Back to the Case....

Now infant is an older child/adolescent & despite best attempts needs supplemental PN

Are there any surgical options ?

SBS: Surgical Considerations

Sara A. Hennessy, MD, FACS

Associate Professor
Director of Surgical ICU
Director of Nutrition
Associate PD Minimally Invasive & Bariatric Surgery Fellowship
Department of Surgery
UT Southwestern Medical Center

Autologous Intestinal Reconstruction Surgery

Surgical procedures designed for children & adults with intestinal failure

Goals include:

Surgical lengthening of bowel to increase absorptive area &

Tapering or plicating dilated bowel to improve motility

Surgical intervention should be weighed on a case-by-case basis against the likelihood of eventually weaning the patient from PN using nonoperative therapies

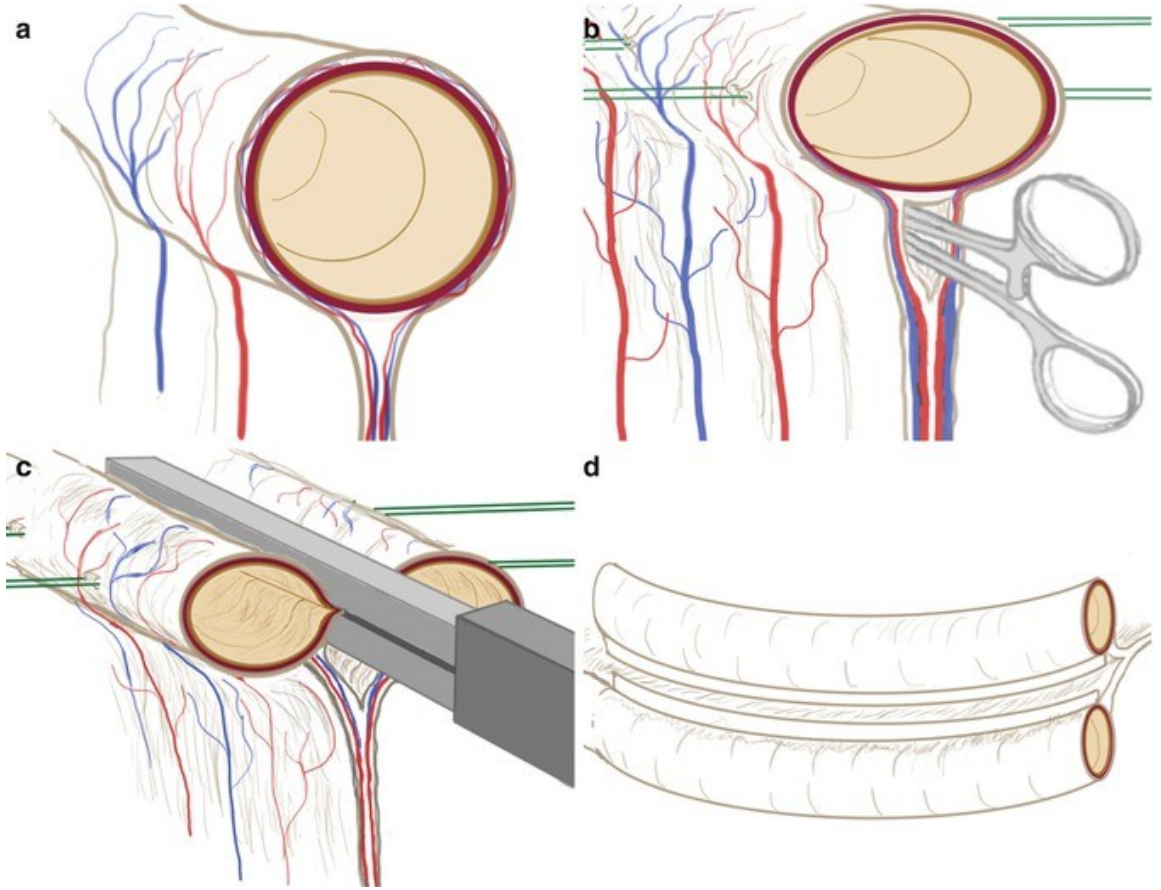
Ideally administered in the setting of an intestinal rehabilitation program and high-volume center

