Gastro BITES

AGA Lunch + Learn

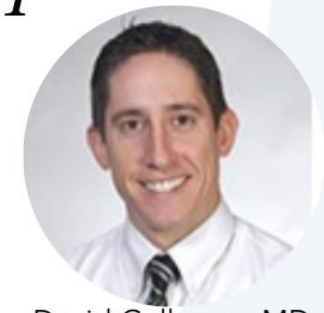
Management of the Patient with Intestinal Failure and Malnutrition: A Multi-Disciplinary Discussion on Best Practices

Tuesday, Sept. 16, 2025, noon EDT

Vikram Christian, MD, CNSC
University of Minnesota

Sabrina Oliver, MS, RD, CSO, CDN
New York-Presbyterian Hospital
Columbia University Medical Center

Sara Hennesy MD, FACS, CNSC
UT Southwestern
Medical Center



David Galloway, MD
University of Alabama
at Birmingham

Introductions & Disclosures

Sabrina Oliver, MS, RD, CSO, CDN
Senior Clinical Nutritionist
New York-Presbyterian Hospital Columbia University Medical Center

Disclosures: Speaker for Abbvie.

Sara Hennesy, MD, FACS, CNSC
Associate Professor, Department of Surgery, UT Southwestern Medical Center
Director of Surgical Intensive Care Unit
Director of Nutrition
Associate PD Minimally Invasive & Bariatric Surgery Fellowship Program
William P. Clements Jr. University Hospital

Disclosures: Board of Directors of the Fellowship Council.

David Galloway, MD
Associate Professor, Department of Pediatrics, Division of Pediatric Gastroenterology, Hepatology, & Nutrition
Director for the Children's Intestinal Rehabilitation Center of Alabama
University of Alabama at Birmingham

Disclosures: Academy for Continued Healthcare Learning- speaker; Alcresta- advisory board member

Objectives

- DEFINE WHAT INTESTINAL FAILURE IS AND HOW IT IS DIAGNOSED.
- UNDERSTAND WHY PATIENTS WITH INTESTINAL FAILURE ARE AT SUCH HIGH RISK OF MALNUTRITION.
- REVIEW DIETARY, PHARMACOLOGICAL, AND SURGICAL TREATMENT OPTIONS FOR THIS PATIENT POPULATION, HIGHLIGHTING THE ROLE OF THE GASTROENTEROLOGIST.

The Intestinal Rehabilitation Journey…

STAGE 1: DIAGNOSIS THROUGH THE FIRST SEVERAL YEARS

Case

Case

- Several segments of small bowel found to be necrotic
- Resection occurs; patient left with an ileostomy
- NICU team consults you and tell you that only 30 cm of small bowel remains. No ICV. All colon minus the cecum.
- Patient currently NPO, full parenteral nutrition
- Family has lots of questions regarding diagnosis, prognosis

- **108** patients
- 24 weeks gestation to 5 years old
- Undergoing exploratory laparotomy

Table 2 Small bowel length

	Mean (cm)
Postconception age	
24-26 wk	70.0
27-29 wk	100.0
30-32 wk	117.3
33-35 wk	120.8
36-38 wk	142.6
39-40 wk	157.4
0-6 mo	239.2
7-12 mo	283.9
13-18 mo	271.8
19-24 mo	345.5
25-36 mo	339.6
37-48 mo	366.7
49-60 mo	423.9

TABLE 1. Mean measured small bowel length in infants and young children

Postconception age	Mean, cm
24–26 wk	70.0
27–29 wk	100.0
30–32 wk	117.3
33–35 wk	120.8
36–38 wk	142.6
39–40 wk	157.4
0–6 mo	239.2
7–12 mo	283.9
13–18 mo	271.8
19–24 mo	345.5
25–36 mo	339.6
37–48 mo	366.7
49–60 mo	423.9
Weight at surgery, g	**Mean, cm**
500–999	83.1
1000–1499	109.9
1500–1999	120.1
2000–2999	143.6
3000–4999	236.5
5000–7999	260.3
8000–9999	300.1
10,000–12,999	319.6
13,000–15,999	355.0
16,000–19,999	407.0
Height at surgery, cm	**Mean, cm**
30–39	97.4
40–49	129.0
50–59	205.9
60–74	272.0
75–89	308.5
90–99	382.5
100–120	396.4

