

Constipation: Setting it to Right Motion

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Abstract

Constipation is common and long-lasting functional gastrointestinal disorder affecting approximately one third of the global pediatric population. It comprises of diverse symptoms from delay or difficulty in defecation. Approximately 95% of childhood constipation is functional in nature without any identifiable cause. The current standard treatment for constipation includes education, disimpaction, laxative therapy, and behavioral modification.

Keywords: Constipation; Gastrointestinal Disorder; Disimpaction; Laxative Therapy.

Introduction

Functional constipation is a common condition affecting up to 30% of the children worldwide [1]. In general, constipation affects children of all ages and is relevant to both primary and tertiary care settings. The term 'constipation' is derived from the Latin word 'Constipare' meaning 'To crowd together'. Constipation is usually characterized by painful defecation, retentive posturing and fecal incontinence. Constipation and fecal incontinence can lead to low self-esteem and behavior problems, causing significant distress and anxiety to the patient and the parents [2]. The exact etiology is not known in most of the children. However, the etiology of constipation in children can be either functional or organic [3]. Functional causes account for approximately 95% of childhood constipation that has no obvious cause [4]. Early identification and treatment of constipation is very important as it improves over all outcomes [2]. The goal of therapy in the treatment of constipation is to produce soft, painless stools and to prevent reaccumulation of feces. Lavage solutions and/or enemas have been employed in the treatment of fecal disimpaction. Once fecal disimpaction is achieved, maintenance therapy with laxatives should be continued to keep the rectum empty and to prevent recurrence of constipation [5]. Besides drug therapy, behavioral and dietary modifications should also be addressed

for an effective management [6].

Definition of Constipation

There is no single definition for constipation. In an attempt to develop uniform definition for constipation, numerous diagnostic criteria were developed by various expert panels from different organizations such as Iowa classic criteria, Bristol stool chart, Rome I and II criteria, PACCT group (The Paris Consensus on Childhood Constipation Terminology) and Working group, (Table 1.). These diagnostic criteria have their own limitations and thus a new diagnostic criterion known as Rome III criteria was developed [7].

In the current scenario, ROME III criteria have been followed to define constipation. According to Rome III criteria, the definition of constipation varies depending up on the age [8].

Definition of Constipation for a Child with a Developmental Age less than 4 years

Functional constipation is defined as presence of two or more of the following criteria for at least 1 month in the absence of organic pathology, (Table 2).

Definition of Constipation for a Child with a Developmental Age of greater than 4 years

Functional constipation is defined as presence of

Table 1: Comparison of criteria of different classifications for childhood constipation

Classification	Frequency of stools	Faecal incontinence	Large stool size- rectal or abdominal exam	Large stool size- toilet	Stool withholding/ Retention	Painful Defaecation	Stool Consistency
Iowa criteria	✓	✓	✓	✓	✓	✓	✓
Rome II	✓	-	-	-	-	-	✓
Working group	✓	-	-	✓	-	✓	✓
PACCT	✓	✓	✓	✓	✓	✓	✓
Rome III	✓	✓	✓	✓	✓	✓	✓

Table 2: Rome III diagnostic criteria for functional constipation in children < 4 years [8]

In the absence of organic pathology, ≥ 2 of the following must occur for at least 1 month

- ≤ 2 defecations per week
- At least 1 episode of incontinence per week after the acquisition of toileting skills
- History of excessive stool retention
- History of painful or hard bowel movements
- Presence of a large fecal mass in the rectum
- History of large-diameter stools that may obstruct the toilet

Accompanying symptoms may include irritability, decreased appetite, and/or early satiety, which may disappear immediately following passage of a large stool

Table 3: Rome III diagnostic criteria for functional constipation in children ≥ 4 years [8]

≥ 2 of the following must occur at least once per week for at least 2 months with insufficient criteria for IBS

- ≤ 2 defecations in the toilet per week
- At least 1 episode of fecal incontinence per week
- History of retentive posturing or excessive volitional stool retention
- History of painful or hard bowel movements
- Presence of a large fecal mass in the rectum
- History of large-diameter stools that may obstruct the toilet

IBS : Irritable bowel syndrome

two or more of the following criteria for at least once per week for at least 2 months with insufficient criteria to fulfill the diagnosis of irritable bowel syndrome (Table 3).

Epidemiology

- Affects 7% to 30% of global pediatric population with younger children being affected most often [1, 9].
- Incidence is high in monozygotic than dizygotic twins [7].
- Accounts for 3% of visits to general pediatric clinics and as many as 30% of visits to pediatric gastroenterologists [10].
- Generally affects children of age between 2 and 4 years, with an increased prevalence in boys [7, 11].
- About 33.3% of children of age 6 to 12 year

experience constipation during any given year [11].

