
Pediatric Intestinal Failure

The Principles of Intestinal Rehabilitation

07/22/2023

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Pediatric Gastroenterology, Hepatology and Nutrition

Ochsner Health Center for Children

Outline

- Definitions
 - Role of Intestinal Rehabilitation (IR) Programs
 - Who to refer/ prognostication
 - State of the program
 - Case presentations
-

Intestinal Failure (IF)

Critical reduction of the gut mass or its function
below the minimum needed to absorb
nutrients and fluids required for adequate
growth in children for a minimum of 60 days
within a 74 consecutive day interval

Norsa et al. Nutrition and intestinal rehabilitation of children with short bowel syndrome: a position paper of the ESPGHAN Committee on Nutrition. Part 1: from intestinal resection to home discharge. J Pediatr Gastroenterol Nutr.

Short Bowel Syndrome (SBS)

The need for PN for >60 days after intestinal resection or a bowel length of <25% of expected

North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition (NASPGHAN) and European Society for Pediatric Gastroenterology Hepatology, and Nutrition (ESPGHAN) recommend that patients who meet one or both of these criteria have access to an Intestinal Rehabilitation Program for consultation or clinical management

■ What is Intestinal Rehabilitation?



Intestinal Rehabilitation:

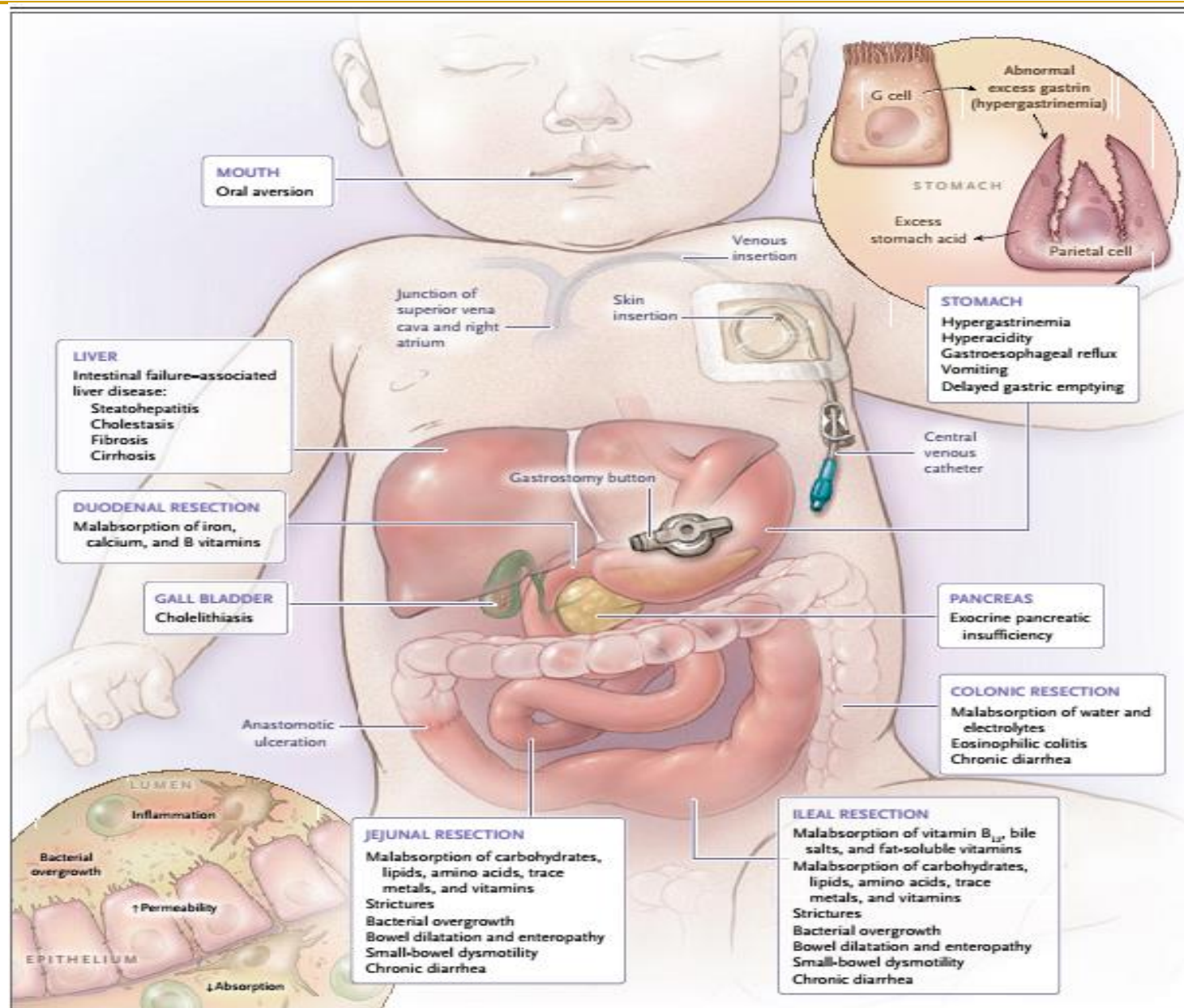
- Promote intestinal adaptation and move towards enteral independence (=enteral autonomy)
- Prevent and manage complications of intestinal failure

Enteral autonomy

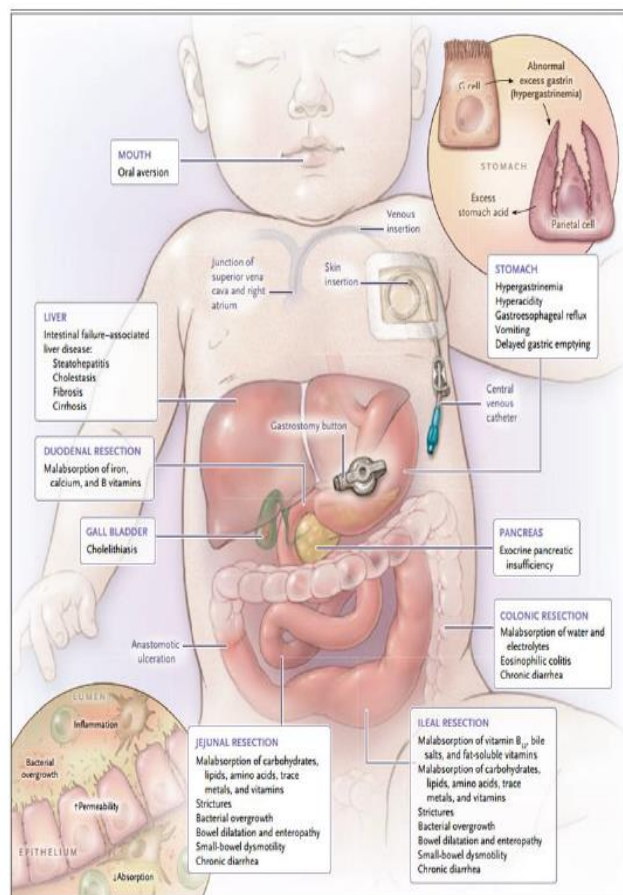
Enteral autonomy is the maintenance of normal growth and hydration status by means of enteral support without the use of parenteral support for a period of 3 consecutive months

Intestinal Rehabilitation: Goals

- Provide patient-centered, comprehensive, evidence-based care
- Promote intestinal adaptation and achieve enteral autonomy
- To provide the most appropriate nutrition, support growth and development
- To minimize complications
 - CLABSI, venous thrombosis, catheter malfunction
 - IFALD
- Monitoring for indications for transplantation
- To improve the survival and quality of life of patients with intestinal failure



There are many feared complications of intestinal failure.



Bowel Anatomy-Related Complications

- Diarrhea
- Malnutrition
- Fluid and electrolyte disturbances
- Micronutrient deficiency
- EFA deficiency
- Small bowel bacterial overgrowth
- D-lactic acidosis
- Acid peptic disease
- Anastomotic ulceration/stricture
- Impaired growth

Extra-Intestinal Complications

- Oxalate nephropathy
- Renal dysfunction
- Metabolic bone disease
- Oral aversion

Liver/Biliary Complications

- Intestinal Failure-Associated Liver Disease
 - Steatosis
 - Cholestasis
 - Fibrosis
 - Cirrhosis
- Gallstones, cholecystitis

Central Venous Catheter-Related Complications

- Infection
- Occlusion
- Breakage
- Central vein thrombosis
- Loss of access



Caring for A Child on Home PN

Central line care

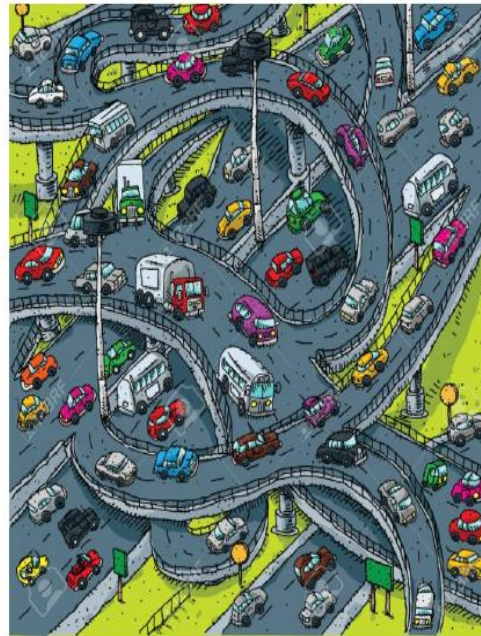
- Daily flushing/heparinization
- Weekly cap change
- Weekly dressing change
- Securement

Monitoring

- Urine check twice daily
- Temperature check twice daily
- Intake and output measurement
- Weight checks
- Overnight bed and diaper/pullup changes every 3-4 hours

Miscellaneous

- Order supplies
- Clinic visits every 1-3 months with GIFT team



Parenteral Nutrition Administration

- Preparation of PN (mixing, adding vitamins)
- Administration over 12-22 hours/day
- Administration of hydration fluids
- Pump programming

Medications

- Preparation
- Administration 3-6 times/day (Intravenous and enteral)

Feeds

- Hyperphagic – several meals/day
- Specialized formulas – strict feeding schedule

Device Management

- Ostomy changes – daily to every 3 days
- Gtube/Jtube management

Multidisciplinary Intestinal Rehabilitation (IR) Teams

- Composed of a team of people who have **special interest** in taking care of this patient population and who deal with these patients on a regular basis

Common team members in multidisciplinary intestinal failure programs.