Indications for AIRS

- Dilated small intestine
- Failure to progress towards enteral autonomy using standard medical and nutritional strategies
  - Ideally administered in an intestinal rehabilitation program
  - Difficult to judge since progress towards enteral autonomy can be slow
- Absence of serious comorbidities that would preclude major surgery (advanced liver disease→ consider intestinal transplantation)
- Adequate bowel length anticipated after AIRS to achieve enteral autonomy.
- Absence of a preexisting gastrointestinal motility disorder.

Bianchi Procedure

- 1st surgical procedure to lengthen the intestine
- AKA longitudinal intestinal lengthening and tailoring (LILT)
- **Ideal candidate**: Children with significantly dilated small bowel who still have at least 40 cm of residual intestine.
- **Procedure**:
    1. Separate the 2 leaves of the mesenteric blood supply to the small bowel so there are 2 equal halves
    2. Longitudinal division of the small intestine into 2 segments
    3. Tubularize each segment and then anastomose end to end



cWessel, L.M., Khasanov, R. (2016). Longitudinal Intestinal Lengthening. In: Rintala, R., Pakarinen, M., Wester, T. (eds) Current Concepts of Intestinal Failure. Springer, Cham. https://doi.org/10.1007/978-3-319-42551-1_9

Bianchi: Key benefits and indications

Increases length and transit time:	Doubling of the length of the affected bowel segment.
	Increases the amount of surface area available for nutrient absorption
	Slows the movement of food, allowing more time for digestion.
Bowel diameter:	Reducing the diameter this improves bowel's motility
	Decreases the risk of bacterial overgrowth a common complication of dilated bowel.
Save bowel tissue:	Procedure preserves existing intestinal mucosa, which maximizes the potential for absorption.

Where is Bianchi now?

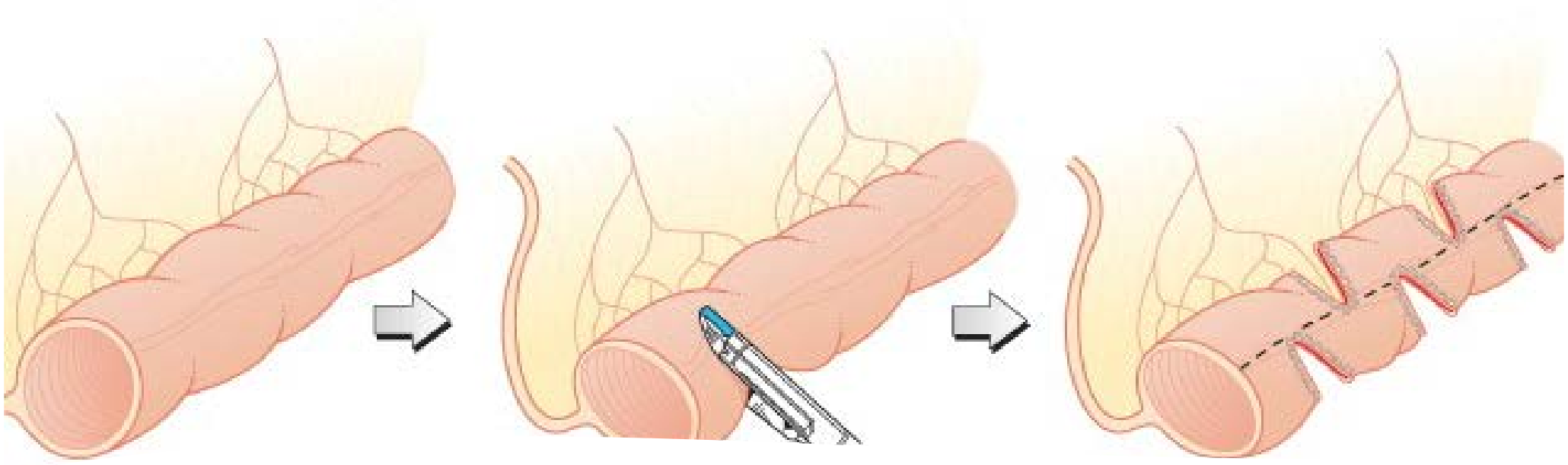
Good:

- Early results were promising
- Successful in improving absorption , achieving enteral autonomy & improving nutritional status

Bad:

- Technically challenging therefore favored less
  - Requires multiple anastomoses
- Complications: leak, bowel obstruction & potential to compromise intestinal blood flow leading to ischemia
- Cannot be performed on segments of intestine with variable dilatation

Declining use due to complexity and STEP procedure



STEP: Serial transverse enteroplasty procedure

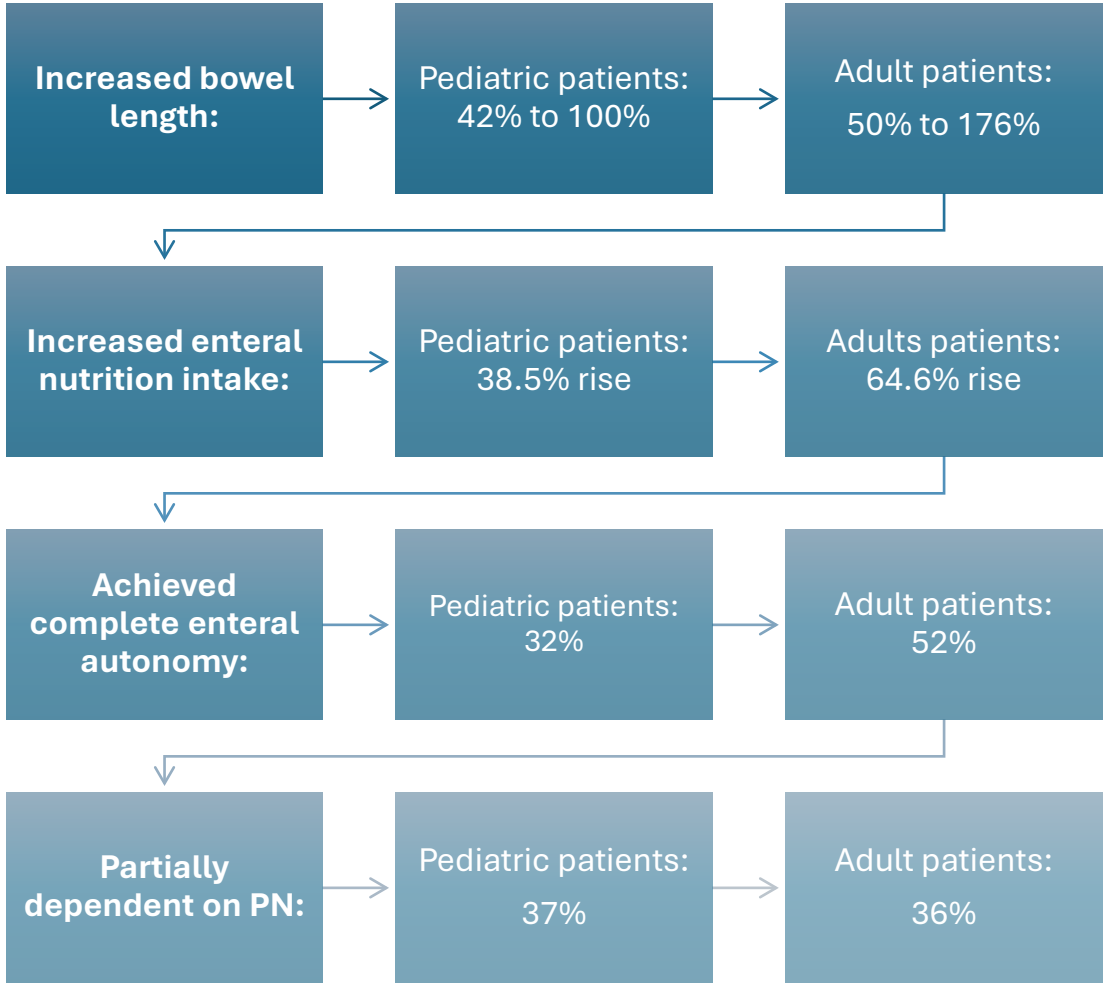
- Favored surgical procedure
  - Used to lengthen small intestine
  - Narrow a dilated segment of the small intestine
- Can be done after Bianchi procedure or more than once
- **Procedure**
  - Identify the section of the small intestine that is abnormally dilated (widened).
  - With a surgical stapler make a series of partial, alternating incisions along the length of the intestine
    - Cuts made perpendicular to the intestine's long axis
    - Direction is alternated in a zigzag pattern to stretch it out
  - Result is a longer, narrower, and zigzag-shaped intestinal tube

