Childhood Constipation: Evaluation and Management

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ABSTRACT

Constipation is a common problem in children. It is also a long-term problem persisting for many months to years in children. Approximately 95% of childhood constipation is functional in nature without any obvious cause. Evaluation of a child with constipation requires a thorough history and physical examination. Hirschsprung's disease is an important cause of constipation arising in infancy and requires a thorough diagnostic evaluation and surgical treatment. Treatment of functional constipation in children requires a well-designed plan and a team approach involving the child, parents, and a health care provider. Treatment involves education of the family about constipation and encopresis, fecal disimpaction, and long-term maintenance therapy of laxatives and behavioral modification. Laxatives such as magnesium hydroxide, lactulose, and mineral oil have been used in children for a long time. A new laxative, polyethylene glycol 3350, has been used successfully in children with constipation and encopresis. Several novel therapeutic interventions have been tried for children presenting with intractable constipation, refractory to conventional treatment.

KEYWORDS: Constipation, encopresis, children, laxatives

Objectives: Upon completion of this article, the reader should be able to summarize the evaluation and treatment of constipation in children.

Constipation with or without encopresis is a common problem in children. In a study of 22-month-old children from Canada, 16% of children were reported to be constipated by their parents.¹ In the United Kingdom, 34% of 4- to 7-year-old children had constipation, and the frequency was 37% among Brazilian children younger than 12 years.² In the United States, it was estimated that constipation accounted for 3% of visits to a general pediatric clinic and up to 25% of visits to a pediatric gastroenterology clinic.³ Also, constipation is often a chronic problem in children, lasting for many

years. Chronic constipation with encopresis can be associated with significant physical morbidity and psychosocial stress. The successful treatment of constipation requires a precise well-organized plan for evaluation and a team approach involving the patient, family, and health care provider.

The aims of this article are to review the evaluation and management of childhood constipation including the role of a new laxative, polyethylene glycol 3350, and to discuss various novel therapeutic approaches for intractable constipation in children.

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DEFINITIONS

At present, there is no uniform accepted definition for constipation in children. Rome II criteria⁴ defined functional constipation as the presence of scybalous, pebble-like hard stools or firm stools two times or less per week for 2 weeks in the absence of organic causes in infants and preschool children. Functional fecal retention by Rome II criteria⁴ is diagnosed by passage of large-diameter stools less than two times per week and retentive posturing to avoid defecation for at least 12 weeks in children from infancy to 16 years of age. Rome II criteria appear to be rather restrictive in nature as many children with constipation seen in practice may not satisfy these criteria. Therefore the North American Society of Pediatric Gastroenterology, Hepatology, and Nutrition (NASPGHAN) committee came up with a simple definition of constipation as a delay or difficulty in defecation that is present for 2 weeks or more and sufficient to cause significant distress to the patient.³ Encopresis is defined as involuntary loss of stools in inappropriate places after the developmental age of 4 years.⁵

CAUSES

Approximately 95% of childhood constipation is functional in nature without any obvious organic identifiable cause. There are rare organic conditions arising with constipation related to anatomical, neurogenic, intestinal neuromuscular, metabolic, or endocrine causes and various drugs (Table 1). Management of constipation secondary to an organic disorder requires treatment aimed at the underlying disorder.

Hirschsprung's disease occurs in ~1 in 5000 live births and is characterized by absence of ganglion cells within the myenteric and submucosal plexus of the colon.⁶ Lack of motility in the affected colonic segment

arises as colonic obstruction and constipation. The most common gene defect in Hirschsprung's disease is in the *RET* proto-oncogene on chromosome 10⁷ and is seen in 50% of familial and 20% of sporadic cases. In more than 75% of cases, the disease is limited to the rectosigmoid area. The majority of children with Hirschsprung's disease are symptomatic within the first weeks or months of life. The symptoms include severe constipation and symptoms of intestinal obstruction such as bilious vomiting and abdominal distension. Approximately 94% of neonates with Hirschsprung's disease fail to pass meconium in the first 24 hours of life. Hirschsprung's disease may also arise with a serious and potentially lethal complication of enterocolitis, in the form of foul-smelling diarrhea with blood, fever, abdominal distension, and shock. Enterocolitis requires prompt management with volume resuscitation, broad-spectrum antibiotics, and rectal irrigation with saline.