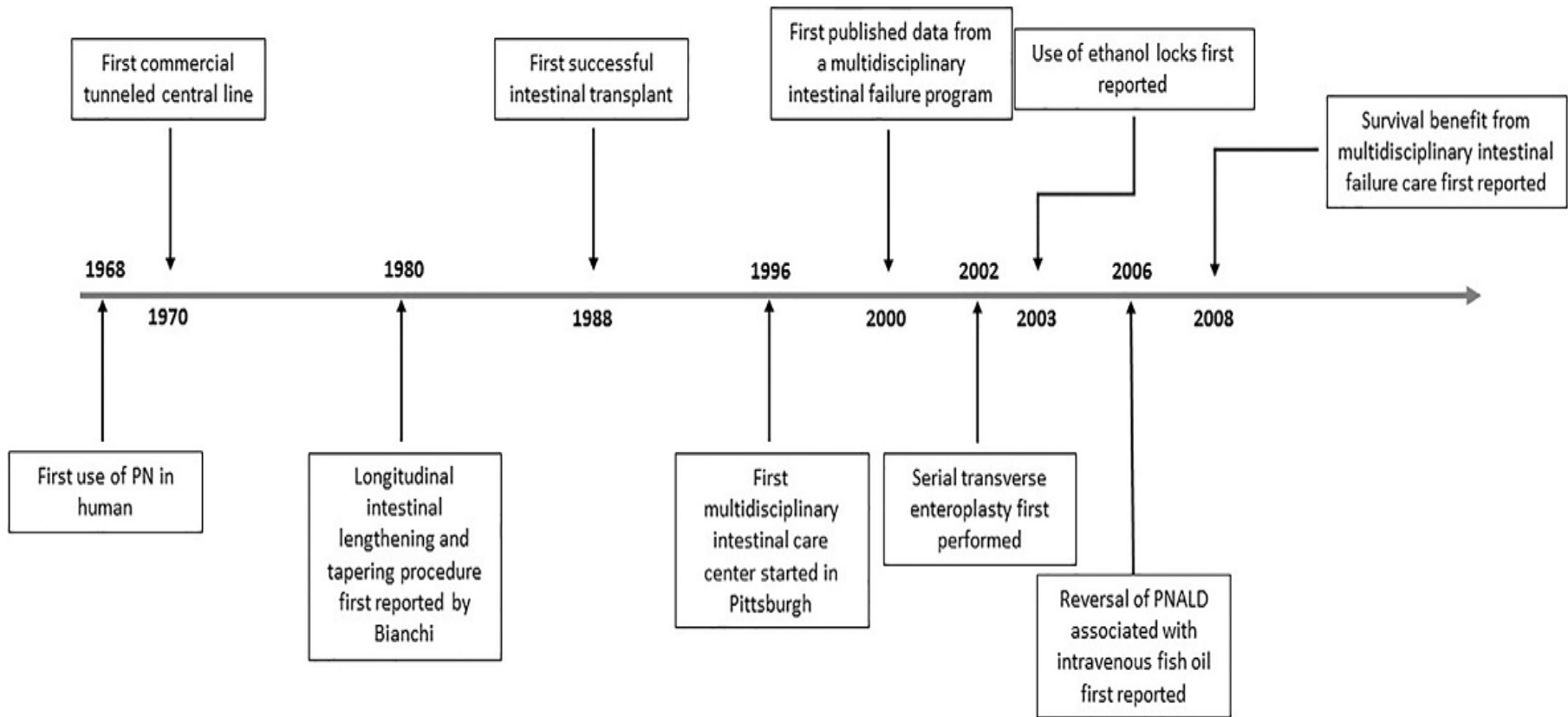
Primary team members	Ancillary members
Pediatric Gastroenterologist	Interventional Radiology
Pediatric Surgeon	Infectious Disease
Transplant Surgeon	GI Motility Specialist
Nurse Coordinator	Neonatologist
Intestinal Failure Dietitian	Psychologist
Pharmacist	Occupational Therapist
Social Worker	

Javid *et al.* Seminars in Pediatric Surgery. 2018

Stanger *et al.* Journal of Pediatric Surgery. 2013

Merritt *et al.* Journal of Pediatric Gastroenterology and Nutrition. 2017

Historical Timeline



Impact of IR programs



Organization and outcomes of multidisciplinary intestinal failure teams

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Journal of Pediatric Surgery (2013) 48, 983–992



Journal of
Pediatric
Surgery
www.elsevier.com/locate/jpsurg

The impact of multi-disciplinary intestinal rehabilitation programs on the outcome of pediatric patients with intestinal failure: A systematic review and meta-analysis

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Received 23 January 2013; accepted 3 February 2013

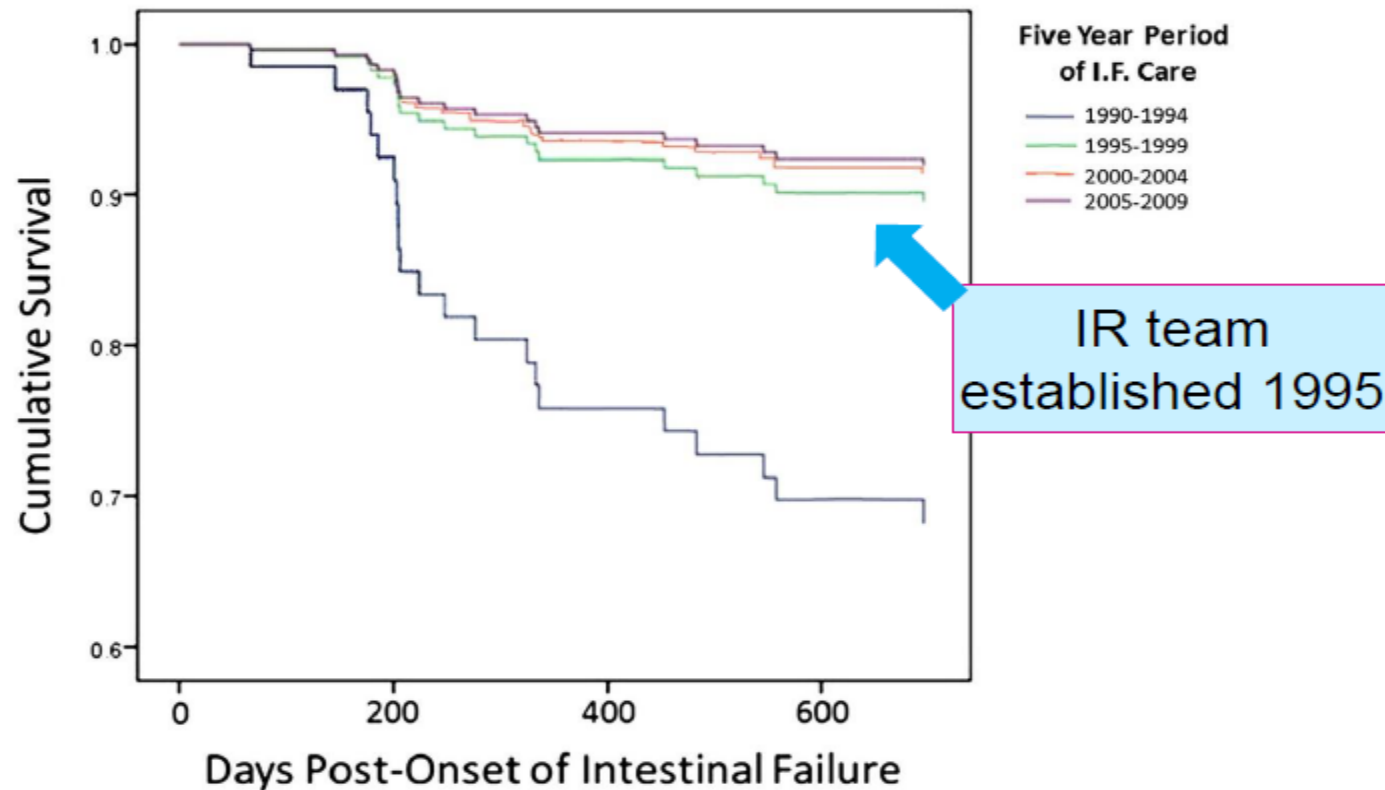
SOCIETY PAPER

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

Treatment by IR team improves patient survival.

Survival Curves for Each 5 Year Period of Care



Hess RA, et al. J Surg Res 2011;170:27-31.

TABLE 3. Outcome reports from intestinal rehabilitation programs with retrospective (pre-) control groups

Population	Outcome	P
	Death	
>50% resection or PN > 2 mo (7)	10/34 pre vs 4/40, 3/37, 4/60 ^{*,†}	0.011
SBS; PN > 90 days (43)	9/30 pre vs 6/54	<0.05
Transplant referrals (60)	26/33 pre vs 12/18 (early IRP), 8/33 (late IRP) [‡]	<0.0005
Infants with IF (68)	9/33 pre vs 0/22	0.01
SBS < 25% predicted or PN > 3 mo (71)	3/26 pre vs 1/22	0.60
Neonates with SBS (15)	15/40 pre vs 18/54	0.84
	Death if not weaned from PN	
SBS; PN > 90 days (43)	9/10 pre vs 6/18	<0.01
	Death in patients with liver failure	
Neonates with SBS (15)	9/10 pre vs 6/13	0.03
	Death on waiting list	
Transplant referrals (60)	21/24 pre vs 8/13 (early IRP), 1/19 (late IRP) [‡]	<0.001 [§]
	Progressive liver failure	
Neonates with SBS (15)	10/40 pre vs 13/54	0.15
SBS < 25% predicted or PN > 3 mo (71)	2/26 pre vs 0/22	0.51
	Sepsis per 1000 days PN	
SBS < 25% predicted or PN > 3 mo (71)	1.7 pre vs 0.7	0.018
Neonates with SBS (15)	0.5 pre vs 0.3	0.01
	Removed from list/improved	
Transplant referrals (60)	1/24 pre vs 1/13 (early IRP), 12/19 (late IRP) [‡]	<0.0005 [§]
	Enteral autonomy	
SBS; PN > 90 days (43)	20/30 pre vs 36/54	NS
Neonates with SBS (15)	25/40 pre vs 35/54	0.82
	PN duration to autonomy	
SBS < 25% predicted or PN > 3 mo (71)	15 mos pre vs 6 mos	0.0015
Neonates with SBS (15)	71 days pre vs 76 days	0.80
	Lipid modulation	
Transplant referrals (60)	1/33 pre vs 1/18 (early IRP), 26/33 (late IRP) [‡]	<0.0005
Infants with IF (68)	2/33 pre vs 14/22	<0.001
>50% resection or PN > 2 mo (7)	0/34 pre vs 0/40, 0/37, 11/60 [†]	NR [¶]
SBS; PN > 90 days (43)	0/30 pre vs 14/54	NR
	Bowel lengthening procedure	
Neonates with SBS (15)	0/40 pre vs 14/54	<0.001
Infants with IF (68)	0/33 pre vs 4/22	0.03
SBS < 25% predicted or PN > 3 mo (71)	10/26 pre vs 5/22	0.233 [#]
SBS; PN > 90 days (43)	3/30 pre vs 6/50	NS
	SBBO treatment	
Infants with IF (68)	8/33 pre vs 20/22	0.01
	Ethanol lock therapy	
>50% resection or PN > 2 mo (7)	No difference in mortality [†]	NS

Pre- and post-IR program installation comparisons:

Death rates:

>50% resection or PN > 2 mo: **10/34 pre vs 4/40, 3/37, 4/60; p= 0.011**

Infants with IF: **9/33 pre vs 0/22 p=0.01**

CLBSIs:

SBS < 25% predicted or PN > 3 mo: **1.7 pre vs 0.7; p=0.018**

Neonates with SBS: **0.5 pre vs 0.3; p=0.01**

Lipid modulation

Infants with IF: **2/33 pre vs 14/22; $p < 0.001$**

Bowel lengthening

Neonates with SBS: **0/40 pre vs 14/54; $p < 0.001$**

Infants with IF: **0/33 pre vs 4/22; $p = 0.03$**

PN duration to autonomy

SBS < 25% predicted or **PN > 3 mo (71) 15 mos pre vs 6 mos 0.0015**

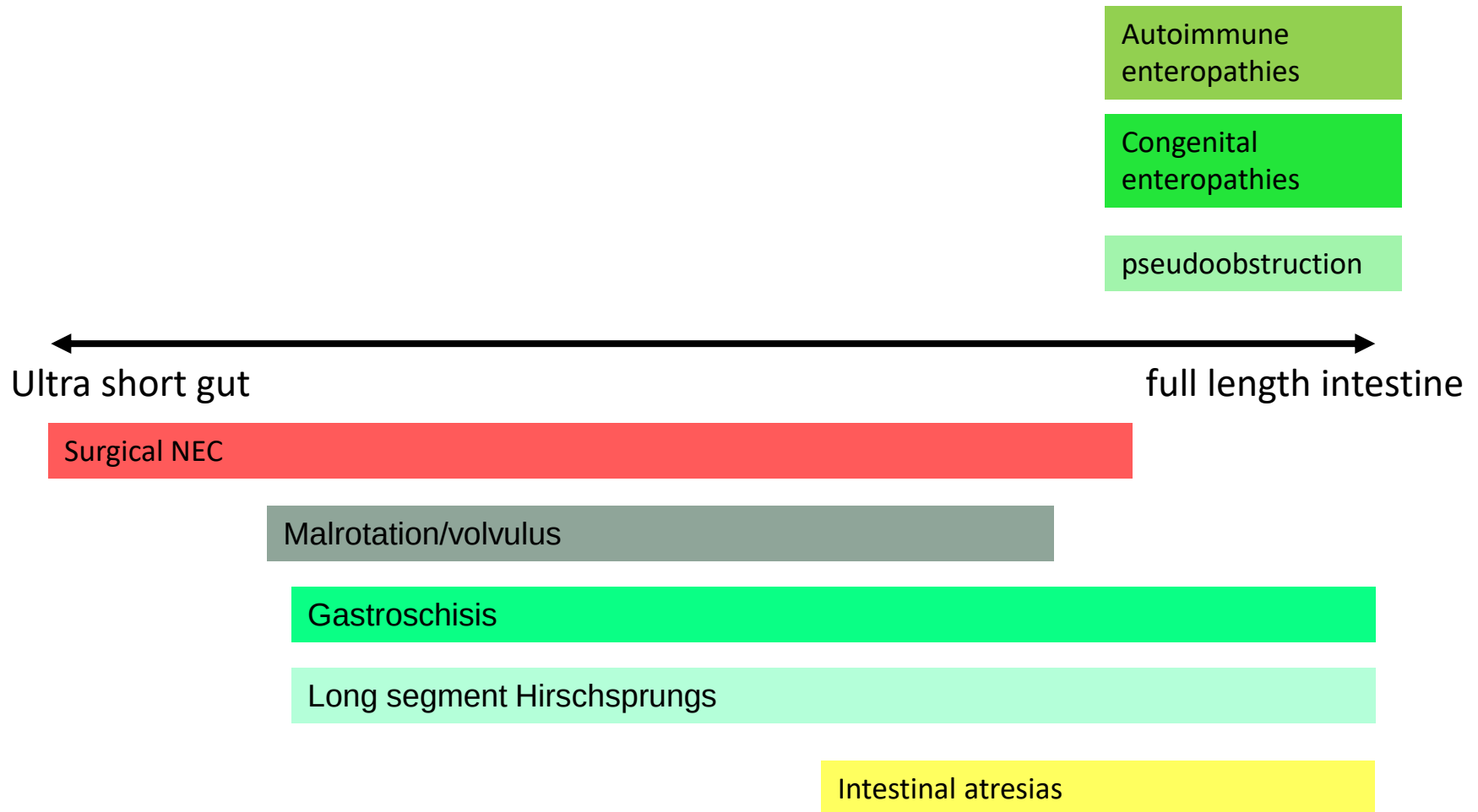
Who should be consulted on/referred to an IR program?

- NASPGHAN recommends that intestinal failure/short bowel syndrome patients **not making progress towards enteral autonomy and continuing on PN >3 months**, those with **high clinical complexity** or with worsening or non resolving **IFALD**, **recurrent sepsis**, **deep vein thrombosis or loss of venous access** be referred to an intestinal rehabilitation program for consultation or management

Etiology of Short Bowel Syndrome in Pediatrics

Prenatal	Neonatal	Postnatal
Atresia (unique or multiple)	Midgut volvulus (midgut or segmental)	Midgut volvulus (malrotation, bands or tumor)
Apple peel syndrome	Necrotizing enterocolitis	Arterial thrombosis
Midgut volvulus (malrotation)	Arterial thrombosis	Inflammatory bowel disease
Segmental volvulus	Venous thrombosis	Post-trauma resection
Abdominal wall defects		Extensive angioma
Gastroschisis; Omphalocele		
Extensive Hirschsprung's disease		

Etiology of Intestinal Failure in Pediatrics: Anatomical vs. Functional Perspectives



Intestinal Failure

- Describes a physiological state
 - Encompasses both anatomic and/or functional causes
 - Leads to alterations in the normal physiological function of the intestine
 - Implies a dependence upon total parenteral nutrition to maintain homeostasis
-

Management of Intestinal Failure: Intestinal Adaptation

- The mechanism through which feeds can be advanced over time
 - Compensation for loss of enterocyte mass
 - Marked by increase in intestinal absorptive capacity
 - Measured as tolerance to feeds or radiographic evidence of intestinal dilation
-

Intestinal Adaptation

Starts immediately after surgery

accelerated period 3 months after surgery;
most effective in first 2 years of life

Gut Adaptation

- Like rehabilitating from a stroke which caused sudden and permanent loss of right arm function:
 - Possible to gain strength and dexterity in left arm to compensate function
 - Need time and therapy
 - It will probably never be the same as having 2 functioning arms
 - Need to allow **TIME** for adaptation
-

Management of Intestinal Failure:

Intestinal Adaptation

- Ways to promote adaption
 - **Nutritional:** gradual introduction of enteral feeds, feeding plan modifications
 - **Medical:** anti- and pro-motility agents, bulking agents, fiber, teduglutide (Gattex; children one and older)
 - **Surgical:** lengthening, tapering, resections etc
-

Triad of Nutritional Support in Intestinal Failure

Parenteral Nutrition

Goal for TPN Weaning

Maintain fluid/electrolyte/nutrient balance as nutrition is converted from parenteral to enteral feeds.

Tools for enteral autonomy:

1. Adequate anatomy
2. Enteral feeding device or surgeon willing to place one
3. Caregiver willingness

Enteral Nutrition

Tools for oral autonomy:

1. Adequate anatomy and neuroanatomy
2. Oral feeding skills
 - a. Innate at birth
 - b. Learned afterwards
3. Willing/patient caregiver

Oral Feeding Skills

Prognostication

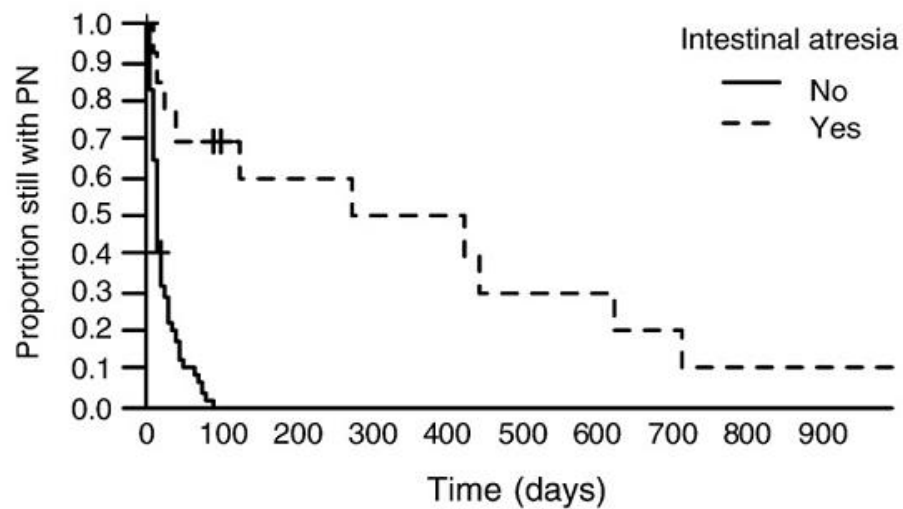
Questions to ask

- Underlying diagnosis
 - Remnant gut length
 - Segments resected
 - Colon/ICV present/absent
 - Gestational age
 - Cholestasis + or not
 - Septic events?
-

Predictors of Outcome in SBS

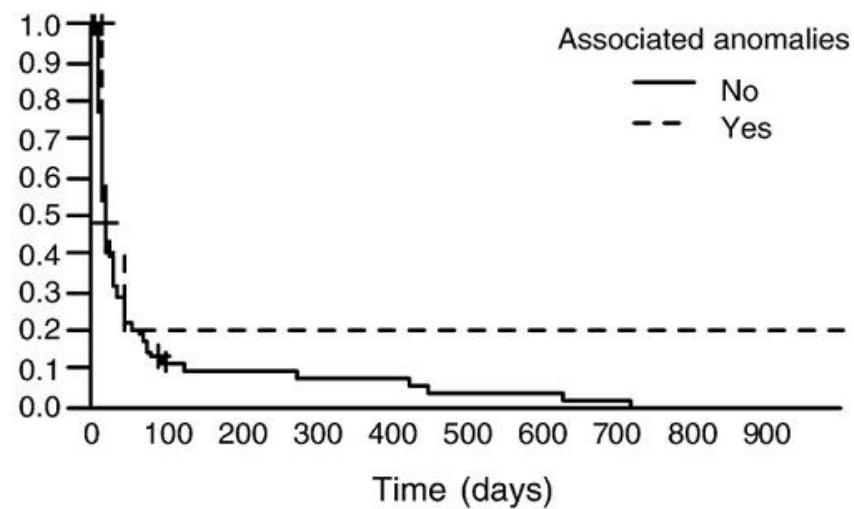
Positive Factors	Negative Factors
Residual bowel length >35 cm	Residual bowel length <15 cm or <10 % of expected
Presence of ileocecal valve	Liver Disease
Primary anastomosis of resected bowel	Bacterial Overgrowth
>50% enteral tolerance at 6 months	Underlying disease: Gastroschisis (especially with atresia)
Colon in continuity	>50% of colon resected