- Approximately 30% to 75% of children with long-standing functional constipation develop abdominal/rectal fecal impaction [1].

Physiology of Constipation

Fecal continence is maintained by involuntary and voluntary muscle contractions that usually involves rectum, pelvic floor and anal sphincters together with sensorineural pathways [11, 12]. Any dysfunction of these organs or pathways leads to incontinence [13]. Basically, stool traverse through the colon and gets stored in the anorectum until it gets evacuated in a socially acceptable manner. The normal process of defecation starts when the accumulated feces in the rectum cause relaxation of the tonically contracted internal anal sphincter, allowing the stool to come in contact with sensitive receptors in the anal canal [14].

When the feces is in contact with sensitive receptors and if the individual desires to defecate then the pelvic-floor muscles relaxes including the puborectalis (which wraps around the anorectum, maintaining an anorectal angle between 80° and 110°) allowing the pelvic floor to descend by 1 to 3.5 cm. With the descent of the pelvic floor, the

anorectal angle is straightened by at least 15° that causes relaxation of external anal sphincter, and the feces is evacuated, (Figure 1) [15]. If the defecation is to be delayed, then the voluntary contraction of the puborectalis muscle and the external anal sphincter muscle reduces the anorectal angle to less than 85° and 105° [14].

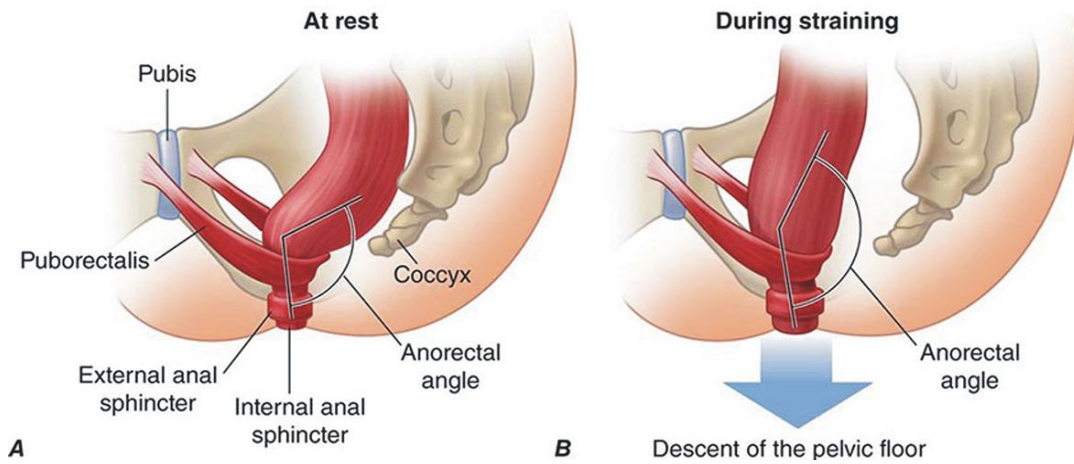


Fig. 1: (A) Sagittal view of the anorectum at rest (B) Anorectum during straining to defecate.

Physiology of Constipated Child: The Vicious Cycle of Constipation

In most children, it is believed that chronic constipation results from intentional or subconscious withholding of stools [14]. Children avoid defecation by tightening the external anal sphincter and by

squeezing the gluteal muscles. These actions push the feces deep inside the rectal vault and thereby reduce the urge to defecate [11]. This process creates a vicious cycle of progressive accumulation of feces, (Figure 2) [16].

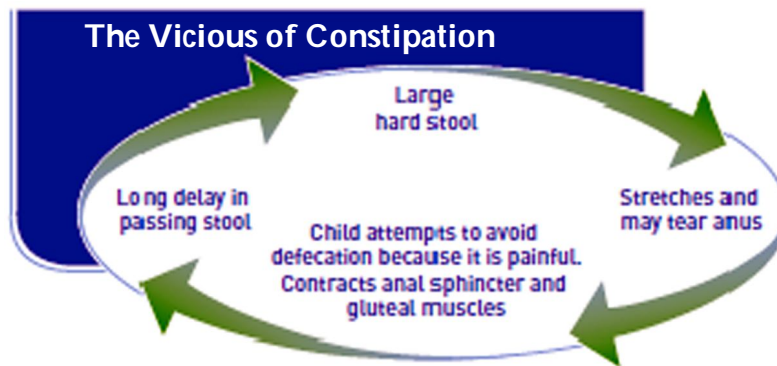


Fig. 2: The vicious cycle of constipation

Etiology of Constipation

The etiology of constipation in pediatrics can be divided into functional and organic causes, (Figure 3) [2-4].

