UC DAVIS HEALTH | CHILDREN'S HOSPITAL

UC Davis Children's Hospital Short Bowel Syndrome Enteral Nutrition Guidelines

The following guidelines are intended for infants with short bowel syndrome (SBS) hospitalized in the neonatal intensive care unit (NICU) or Pediatric Gastroenterology ward team at UC Davis Children's Hospital. These guidelines are not prescriptive, and individualized decision making by the treatment team should be used to modify and apply these guidelines to each individual infant's unique clinical course.

Definition of Short Bowel Syndrome:

Short bowel syndrome is one potential etiology of intestinal failure in the pediatric population. Possible causes of short bowel syndrome include necrotizing enterocolitis, volvulus, gastroschisis, intestinal atresia, among other rarer genetic conditions. Intestinal failure refers to the inability of the remaining intestine to adequately absorb nutrients needed to sustain life. North American Society for Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN) recommends a definition of intestinal failure as the need for parenteral nutrition (PN) for >60 days due to intestinal disease, dysfunction, or resection. Their recommended definition of SBS is the need for PN for >60 days after intestinal resection or a bowel length of <25% of expected. Term infants have approximately 150-250cm small bowel *Ultimately, there is no single agreed upon length of small bowel that leads to the diagnosis of short bowel syndrome.* Instead, it is a clinical diagnosis based on an assessment of the portion and segments of bowel remaining after a resection, the need for PN support >60 days, and the presence of intestinal failure.

Goal of SBS nutritional support and Intestinal Adaptation:

The long-term goal for any infant or child with SBS is to slowly advance enteral nutrition and reduce parenteral nutrition to achieve enteral autonomy without the need for central venous access. The process of intestinal adaptation involves changes to the remaining bowel to improve absorption of fluid and nutrients. These changes include villous lengthening, increased crypt depth, increase enterocyte cells, alteration in the microbiota, and changes in intestinal hormone and cell signaling. Exposure of the bowel to intraluminal nutrients including proteins, short chain fatty acids, and carbohydrates stimulate intestinal adaptation. Several factors impact how quickly a child with SBS can achieve enteral autonomy including length of small bowel, presence of ileocecal valve, length of colon remaining, underlying etiology of short bowel syndrome, age at which intestinal insult/resection occurred, and other medical

comorbidities. Data from one pediatric study of children with small bowel demonstrated over 95% of children with >50cm small bowel achieved enteral autonomy by age 2, where <40% of children with <50cm small bowel remaining were able to achieve enteral autonomy. A multidisciplinary intestinal rehabilitation team approach in the inpatient and outpatient setting can optimize intestinal adaptation and improve outcomes for patients with SBS.

Goals of SBS enteral nutrition:

- Initiate trophic enteral feeds as early after surgical resection or re-anastomosis as possible when pediatric surgery team and NICU team feel patient is ready to do so (bowel sounds, ostomy functioning, no bilious ng output, no emesis)
- Breastmilk (BM) is the preferred enteral nutrition (free amino acids, long-chain fatty acids, immunoglobulins, and growth factors that may enhance intestinal adaptation)
- If maternal or donor BM not available or appropriate, then use an elemental amino acid based formula. (risk of allergic/eosinophilic disease, improved intestinal adaptation, mixture of long-chain triglycerides and medium-chain triglycerides to promote adaptation and improve absorption in setting of altered bile acid reabsorption)
- If direct bilirubin >2 consider Pregestimil formula alternative for higher percentage of fat from MCT, though defer to clinical judgement of physician and RD
- Continuous enteral NG or GT feeds are preferred to maximize functional capacity and bowel adaptation (saturate carrier transport proteins to enhance adaptation)
- 20kcal/oz breast milk or elemental formula is preferred particularly when initially advancing enteral feeds and tapering TPN to promote intestinal adaptation while avoiding large osmotic load that can cause increased stool output and poor absorption. Clinical judgement and discussion with RD needed to ensure optimal calorie, fat, and calcium/phosphorous intake with combination of enteral and parenteral nutrition.
- Small oral feeds at age-appropriate volumes to allow for suck and swallow skills and prevent oral aversion (speech therapy/RN help to assess readiness)

Algorithm for SBS Enteral Feeding:

- Begin 10ml/kg/day of BM or elemental formula 20kcal/oz over 24 hours continuously (GT/NG)
- Advance feeds by 10-20ml/kg/day as tolerated (stool or most distal ostomy output <30ml/kg/day, no perianal skin breakdown, no emesis, stable weight gain, adequate urine output)
- Do not advance more than once per 24 hours
- If infant demonstrates feeding intolerance (stool or most distal ostomy output >30ml/kg/day, emesis, poor weight gain, inadequate urine output), then reduce to previously tolerated volume and wait at least 48-72 hours prior to attempting to advance again if demonstrating tolerance to current feeding rate. Stool output should be quantified as percentage of mixed urine and stool diapers by RN flowsheet documentation.