Struijs et al. *Journal of Pediatric Surgery* (2009) 44, 933-938

INTESTINAL FAILURE - DEFINITION

- “the reduction of functional intestinal mass below that which can sustain life, resulting in dependence on supplemental parenteral support for a minimum of 60 days within a 74 consecutive day interval.”
- Results in parenteral support dependence
- Acute (<30 days), Chronic (>90 days)

Modi BP, Galloway DP, et al. *JPEN*. 2022 Jan; 46(1): 42-59. PMID 34287974

SHORT BOWEL SYNDROME - DEFINITIONS

- Short bowel syndrome is "the development of IF secondary to loss of small bowel, either from congenital absence or following surgical resection
  - The most common cause of IF
- Ultrashort-bowel syndrome is the development of IF following significant small-bowel resection resulting in a residual small-bowel length that is <10% of expected
  - <10% small bowel is poor prognosis for achieving enteral autonomy

- Modi BP, Galloway DP, et al. *JPEN*. 2022 Jan; 46(1): 42-59. PMID 34287974
- Cole et al. *Pediatrics* 2008;122(3)

European Anatomical classification of SBS

Type 1

Type 2

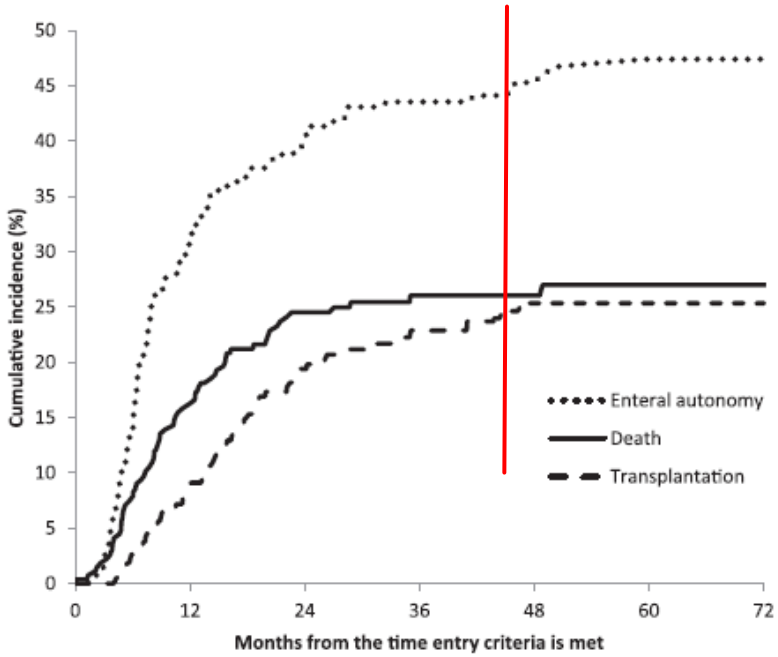
Type 3

- Ou et al. *Nutrients*. 2020 Feb 18;12(2):520 PMID 32085587
- https://www.lecturio.com/concepts/short-bowel-syndrome/

Vitamins/mineral sites of Absorption

Duodenum	Vitamin A, B1, iron, calcium, glycerol, fatty acids, monoglycerides, amino acids, monosaccharides, disaccharides (lactose)
Jejunum	
Entire	Glucose, galactose, Vitamin C, D, E, K, Vitamin B1, B2, B6, amino acids, glycerol, fatty acids, monoglycerides, folic acid, biotin, copper, zinc, potassium, pantothenic acid, iodine, calcium, magnesium, phosphorus
Proximal	Vitamin A, iron, disaccharides (lactose)
Distal	Disaccharides (isomaltose, maltose, trehalose, sucrose), dipeptides
Ileum	
Entire	Chloride, sodium, Vitamin D, E, K, Vitamins B1, B2, B3, B6, iodine, calcium, magnesium, phosphorus
Proximal	Potassium, disaccharides (isomaltose, maltose, trehalose, sucrose)
Distal	Vitamin B12, intrinsic factor
Colon	Water, biotin (synthesis)