The symptoms and signs of constipation may vary according to age of the child [14]. The common symptoms and signs of constipation are summarized in Table 4 [2, 14, 17].

Clinical Presentation

Symptoms and Signs

Classification of Constipation

Constipation can be classified into three broad

categories namely:

Normal-transit constipation: Also known as functional constipation is characterized by perceived difficulty in defecation. In normal-transit constipation,

stool traverse through the colon at a normal rate and frequency, yet patients believe they are constipated. Patients with this type of constipation usually respond to increased fluid and fiber intake.

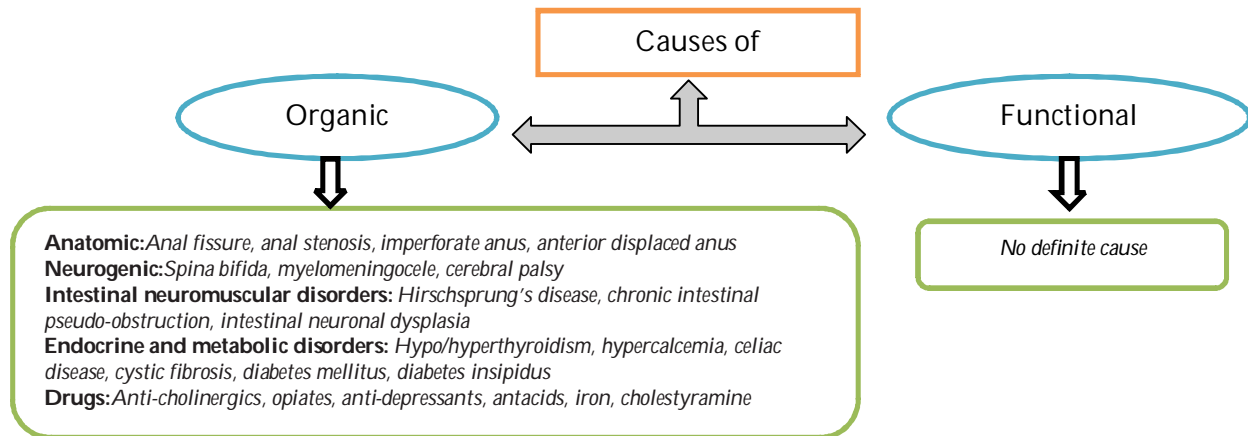


Fig. 3: Causes of constipation in children

Table 4: Symptoms and signs of constipation

Symptoms:	Signs:
♦ Infrequent bowel movement	♦ Abdominal distention
♦ Painful bowel movement	♦ Abdominal tenderness
♦ Hard stools	♦ Abdominal fecal mass
♦ Abdominal pain	♦ Anal fissure
♦ Fecal soiling	♦ Rectal fecal mass
♦ Blood in stools	
♦ Retentive posturing	

Slow-transit Constipation

This is often caused by alterations in intestinal innervations and is characterized by infrequent bowel movements. Hirschsprung's disease is a classic example of this type.

Disorders of Defecatory/Rectal eEvacuation

It is most commonly due to dysfunction of the pelvic floor or anal sphincter. Prolonged avoidance of the pain associated with either the passage of a large, hard stool or an anal fissure or hemorrhoid leads to defecatory disorders [15, 18].

Examination

In majority of the cases, detailed history of the

patient and physical examination are sufficient to diagnose constipation and hence tests are often not required. However, in few cases children may be subjected to plain abdominal X-ray, ultrasound, anorectal/colonic, manometry and rectal biopsy to exclude secondary causes [17].

Differential Diagnosis of Constipation

It is surprising to know that approximately 95% of childhood constipation is functional in nature without any obvious organic identifiable cause. Conversely, the remaining 5% of the childhood constipation occurs from rare conditions that are related to anatomical, neurogenic, intestinal neuromuscular, metabolic, or endocrine causes and

Table 5: Red flags-common symptoms and signs suggestive of organic causes of constipation

History	Examination
Failure to thrive	Absent/Brisk lower limb reflexes
Weight loss	Fever
Sensitivity to cold, fatigue, dry skin and pallor	Perianal skin tags or fistulae
Abnormal bowel habit since birth	Blood/mucus mixed in with stool
Delayed passage of meconium	Mouth ulcers
Change of bowels with introduction of cow's milk	Associated hypotonia

various drugs, Figure 3. [2-4]. Differential diagnosis helps to identify whether the child has organic or functional cause of constipation, quantifies the severity and aid in identifying any ‘red flags’ suggestive of an underlying organic condition (Table 5) [2, 11]. Thus, differential diagnosis of constipation is important as management of constipation secondary to an organic disorder requires treatment aimed at the underlying disorder.

