Chapter

Management of Pediatric Constipation

Raashid Hamid and Shazada Shahid Banday

Abstract

Constipation is a common problem in children. It accounts for 20–30% of pediatric outdoor office. It is common in both rich and poor countries despite the belief that developing countries consume food rich in fiber. Normal bowel movement in breastfed babies may range from several times a day to once in every 10 days. Constipation can be both functional and pathological. Functional constipation has no underlying cause and is the most common type of constipation found in children. My main focus will be on this common type of constipation. In functional constipation routine, digital rectal examination is not recommended unless impaction is suspected. Abdominal radiography is recommended only in equivocal clinical examination or if impaction is suspected and examination not conclusive. Dietary and behavior modifications, toilet training, and parent education are important in the management of functional constipation. Initial management of functional constipation includes disimpaction of stools. Lactulose is safe in all age groups. Polyethylene glycol is more effective than lactulose but is costly. Maintenance therapy may take some time till constipation improves. Some rare situations such as refractory and slow transient constipation are also discussed in this chapter.

Keywords: functional constipation, laxatives, children

1. Introduction

Constipation in children is a common problem and accounts for up to 25% of pediatric clinical consultation [1]. The most common cause of constipation is functional (without any organic etiology or anatomical malformation), with an estimated prevalence of 3% worldwide. Infants on an average pass four stools per day in the first day of life, which gradually decreases to an average of 1.7 stools per day at 2 years of age and 1.2 stools per day at 4 years of age [2]. Evidence suggests that dietary, lifestyle, cognitive, emotional/behavioral, and broader psychosocial factors may all play a role in the etiology, maintenance, and clinically effective treatment of functional GI disorders. Constipated children have more outpatient and emergency department visits for abdominal pain, and their overall annual medical cost is approximately twice as much as that of children without constipation. Diagnosis of functional constipation requires a careful history and thorough physical examination. Management includes initial disimpaction followed by maintenance therapy with dietary modification, toilet training, and oral laxative. Laxatives may be needed for several months and sometimes years [3]. Noncompliance to laxative is the commonest cause of recurrence. Refractory constipation is defined as nonresponse to optimal treatment for at least 3 months. This form of constipation may be diagnosed by colon transit time (CTT)

study, which can be done by radio-opaque markers and by radionuclide scintigraphy. Antegrade continence enema is an option in patients with optimal CTT. Children with constipation having warning signs need further evaluation in the form of anorectal manometry barium/contrast enema and sometimes rectal biopsy. Absence of ganglion cells on rectal biopsy suggests Hirschsprung's disease requiring surgical treatment [4].

2. Definition of constipation

Functional constipation is defined as presence of two or more of the following ROME III criteria in the absence of any organic etiology, and the duration of constipation should at least be 1 month in children <4 years of age, and at least once per week for at least 2 months in children ≥4 years of age [5] (**Table 1**).

Child with age < 4 years	Child with age ≥ 4 years
• ≤2 defecations/week	• ≤2 defecations in the toilet per week
• One episode of incontinence per week after	• One episode of fecal incontinence per week
• Excessive stool retention	• Retentive posturing or excessive volitional stool retention
• Painful or hard bowel movements	• Painful or hard bowel movements
• Presence of a large fecal mass in the rectum	• Large fecal mass in the rectum
• Large-diameter stools that may obstruct the toilet	• Large-diameter stools that may obstruct the toilet

Table 1.
Diagnostic criteria for functional constipation in children.

3. Etiology and pathogenesis of constipation

Disruption of the normal physiology leads to constipation. Constipation may result from impaired propulsion of stools, sensation of rectum, and rectal outlet obstruction [6]. Disruption of the normal physiology leads to constipation. Constipation may, result from impaired propulsion of stools, sensation of rectum, rectal outlet obstruction. Conditions that lead to impaired propulsion are metabolic abnormalities such as hypo/hypercalcemia, hypothyroidism, cystic fibrosis, celiac disease, and genetic predisposition. Use of narcotics, psychotropics, and anticholinergic defective/impaired sensation may occur in spinal cord abnormalities or secondary sensory impairment due to megarectum from chronic fecal retention. Other anatomical and pathological causes of constipation include Hirschsprung's disease, imperforate anus, pelvic or sacral mass, anal or colonic stricture, anteriorly displaced anus or Functional as in intentional fecal retention, and pelvic floor dyssynergia.

