

# Role of laxative in chronic abdominal pain in paediatric age group

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## Abstract

The aims of the study were to identify the frequency and causes of chronic abdominal pain in paediatric age group (age 4 to 12 years) and to study use of laxative in chronic abdominal pain presented from June 2014 till June 2016 at RSCMGMC and CPR hospital Kolhapur. We evaluated prospectively the complete charts of children >4 years old, for complaints and causes of chronic abdominal pain. Of 200 patients evaluated 90 were boys and 110 girls with a mean age of 9.1 years. All patients were evaluated for chronic abdominal pain and put on intensive laxative therapy followed by maintenance dose. Although many laxative agents are used, we used an agent polyethylene glycol (PEG) to prevent comparative bias. At the time of evaluation, the mean duration of PEG therapy was 5.7 months, and the mean PEG dose was 0.75 g/kg daily. There were no major clinical adverse effects. All children preferred PEG to previously used laxatives, and daily compliance was measured as good in 90% of children. Constipation as cause of abdominal pain occurred in 87% (174 out of 200) of patient and relieved by laxatives, childhood functional abdominal pain in 5% (10 out of 200), colic in 3% (6 out of 200), gastro esophageal reflux in 3.5% (7 out of 200) and infection in 1.5% (3 out of 200). Functional constipation was the most frequent cause of chronic abdominal pain in a large primary care paediatric population. A careful history and thorough physical examination is all that is required to diagnose functional constipation. Management includes disimpaction followed by maintenance therapy with oral laxative, dietary modification and toilet training. In most of the cases laxative needs to be continued for several months and sometimes years. Early withdrawal of laxative is the commonest cause of recurrence.

**Keywords:** prospective study, functional abdominal pain, functional constipation, children.

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Received Date: 27/07/2016 Revised Date: 17/08/2016 Accepted Date: 12/09/2016

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DOI: 01 October  
2016

## INTRODUCTION

Abdominal pain is among the most common complaints of childhood worldwide. It affects the child's wellbeing, and the cost from missed school days and use of healthcare resources are high<sup>1</sup>. Recurrent abdominal pain is a symptom, not a diagnosis. The seminal work of Apley and Naish, who studied 1000 school children in

Bristol, England, used a pragmatic definition of 3 episodes over 3 months, severe enough to affect daily activity to define recurrent abdominal pain<sup>2</sup>. In clinical practice, it is generally believed that intermittent or constant abdominal pain that exceeds 2 or 3 months in duration can be considered chronic<sup>2</sup>. Chronic abdominal pain occurs in more than 10% of children<sup>3</sup>. The role of gender remains undefined. Chronic abdominal pain can be due to functional as well as organic causes. Functional abdominal pain is abdominal pain without evidence of an inflammatory, anatomic, metabolic or neoplastic disorder<sup>4</sup>. It is thought that children with functional gastrointestinal disorders such as recurrent or chronic abdominal pain have abnormal bowel reactivity to physiologic stimuli, such as a meal, gut distension and hormonal changes; to noxious stimuli such as inflammatory processes; or psychological stressful stimuli, such as anxiety and separation anxiety. Only in a small number of children is the chronic abdominal pain

caused by an underlying organic disease. We had noticed that many of the children, with a complaint of chronic abdominal pain, had underlying constipation. Because of the significant direct and indirect costs associated with chronic abdominal pain in children, our aims were to evaluate the causes of chronic abdominal pain, determine the frequency of underlying constipation and to evaluate role of laxative in chronic abdominal pain in paediatric population. Constipation is a common problem in the pediatric population. This symptom accounts for 3% of outpatient visits to general pediatric clinics and up to 25% of visits to pediatric gastroenterology clinics<sup>5</sup>. Treatment regimens vary widely and include dietary and behavioral modification, counseling, and the use of various laxatives and stool softeners. Although many laxative agents are used like lactulose, lactitol, polyethylene glycol, sorbitol we used an agent polyethylene glycol (PEG) to prevent comparative bias. Polyethylene glycol 3350 (PEG) is a relatively new osmotic laxative. Polyethylene glycol is a component of the PEG-electrolyte lavage solution that has been used in large volume to cleanse the gastrointestinal tract for diagnostic and surgical procedures in children<sup>6</sup>. Polyethylene glycol 3350 is a nontoxic and highly soluble compound that is minimally absorbed in the gastrointestinal tract<sup>7</sup>. Due to these properties, PEG acts as an osmotic agent, increasing fecal water content<sup>8</sup>. Polyethylene glycol 3350 without electrolytes is supplied as a powder that is palatable when dissolved in a beverage such as water or juice. Recent studies<sup>9</sup> in adults have reported short-term efficacy of PEG without any major clinical adverse effects. Polyethylene glycol has been approved by the Food and Drug Administration for the short-term treatment of constipation in adults. Three small pediatric studies<sup>10</sup> have reported short- and long-term efficacy of PEG. Polyethylene glycol is widely used in clinical practice for children with constipation.

