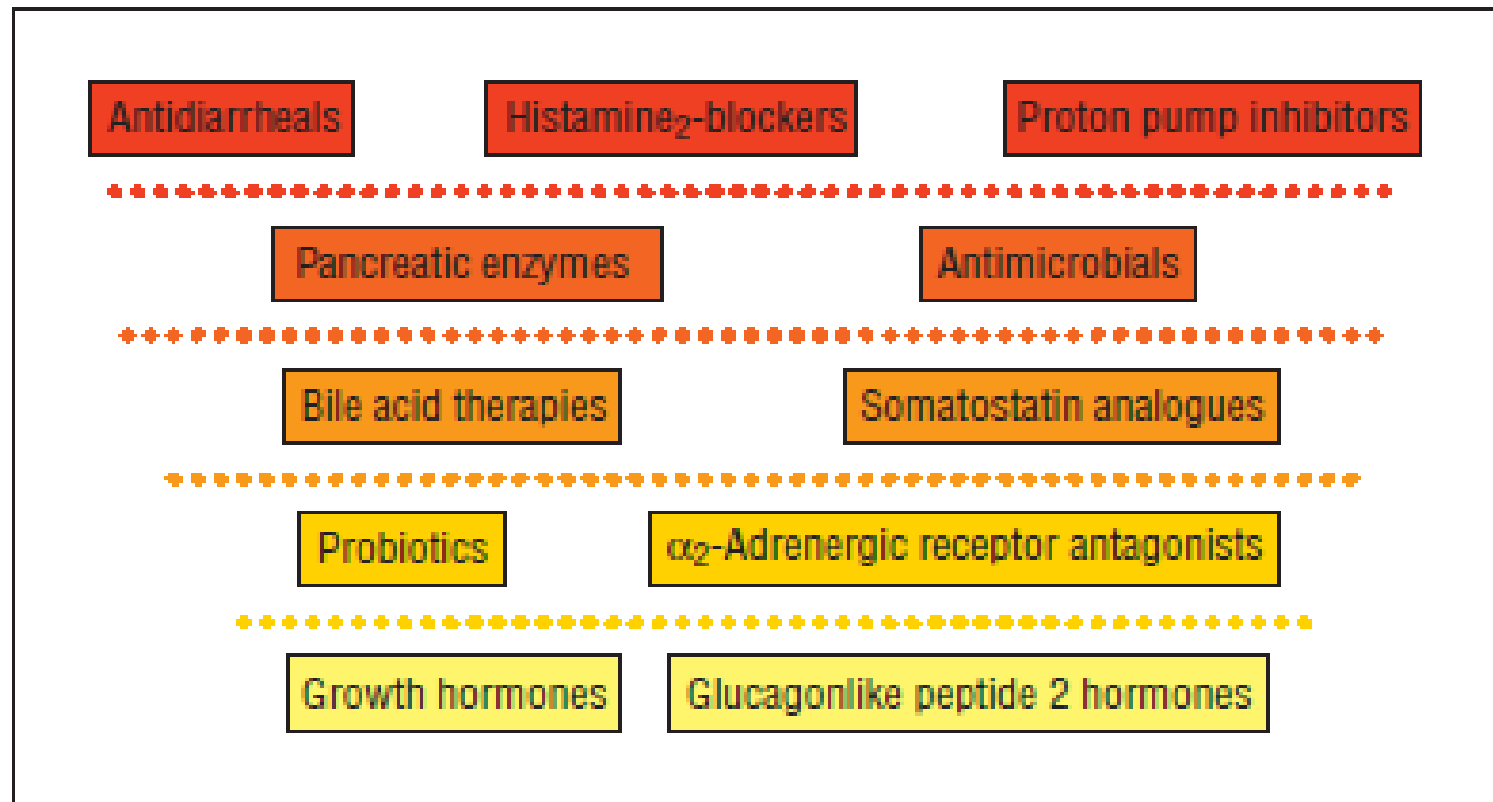
- Glucagon-like peptide-1 (GLP-1) and GLP-2 agonists
 - Study demonstrated enhanced absorption with combination GLP-1 and GLP-2 analogues