Breastfed infants produce more frequent and larger stools than those fed standard infant formula until food is introduced at 5 months of age. Bowel movement frequency decreases with age. Stool production occurs more often in the first month of life and may be attributed to immaturity of the gastrointestinal tract. The passage of hard stool are perceived as painful leading to stool withholding, as the child becomes afraid to defecate. Furthermore, withholding creates a cycle of more pain on defecating (**Figure 1**). Signs of withholding behavior include arching the back, stiffening the legs, and unusual postures/crossing of legs in older children [7]. Parents may misinterpret withholding as straining or an attempt to defecate.

It can be challenging for some parents to toilet train their children. Research supports that stool toileting refusal occurs in 1 of every 5 children. This leads to stool withholding behavior and incontinence [8]. Functional constipation is at

times associated with autism and attention-deficit hyperactivity disorder (ADHD). However, the literature indicates that the rate of constipation does not differ significantly between children with or without ADHD [9]. Other causes diet changes such as the introduction of solids or cow's milk, illness, and change in routine. In some situations, children defer the defecation by playing, operating computers, watching

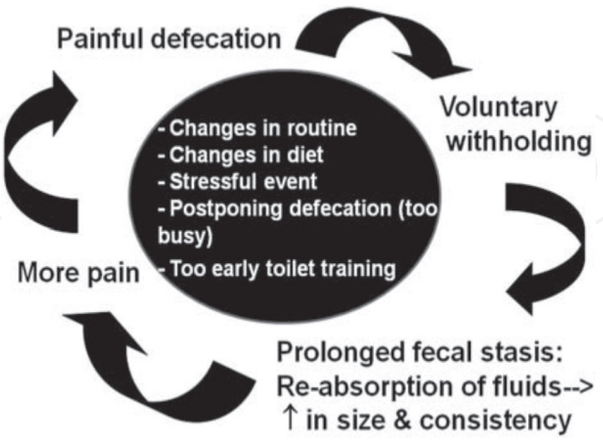

Figure 1.
Viscous circle of constipation and pain. Painful defecation leads to voluntary withholding behavior and prolonged fecal stasis (stools becomes harder and larger). Passage of hard stools leads to more pain due to fissures which further aggravates constipation.

a. Anal achalasia
b. Colonic inertia
c. Anatomic malformations
d. Imperforate anus
e. Anal stenosis
f. Celiac disease
g. HSD
h. Dietary protein allergy
i. Vitamin D intoxication
j. Cystic fibrosis
k. Pelvic mass (sacrococcygeal teratoma)
l. Spinal cord anomalies, trauma, tethered cord
m. Abnormal abdominal musculature (prune belly, gastroschisis, Down syndrome)
n. Hypothyroidism, hypercalcemia, hypokalemia
o. Diabetes mellitus
p. Opiates, anticholinergics
q. Pseudo-obstruction (visceral neuropathies, myopathies, mesenchymopathies)
r. Multiple endocrine neoplasia type 2B

Table 2.
Causes of constipation in infants/toddlers and children/adolescents.

television, and nonavailability/unhygienic conditions of the toilet rooms. Moreover some children remain in hurry and do not spend enough time completely emptying the rectum of stool. Common pathological causes of constipation in childhood include, Hirschsprung's disease, myopathy, congenital anomalies like anal stenosis, anteriorly located anus, spinal cord anomalies (meningomyelocele, myelomalacia, spina bifida), hypothyroidism, hypercalcemia, cerebral palsy, and mental retardation. Some drugs causing constipation include anticonvulsants, antipsychotic, codeine containing antidiarrheal [10] (**Table 2**).