STEP Benefits & Complications

- No bowel anastomoses are created
- Can be performed on variable sized bowel
- **Outcomes**:
  - increases intestinal length
  - improves intestinal absorptive capacity
  - may decrease the risk of D-lactic acidosis due to small intestine bacterial
- No prospective comparison of medical versus surgical therapy for SBS has been performed.
  - Independent effect of the STEP itself on PN wean has not been established.
- **Complications**
  - Gastrointestinal bleeding
  - Stricture
  - Obstruction
  - Leak

Serial transverse enteroplasty (STEP) in case of short bowel syndrome: did we achieve our goal? A systematic review

Lauro A, Santoro A, Cirocchi R, Michelini M, Zorzetti N, Cianci MC, Bellini MI, Casadei C, Ripoli MC, Coletta R, Khouzam S, Marino IR, D'Andrea V, Morabito A. Serial transverse enteroplasty (STEP) in case of short bowel syndrome: did we achieve our goal? A systematic review. Updates Surg. 2022 Aug;74(4):1209-1223. doi: 10.1007/s13304-022-01316-3. Epub 2022 Jul 8. PMID: 35804224.



Population:

- 308 adult & pediatric short bowel syndrome patients
- Intestinal length for pediatrics 18 to 26 cm and adults from 30 to 70 cm

Predictive factors of achieving full enteral nutrition

- Longer pre-STEP bowel length
- Preservation of the ileocecal valve

Complications:

- Need for re-STEP in pediatric patients (17.22%)

Survival:

- ReSTEP: 17% in pediatric patients/ 0 in adults
- Mortality : 5% in pediatric patients/7% in adults
- intestinal transplantation: 6% in pediatric patients/0 in adults

Serial Transverse Enteroplasty (STEP) for Short Bowel Syndrome (SBS) in Children: A Multicenter Study on Long-term Outcomes

Dagorno C, Montalva L, Capito C, Lavrand F, Guinot A, De Napoli Cocci S, Gelas T, Dubois R, Dariel A, Dugelay E, Chardot C, Bonnard A. Serial Transverse Enteroplasty (STEP) for Short Bowel Syndrome (SBS) in Children: A Multicenter Study on Long-term Outcomes. J Pediatr Surg. 2025 Jan;60(1):161909. doi: 10.1016/j.jpedsurg.2024.161909. Epub 2024 Sep 26. PMID: 39368852.