Carter BA, et al. J Pediatr.2017

Madsen KB, et al. Regul Pept.2013



Strategies for managing Type 3 IF in CCF



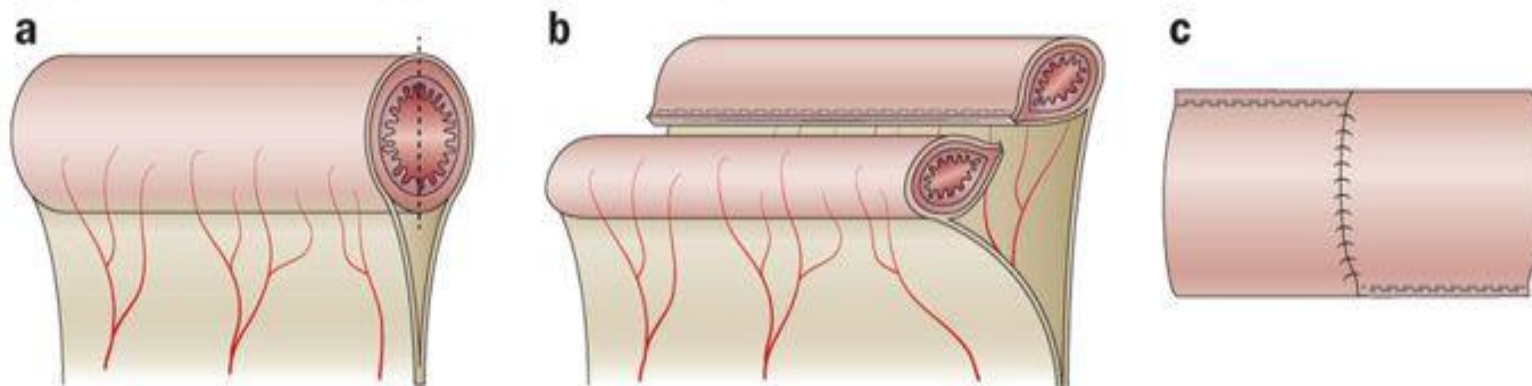
Intestinal Lengthening in Adult Patients with Short Bowel Syndrome

Govardhana Rao Yannam • Debra L. Sudan •
Wendy Grant • Jean Botha • Alan Langnas •
Jon S. Thompson

- ▶ Twenty adult patients
 - ▶ Bianchi (n=6)
 - ▶ Serial transverse enteroplasty (STEP) (n=15)
- ▶ Indications were
 - ▶ To increase the enteral caloric intake thereby reduce or wean parenteral nutrition (PN) (n=14)
 - ▶ For bacterial overgrowth (n=6)



Longitudinal lengthening (Bianchi procedure)



Serial transverse enteroplasty (STEP)