Quiros-Tejeira et al, J Peds 2005;145:157-63



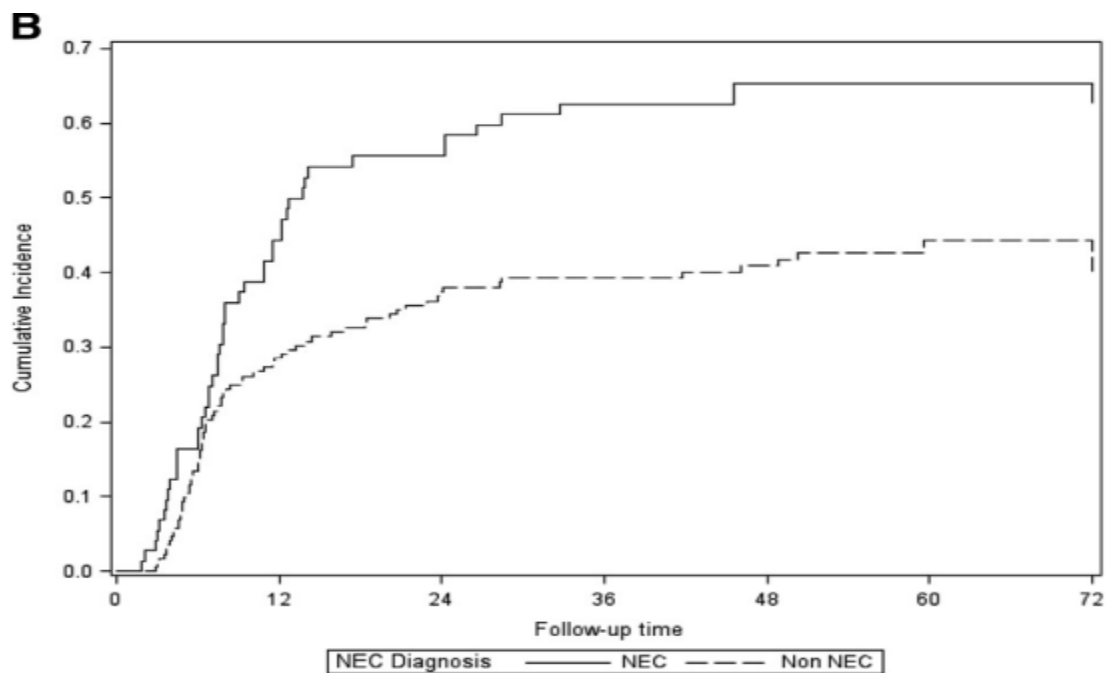
	n	events	median	L95%	U95%
No	66	62	16	14	21
Yes	13	11	274	42	-

P-value < .001



	n	events	median	L95%	U95%
No	73	68	17	15	28
Yes	6	5	17	16	-

P-value .209



Predicting Intestinal Adaptation in Pediatric Intestinal Failure

A Retrospective Cohort Study

Christina Belza, MN, RN,* Kevin Fitzgerald, BMSc,* Nicole de Silva, MSc, RN,*
Yaron Avitzur, MD,*† Karen Steinberg, MN, RN,* Glenda Courtney-Martin, PhD, RD,*
and Paul W. Wales, MD, MSc, FACS, FRCSC*‡

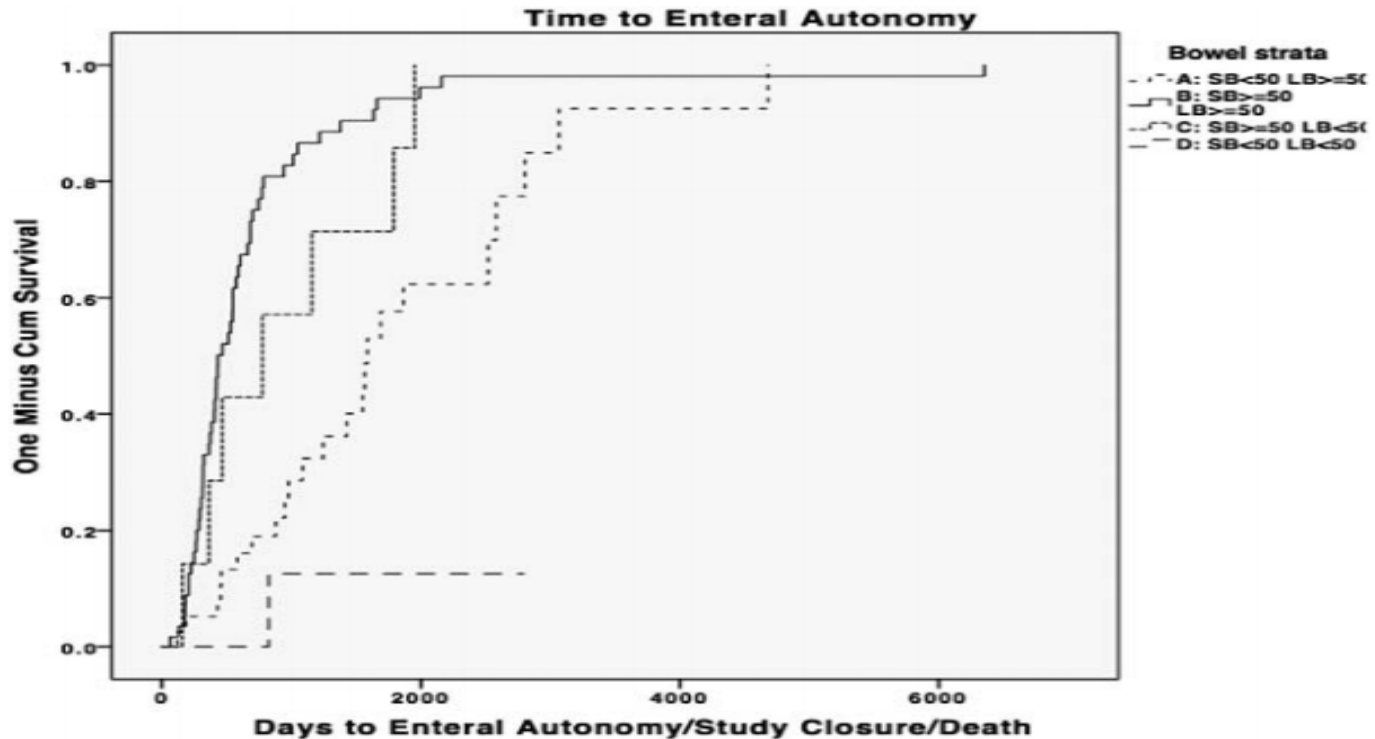


FIGURE 2. Kaplan–Meier survival curve. Based on the scatter-plot 4 intestinal failure anatomy strata were created. Infants with greater than 50% SB and LB weaned from PN after a median time of 432 days (95% CI: 301.5–562.5; $P < 0.001$). Patients with $> 50\%$ SB but $< 50\%$ LB weaned off PN in 776.0 days (95% CI 0–1571.5; $P < 0.001$). Children with less than 50% SB remaining but more than 50% LB weaned in a median of 1588 days (95% CI: 1388.0–1788.0; $P < 0.001$).

Intestinal length

Table 2 Small bowel length

	Mean (cm)	SE
Postconception age		
24-26 wk	70.0	6.3
27-29 wk	100.0	6.5
30-32 wk	117.3	6.9
33-35 wk	120.8	8.8
36-38 wk	142.6	12.0
39-40 wk	157.4	11.2
0-6 mo	239.2	18.3
7-12 mo	283.9	20.9
13-18 mo	271.8	25.1
19-24 mo	345.5	18.2
25-36 mo	339.6	16.9
37-48 mo	366.7	37.0
49-60 mo	423.9	5.9

- a bowel length of <25% of expected after a resection

Home Parenteral Nutrition

Anatomy

Small Bowel Length

- Jejunoleal anastomosis < 35 cm
- Jejunocolic anastomosis < 60 cm
- End jejunostomy < 115 cm

Carbonnel et al. JPEN 20:275-280, 1996.

Current state of OUR program

Ochsner Children's Intestinal Rehabilitation and Care Program

Implemented: January 2023

The 'Team'

Physicians:

Jasmeet Mokha, MD MPH

RNs:

Lauren Howley, RN, BSN PED-BC
Brianna Marzett, RN

RDs:

Leslie Cenac, RD LDN
Lauren Brinks, RD LDN

Pharmacist:

Katie Cook, PharmD, BCPPS

Social Worker:

Mary Beth Chapman, LCSW

Surgeons:

Rodney Steiner, MD
Jessica Roybal, MD
Vincent Adolf, MD

Advanced endoscopist:

Matthew Giefer, MD

Hepatologist:

Ryan Himes, MD

Palliative Care:

Michelle Jones, MD

Radiologist:

Chris Arcement, MD

Pathologist:

Zachary Dureau, MD

Data/Research Support:

Daniel Radus

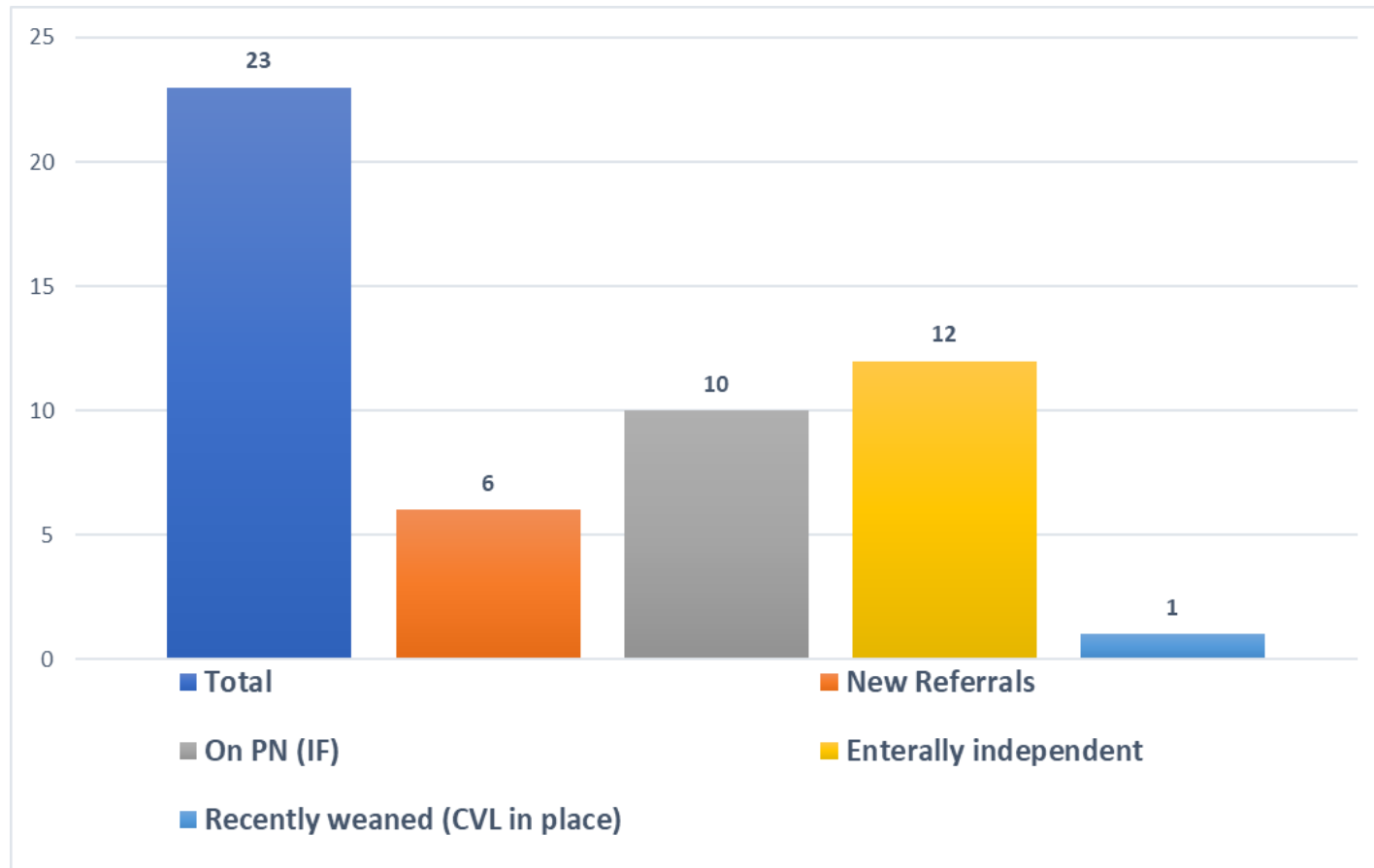
Our Mission

- To be a regional and national referral centers that provides comprehensive, safe, state-of-the-art care to improve the survival and quality of life and minimize complications in patients with IF
-