The diagnosis of Hirschsprung's disease is made by a rectal biopsy specimen showing absence of ganglion cells. Anorectal manometry and barium contrast enema are also useful tests for the diagnosis. The treatment of Hirschsprung's disease requires relief of obstruction with the creation of a stoma proximal to the aganglionic segment followed by surgical removal of the affected colonic segment in a few weeks.⁶ Various surgical approaches include the Swenson pull-through operation, Soave modification, and Duhamel procedure. A laparoscopy-assisted one-stage endorectal pull-through procedure has been used with good results.⁸ Long-term complications of Hirschsprung's disease include anorectal stenosis, enterocolitis, and fecal incontinence.⁶

EVALUATION OF CONSTIPATION

Medical History

A thorough history is recommended as part of a complete evaluation of a child with constipation. The first step is to find out what the family means when using the term constipation. Children have very variable stooling patterns that change with age. Infants pass four to five stools per day in the early weeks of life and then usually have one to two stools per day by the age of 1 year.⁹ Eighty-five percent of children aged 1 to 4 years have anywhere from two bowel movements per day to one bowel movement every other day.¹⁰ Therefore, a detailed history should be obtained about the frequency of bowel movements and the consistency and size of the stools. Symptoms such as pain or blood with defecation or soiling in children beyond 4 years of age are clearly abnormal. Toddlers often demonstrate withholding behavior in the form of going stiff and clenching buttocks together to avoid painful defecation related to hard stools. Fecal soiling secondary to fecal retention may be mistaken for diarrhea by some parents.

Table 1 Organic Causes of Constipation in Children

<i>Anatomic</i>
Anal fissure, anal stenosis, imperforate anus, anterior displaced anus
<i>Neurogenic</i>
Spina bifida, myelomeningocele, cerebral palsy
<i>Intestinal neuromuscular disorders</i>
Hirschsprung's disease, chronic intestinal pseudo-obstruction, intestinal neuronal dysplasia
<i>Endocrine and metabolic disorders</i>
Hypothyroidism, hypercalcemia, celiac disease, cystic fibrosis, hyperparathyroidism, diabetes mellitus, diabetes insipidus, lead toxicity
<i>Drugs</i>
Anticholinergics, opiates, antidepressants, antacids, iron, cholestyramine

The onset of constipation in the neonatal period should raise suspicion of Hirschsprung's disease. Similarly, symptoms of fever, vomiting, persistent abdominal distension, and poor weight gain are not associated with functional constipation and should alert the physician to consider an organic disorder. Children with constipation often have urinary symptoms in the form of frequency, enuresis, and urinary tract infections. The dietary history should include estimation of intake of milk products and any allergic symptoms related to milk protein intake. Daily fiber intake is suboptimal in the majority of children with constipation.¹¹ A psychosocial history should include family structure and family dynamics, as family support is an important factor in an eventual successful outcome. Many children have received some treatment before presentation, and it is useful to know about use of previous laxatives and results of these treatments. Past history should also include various medications (Table 1) that can lead to constipation.

Physical Examination

A careful examination is important in the child who presents with constipation. The abdominal examination may reveal a fecal mass in the left lower quadrant or in the suprapubic region indicating fecal retention. Rectal examination is recommended at least once in the evaluation.³ It can be a difficult task in children because of lack of cooperation and previous painful experiences of rectal examinations or enemas. It may be helpful to explain the rectal examination to children to decrease their anxiety. The perianal area should first be examined for evidence of fecal soiling, anterior displacement of the anus, anal fissures, and perianal sensation. Then digital examination is performed to assess anal canal tone, consistency and amount of stools, and size of the rectal vault. In children with Hirschsprung's disease, examination often reveals an empty rectum and the examination may be followed by explosion of flatus and stools. The sacrum should be examined for dimple, which may indicate an occult spinal abnormality. In children with incontinence, it is important to assess the power and reflexes of the lower extremities to rule out spinal cord abnormality.