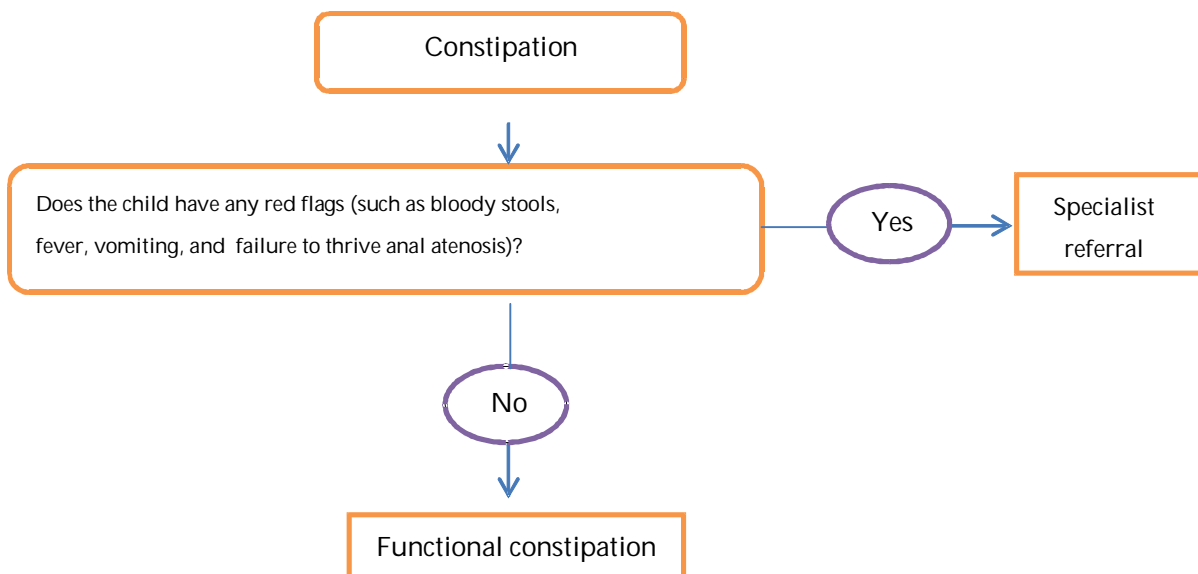
Diagnosis of Constipation

Clinicians often use Rome II or Rome III criteria for the diagnosis of constipation in children [19].

Obtaining a thorough medical history (from both parents and the child) and physical examination are very important for diagnosing constipation (Table 6) [2, 11]. It is interesting to know that 28%-50% of constipated children have positive family history for constipation [7]. The presence of fever, abdominal distention, anorexia, nausea, vomiting, weight loss or poor weight may represent organic etiology [14]. The gastroenterologist should perform rectal examination to assess rectal tone and determine the presence of rectal distention/impaction. The finding of rectal impaction may confirm the diagnosis of functional constipation, (Table6). The algorithm for diagnosing constipation is shown in Figure 4 [11].

Table 6: Findings consistent with functional constipation

History	
☞	Extremely hard stools, large-caliber stools
☞	Fecal soiling
☞	Pain or discomfort with stool passage; withholding of stool
☞	Blood on stools, perianal fissures
☞	Decreased appetite, waxing and waning of abdominal pain with stool passage
☞	Diet low in fiber or fluids, high in dairy products
☞	Hiding while defecating before toilet training is completed
☞	Postures suggestive of stool retention (e.g., standing with legs crossed, rocking, squeezing the gluteal muscles)
☞	Timing of bowel movements
☞	Avoiding the toilet
Physical examination	
☞	Mild abdominal distention: Palpable stool in left lower quadrant
☞	Normal placement of anus: Normal anal sphincter tone
☞	Rectum packed with stool: Rectum distended
☞	Presence of anal wink and cremasteric reflex