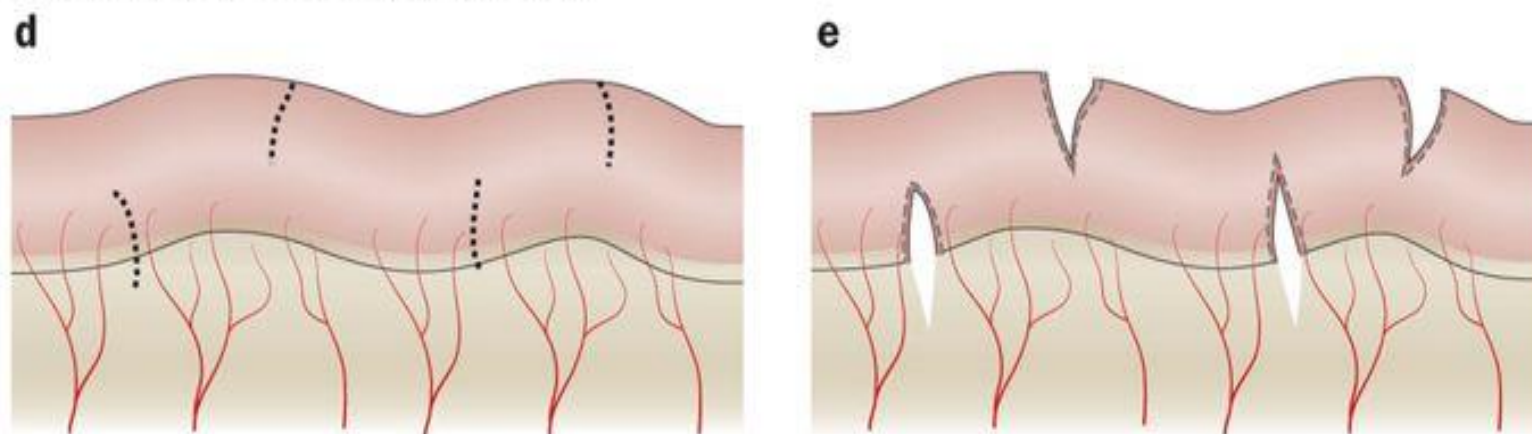


Table 2 Summary of patient characteristics

Patient no.	Procedure	Bowel anatomy				
		Length of SB remnant	Additional SB length gained	Final SB length	% of SB length gained	Colon anatomy
To increase enteral caloric intake						
1	Bianchi and STEP	80	60	140	75	TC and LC
2 ^c	STEP	55	12	67	21	LC
3	STEP	58	92	150	158	LC
4	STEP	62	110	172	177	All
5 ^b	Bianchi	48	36	84	75	All
6 ^b	Bianchi	150	10	160	6	Left
7 ^b	STEP	64	12	76	18	TC and LC
8 ^b	STEP	52	13	65	25	All
9 ^d	STEP	25	13	38	52	Rectum
10 ^b	STEP	113	36	149	31	TC and LC
11 ^b	STEP	62	22	84	35	All
12 ^b	STEP	45	10	55	22	All
13 ^b	STEP	50	15	65	30	Left
14 ^b	STEP	33	33	66	100	Left
Bacterial overgrowth						
15	Bianchi	120	25	145	20	All
16	Bianchi	45	25	70	55	TC and LC
17	Bianchi	60	15	75	25	All
18	STEP	90	20	110	22	TC and LC
19 ^a	STEP	150	20	170	13	All
20 ^b	STEP	60	10	70	16	TC and LC

J Gastrointest Surg (2010) 14:1931–1936
DOI 10.1007/s11605-010-1291-y

ORIGINAL ARTICLE

Intestinal Lengthening in Adult Patients with Short Bowel Syndrome

Govardhana Rao Yannam • Debra L. Sudan •
Wendy Grant • Jean Botha • Alan Langnas •
Jon S. Thompson

- D **Conclusions:** Bowel lengthening is technically feasible and effectively leads to weaning from PN in more than half of the adult patients.
- D Lengthening procedures may be an underutilized treatment for adults with short bowel syndrome



Serial Transverse Enteroplasty (STEP): A Novel Bowel Lengthening Procedure

By Heung Bae Kim, Dario Fauza, Jennifer Garza, Jung-Tak Oh, Samuel Nurko, and Tom Jaksic
Boston, Massachusetts