Diagnostic Evaluation

A thorough history and physical examination are generally sufficient to diagnose constipation in children. The majority of children have functional constipation and do not require any specific diagnostic tests. A plain abdominal film can be useful for the assessment of fecal retention, particularly when a rectal examination is not performed. It may also aid in assessing the lower spine in children with fecal incontinence and urinary symptoms. In children who do not seem to respond to treatment, blood tests are recommended to rule out hypothyroid-

ism, celiac disease, hypercalcemia, or lead poisoning.³ Constipation in early infancy requires diagnostic evaluation to rule out Hirschsprung's disease. A barium enema is often ordered as a first step in a child with suspected Hirschsprung's disease. It may show the classical finding of a transition zone between distal nondilated aganglionic colon and proximal dilated ganglionic segment. Anorectal manometry reveals lack of relaxation of the anal sphincter in response to rectal distension in a child with Hirschsprung's disease. Rectal suction biopsy showing absence of ganglia in the submucosa and hypertrophied nerve fibers with acetylcholinesterase staining is the "gold standard" test for the diagnosis of Hirschsprung's disease.⁶ Colonic motility studies and full-thickness colonic biopsies are useful to evaluate children with suspected chronic intestinal pseudo-obstruction. Colonic transit time studies are usually used for research purposes and not in clinical settings.

TREATMENT OF FUNCTIONAL CONSTIPATION

For the management of functional constipation, evidence-based clinical practice guidelines were published by the NASPGHAN committee in 1999.³ This stepwise approach involves education, disimpaction, maintenance therapy including dietary intervention, laxative therapy, and behavioral modification.

Education

Education of the family and the child involves unhurried explanation of the physiology of normal defecation and the pathogenesis of constipation and encopresis, preferably with the help of a diagram of the anorectum. It is important to stress to the child and the family that encopresis is an involuntary process secondary to fecal retention. A positive and supportive attitude of the family is an important factor in the treatment and for eventual success. It is important to explain the action of laxatives and the treatment plan in detail. During the first consultation it should also be stressed that this is a chronic problem and requires regular long-term treatment for months to years.

Disimpaction

Fecal disimpaction can be performed by the oral or rectal route using different medications as shown in Table 2. The approach for disimpaction depends on the urgency for disimpaction and physician's preference. The oral approach is noninvasive and takes a longer time for disimpaction. The rectal approach is invasive and leads to faster disimpaction, within hours.

Polyethylene glycol electrolyte lavage solution has a high rate of success but often requires nasogastric tube

Table 2 Fecal Disimpaction Regimen in Children

Medication	Dosage
ORAL DISIMPACTION	
<i>Over 1–2 days</i>	
Polyethylene glycol with electrolytes solution	25 mL/kg/h, up to 1000 mL/h until fecal effluent is clear
<i>Over several days</i>	
Milk of magnesia	2 mL/kg twice a day for 7 days
Mineral oil	3 mL/kg twice a day for 7 days
Lactulose or sorbitol	2 mL/kg twice a day for 7 days
Polyethylene glycol 3350 (PEG)	1.5 g/kg per day for 3 days
RECTAL DISIMPACTION	
Glycerin suppositories	1 suppository for infants and toddlers
Phosphate enema	6 mL/kg, up to 135 mL for ≥ 2 years
Milk and molasses enema	(1:1 milk/molasses) 200–600 mL for older children

administration and is associated with adverse effects such as nausea, vomiting, and abdominal distension.^{3,12} Fecal disimpaction can be achieved by using higher doses of laxatives such as mineral oil, magnesium hydroxide, or lactulose for a few days.^{3,12} Youssef et al¹³ reported the use of polyethylene glycol 3350 without electrolytes (PEG) for successful disimpaction in children. PEG is a recently introduced osmotic laxative that is available in the form of a virtually tasteless and odorless powder (MiraLax[®]; Braintree Laboratories, Braintree, MA). In a prospective study, 40 children with fecal impaction were divided into four groups receiving one of four doses of PEG: 0.25, 0.5, 1.0, or 1.5 g/kg/day for 3 days. All 10 patients receiving 1.5 g/kg/day had successful disimpaction without any major adverse effects.¹³