4. Sequelae of constipation

Fecal retention contributes to dysfunctional voiding, vesicoureteral reflux, and urinary tract infections. Increased stool in the rectum can cause abnormal bladder pressure and function. Urinary tract infections and enuresis occur in 30% of constipated children [11]. Some patients with constipation present as abdominal pain, obstruction, loss of apetite, and poor school attendance.

5. Evaluation of constipation

A thorough history and examination is very essential part of complete evaluation of a child with constipation. Important information includes any history of delayed passage of meconium, duration of constipation, the frequency of bowel movements, the consistency and size of the stools, painful defecation, bleeding per rectum (blood present in the stool or the toilet paper), abdominal pain. Identification of alarm signs favors organic diseases, and these signs are given in **Table 3** [13].

The current evidence-based recommendations do not support digital examination of the anorectum, unless the diagnosis of functional constipation is uncertain, alarm signs are present, or there is intractable constipation. Abdominal radiograph is only recommended if fecal impaction is suspected clinically and physical examination is unreliable or not possible. Routine laboratory tests for hypothyroid, celiac disease, or hypercalcemia are not indicated, unless alarm symptoms are present [13] (**Table 4**).

Some children have a history of irregular bowel movements without clear history of constipation, and in these cases, colonic transit time (CTT) with radiopaque markers study can be useful. The history obtained may also be not as clear and in these patients, an evaluation can be helpful [14]. The CTT study provides objective evaluation of bowel movement.

Younger the infant (less than 6 months) more are the chances of an organic etiology for constipation. Hirschsprung's disease (HSD) must be suspected in infants with history delayed passage of meconium (more than 48 h after birth), constipation since birth, recurrent abdominal distention and enterocolitis. In infants, neonated HSD can present as enterocolitis, a potentially fatal complication that presents as fever, abdominal distension, and explosive, bloody diarrhea. Patients with suspected Hirschsprung's disease should be referred to a pediatric surgeon. On examination, the position (anteriorly displaced anus) and patency of the anus should be assessed. Spinal examination should be done for spina bifida and tethered cord [13, 15].

Further evaluation is indicated in older children with red flags or with intractable constipation despite strict adherence to therapy. Laboratory studies should

1. Distented abdomen
2. Absent lumbosacral curve
3. Pilonidal sinus/dimple covered by a tuft of hair
4. Midline pigmentary abnormalities of the lower spine
5. Sacral agenesis
6. Flat buttocks
7. Anteriorly displaced anus
8. Patulous anus
9. Tight, empty rectum in presence of palpable abdominal fecal mass
10. Gush of liquid stool and air from rectum on withdrawal of finger
11. Occult blood in stool
12. Absent anal wink
13. Absent cremasteric reflex
14. Decreased lower limb tone and/or strength
15. Absence or delay in relaxation phase of lower extremity deep tendon reflex
16. Failure to thrive

Table 3.
Alarm signs that favor organic diseases.

Condition	Diagnostic evaluation
Anatomic malformations of the colon and rectum	
Imperforate anus, anal or colonic stenosis, anteriorly displaced anus	Physical examination, barium enema
Spinal cord abnormalities	Spinal magnetic resonance imaging, anorectal manometry, urodynamics
Meningomyelocele, spinal cord tumor or trauma, tethered cord	
Metabolic conditions	
Hypothyroidism	Thyroid studies
Hypercalcemia, hyperkalemia	Serum calcium and potassium levels
Diabetes mellitus	Fasting glucose level
Diabetes insipidus	Serum and urine osmolarity
Neuropathic gastrointestinal disorders	
Hirschsprung's disease, internal anal sphincter achalasia	Anorectal manometry, rectal suction biopsy
Visceral myopathy/neuropathy	Colonic manometry
Drug use/toxin exposure	History, drug level
Opiates, phenobarbital, anticholinergics and attention-deficit/hyperactivity disorder drugs, antacids and sucralfate (Carafate), antidepressants, antihypertensives	Lead level
Lead toxicity	
Celiac disease	Sweat test
Cystic fibrosis	Cow's milk elimination
Cow's milk protein intolerance	Special testing
Connective tissue disorder, mitochondrial disorders	Psychological and psychiatric evaluation
Psychiatric disorders	
Functional constipation	History and physical examination; no testing