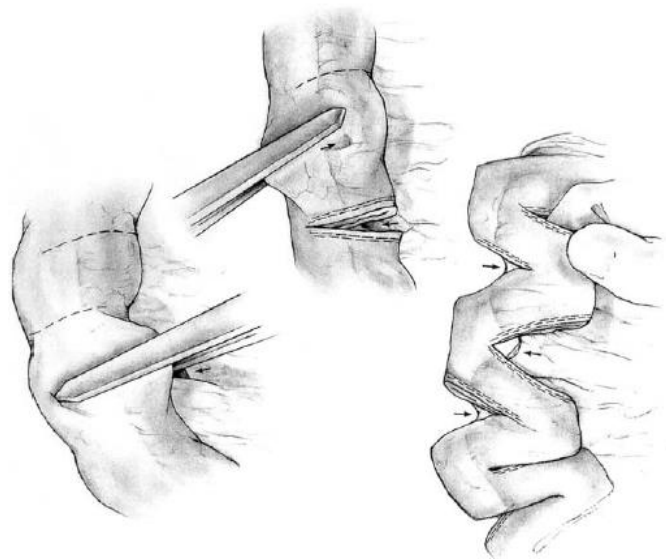
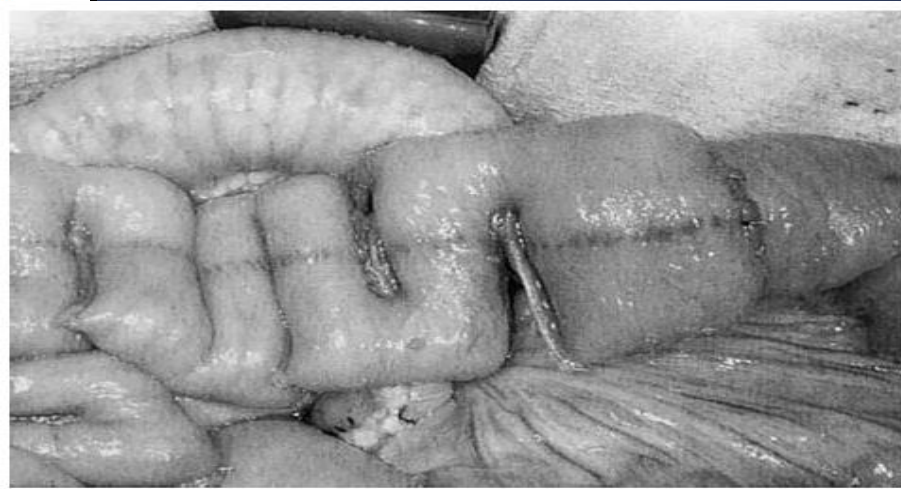


Fig 1. Schematic drawing of the serial transverse enteroplasty procedure. The small arrows show the direction of insertion of the GIA stapler and the sites of the mesenteric defects. The staplers are placed in the 90° and 270° orientations using the mesentery as the 0° reference point.

Conclusions: (STEP) significantly increases intestinal length without any evidence of obstruction. It may be a safe and facile alternative for intestinal lengthening in children with short bowel syndrome



CASE REPORT

The First Clinical Application of the Spiral Intestinal Lengthening and Tailoring (Silt) in Extreme Short Bowel Syndrome

T. Cserni • B. Biszku • I. Guthy • F. Dicső • L. Szaloki •
S. Folaranmi • F. Murphy • G. Rakoczy • A. Bianchi •
A. Morabito