The rectal approach with enemas and suppositories is invasive and usually not welcome by children (Table 2). Glycerin suppositories can be used safely and effectively in infants. Phosphate enema administration is generally effective and safe, but rare complications have been reported. Phosphate enemas can cause hyperphosphatemia and hypocalcemia, leading to convulsions, coma, and even death.¹⁴ The risk of hyperphosphatemia seems to be high in young children, and therefore phosphate enemas are not recommended in children younger than 2 years.³ Milk and molasses enemas have been reported to cause significant cardiopulmonary compromise in children with serious underlying medical illnesses.¹⁵

Dietary Intervention

Use of fiber has been a general recommendation in children with constipation. The role of fiber has been confirmed by two well-designed studies in children with constipation.^{16,17} Glucomannan is a soluble fiber prepared from the tubers of the Japanese Konjac plant and has no unpleasant smell or taste.^{16,17} Staiano et al¹⁶ studied 20 children with severe brain damage and

chronic constipation. Children received glucomannan at 100 mg/kg two times a day (10 patients) or placebo (10 patients) for 12 weeks. Glucomannan significantly increased stool frequency and allowed reduction in the use of laxatives compared with placebo.¹⁶ In a double-blind, randomized, placebo-controlled crossover study, Loening-Baucke et al¹⁷ studied 31 children with functional constipation, 18 of whom also had encopresis. In this crossover study, glucomannan and placebo were given as 100 mg/kg body weight daily (maximal 5 g/day) for 4 weeks each. Successful treatment was defined as three or more bowel movements per week and one or less soiling episode in the last 3 weeks without abdominal pain. Significantly more children were successfully treated while receiving fiber (45%) as compared with placebo treatment (13%).¹⁰ Children with constipation only were more likely to be treated successfully with fiber (69%) than those with constipation and encopresis (28%).¹⁷ It can be concluded from these well-designed studies that fiber is beneficial in the treatment of constipation.

Excess intake of dairy products such as cheese may predispose children to constipation. Cow's milk protein allergy can be associated with refractory constipation in children, and these children are likely to have coexisting rhinitis, dermatitis, bronchospasm, and perianal lesions.¹⁸ Although this association does not seem to be a common occurrence, it seems worthwhile to eliminate cow's milk for 2 weeks in children with constipation refractory to conventional treatment.

Laxative Therapy

The recommended doses and adverse effects of available laxatives are shown in Table 3. The NASPGHAN committee recommended osmotic laxatives such as magnesium hydroxide, lactulose, and the lubricant laxative mineral oil for long-term use.³ All these medications have been used for a long time and are generally well

Table 3 Commonly Used Laxatives in Children

Medication	Dosage	Adverse Effects
<i>Osmotic laxatives</i>		
Magnesium hydroxide (milk of magnesia)	1–3 mL/kg/day	Hypermagnesemia, hypophosphatemia, and secondary hypocalcemia; use with caution in infancy and renal impairment
Lactulose	1–3 mL/kg/day	Flatulence, bloating, abdominal cramps, nausea, hyponatremia
Polyethylene glycol 3350 (PEG)	0.8 g/kg/day (dilute 17 g/240 mL of liquid)	Flatulence, abdominal pain
<i>Lubricant laxatives</i>		
Mineral oil	1–3 mL/kg/day	Nausea, vomiting, anal leakage, risk of lipid pneumonia if aspirated; not recommended in infants and neurologically impaired children
<i>Stimulant laxatives</i>	(Short-term use only)	Abdominal pain, idiosyncratic hepatitis, melanosis coli, hypertrophic osteoarthropathy
Senna	2.5–15 mL/day	
Bisacodyl	5–15 mg/day	Abdominal pain, hypokalemia, renal mucosal abnormalities, urolithiasis