Table 4.
Differential diagnosis and evaluation of constipation in children.

be performed to exclude systemic diseases, such as hypothyroidism, celiac disease, or lead toxicity. Anorectal manometry can assess for sphincter abnormalities, such as Hirschsprung's disease or a nonrelaxing internal anal sphincter (IAS). Magnetic resonance imaging is uses to evaluate for a tethered cord, spinal cord tumor, or sacral agenesis [16, 17].

6. Treatment

6.1 Education and behavior modification/dietary changes

It is important to explain that overflow of stools leads to fecal pseudo-incontinence and is not an voluntary defiance. Regular toileting (for 5–10 min) after meals combined with a reward system is often helpful. Parents should expect gradual improvement with occasional relapses and encourage to maintain a positive and supportive attitude throughout the treatment. Although behavior modification may help in occasional cases, intensive behavior therapy does not seem to add to treatment success. Studies have shown that children with constipation have a lower fiber intake than other children. Too early and vigorous toilet training may be detrimental for the child. The child is encouraged to sit on the toilet for 5–10 min, 3–4 times a day immediately after major meals for initial months [11].

Dietary changes are often advised in children with constipation. Some authors suggest that increased intake of fluids and carbohydrates (e.g., sorbitol in prune, pear, and apple juice) can help soften stools, particularly in infants. A well-balanced diet that includes whole grains, fruits, and vegetables is recommended for children with constipation [12]. Guidelines do not support the following therapies for the treatment of childhood functional constipation: fiber supplements, extra fluid intake, routine use of pre- or probiotics, or alternative treatments such as acupuncture or chiropractic therapy. Child with cow's milk intolerance may respond to a trial of a cow's milk-free diet, especially in young children with anal fissures [13].

6.2 Management of children with functional constipation

6.2.1 Initial treatment with disimpaction

Fecal impaction is diagnosed on per abdomen examination, digital rectal examination, or excessive stool in the colon identified by abdominal radiography. Disimpaction can either be performed by oral or rectal routes; studies have shown no significant differences between the two routes. Evidence shows that PEG and enemas are equally effective for fecal disimpaction. Polyethylene glycol is ideal for oral disimpaction at a dose of 1.5 g/kg/day for 3–6 days; maximum dose 100 g/day. Rectal disimpaction has also been effectively performed with glycerin suppositories in infants and bisacodyl suppositories in older children. Use of soap suds, tap water, and magnesium enemas is not recommended because of their potential toxicity [17].

6.2.2 Follow-up maintenance therapy

Lactulose is considered to be safe for all ages. Evidence shows that PEG is more effective compared with lactulose, milk of magnesia, mineral oil, or placebo.

Lactulose is recommended in case PEG is not available (JPGN). Some authors suggest medical therapy should be continued for at least the time since a child had constipation. Regular follow-up (by reviewing stool records and repeating abdominal

and (if required) rectal examination) is a key to the success of functional constipation. As mentioned above, dosage adjustment may be needed. Once a regular bowel habit is established, the laxative dosage is to be decreased gradually before stopping [18]. Parents should maintain a daily record (stool diary) of bowel movements, fecal soiling, pain or discomfort, consistency of stool, and the laxative dose. This helps in modification of dosage of laxatives (**Table 5**). About 50% will recover, and will be without laxatives after 6–12 months. Approximately, an additional 10% is well while taking laxatives, and 40% will still be symptomatic despite the use of laxatives. Children with early age of presentation (<4 years), associated with fecal incontinence, and history of longer duration of symptoms (>6 months) have poor outcome [3].