Created using Fig 28.1 from Caldwell. Surg Clin North Am 61:491, 1981 as reference



Cumulative incidence (Number at risk)	O mos	12 mos	24 mos	36 mos	48 mos	60 mos	72 mos
Death	0% (272)	16% (220)	25% (182)	26% (126)	26% (126)	27% (76)	27% (76)
Transplantation	0% (272)	9% (199)	19% (142)	23% (89)	26% (52)	26% (52)	26% (52)
Enteral autonomy	0% (272)	31% (120)	40% (42)	44% (26)	45% (14)	47% (9)	47% (9)

Figure 3. Primary outcomes: enteral autonomy, death, and intestinal transplantation. The data below the graph show the cumulative incidence of and the number of children who remain at risk for developing the outcome.

Squires et al. *J Pediatr* 2012; 161:723-8

SOCIETY PAPER

Intestinal Rehabilitation Programs in the Management of Pediatric Intestinal Failure and Short Bowel Syndrome

*Russell J. Merritt, †Valeria Cohran, ‡Bram P. Raphael, §Timothy Sentongo, ||Diana Volpert, ¶#Brad W. Warner, and **Praveen S. Goday, on behalf of the Nutrition Committee of the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition

- Mission of IR program: "to be regional, national, and/or international referral centers that provide comprehensive, safe, state of the art care to improve the survival and quality of life and minimize complications in patients with IF"

Ultimate Goal: Enteral autonomy

(*JPGN* 2017;65: 588–596)

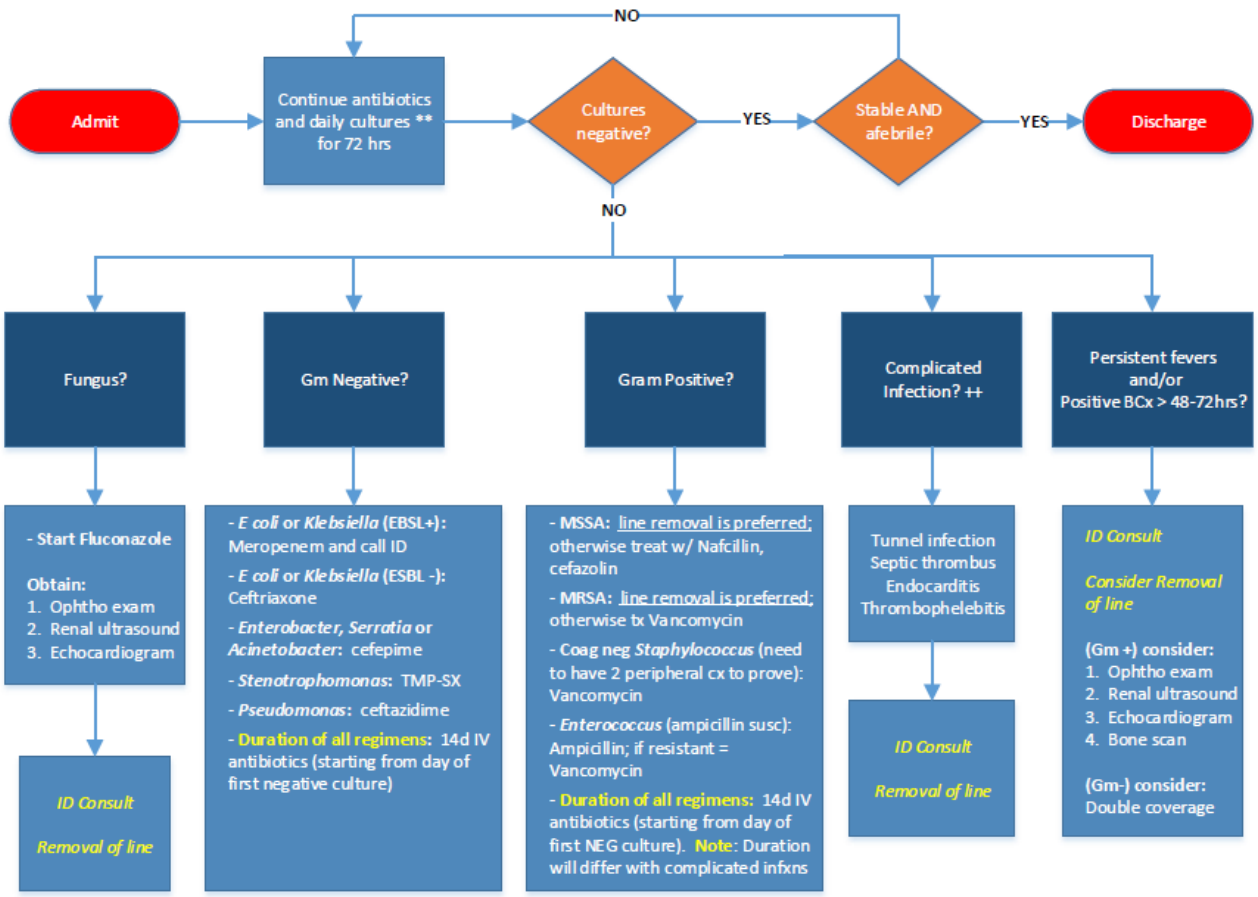
Intestinal Failure Line Infection Reference Guide- (3/5/25)