## EPIDEMIOLOGY

European and American community based epidemiological studies have found prevalence rates of recurrent abdominal pain varying between 0.5% and 19 %<sup>2</sup>. Apley and Naish found that the incidence of detectable pathology in recurrent abdominal pain was only 8 %<sup>2</sup>. More recent studies, with analysis of the results of investigations in selected cohorts, have found rates of pathology in up to 30% in a tertiary referral setting<sup>11</sup>. In the present day Western setting, irritable bowel syndrome is the commonest cause of functional RAP in children, accounting for 52% of cases<sup>11</sup>. The diagnosis of RAP may differ in developing countries compared to Western Nations, as infective causes are more prevalent and inflammatory bowel disease is less common<sup>11</sup>.

## MATERIAL AND METHODS

### Identification of the Study Population

We evaluated prospectively all children, 4 to 12 years of age, who presented with chronic abdominal pain at RCSMGMC and CPR hospital, Kolhapur, during one year period from June 2015 till June 2016. Medical visits for primarily chronic abdominal pain with or without other gastrointestinal symptoms were reviewed in detail for complaints of abdominal pain, duration of this complaint, symptoms of constipation, other symptoms, and final diagnosis for the abdominal pain. These data were entered into a pre-designed data collection form which was developed for this study. The final diagnosis for each patient was made, depending on symptoms, physical findings, blood tests, cultures, X-rays, when available, and/or response to treatment and resolution of the abdominal pain with treatment. Study subjects were in otherwise good health as judged by a physical examination. Study subjects were excluded if they had allergy or sensitivity to study medications, prior gastrointestinal (GI) surgery, known or suspected GI obstruction, ileus, heart failure, renal failure, ascites, other known chronic bowel, liver or cardiopulmonary disorders, if they were pregnant or lactating, or if they were taking medications known to affect bowel function. Patients were excluded if loose stools were present and if there were sufficient criteria for irritable bowel syndrome. Study subjects returned to their study centre at 2, 4, 6, 9 months.

### Definitions

Apley and Naish<sup>2</sup> defined recurrent abdominal pain as at least 3 episodes of pain occurring within 3 months that are severe enough to affect the child's activities. We used the following definition for functional abdominal pain: the child had to have periodic or constant abdominal pain with functional impairment and an unremarkable physical examination and diagnostic evaluation, except related to stool retention. The term chronic abdominal pain includes all causes, functional as well as organic causes. Functional constipation was defined by the classical Iowa criteria, which we and others have used for more than 20 years<sup>12</sup>. Functional constipation was defined by duration of at least 2 months.

### Criteria for Functional Constipation

Functional constipation was defined by duration of at least 2 months and by >2 of the following characteristics in children >4 years of age:

1. Frequency of bowel movements of less than three stools per week.
2. >1 episode of faecal incontinence (formerly called encopresis) per week.
3. History of retentive posturing (or excessive volitional stool retention)

4. History of painful or hard bowel movements.
5. Large stools in the rectum or felt on abdominal examination, or
6. Passing of stools so large that they obstruct the toilet.

In children <4 years of age, the history of retentive posture or stool withholding maneuver is being replaced by history of excessive stool retention as retentive posture is difficult to assess in younger children. Colic is a symptom complex of early infancy that is characterized by paroxysms of irritability, fussing, or crying, that starts and stops without obvious cause, episodes lasting for >3 hours per day and occurring at least three times per week for at least one week<sup>13</sup>.

