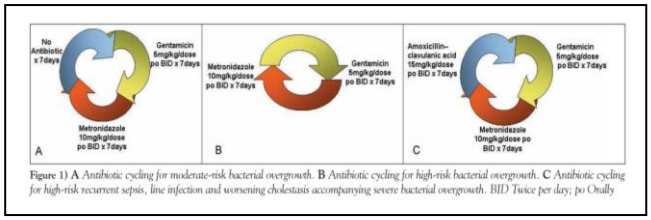
Pediatric Small Intestinal Bacterial Overgrowth (SIBO)

Definition	Presence of $>10^5$ non-pathologic bacteria per 1 mL of intestinal aspirate (e.g., gram-negative bacteria, strict anaerobes, and enterococci)
Pathophysiology	Bacteria migrating from the lumen of the large bowel to the small bowel
Risk factors	➢ **Hypochlorhydria (induced by H2-receptor antagonists or proton pump inhibitors)** ➢ **Intestinal dysmotility (causing stasis) – COMMON in CMC** ➢ Ostomies (potential for bacterial ingress) ➢ Immunodeficiency ➢ Major abdominal surgery ➢ Disorders of the intestinal mucosa (e.g., Celiac disease, IBD) ➢ Short-bowel syndrome ➢ Absence of ileocecal valve ➢ SES (more prevalent in children from low-income countries)
Clinical features	Nonspesific GI symptoms (e.g., **abdominal pain/irritability**, diarrhea, constipation, vomiting, abdominal distension, flatulence) ➢ Symptoms may be masked by manifestations of the underlying GI diseases ➢ Symptoms often recur after treatment
Complications	1. Malabsorption/malnutrition/vitamin deficiencies (B12, A, E, D & K) 2. Bacterial translocation → sepsis, spread to MLN and visceral organs 3. Growth failure/stunting
Diagnostic tests	**Diagnosis is largely clinical (requires a high index of suspicion) and requires exclusion of other GI conditions that present similarly** ➢ Blood work: ▪ Metabolic acidosis (due to production of D-lactate), increased serum folate, decreased serum vitamin B12 ▪ **NOT diagnostic/specific** ➢ Upper small intestinal direct aspirate culture: ▪ Via UGI endoscopy or NJT ▪ **NOT COMMONLY used** due to its limitations: Reflects only a single site of small intestine (compromised reproducibility), potential of contamination by oropharyngeal bacteria, less than 20% of the bacteria can be grown in lab, labour intensive and expensive, lack of standardization of diagnostic test protocol ➢ Hydrogen breath test: ▪ Lactulose and glucose are commonly used as substrates ▪ Hydrogen (+/- methane) in exhaled air is measured ▪ **NOT COMMONLY used** due to its limitations: Requires the presence of an active bacteria flora capable of metabolizing carbohydrate to hydrogen, does not account for metabolic consumption of hydrogen by the lumen, inaccurate when pediatric patients cannot breathe into the collecting devices, lack of cut-off values, specialized equipment and trained technicians required ➢ PCR-DGGE: ▪ Applied to different samples obtained noninvasively (e.g., fecal mass) or invasively (e.g., small intestinal aspirate & MLN) ▪ Promising investigation, but **NOT widely available** in clinical practice
Treatment	**General measures:** ➢ Low FODMAP (Fermentable Oligosaccharides, Disaccharides, Monosaccharides, and Polyols) diets ➢ Be cautious with PPI, H2-receptor blockers and antidiarrheals **Antibiotics:** **Oral antibiotics used (approximately seven to 10 days) to treat small intestinal bacterial overgrowth** Antibiotic — Dose Trimethoprim/sulfamethoxazole — 2–10 mg/kg/dose bid Metronidazole — 10 mg/kg/dose bid Broad-spectrum antibiotics Amoxicillin-clavulanic acid — 15 mg/kg/dose bid Rifaximin — 10–15 mg/kg/dose bid *Tetracycline — 10–15 mg/kg/dose tid Fluoroquinolones Ciprofloxacin — 10–20 mg/kg/dose bid Aminoglycoside antibiotics Gentamicin — 5 mg/kg/dose bid Neomycin — 2.5 mg/kg/dose qid *Recommended for children older than eight years of age. bid Twice per day; qid Four times per day; tid Three times per day. Data from reference 52  Figure 1) A Antibiotic cycling for moderate-risk bacterial overgrowth. B Antibiotic cycling for high-risk bacterial overgrowth. C Antibiotic cycling for high-risk recurrent sepsis, line infection and worsening cholestasis accompanying severe bacterial overgrowth. BID Twice per day; po Orally - Moderate risk: No radiological or clinical evidence of dysmotility - High risk: Radiological and/or clinical evidence of dysmotility ➢ If duodenal aspiration is possible, a tailored antibiotic regimen according to sensitivity is considered ➢ Number of cycles: Individualized **Probiotics:** May have a role in treating SIBO (often need to be combined with antibiotics)
References	BA Malik, YY Xie, E Wine, HQ Huynh. Diagnosis and pharmacological management of small intestinal bacterial overgrowth in children with intestinal failure. Can J Gastroenterol 2011;25(1):41-45.