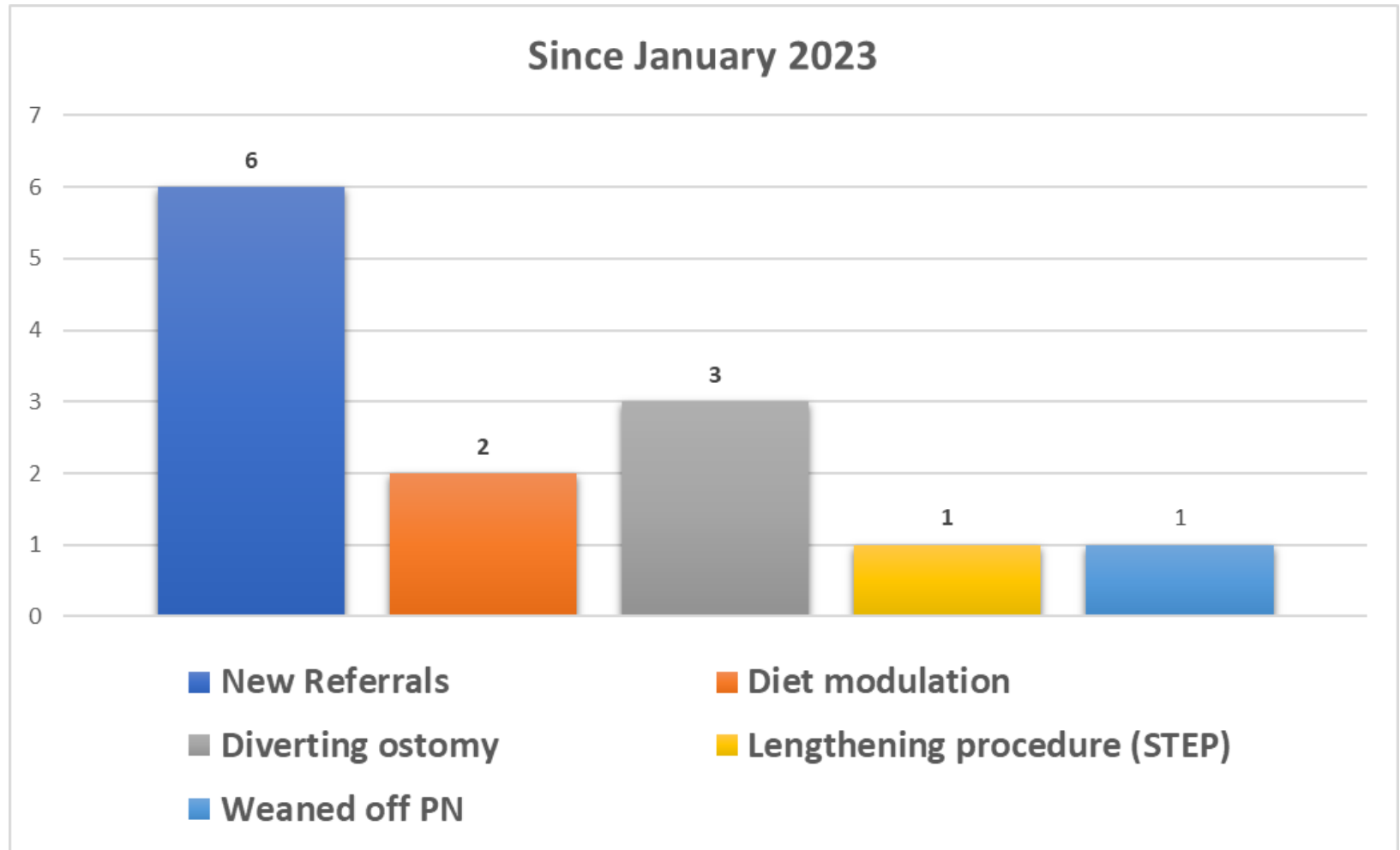
Our Goal

- To promote intestinal adaptation and enteral autonomy while decreasing the morbidity and mortality of IF
-

Patient Distribution – July 2023



New Referrals



Nutritional Surveillance

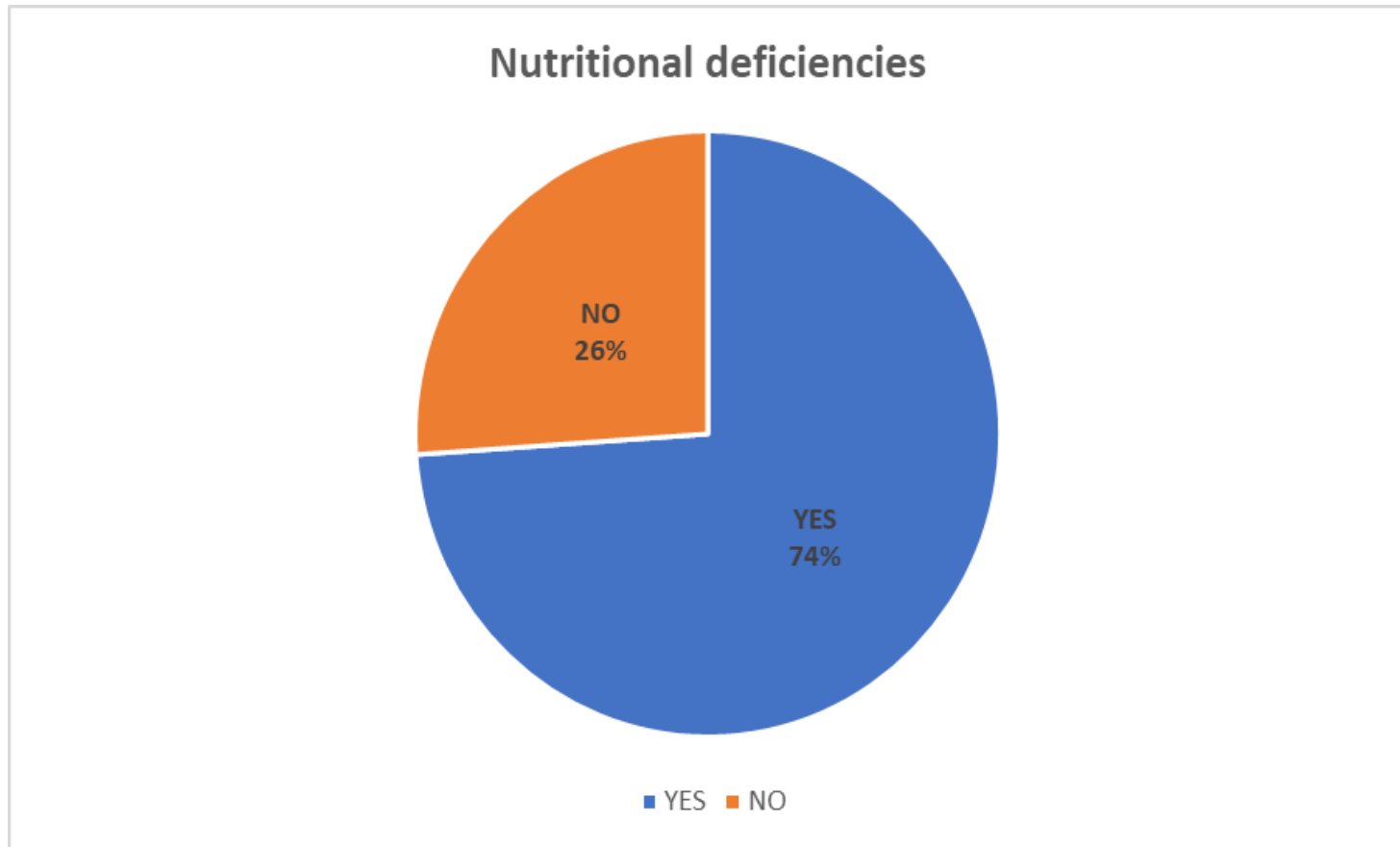
- Implemented per national recommendations in January 2023

Table 2

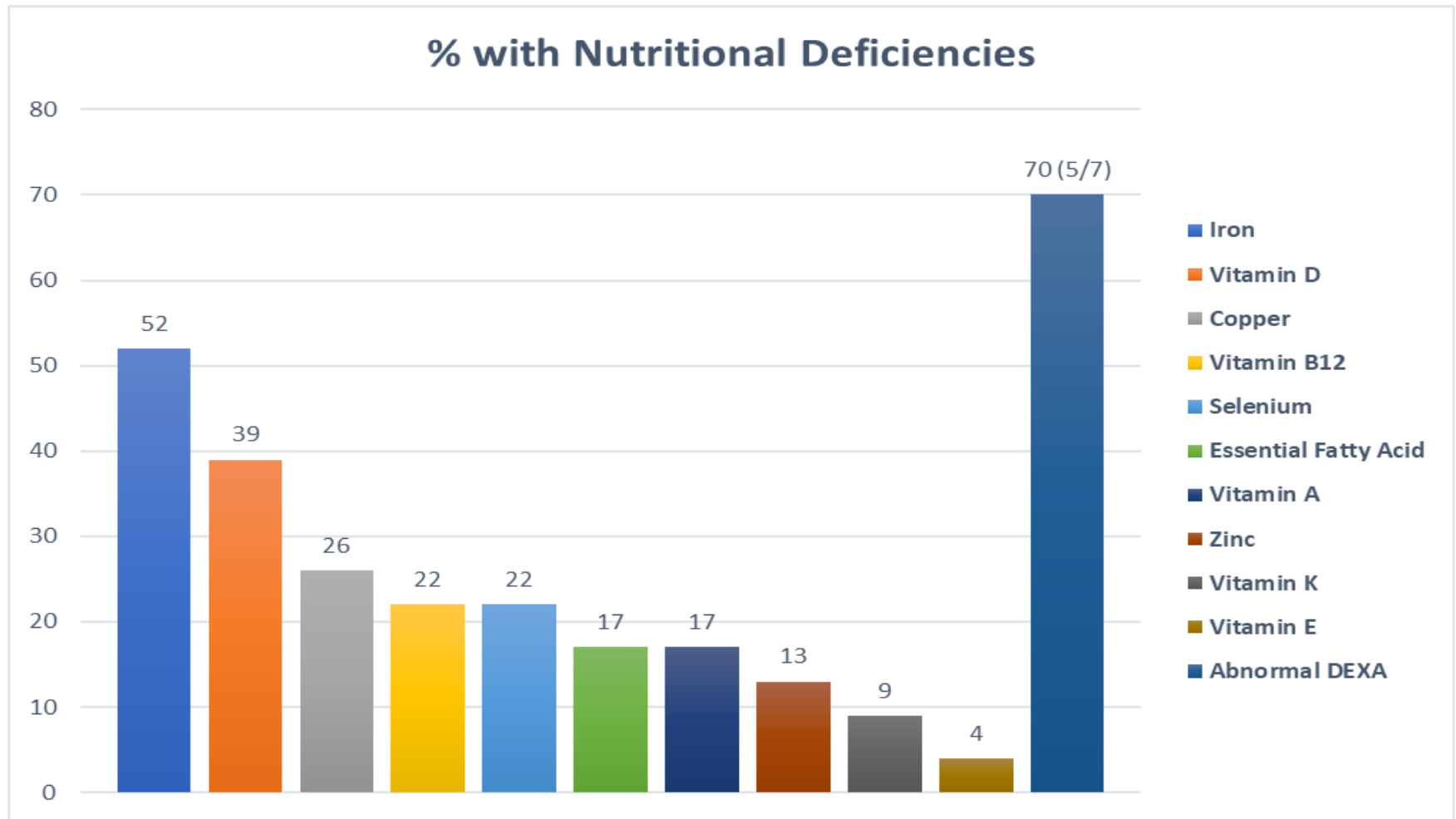
Recommended laboratory monitoring for pediatric patients with intestinal failure.