6.2.3 Refractory constipation

Refractory constipation is defined when there is no response to optimal conventional treatment for at least 3 months. The refractory constipation has a prevalence of 20–30%, but the prevalence is much higher in underdeveloped countries like India [19]. While managing a case of refractory constipation common organic causes (Hirschsprung disease, hypothyroidism, celiac disease, hypercalcemia, spinal cord abnormalities) should be ruled out first. Motility studies like colon transit time (CTT), anorectal manometry with balloon expulsion test, and colonic manometry should be performed to rule out organic causes before labelling constipation as refractory [20].

6.2.4 Slow transient constipation

In radiographic CTT study, after oral administration of radio-opaque markers, radiograph of abdomen is taken sequentially on the fourth and seventh day; X-ray markers are counted in right colon; and if retention of contrast occurs after 62 h, it is called as slow transient constipation. Clinical features of slow transit constipation in these children include history of delayed passage of meconium, onset of symptoms early of symptoms early in first year and/or failure to toilet training, feces soft rather than rock hard, high fiber diets worsen the symptoms, and delay in colonic transit on transit study [21]. The management of slow transit constipation is challenging as they do not respond to conventional laxative therapy and the main concern is soiling. Fiber therapy is contraindicated. The only effective therapy for this subset of patients is antegrade continence enema. Malone antegrade continence enema (MACE) helps in refractory slow transit constipation cases [22]. Appendix is exteriorized as small

Drugs	Dose	Side effects
Lactulose	1–2 g/kg, 1–2 doses	Bloating, abdominal cramps
Milk of magnesia	1–3 mL/kg/day, 1–2 doses	Hypocalcemia, hypermagnesemia, hypophosphatemia
PEG for disimpaction	25 mL/kg/h (R/T) or 1–1.5 g/kg	Nausea, bloating, cramps, vomiting
PEG for maintenance	5–10 mL/kg/day or 0.4–0.8 g/kg/	Nausea, bloating, cramps, vomiting
Bisacodyl	0.5–1 suppository (10 mg) 1–3 tabs/dose	Abdominal pain, diarrhea, hypokalemia
Senna	2–6 years: 2.5–7.5 mL/day (8.8 mg/5 mL)	Melanosis coli, hepatitis, hypertrophic 6–12 years: 5–15 mL/day osteoarthropathy, neuropathy

Table 5.
Laxatives-dosage and side effects.

opening on to the skin. Colonic manometry results should be optimal before contemplating MACE.

Internal anal sphincter achalasia (IAS) is a rare but important cause of refractory constipation. In a study of 332 patients with severe constipation, De Caluwe et al. [23] have reported this as a cause in just 4.5% of cases. This is associated with severe constipation and incontinence. It is diagnosed by the absence of anorectal inhibitory reflex (ARIR) on anorectal manometry along with the presence of ganglion cell on rectal. Sphincter myectomy is more rewarding than intrasphincteric botulinum toxin injection.

7. Conclusions

Functional constipation is quite common in both developed and not developed nations and is benign. Parent education, toilet training, dietary changes, initial moral or rectal disimpaction and use of appropriate laxative and follow-up of the responses to the treatment are keystone of successful management. Meticulous history and proper physical examination, including digital rectal examination, can differentiate functional from organic constipation. Treatment in functional constipation can be started before any investigation. Disimpaction either with oral polyethylene glycol or rectal enemas is the first step in the management of constipation. Polyethylene glycol is more effective but costlier than lactulose. At times, prolonged maintenance of laxative therapy (months to years) may be required and noncompliance leads to recurrence. Radiological colon transit time is useful in the management of refractory constipation. Slow transit constipation is a different entity, and Malone continence enema helps in this subset of patients. Some pathological and surgical causes need to be ruled out if warning signs or symptoms are present, which may require contrast enema, anorectal manometry, and rectal biopsy.