tolerated.³ Magnesium hydroxide (milk of magnesia) has been used for up to 12 years in one longitudinal follow-up study in children.¹⁹ Van Ginkel et al²⁰ reported effective use of lactulose over the long term, up to 8 years, in a large cohort of children with chronic constipation. Stimulant laxatives such as senna and bisacodyl are not recommended for long-term use because of adverse effects but can be used for the short term as rescue therapy.³ PEG has been reported to be a safe and effective laxative in the short-term treatment of constipation in adults²¹ and is approved by the Food and Drug Administration for adults. Since the publication of the NASPGHAN guidelines, PEG has now been evaluated more extensively in children with constipation.

In a prospective open-label study, Pashankar and Bishop²² treated children with constipation and encopresis with PEG for 2 months. PEG was started at a dose of 1 g/kg/day mixed in a beverage of the patient's choice (17 g in 240 mL of fluid) and parents were asked to adjust the dose to yield two soft stools per day. There were no major adverse effects and PEG was tolerated well. Soiling frequency, stool frequency, and consistency all improved with PEG therapy and the mean effective dose was found to be 0.8 g/kg/day (range 0.2 to 1.4).²² In a short-term crossover study, PEG was compared with lactulose in 37 children with constipation.²³ Over 4 weeks, both agents caused similar improvements in the ease of stool passage, stool frequency, and consistency without any significant side effects.²³ When PEG was used in 46 children with constipation and dysfunctional voiding in another study,²⁴ 39% became dry, 56% had decreased wetting, and there was improvement in non-invasive urodynamic studies and constipation. PEG therapy has also been used successfully in constipated children younger than 2 years without any major adverse effects.²⁵

Loening-Baucke²⁶ compared the use of PEG in 28 children with the use of magnesium hydroxide in 21 children for the treatment of constipation and encopresis. Over 12 months, both laxatives had the same efficacy and no major adverse effects. However, 33% of children refused to take magnesium hydroxide on a consistent basis and none refused to take PEG.²⁶ In another long-term study by Pashankar et al,²⁷ PEG therapy caused significant improvement in stool frequency and consistency and in symptoms such as pain and fear associated with defecation in 43 children with constipation. In a group of 31 children with constipation and encopresis, soiling frequency and other bowel movement parameters improved significantly and 52% of children had no episodes of soiling for at least 1 month following an average duration of 8 months (range 3 to 30) of PEG therapy.²⁷ Safety of long-term use of PEG was shown by the same authors²⁸ in 83 children who received PEG for an average duration of 8.7 months (range 3 to 30). The adverse effects seen with PEG therapy were mild and included transient dose-dependent diarrhea (10%) and bloating (6%). The laboratory evaluation results, including hemoglobin, serum electrolytes, renal and liver function tests, serum albumin, and osmolality, did not reveal any significant abnormalities. As PEG was mixed in a beverage of the patient's choice, daily compliance over the long term was reported to be 90% by parents and all patients were willing to continue with PEG treatment.²⁸ On the basis of all of these studies, it appears that PEG is an effective and safe laxative with the added advantage of good acceptance by patients and can be added to the list of laxative agents useful for the long-term treatment of constipation in children.

Many children require laxative therapy for months to years. The choice of the medication depends

on the child's preference, safety, cost, ease of administration, and the practitioner's experience.

Behavioral Modification

Behavioral modification is an important component of therapy, particularly for children with constipation and encopresis. It involves regular toilet sitting for up to 5 minutes three or four times a day after meals to establish normal bowel habits. This is combined with a reward system and positive reinforcement from parents. A meta-analysis of three trials showed that the combination of laxative therapy and behavioral modification is better than laxative therapy alone or behavioral modification alone for children with encopresis.²⁹ Therefore, behavioral modification therapy should be used along with laxatives for an optimal outcome in children with chronic constipation and encopresis.