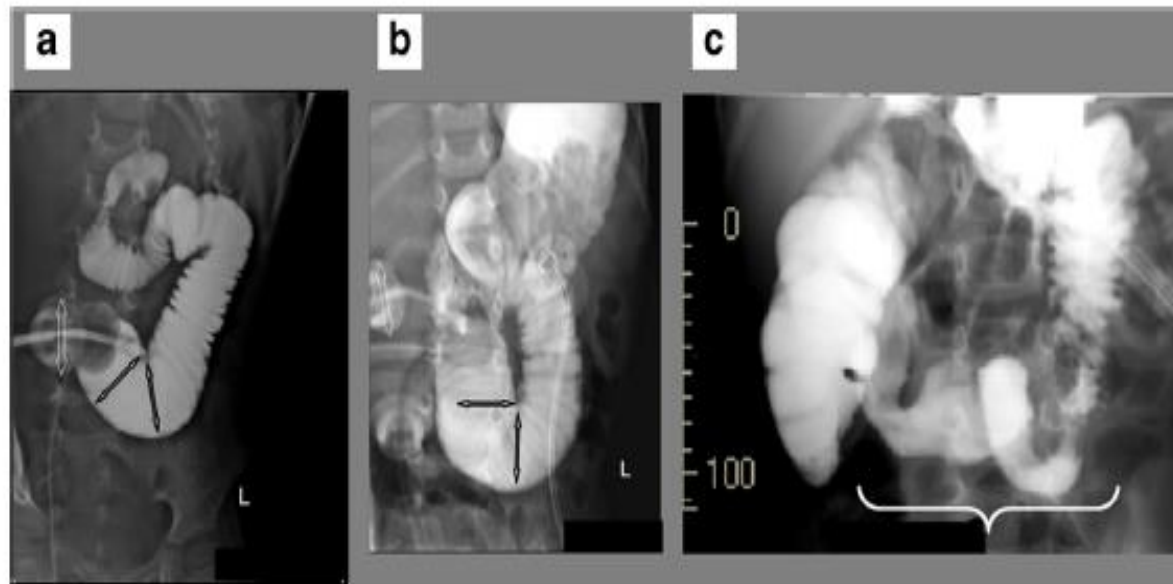
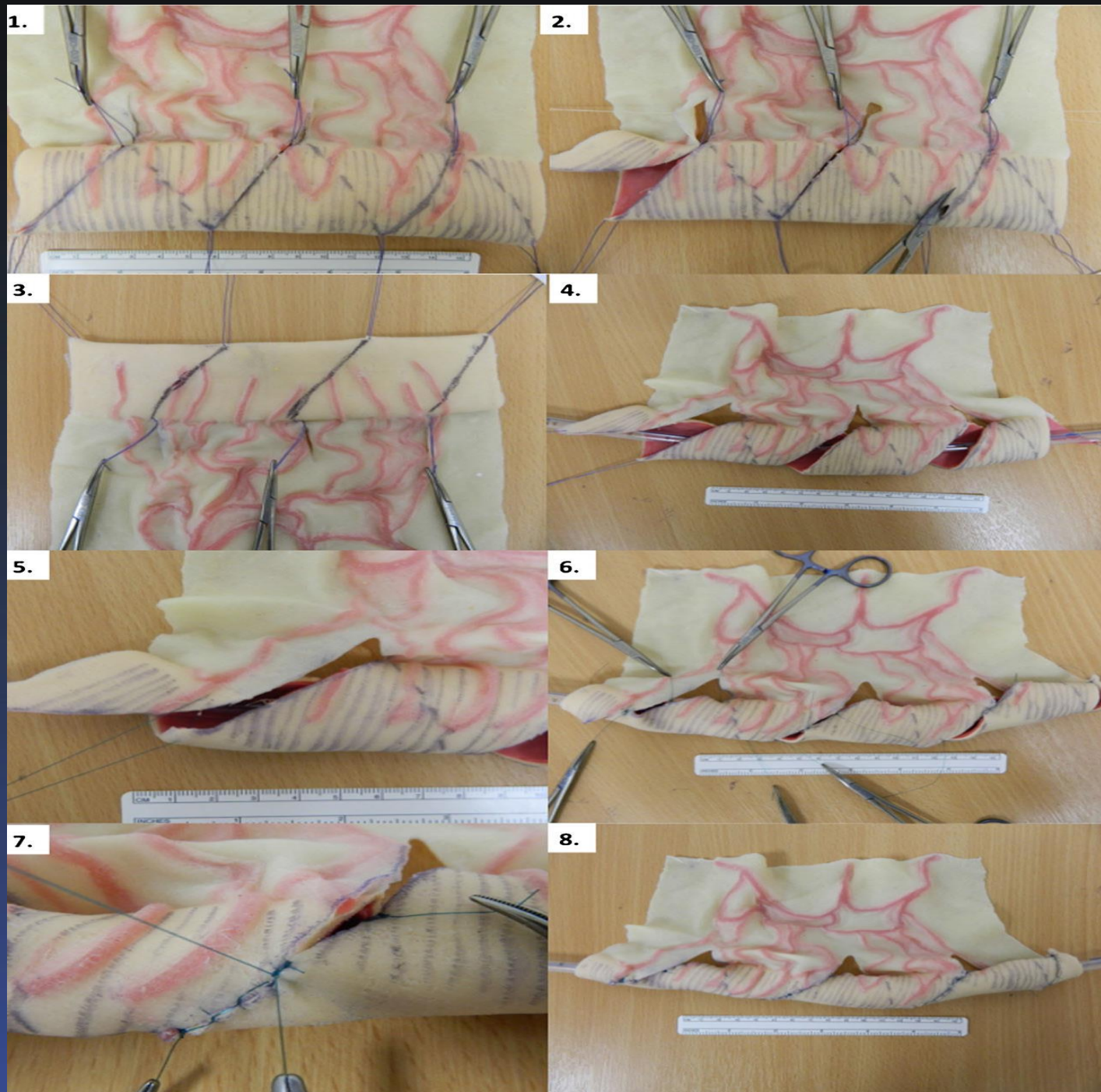