- Offer oral feeds 3x per day (hold continuous feeds for 1 hour and offer that volume PO), can increase offered oral feeds to 5x per day if tolerating TID oral feeds for 1 week
- Advance feeds by 10-20ml/kg/day if SOP <30cc/kg/day, no perianal skin breakdown, no emesis, weight gain, adequate urine output (goal of 150-200cc/kg/day)
- Work with RD to ensure reciprocal reduction in PN fluid/calories with enteral feeding advancements. Concentration of enteral feeds to higher calorie formula or fortified BM can be considered on a case by case basis depending on feeding tolerance, length of bowel, and percentage of calories from PN vs enteral nutrition, and growth trends.
- Refeeding of ostomy output through distal mucus fistulas as guided by pediatric surgery team

Laboratory monitoring for children with SBS on PN:

- Urine Na in baby with high ostomy/stool output or poor weight gain (goal >20)
- At least weekly CMP, mag, phos, TG
- Essential fatty acid panel (30 days after initiating PN)
- Zinc, copper, selenium, ceruloplasmin with CRP 30 days after initiating PN (repeat 1-3 months depending on levels)
- INR if direct bilirubin >2 or 60-90 days on PN or prior to discharge
- Vit A/D/E and B12 60-90 days on PN or before discharge or within 2 weeks of tapering off PN

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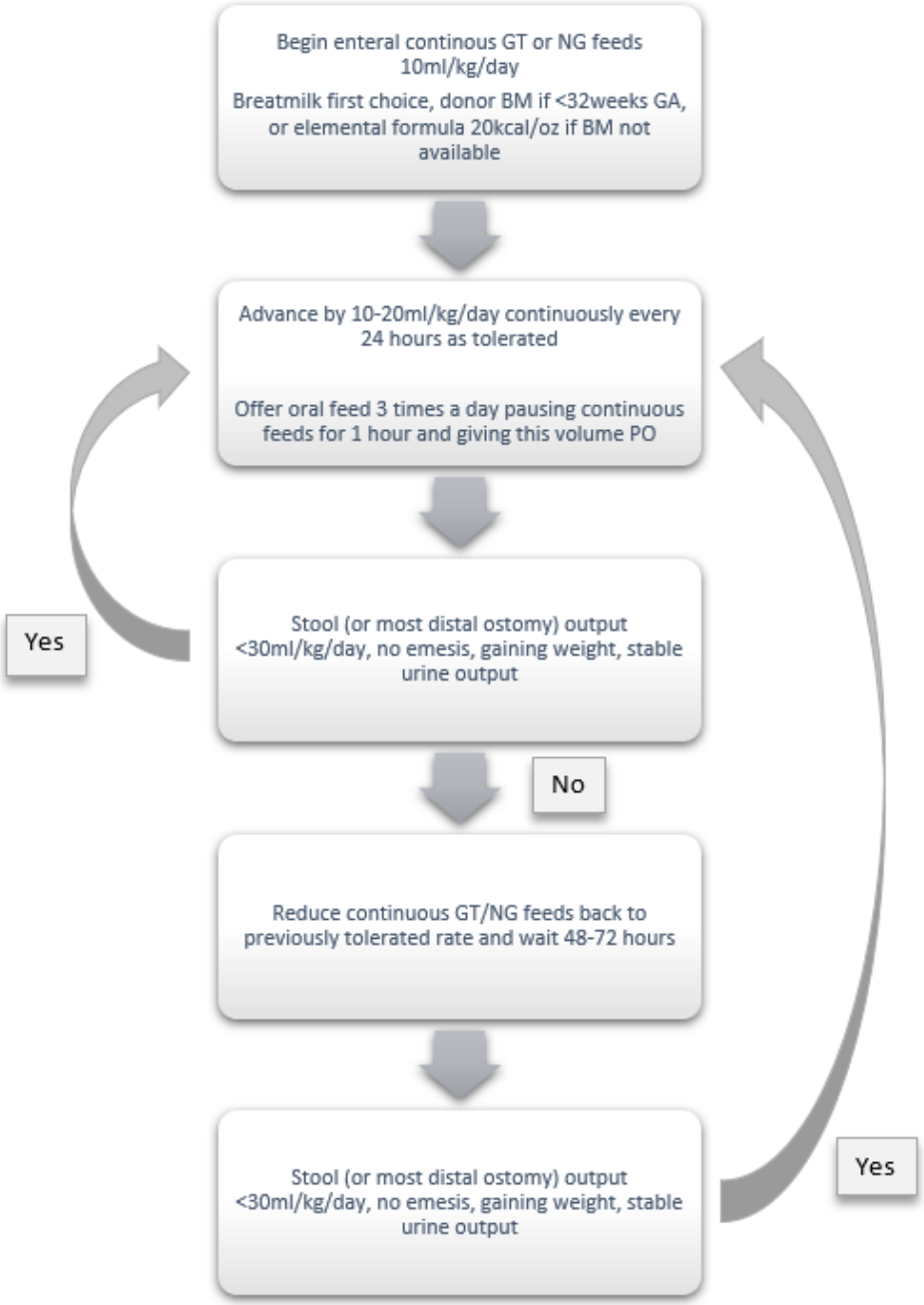
UC Davis Children's Hospital Algorithm for Short Bowel Syndrome Enteral Nutrition



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