LONG-TERM OUTCOME

With a well-designed conventional treatment plan, the majority of patients with functional constipation experience significant improvement. Complete recovery, defined as three or more bowel movements a week with minimal soiling ($\leq 2/\text{month}$) and no abdominal pain while without laxatives, is less frequently achieved. Recovery rates are between 30% and 50% at the end of 1 year⁵ and up to 63% at 7 years of follow-up.¹⁹ Recently, van Ginkel et al²⁰ observed 418 constipated children (two thirds with and one third without encopresis) treated with lactulose for a median duration of 5 years. The recovery rate was 63% for 193 children after 5 years and 68% for 48 children after 8 years. Approximately 30% of children, who had reached adolescence, were still having problems with constipation or encopresis.²⁰ These studies stress the chronic nature of constipation in children and the need for ongoing management.

NEW APPROACHES FOR INTRACTABLE CONSTIPATION

Intractable constipation can be defined as constipation resistant to a conventional treatment approach. Common causes of intractable constipation are failure of compliance with treatment by patient or parent, or both, and inadequate management by the physician, and these should be addressed first. Intractable constipation secondary to underlying disorder should be treated accordingly. Several different therapeutic approaches have been tried for intractable constipation.

Botulinum Toxin Injection

Internal anal sphincter achalasia can cause outlet obstruction of defecation. It is usually seen in children

with Hirschsprung's disease and occasionally in normal children.³⁰ *Clostridium botulinum* toxin acts on the neuromuscular junction to block the release of acetylcholine and weakens the muscle for a variable duration of time. Ciamarra et al³⁰ used four-quadrant intrasphincteric injections of botulinum toxin for anal sphincter achalasia in 20 children presenting with intractable constipation. The improvement in constipation was extremely variable, ranging from 1 week to 18 months, and some children required repeated injections to sustain the improvement. There were no adverse effects or fecal incontinence associated with this procedure.³⁰ Therefore, although overall success was short term and not universal, it seems worthwhile to try this approach in a selected group of patients before considering sphincter myectomy.

Antegrade Colonic Enemas

Antegrade colonic enemas are given through a cecostomy with irrigation solutions such as polyethylene glycol electrolyte solution, phosphate soda solution, or a combination of glycerin and normal saline. In most cases, patients are likely to pass stools and empty the colon within 2 hours and can achieve a reasonable degree of social continence. This technique has been used successfully in children with defecation problems related to spina bifida, cerebral palsy, anorectal anomalies, and Hirschsprung's disease and in otherwise normal children.^{31,32} Cecostomy can be performed surgically (open or laparoscopic) or under fluoroscopy by the radiologists. Rivera and colleagues used colonoscopy successfully for cecostomy placement in 12 children.³³ In a review of 273 procedures performed in the United Kingdom, the overall success rate was 79%.³¹ The main complications of cecostomy included stomal stenosis (30%), stomal leakage (7%), and adhesive obstruction (2%).³¹ Antegrade enemas can also be given through left colostomy and have proved to be effective in children with spina bifida.³⁴

Role of Surgery

Surgery is necessary for children with Hirschsprung's disease or congenital anorectal malformations but has otherwise rarely been recommended for management of functional constipation in children. However, recent reports are proposing a role of surgery in childhood intractable constipation. Internal sphincter myectomy has been shown to have successful long-term outcome in children with internal anal sphincter achalasia.³⁵ Woodward et al³⁶ reviewed 10 otherwise normal children who underwent a Hartmann procedure and end sigmoid colostomy for intractable functional constipation. The main complication was small bowel obstruction in one patient. After a median follow-up of

31 months, parents reported satisfaction with the colostomy.³⁶ In another report, 19 otherwise healthy children had segmental or total colonic resection for abnormal colonic motility.³⁷ There was improvement in constipation symptoms without any major complications following surgery, and 89% of parents reported satisfaction 11 months after surgery.³⁷ Because of the potential for major complications, this radical option should be reserved for severe and selected cases when all other options have failed.

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