UAB-COA Center for Advanced Intestinal Rehabilitation

UAB MEDICINE PEDIATRICS | Children's of Alabama

Surgery Floor

Process



Narrow Antibiotic coverage per Biofire Blood Culture Identification 2 (BCID2) panel and culture sensitivities

Criteria for ID Consult:

- all MSSA, MRSA, Gram negative, and fungal infections; complicated infections
- ESBL+ Ecoli or Klebsiella culture
- prior to usage of Meropenem
- persistent fever and/or bacteremia for 48-72 hours despite appropriate therapy
- 2 or more admissions in 1 month with line infections
- Antibiotic locks should be considered in any event that line is not removed

Line removal criteria:

- rapid deterioration
- infection with any of the following: fungus, *S. aureus*, *Pseudomonas*
++ complicated infection
- positive cultures despite >48 hours of appropriate antibiotics

Line replacement criteria:

- 72hrs of negative cultures starting from day of first negative culture.
- cultures need to be obtained on each day of the 72 hr period

Notes

** **Daily cultures:** *central line* (all lumens) only; Obtain repeat *peripheral culture* only if initial positive

++ **Complicated infection:** Tunnel infection, septic thrombus, endocarditis, suppurative thrombophelebitis

- Tunnel infection: pain and erythema along catheter tunnel site with purulent drainage
- Septic thrombus: blood cultures + for > 72 hrs after empiric treatment and evidence of venous thrombus on ultrasound

Antibiotic Dosing

- **Cefepime** 50 mg/kg/dose q8hr (max 2 g/dose)
- **Vancomycin** 20 mg/kg/dose q8hr (max 1.5 g/dose)
- **Pip-taz** 100 mg/kg/dose q8hr (max 4 g/dose)
- **Ceftriaxone** 75 mg/kg/dose q daily (max 2 g/day)
- **Ceftazidime** 50 mg/kg/dose q8hr (max 6 g/day)
- **Meropenem** 20 mg/kg/dose q8hr (max 2 g/dose)
- **Micafungin** 6 mg/kg/dose q daily (max 150 mg/dose)
- **Fluconazole** 12 mg/kg/dose q daily (max 800 mg/day)
- **Nafcillin** 50 mg/kg/dose q6hr (max 12 g/day)
- **Ampicillin** 50 mg/kg/dose q6hr (max 12g/day)
- **Cefazolin** 50 mg/kg/dose q8hr (max 6 g/day)
- **TMP-SX** 5 mg/kg/dose q8hr (max 320 mg/day)