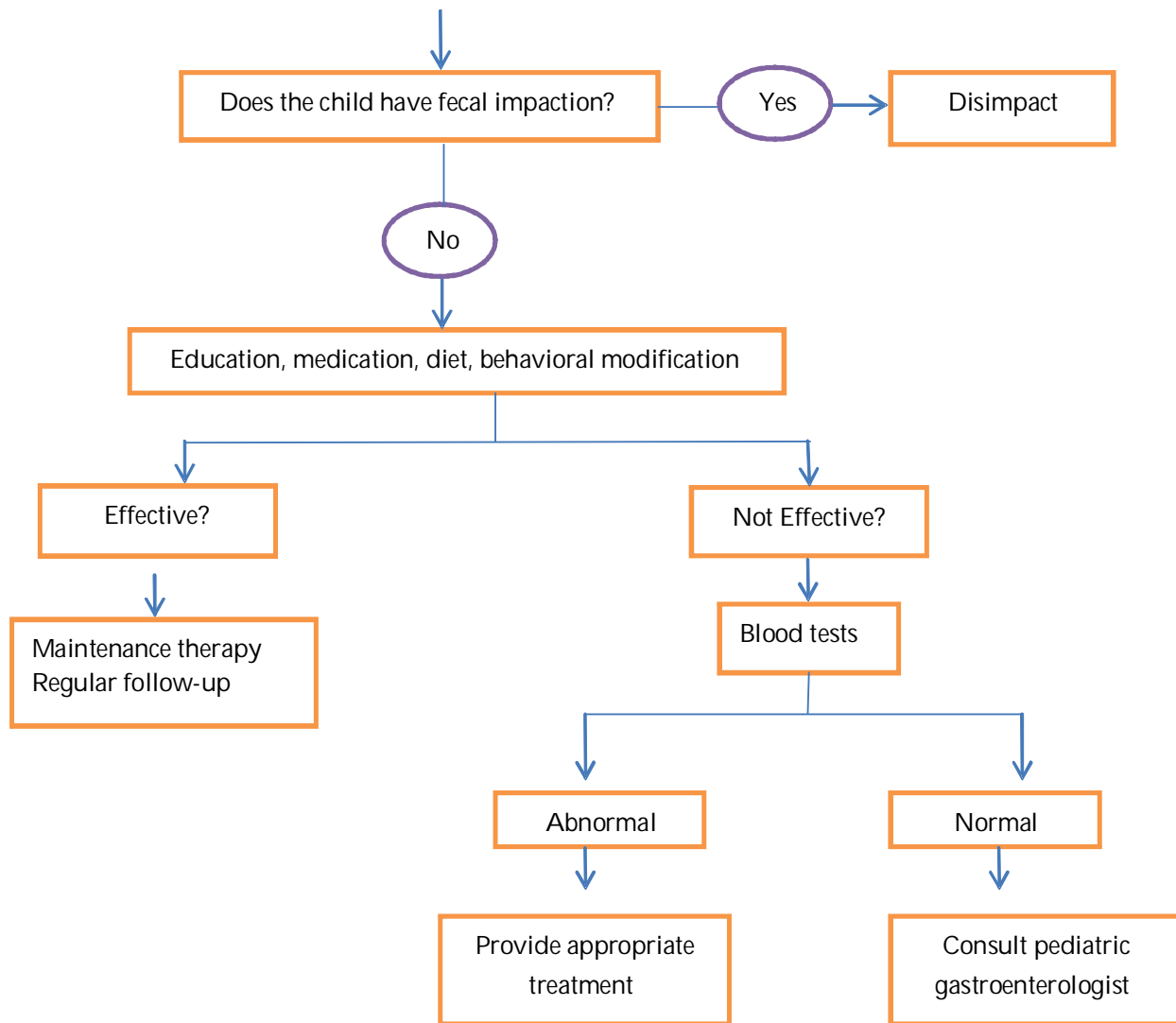


Fig. 4: Diagnosis and management of functional constipation

Treatment of Constipation

The treatment of constipation is essentially multifactorial and requires stepwise approach that involves education, disimpaction, maintenance, therapy including dietary intervention, laxative therapy, and behavioral modification. The goal of therapy is to disimpact the feces and to restore regular bowel habits [11, 20]. On the contrary, management of constipation secondary to an organic disorder requires treatment aimed at the underlying disorder [4]. The algorithm for the management of functional constipation in children older than 1 year is shown in Figure 4 [11].

Fecal Disimpaction

Fecal impaction is defined as a large fecal mass which is diagnosed by either abdominal palpation or rectal examination [1]. Fecal impaction is a common

gastrointestinal problem associated with significant morbidity [22]. It has been reported that 30% to 75% of children with long-standing functional constipation have fecal impaction that can lead to incontinence in 90% of the patients [1]. The disimpaction of the feces should be done immediately to minimize the risk of complications [4]. According to NICE guidelines, fecal disimpaction is important particularly in severe cases for maintenance treatment to work [17].