Author details

Raashid Hamid* and Shazada Shahid Banday
Department of Pediatric and Neonatal Surgery, Sheri-I-Kashmir Institute of Medical Sciences, Soura, Srinagar, Jammu and Kashmir, India

*Address all correspondence to: drraashidhamid@gmail.com

References

[1] Benninga M, Candy DC, Catto-Smith AG, et al. The Paris Consensus on Childhood Constipation Terminology (PACCT) Group. Journal of Pediatric Gastroenterology and Nutrition. 2005;**40**:273-275

[2] Weaver LT, Steiner H. The bowel habits of young children. Archives of Disease in Childhood. 1983;**59**:649-652

[3] Poddar U. Approach to constipation in children. Indian Pediatrics. 2016;**53**:319-327

[4] Southwell BR, Clarke MC, Sutcliffe J, et al. Colonic transit studies: Normal values for adults and children with comparison of radiological and scintigraphic methods. Pediatric Surgery International. 2009;**25**:559-572

[5] Hyman PE, Milla PJ, Benninga MA, Davidson GP, Fleisher DF, Taminiau J. Childhood functional gastrointestinal disorders: Neonate/toddler. Gastroenterology. 2006;**130**:1519-1526

[6] Baucke VL. Prevalence, symptoms and outcome of constipation in infants and toddlers. The Journal of Pediatrics. 2005;**146**:359-363

[7] Loening-Baucke V. Chronic constipation in children. Gastroenterology. 1993;**105**:1557-1564

[8] Loening-Baucke V. Constipation in early childhood: Patient characteristics, treatment and long-term followup. Gut. 1993;**34**:1400-1404

[9] Kehar M, Yadav SP, Sachdeva A. Constipation in children. JIMSA. 2012;**25**:31-33

[10] Khanna V, Poddar U, Yachha SK. Constipation in Indian children: Need for knowledge not the knife. Indian Pediatrics. 2010;**47**:1025-1030

[11] Loening-Baucke V. Polyethylene glycol without electrolytes for children with constipation and encopresis. Journal of Pediatric Gastroenterology and Nutrition. 2002;**34**:372-377

[12] Benninga MA, Buller HA, Staalman CR, Gubler FM, Bossuyt PM, van der Plas RN, et al. Defecation disorders in children, colonic transit times versus the Barr-score. European Journal of Pediatrics. 1995;**154**:277-284

[13] Tabbers MM, Di Lorenzo C, Berger MY, Faure C, Langendam MW, Nurko S, et al. Evaluation and treatment of functional constipation in infants and children: Evidence-based recommendations from ESPGHAN and NASPGHAN. Journal of Pediatric Gastroenterology and Nutrition. 2014;**58**:25874

[14] Taitz LS, Water JKH, Urwin OM, Molnar D. Factors associated with outcome in management of defecation disorders. Archives of Disease in Childhood. 1986;**61**:472-477

[15] Partin JC, Hamill SK, Fischel JE, Partin JS. Painful defecation and fecal soiling in children. Pediatrics. 1992;**89**:1007-1009

[16] Metaj M, Laroia N, Lawrence RA, Ryan RM. Comparison of breast- and formula-fed normal new born in time to first stool and urine. Journal of Perinatology. 2003;**23**:624-628

[17] Jung PM. Hirschsprung's disease: One surgeon's experience in one institution. Journal of Pediatric Surgery. 1995;**30**:646-651

[18] Candy D, Belsey J. Macrogol (polyethylene glycol) laxatives in children with functional constipation and fecal impaction: A systematic review. Archives of Disease in Childhood. 2009;**94**:156-160

[19] Southwell BR, King SK, Hutson JM. Chronic constipation in children: Organic disorders are a major cause. Journal of Paediatrics and Child Health. 2005;**41**:1-15

[20] Kwshtgar A, Ward HC, Clayden GS. Diagnosis and management of children with intractable constipation. Seminars in Pediatric Surgery. 2004;**13**:300-309

[21] Hutson JM, McNamara J, Gibb S, Shin YM. Slow transit constipation in children. Journal of Paediatrics and Child Health. 2001;**37**:426-430

[22] Malone PS, Ransley PG, Kiely EM. Preliminary report: The antegrade continence enema. Lancet. 1990;**336**:1217-1218

[23] De Caluwe D, Yoneda A, Akl U, Puri P. Internal anal sphincter achalasia: Outcome after internal sphincter myectomy. Journal of Pediatric Surgery. 2001;**36**:736-738