Table 1
STEP - Characteristics of patients, surgery, and outcome.

	n = 36
Neonatal data	
Female	12
Birth weight (g)	2470 [2000; 2758]
Gestational age (weeks)	34.6 [33; 35.9]
Comorbidities (neurological, cardiac)	17
Before STEP	
Number of surgeries	3 [2;4]
PN before STEP	33
Length of bowel (cm)	40 [27; 48.5]
Anatomy	
Type I	2
Type II	20 (including 11 < 40 cm)
Type III	14 (including 7 < 40 cm)
First STEP (n=36)	
Age (months)	10.8 [4.5; 63.8]
Weight (kg)	9.7 [4.5; 18.4]
Length of bowel tapered STEP (cm)	20 [15; 32.5]
Number of staples	6 [3; 9]
Ileocecal valve preservation	14
Post-operative outcomes	
Complications (Clavien-Dindo ≥3):	9
- adhesive bowel obstruction	4
- anastomotic ulcerations/stenosis	2
- post-operative sepsis	1
- stoma necrosis	1
- strangulated inguinal hernia	1
Bowel-derived bloodstream infections	5
Length of stay (LOS) (days)	38 [19; 62]
Second STEP (n=11)	
Delay after first surgery (years)	3.7 [1.7; 5.3]
Age at surgery (years)	4.2 [2.8; 6.8]

Quantitative data is presented as median (interquartile range), qualitative data as number (percentage).

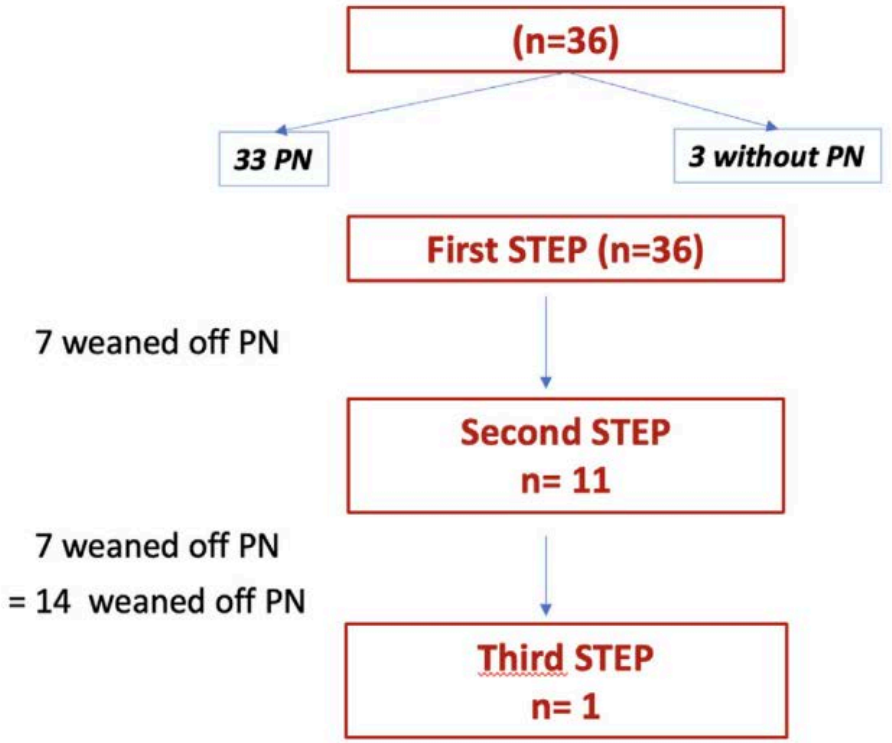


Fig. 1. Flow chart.