Different Methods to Achieve Fecal Disimpaction

Fecal disimpaction is a crucial step in the treatment of childhood constipation and thus it is always recommended to take proper care before treating constipated children [23]. Fecal disimpaction can be performed either by the oral or rectal route and is usually carried out when the amount and character

of feces in the colon causes discomfort and affects normal feeding. The approach for disimpaction depends on the urgency for disimpaction and physician's preference. Initially, the treatment for disimpaction is associated with extreme soiling and the excessive dose may cause abdominal pain. Thus, it is always recommended to initiate the therapy during weekends or holidays to reduce the stress for

the child and his/her caretakers [17, 20]. Enemas, suppositories or manual disimpaction have been commonly used in the treatment of fecal disimpaction. However, use of these approaches is declining due to their numerous disadvantages, (Table 7). Invasive procedures not only increase physical risks to the child but also lead to significant psychological trauma [23].

Table 7: Limitations of invasive procedures [23]

Methods	Demerits
Enemas	<ul style="list-style-type: none"> ☞ Painful and distressing for the child ☞ Requires physical restraint/intravenous sedation ☞ Use of enema against a child's will further leads to psychological trauma
Suppositories	<ul style="list-style-type: none"> ☞ Painful and distressing for the child
Manual disimpaction	<ul style="list-style-type: none"> ☞ Requires general anesthesia ☞ Procedure is unpleasant ☞ Increases the risk of structural injury to the anal sphincter which may contribute to sphincter weakness in later life in few patients ☞ Painful procedures

Maintenance Therapy

Dietary Intervention

Studies have evidenced that low dietary fiber intake play a vital role in the pathogenesis of chronic idiopathic constipation. Numerous studies have shown that dietary fiber intake has a positive effect in the treatment of constipation and hence increasing the fiber consumption is considered to be a first-line therapy for the treatment of constipation. Recommendations for dietary fiber intake differ widely between various authoritative bodies. The

daily intake allowance for dietary fiber in children is shown in Table 8. American Academy of Pediatrics (AAP) recommends a balanced diet with higher fiber foods such as whole grains, fruits, and vegetables. The recommended daily dietary fiber intake for children is 0.5 g/kg/day. Dose up to 35 g/day can be administered [19, 24].

Laxatives in the Management of Constipation

Once the impacted stool has been removed, laxatives should be initiated immediately as maintenance therapy to maintain soft bowel movements (once or twice daily) and to prevent recurrence [6, 11]. It is worthy to know that most children with constipation require long-term therapy with laxatives [4]. North American Society of Pediatric Gastroenterology, Hepatology (NASPGHAN) committee and National Institute for Health and Care Excellence (NICE) guidelines recommend laxatives in the treatment of constipation, (Table 9) [8, 14, 15, 25, 26].

Table 8: DIA for dietary fibre in children

Age (Years)	Total fibre/day
1-3	19g
4-8	25g
9-13	31g (Boys), 26 g (Girls)
14-18	38g (Boys), 26 g (Girls)

DIA: Daily intake allowance

Table 9: Drugs for the treatment of constipation

Class of drugs	NICE Guidelines	NASPGHAN Guidelines	Comments
Osmotic Laxatives PEG 3350 plus Electrolytes ⁷	<p>Fecal impaction 1-5 years: 2 sachets on 1st day, then 4 sachets daily for 2 days, then 6 sachets daily for 2 days, then 8 sachets daily. 5-12 years: 4 sachets on 1st day, then increased in steps of 2 sachets/day; max 12 sachets/ day. 12-18 years: 4 sachets on 1st day, then increase by 2 sachets daily to maximum of 8 sachets/day</p> <p>Ongoing maintenance (Chronic constipation) 1-6 years: 1 sachet daily*, max: 4 sachets/ day. 6-12 years: 2 sachets daily*, max: 4 sachets/day</p>	<p>Fecal impaction 1 to 1.5 g/kg/day for 3-6 days</p> <p>Ongoing maintenance (Chronic constipation) 0.2 to 0.8 g/kg/day</p>	<p>PEG is poorly absorbed and not metabolized by colonic bacteria and may therefore cause less bloating and cramping.</p> <p>Superior palatability and acceptance by children</p>