Fig. 1 Contrast studies demonstrating the small bowel size before bowel expansion (a) after bowel expansion (b) and after SILT (c). *White arrows* (marking the plough used for catheter fixation in the stoma) are used to equalize magnification between image a and b. They are the same size on both a and b images. The *black arrows* are representing the bowel

diameter before bowel expansion on a and b images. Dilatation and some lengthening after bowel expansion can be observed in image b. Image c shows the tailored and lengthened segment anastomosed end to side into the ascending colon





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- ▶ A 3-year-old girl had remaining 15 cm jejunum after midgut volvulus
- ▶ The length of the jejunum increased from the initial 15 to 22 cm during 12 months of PN and bowel expansion
- ▶ 11 cm of distended bowel was further lengthened up by SILT giving a total small bowel length of 33 cm.
- ▶ **Conclusion** SILT procedure is a safe and feasible technique for human intestinal lengthening and tailoring



Intestinal transplantation

North American	European
Indications Failure of home parenteral nutrition (HPN) Impending or overt liver failure Central venous thrombosis of ≥ 2 central veins Frequent and severe central venous catheter-related sepsis Frequent episodes of severe dehydration despite intravenous fluids in addition to HPN High risk of death attributable to the underlying disease Intra-abdominal invasive desmoids tumour Congenital mucosal disorders Ultra-short bowel syndrome Intestinal failure with high morbidity and low acceptance of HPN Need for frequent hospitalisation, narcotic addiction or inability to function Patient's unwillingness to accept long-term HPN	Indication Irreversible, benign, chronic intestinal failure with no possibility of bowel rehabilitation associated with life threatening complications of HPN Individual case-by-case decision for all patients Non-indications High risk of death due to underlying disease Chronic dehydration Significantly impaired quality of life



Intestinal transplantation

- ▶ The grafts include **liver-containing grafts** (liver-small bowel or multivisceral) or **liver-free grafts** (isolated small bowel including small bowel and colon or modified multivisceral including stomach, pancreas, small bowel, and colon)
- ▶ **Patient survival** rates continue to improve, the last international registry data reported 1-, 5-, and 10-year survival as 76%, 56%, and 43%
- ▶ **Complications**
 - ▶ Rejection, graft-versus-host disease, post-transplant lymphoproliferative disorder, and infection



Conclusions

- ▶ IF is an uncommon condition, but the impact on the individual is enormous
- ▶ Prevention is the most important
- ▶ The MDT approach to ensuring longevity in these complex patients
- ▶ As growth factors develop, opportunities to wean patients off PN become closer to reality



Conclusions

- ▶ In the absence of relatively cheap hormonal treatments to facilitate intestinal adaption, surgical rescue procedures are vital to maintain functioning gut
- ▶ Intestinal lengthening and transplant are important options



Thank you