Dexa scan | **Q 2 years | Z score 0 to -1

2016

SMOF FDA approved (for adults)

2018

Omegaven FDA approved

2022

SMOF FDA approved (for pediatrics)

Original Communication

aspen LEADING THE SCIENCE AND PRACTICE OF CLINICAL NUTRITION American Society for Parenteral and Enteral Nutrition

Preventing the Progression of Intestinal Failure–Associated Liver Disease in Infants Using a Composite Lipid Emulsion: A Pilot Randomized Controlled Trial of SMOFlipid

Journal of Parenteral and Enteral Nutrition
Volume 41 Number 5
July 2017 866–877

DOI: 10.1177/0148607115626921
journals.sagepub.com/home/pen
SAGE

Table 1

Comparison and characteristics of parenteral lipid emulsions

Product Manufacturer	Intralipid® Baxter Healthcare/ Fresenius Kabi	Liposyn II® Hospira	ClinOleic® Baxter Healthcare/ Parenteral S.A.	SMOFLipid® Fresenius Kabi	Omegaven® Fresenius Kabi
Oil source (g)					
Soy bean	10	5	2	3	0
Safflower	0	5	0	0	0
MCT	0	0	0	3	0
Olive oil	0	0	8	2.5	0
Fish oil	0	0	0	1.5	10
α-tocopherol (mg/L)	38	NP	32	200	150–296
Phytosterols (mg/L)	348 ± 33	383	327 ± 8	47.6	0
Fat composition (g)*					
Linoleic	5.0	6.5	0.9	2.9	0.1–0.7
α-Linolenic	0.9	0.4	0.1	0.3	< 0.2
EPA	0	0	0	0.3	1.28 –2.82
DHA	0	0	0	0.05	1.44 –3.09
Oleic	2.6	1.8	2.8	2.8	0.6 – 1.3
Palmitic	1.0	0.9	0.7	0.9	0.25 – 1
Stearic	0.35	0.34	0.2	0.3	0.05 – 0.2
Arachidonic	0	0	0.03	0.05	0.1 – 0.4

MCT: medium chain triglyceride; EPA: eicosapentaenoic acid; DHA: docosahexaenoic acid

Reference: Le HD, Fallon EM, de Meijer VE, Malkan AD, Puder M, Gura KM. Innovative parenteral and enteral nutrition therapy for intestinal failure. Semin Pediatr Surg. 2010 Feb;19(1):27-34. PMID: 20123271

Reference: Diamond IR, Sterescu A, Pencharz PB, Wales PW. The rationale for the use of parenteral omega-3 lipids in children with short bowel syndrome and liver disease. Pediatr Surg Int. 2008 Jul;24(7):773-8. PMID: 18504595.

Gattex (teduglutide)

- GLP2 analogue (terminal ileum, proximal colon)
  - **Native** GLP2 degraded in minutes
  - **Synthetic** GLP2 resistant to dipeptidyl peptidase-IV → lasts longer → therapy

- **Effects**:
  - Stimulates intestinal mucosal growth
  - Elongates villi and crypts
  - Increases crypt cell proliferation
  - Reduces gastric motility, inhibits gastric acid secretion
  - Increases mesenteric blood flow

Kocoshis et al. *JPEN*. 2020 Jan; 44(4): 621-631. PMID 31495952

Gattex (teduglutide)

- **Endpoint**: 20% reduction in parenteral support
- Initial study periods: 12-24 weeks
- Recent studies: 48-94 weeks
- Side effects: abdominal pain, vomiting
- **Efficacy**:
  - ~60% achieve endpoint
  - ~50% will maintain the endpoint
- **Unknowns**
  - Studies on reversal of efficacy if drug withdrawn
  - Rates of enteral autonomy

- Chiba et al. JPGN 2023 Sep 1. ;77(3):339-346. PMID 37364133
- Hill et al. JPEN 2021 Sep; 45(7):1456-1465. PMID 33305440