Lactulose	1-5 years: 2.5-10 ml BID, adjusted according to response. 5-18 years: 5-20 ml BID, adjusted according to response	1-3 mL/kg/day in divided doses; available as 70% solution.	Flatulence, abdominal cramps, hypernatremia
Magnesium hydroxide*	-----	1-3 ml/kg/day of 400 mg/5 ml	Overdose can lead to hypermagnesemia, hypophosphatemia and secondary hypocalcemia
Sorbitol*	-----	1-3 ml/kg/day in divided doses	Flatulence, abdominal cramps, hypernatremia
Phosphate enemas	-----	≥ 2 years: 6 ml/kg up to 135 ml	Hypocalcemia with tetany, hyperphosphatemia, risk of mechanical trauma to rectal wall, abdominal distention or vomiting
Stimulant laxatives	-----	-----	-----
Bisacodyl	4-18 years: 5-20 mg OD (PO); 2-18 years: 5-10 mg OD (Rectum)	≥ 2 years: 5-10 mg as suppository or 5-15 mg as tablet	Abdominal pain, diarrhea, hypokalemia
Senna	1 month to 4 years: 2.5-10 ml/day 4-18 years: 2.5-20 ml/day	2-6 years: 2.5 - 7.5 ml/day; 6-12 years: 5-15 ml/day	Idiosyncratic hepatitis, melanosis coli, hypertrophic osteoarthropathy, analgesic nephropathy
Docusate sodium	12-18 years: Up to 500 mg daily in divided doses	-----	-----

? Pediatric oral powder formula contains PEG 3350: 6.563 g; sodium bicarbonate: 89.3 mg; sodium chloride: 175.4 mg; potassium chloride: 25.1 mg/sachet,

*Adjust dose to produce regular soft stools, NASPGHAN: North American Society of Pediatric Gastroenterology, Hepatology, and Nutrition, NICE: National Institute for Health and Care Excellence, PEG: Polyethylene glycol.

NASPGHAN committee recommends osmotic laxatives for long-term management of constipation due to their excellent tolerability profile [4]. Earlier, lactulose (an osmotic laxative) was considered to be the first-line drug in the treatment of constipation. Lactulose is fermented by colonic bacteria and decreases colonic pH that leads to expansion of fecal

volume and eventually leads to colonic transit. Lactulose although effective, it has numerous disadvantages, Box 1 [27]. On the other hand, stimulant laxatives such as senna and bisacodyl have been associated with adverse effects and hence should be used only for short-term as rescue therapy [4].

Box 1: Disadvantages of lactulose

- ❖ The action of lactulose is dependent on the colonic microflora.
- ❖ Causes bloating and abdominal pain due to excess production of gas resulting from fermentation.
- ❖ Alters the bacterial colonic flora and hence it is associated with reduced efficacy when used for long-term use [27]

Which laxative to use?

Among osmotic laxatives, Polyethylene glycol (PEG) has been approved by the Food and Drug Administration for the treatment of constipation [4]. PEG is considered to be the first-line drug for the treatment of fecal impaction as per UK NICE guidelines [17]. PEG, an organic polymer with a high molecular mass is physiologically inactive and is not absorbed or metabolized in the gut. Unlike other laxatives, PEG acts by inhibiting absorption of water from fecal material in the large bowel and thus retains water in the feces. PEG is effective and safe with excellent tolerability profile in the treatment of fecal disimpaction and as maintenance therapy in chronic constipation [28]. Comparative studies have shown that PEG is superior to placebo and lactulose in the treatment of childhood constipation. PEG is as effective as milk of magnesia, liquid paraffin, and the fiber mixture but has a better acceptance rate [29].

Advantages of PEG [23, 27]

PEG 3350 exhibits a linear dose-response relationship when ingested, retaining water in the bowel to potentially produce an almost unlimited laxative action. This unique property is not seen with other laxatives such as senna or lactulose as their metabolic process gets saturated leading to non-linear dose response relationship.

- ☞ PEG 3350 is effective in preventing recurrence of fecal impaction and thus reduces the treatment cost.
- ☞ PEG 3350 plus electrolytes can be easily administered at home and therefore reduces the need for hospitalization.
- ☞ PEG has high compliance rate when compared to other laxatives.
- ☞ PEG is associated with minimal adverse effects when compared to other laxatives as it is not

absorbed in the body.

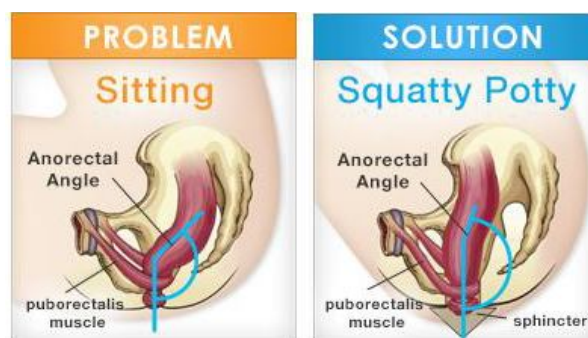
- ☞ PEG 3350 is safe as the PEG load recovery in urine is minimal.