Labs	Frequency	Indication
Urine electrolytes	monthly	Dehydration, poor weight/length gain
Thyroid screening, Urine Iodine	Q3 months if patient has one or more of the indications listed	(1) (50% of caloric requirements from enteral for) 6 months (2) Poor growth (3) Feeding intolerance
25(OH)Vitamin D	Q3-6 months	All patients
RBC Folate	Q6 months	Evidence of anemia with Macrocytosis
Iron studies (Fe/TIBC/Ferritin)	Q1-3 months	Evidence of anemia with microcytosis, patient on enteral or parenteral iron
Ceruloplasmin/Copper	Q3-6 months	Cholestasis/persistent anemia
Zinc	Q3-6 months	Chronic diarrhea/high ostomy output
Vitamins A, E, PT/INR	Q 6 months	Cholestasis
Chromium	If indicated	Difficult glycemic control
Fatty acid profile	If indicated	Total fat intake < 0.5 g/kg for > 5 days
D-lactate	If indicated	Encephalopathy or Anion-gap metabolic acidosis
Manganese	If indicated	Cholestasis
Methylmalonic acid (Urine/Serum) and vitamin 12	If indicated, Q 12 months	Ileal resection, macrocytic anemia
Carnitine	If indicated, yearly	On exclusive TPN

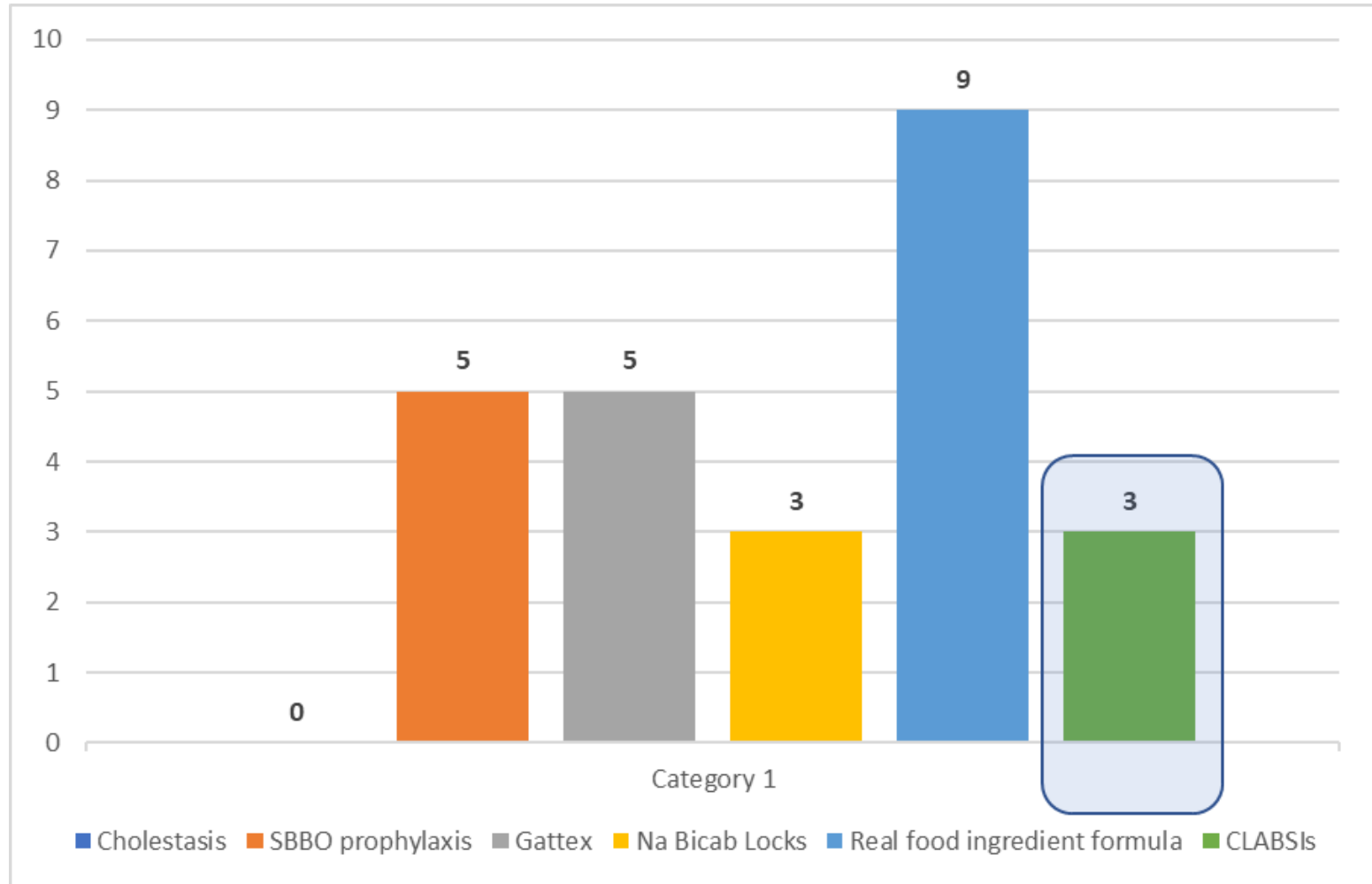
Nutritional Deficiencies



Distribution



Other interventions



Future directions

- Streamline outpatient PN ordering
 - Clinical protocols – Fever in patients with IF presenting to ED; inpatient CLABSI management etc.
 - Lock therapies- ethanol, Na bicarbonate, antibiotic
 - Lipid modulation protocols
 - International IF registry participation
-

Case presentations

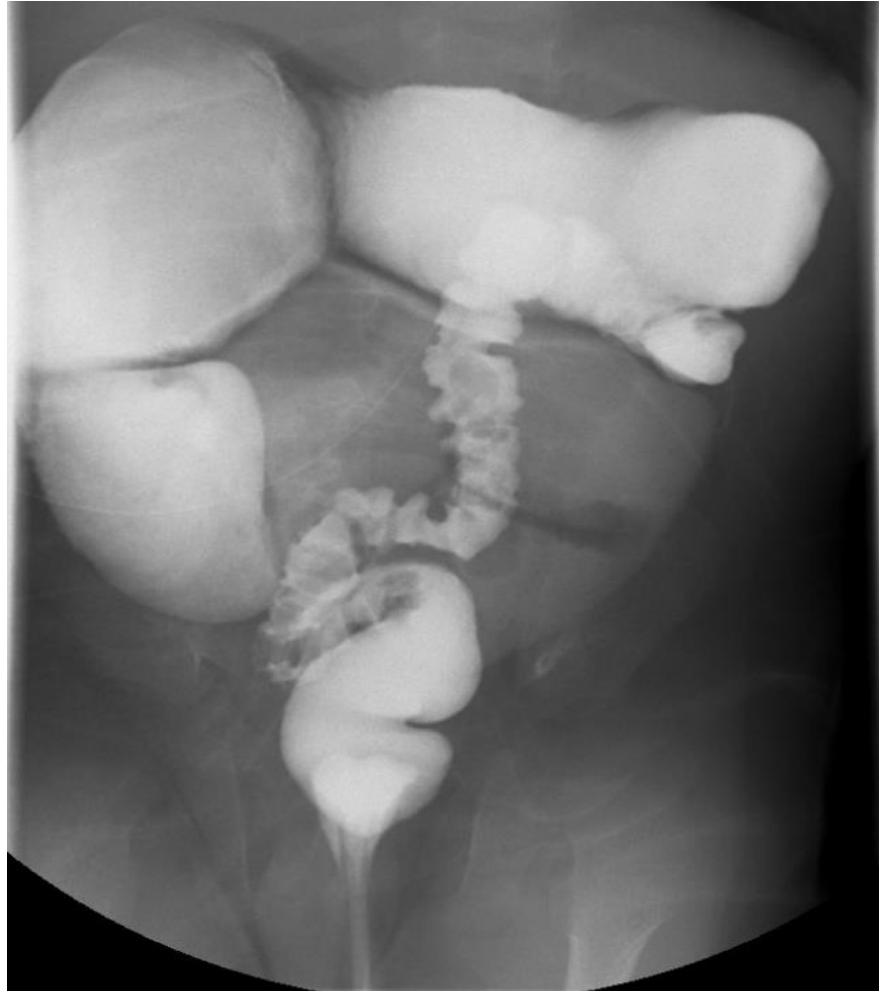
Case 1

- 4 month old transferred from a NICU in Tennessee
- Born at 36 weeks of gestation with gastroschisis with intestinal atresia, type 3 and a microcolon.
- After initial surgery was left with about 34 cm of proximal intestine, jejunostomy and a microcolon (not in continuity).
- High ostomy output, recurrent ostomy prolapse, some emesis
- Ostomy takedown 6 weeks later - since the reconnection, did not tolerate feeds and continued to vomit even on clamping of the G-tube. Distended at baseline. G-tube currently to gravity draining 20-25 mL/kilogram per day
- Fed via G-tube, boluses and later continuous
- Breast milk later an amino acid based formula
- On TPN via PICC
- Growth OK
- Recent studies show dilated proximal bowel loops but contrast passing through the anastomosis.