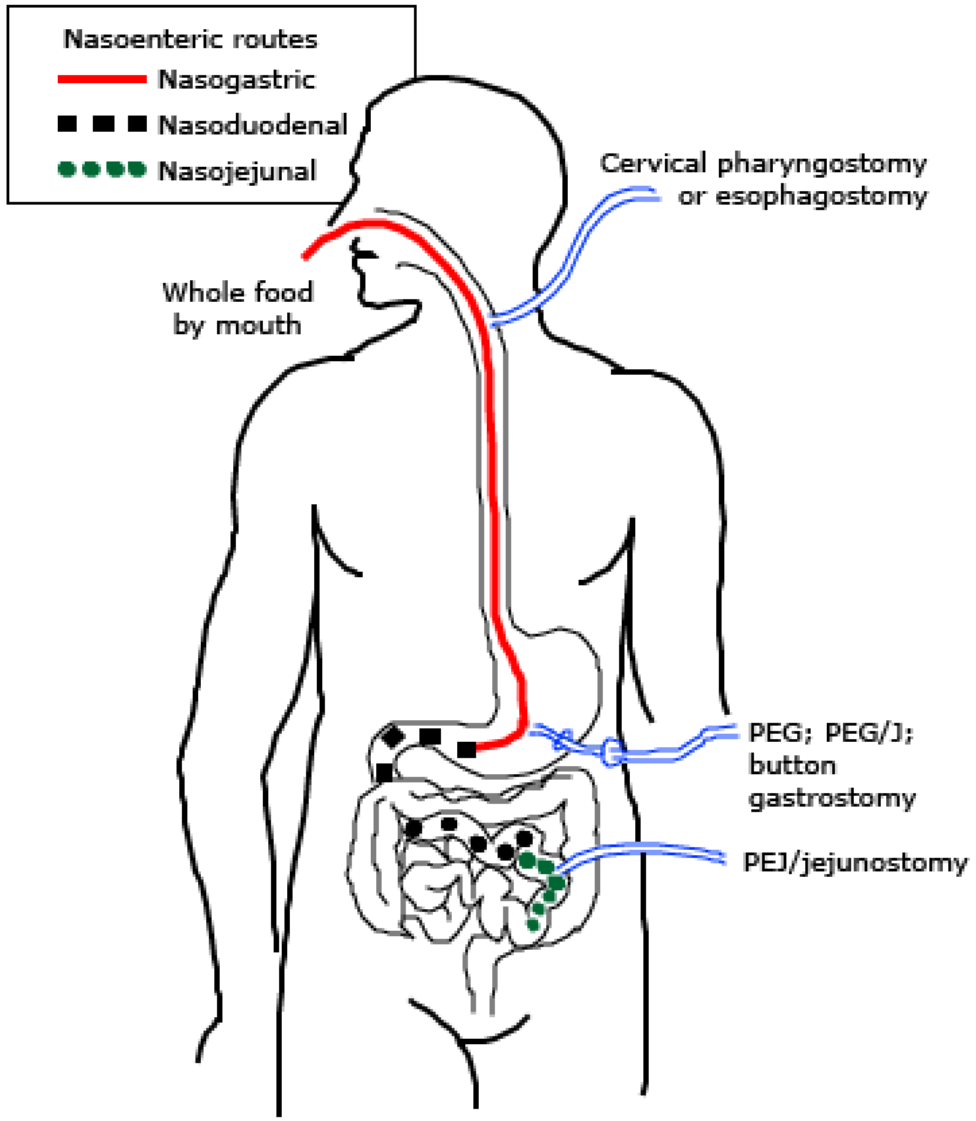
Enteral nutrition

Enteral feeds should be introduced as soon as the patient's condition stabilizes
Advance carefully but persistently
Presence of nutrients in the intestinal lumen is essential to promote intestinal adaptation
Enteral nutrition is most effective for adaptation when initiated early & even in small amounts
Absence of enteral feeding may induce atrophy of the mucosa

What about enteral access ?

Routes of enteral nutrition

- **Gastric feeding**
  - Short term – NG
  - Long term – PEG tube, G tube
- **Post pyloric feeding**
  - Short term – ND, NJ
  - Long term – GJ, J tube, PEJ tube
- **Timing**
  - Long term > 3 months
  - Short term = < 3 months * exception liver disease



Gastric vs Post-pyloric Feeding

Gastric Feeding

Advantages

- More physiologic
- Ease of placement
- Convenience – bolus or continuous

Disadvantages

- Delayed gastric emptying
- GERD and aspiration

Post-pyloric Feeding

Advantages

- Minimize aspiration risk
- Role in critically ill
- Role in pancreatitis

Disadvantages

- Difficult placement & ease of displacement
- Feeding intolerance

Other Considerations

- Anatomy, altered surgical anatomy
- GI disorders – gastroparesis, esophageal dysphagia with aspiration, diarrhea