PEG plus Electrolytes: Gold standard therapy for the Treatment of Constipation in Children

PEG solutions containing electrolytes is considered to be a choice of therapy for fecal disimpaction [17]. PEG with electrolytes is used in Europe, Australia, and other parts of the world. Electrolytes such as sodium chloride, potassium chloride, sodium bicarbonate, and sodium sulfate are added to PEG in varying concentrations to counter-act the loss of electrolyte that occurs when large volume is used for lavage [28]. It is available as sachets of varying sizes [29]. PEG electrolyte solutions are administered orally in small volumes of solutions [23]. Refer Table 9 for information on dose. PEG with electrolyte solutions have been successfully and safely used in children with refractory constipation [27].

Mechanism of Action of PEG plus Electrolytes

- ☞ PEG plus electrolytes is an effective but gentle Iso-osmotic laxative with a natural mode of action.
- ☞ When PEG plus electrolytes is mixed with water the PEG molecules attract and bond with it, this is then swallowed usually as in 62.5 mL dose and no additional water is needed for PEG plus electrolytes to work.
- ☞ PEG then acts locally in a colon to relieve constipation. It works through several natural actions.
- ☞ The water retained by PEG plus electrolytes in bowel softens the stool and bulks it ups slightly. As the stool gently expands it triggers colonic activity and the bowel movement in a natural way.
- ☞ Because of the water lubricating effect and rehydrated softens stool, the bowel movement feels more comfortable. Unlike osmotic laxatives they control water from the body, PEG plus electrolytes uses the water bonds with to produce an iso-osmotic effect so it's less likely to dehydrate the body.
- ☞ Thanks to precisely measured quantity of electrolytes. There is no gain or loss of electrolytes either.
- ☞ After exerting its therapeutic action, PEG is expelled from the body virtually unabsorbed.



The puborectalis muscle **partially relaxes**, keeping the colon kinked and blocking the flow of waste.

The puborectalis muscle **fully relaxes** allowing the colon to empty quickly and completely.

Fig. 5: Comparison between sitting posture and squatty posture on fecal elimination

Importance of Squatting Posture

Constipation can be caused by various factors including unhealthy toilet posture. In a sitting posture, anorectal angle is kinked which chokes the rectum leading to retention of feces. This makes elimination difficult and incomplete, creating the need to strain. On the contrary, transition from sitting posture to squatty posture has been reported to achieve optimal fecal elimination. This is because the squatty posture causes relaxation of puborectalis muscle and allows anorectal angle to straighten, resulting in easier defecation (Figure 5) [30].

Beneficial Effects of Squatty Posture

- Reduces straining and decreases the pressure in the anal and rectal veins.
- Reduces the risk of toxic build-up of fecal matter left in colon.
- Causes efficient bowel evacuation.
- Heal or prevent hemorrhoids [30].

Education about Toilet Training

Behavioral modification therapy in combination with laxatives is more effective in the treatment of chronic constipation when compared to laxative therapy alone or behavioral modification alone [4]. Toilet or potty training should be started when the child has learnt to say or show an adult that they want to go for a wee or poo. Generally, 1.5 to 3 years is considered to be an ideal age for training the children. Parents/ caretakers should:

- ✓ Use clothes such that child can remove easily.
- ✓ Encourage the child to sit on the potty a couple of times every day.

- ✓ Encourage the child to sit on the toilet after meals.
- ✓ Regularly ask the child if he/she wants to go for potty.
- ✓ Praise the child when she/he sits on the toilet.
- ✓ Avoid rushing the child to the potty/toilet.
- ✓ Involve the child when buying a potty or toilet seat.
- ✓ Ensure that the child has a footstool which can support his/her legs to effectively increase intra-abdominal pressure [6, 21].

Prognosis of Childhood Constipation

The prognosis is excellent in children below 5 years of age [17]. However, early onset of symptoms during the first year, family history of constipation, poor self-esteem and prior sexual abuse are associated with poor prognosis [14].

Summary

Constipation in children is an often long-lasting pediatric functional gastrointestinal disorder affecting up to 30% of the children worldwide. Constipation is usually described as constellation of different symptoms related to difficult passage of stool. The current standard treatment consists of disimpaction, maintenance therapy, education, toilet training, and long-term follow-up. PEG in combination with electrolyte solution is recommended by NICE and NASPGHAN guidelines for the treatment of constipation and fecal disimpaction. PEG in combination with electrolyte solution is effective and safe with favorable tolerability profile when compared to lactulose.

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