Intake

- 5 month old developmentally appropriate baby with abdominal distension
 - On full PN via PICC
 - G-tube in place draining to gravity, NPO
 - Appropriate growth
 - Fe deficiency, no other deficiencies
-

Contrast enema

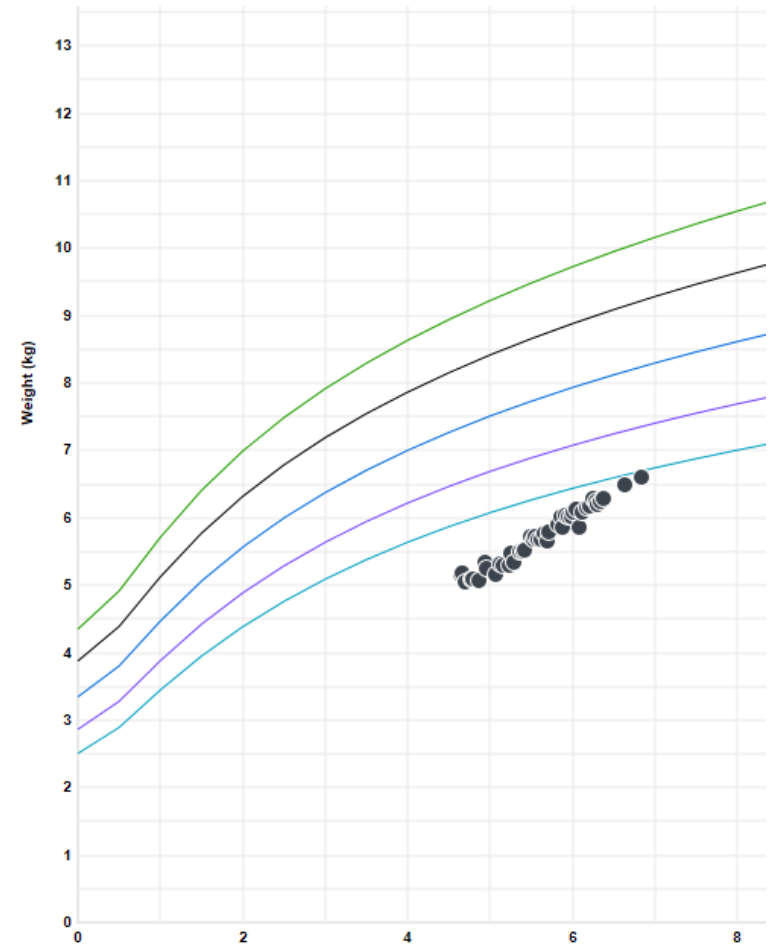


Surgical Plan

- Exploratory laparotomy, lysis of adhesions, serial transverse enteroplasty (STEP) procedure, jejunostomy creation.
 - Tunneled central line (Broviac) placement via left internal jugular vein under ultrasound and fluoroscopic guidance
 - Dilation of gastrostomy tube tract and gastrostomy tube change
 - Suction rectal biopsy (normal)
-

Today

- On feeds with AA based formula at 8 mL/hr via Gtube
- PO 10 mLs TID
- No abdominal distension, emesis or ostomy prolapse
- IV iron q4-6 weeks
- PN providing 85% of caloric needs
- Growing well
- No liver disease or CLABSIs
- At home with family



Future

- Ongoing intestinal rehabilitation and nutritional surveillance
 - Expect prolonged PN dependence
 - Explore functionality of colon when older
-

Case 2

- 2 year old former 32 week twin with intestinal failure related to short gut from NEC in 10/2020, left with ~51 cm of proximal small bowel from the LoT, no ICV and only a very short segment of residual rectosigmoid colon (in continuity).
- Intestinal rehabilitation complicated by feeding intolerance (vomiting, abdominal distention), dumping and frequent central line associated bloodstream infections (CLABSIs). As a result, is on essentially full TPN and trickle feeds.
- Significant abdominal distension requiring rectal tube decompression 4 times daily
- Has been evaluated at George town for a potential transplant; mom still prefers to go the Intestinal Rehabilitation route.
- GJ tube in place
- No liver disease

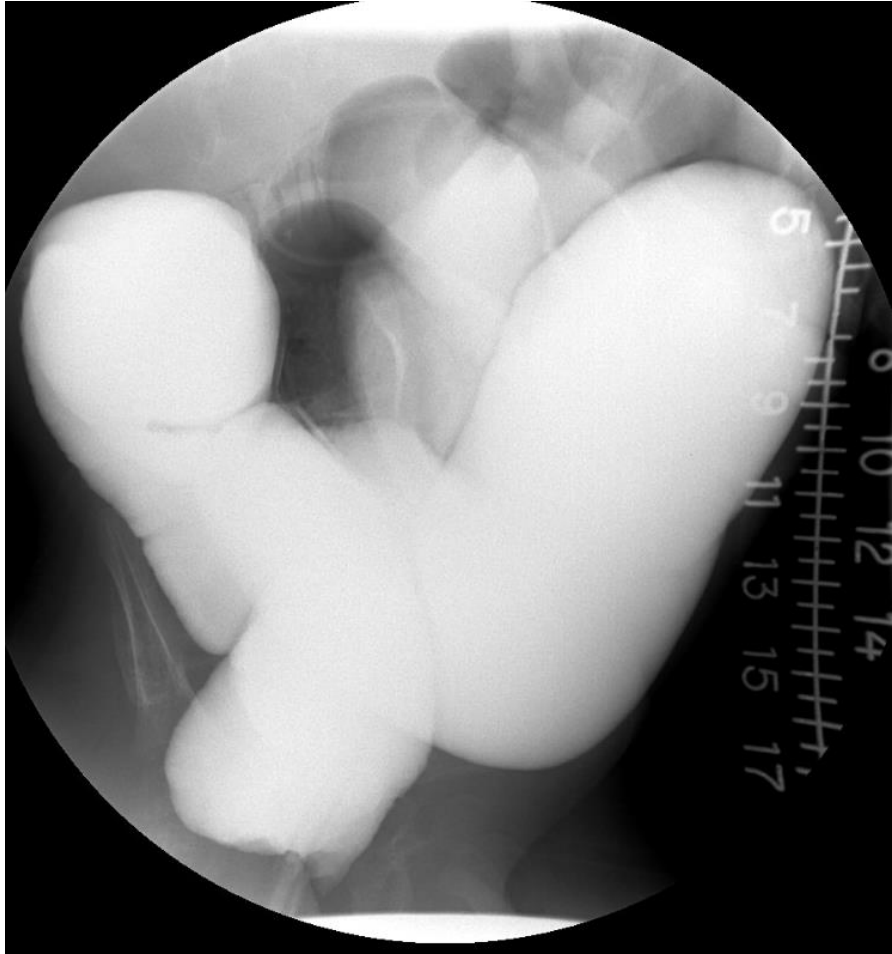
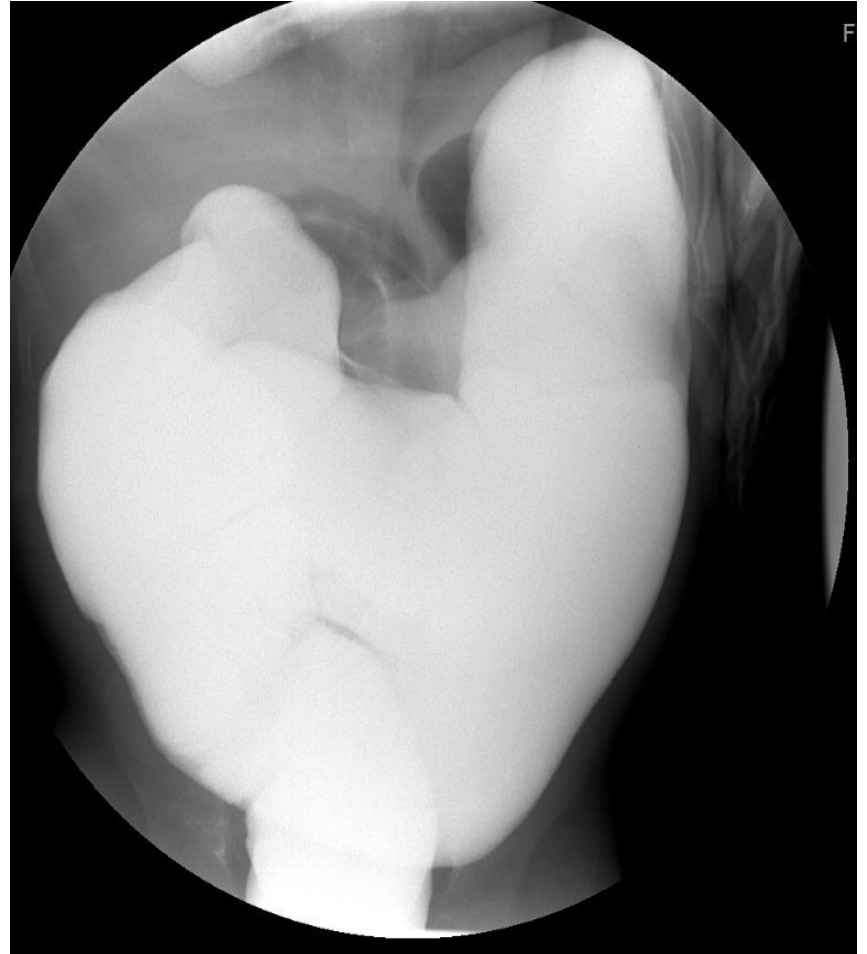
CLABSI history – almost monthly

- CLABSI history:
- 01/14/2023 coag neg staph epi (Vanc locks started)
- 12/07/22: Staph epi
- 09/09/22: Staph epi
- 08/19/22: Staph epi
- 06/12/22: E.coli
- 05/29/22: Candida
- 05/11/22: E.coli
- 02/11/22: Staph Epi
- 01/16/22: Candida
- 01/02/22: Staph epi
- 11/23/21 (Klebsiella), line removed and PICC placed (ethanol locks discontinued due to lack of efficacy and need for maximal PN duration)
- 11/7/21 (polymicrobial), line replaced at OLOL
- 9/13/21 (E. Coli); line replaced at OLOL--ethanol locks initiated
- 8/12/21 (C. Lusitaniae); line replaced at OLOL Children's
- 6/26/21-7/16 (E. Fecalis)

Intake

- Growth reasonable
 - Significant abdominal distension
 - Fe deficiency
 - TPN reviewed
-

Contrast enema



Surgical plan

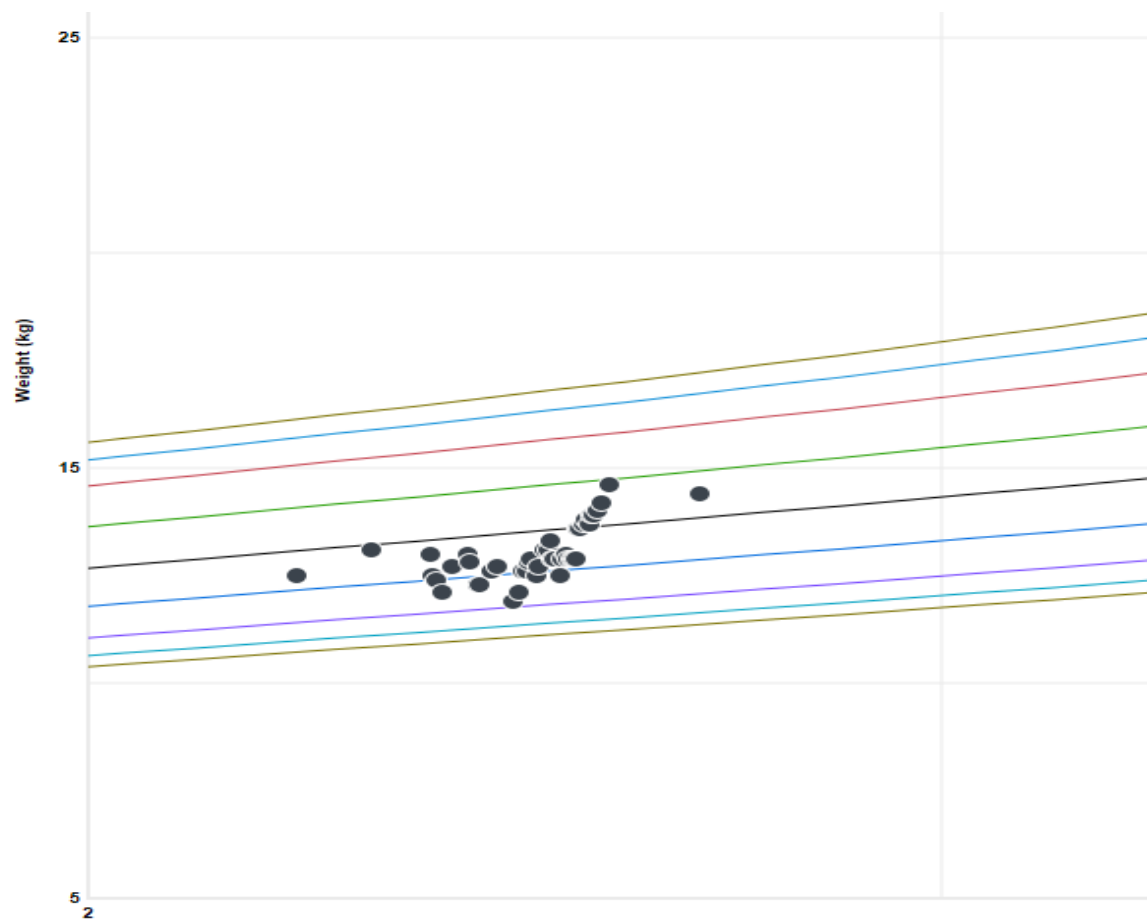
- Exploratory laparotomy, lysis of adhesions, serial transverse enteroplasty (STEP) procedure, ileostomy creation
 - Prolonged post of hospital stay – CLABSI, Gtube leakage, high ostomy output
-

While inhouse

- Abdominal distension resolved – much happier child!!
 - No liver disease
 - Feeds started initially via GJ
 - Switched to Gtube – leakage resolved
 - D/C home in 5/2023 on 6 mL/hr with an amino acid based formula
-

Follow up

- Resumed Gattex
 - 1 CLABSI – multi-organism in June 2023
 - Started on SBBO prophylaxis
 - On Na bicarbonate locks
 - On 8 mL/hr and allowed PO foods
 - Stable electrolytes, growing well (maybe too well)
-



Future

- Expect prolonged PN dependance
 - CLABSIs can complicate picture
 - Might need to revisit intestinal transplant
-

Case 3

- 17 y/o girl with a history of necrotizing enterocolitis leading to short-gut syndrome - at primary surgery, was left with 27 cm of likely proximal small bowel anastomosed to most of her colon.
- STEP at 18 months of age (reported length was now 78 cm)
- PN dependent for the most part of her life - taken off of PN in 2021 December, lost weight, placed back on PN, 3 days a week 12/2022.
- She has been followed at Duke, NC, visited Mount Sinai NY, Nebraska, Pittsburgh
- H/O anastomotic ulcers causing hemodynamically significant bleeds, renal disease
- On Gattex since November of 2021, 3 cycling antibiotics, for small intestinal bacterial overgrowth versus prevention of D lactic acidosis. She has never had any D lactic acidosis episodes.
- On a real food ingredient formula, 4-5 loose stools daily

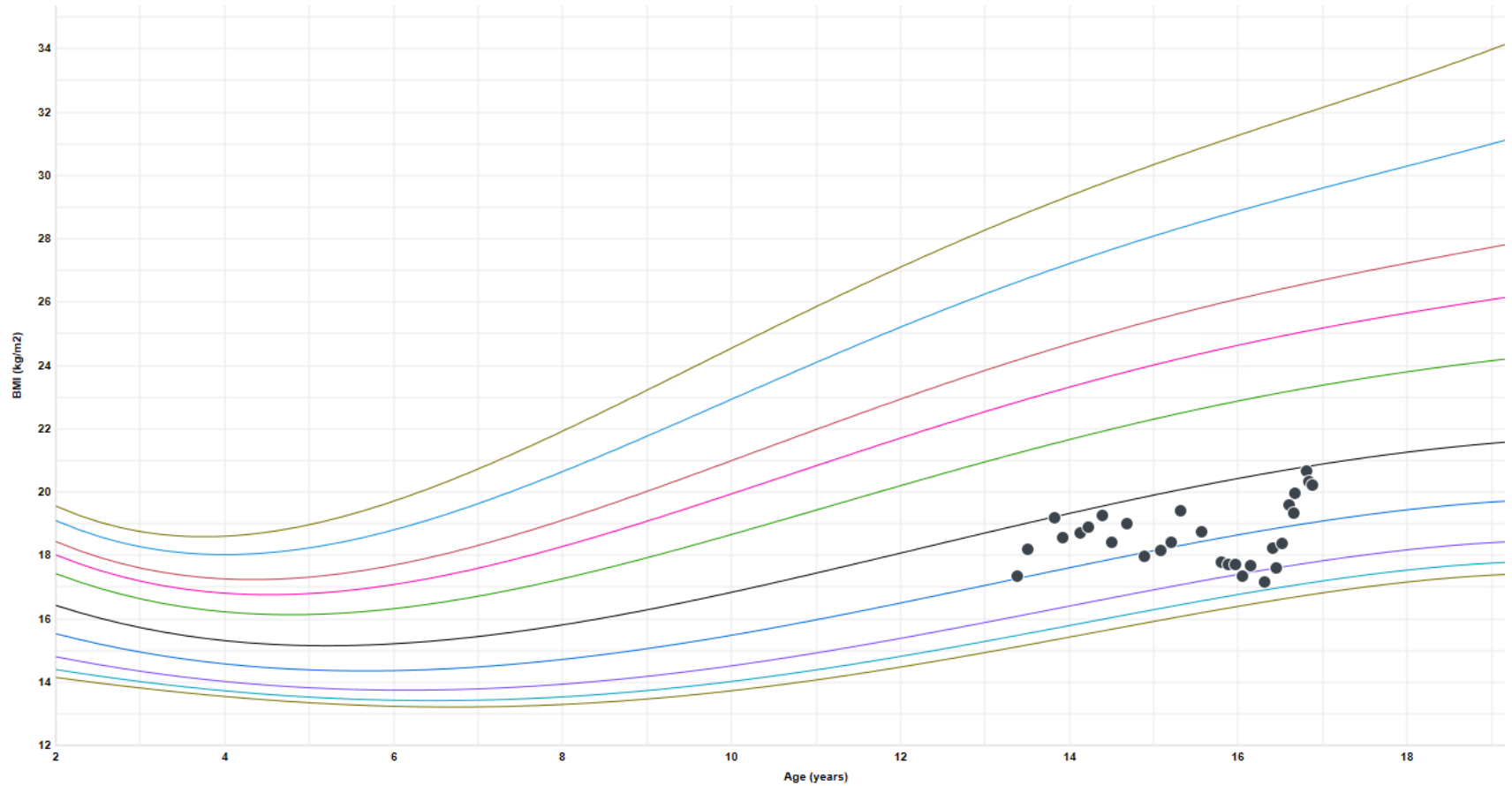
Intake

- Vitamin B12 deficient – monthly IM injections
 - Copper, Zinc deficient, Vit D – supplementation started/adjusted
 - DEXA scan – low bone mineral density
 - Changed formula to real food ingredient peptide – stooling better
 - Added Duocal for additional calories
 - Started cyproheptadine for better tolerance, appetite stimulation
 - Continued Gattex, cycling antibiotics

 - Decreased PN cals/volume by approx. 5% every week with weight gain/stable weight

 - Stopped PN completely 6 weeks ago – weight stable at 4 week IR visit
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Growth



Future

- Watch growth for 8-12 weeks
 - If reasonable – remove CVL
 - Might need IV bisphosphonates for low bone mineral density
 - Ongoing intestinal care and nutritional surveillance
-

Case 4

- 10 y/o female with a history of small bowel/jejunal atresia repaired within first few days of life with small bowel resection a primary jejunoileal anastomosis with a preserved ileocecal valve and colon.
- Remnant small intestine at the time of surgery was approximately 23 cm.
- She has a gtube/fundo.
- Off PN and CVL removed in 2018.
- H/O d-lactic acidosis for which ?? she was placed on Diabetisource.
- History of being treated for small intestinal bacterial overgrowth back in 2019

Intake

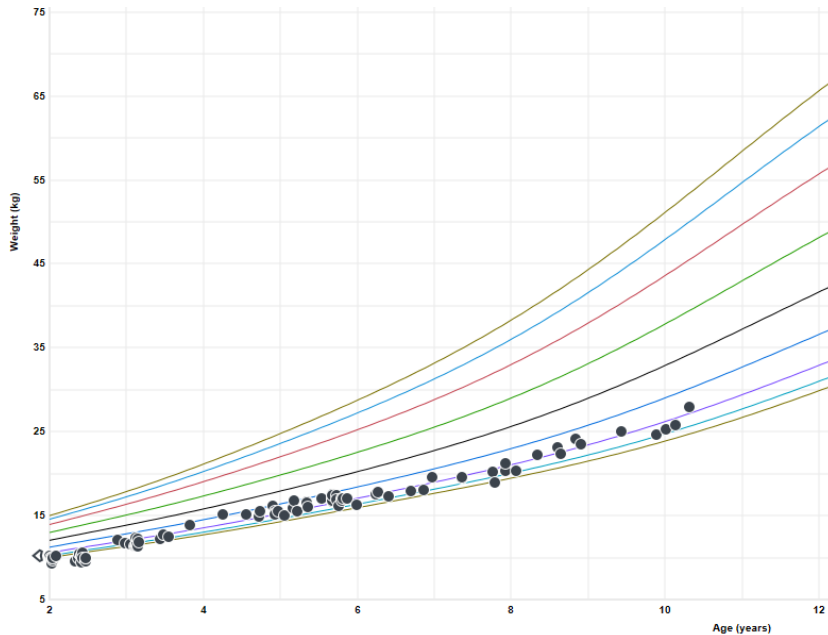
- Growth reasonable
 - Loose stools, 3-6 times daily
 - Bicarb was 16 x 2
 - Deficient in vitamin B12, K, copper, essential fatty acids, Vitamin D
 - DEXA is pending
 - Low TSH
-

Intake

- Growth reasonable
- Loose stools, 3-6 times daily – changed to real food ingredient formula
- Bicarb was 16 x 2 – added bicitra
- Deficient in vitamin B12, K, copper, Vitamin D – replacements added
- DEXA is pending
- Low TSH – repeat was normal, urine iodine normal
- Essential fatty acid deficiency – added 1 table spoon corn oil to regimen

Growth

- Once a short gut, always a short gut!



Future

- Essential fatty acid deficiency – may need IV lipids
 - F/U DEXA
 - Ongoing intestinal care and nutritional surveillance
-

In summary

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- Intestinal Rehabilitation (IR) is a multidisciplinary approach to promote intestinal adaptation and achieve enteral autonomy while minimizing complications
 - Patients not making progress towards enteral autonomy and continuing on PN >3 months and/or developing complications should be referred
 - Overall outcomes of IR programs are improving
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Summary

- Mission of an intestinal programs such as ours is to provide comprehensive, safe, state-of-the-art care to improve the survival and quality of life and minimize complications in children with IF
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Thank you

Questions?

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