### Data Analyses

The relevant information was abstracted and entered into a pre-designed data collection form. Patient characteristics were summarized using observed proportions, means, standard deviations and ranges. T-test, X2-test and Fisher's exact test were used. Significance was accepted at  $p < 0.05$ . Results were expressed as mean + standard deviation or percent.

### ASSESSMENT

The evaluation of the child with abdominal pain is directed primarily to determine the likelihood of serious pathology and to direct investigations appropriately. The key to this is a thorough multisystem review of symptoms and examination. There are several "red flag" symptoms and signs to alert the clinician to those at potentially higher risk of significant pathology as presence of

involuntary weight loss, reduced growth, significant vomiting, chronic severe diarrhea, bleeding per-rectum, hematemesis, unexplained fever and a family history of IBD<sup>14</sup>. The history and examination should determine the appropriate level of investigation. In a tertiary hospital setting, the commonest organic causes include gastro-esophageal reflux disease (8.7%), Crohn's disease (7%), Celiac disease (4%), duodenal ulcer (1%), food allergy (1%) and *Helicobacter pylori* gastritis (8%). If celiac screen (anti-endomysial antibodies) is positive, then a small bowel biopsy is indicated for definitive diagnosis; if inflammatory bowel disease (IBD) is suspected, then upper and lower gastrointestinal endoscopy is indicated<sup>14</sup>.

### Causes of Chronic Abdominal Pain

200 children had been examined for chronic abdominal pain. Chronic abdominal pain occurred in 120 boys (60%) and in 80 girls (40%). The pain in boys was due to functional constipation in 68, due to childhood functional abdominal pain in 5, due to Colic in 2, due to Gastroesophageal reflux in 3, due to chronic infection as *Entamoeba histolytica* infection in 2 patients. The pain in girls was due to functional constipation in 86, due to childhood functional abdominal pain in 5, due to Colic in 4, due to Gastroesophageal reflux in 4, due to Chronic infection as *Entamoeba histolytica* infection in 1 patient. There was no significant difference in causes of abdominal pain in boys and girls. Overall abdominal pain was due to functional causes in 95 % and in only 5 % of the chronic abdominal pain was due to organic disease.

**Table 1: Causes of Chronic Abdominal Pain**

No. %	Chronic abdominal pain		
	All (200)	Boys (90) 45%	Girls (110) 55%
Due to functional GI disorders:	190 (95 %)	85	105
Due to functional constipation	174	78	96
Childhood functional abdominal pain	10	5	5
Colic	6	2	4
Due to organic causes:	10 (5%)	5	5
Gastroesophageal reflux	7	3	4
Chronic infection	3	2	1

Our outcome data documented relief of abdominal pain with adequate laxative treatment in 174 children.

### ETIOLOGY

Constipation is quite common in India and functional constipation is the commonest cause. In fact 95% cases are due to functional and only 5% are due to some organic causes<sup>12</sup>. Among the organic causes, Hirschsprung disease is the most common and important cause<sup>16</sup>.

### CAUSES OF CONSTIPATION IN CHILDREN

Functional constipation of childhood

**Motility related:** Hirschsprung's disease, myopathy

**Congenital anomalies:** Anal stenosis, anteriorly located anus, spinal cord anomalies (meningomyelocele, myelomalacia, spina bifida)

**Neurological:** Cerebral palsy, mental retardation

**Endocrine/metabolic:** Hypothyroidism, renal tubular acidosis, diabetes insipidus, hypercalcemia

**Drugs:** Anticonvulsants, antipsychotic, codeine containing anti-diarrheal.

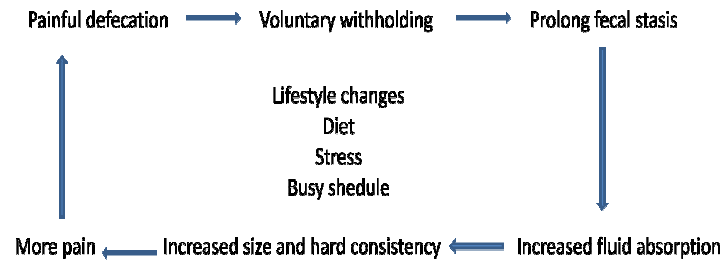


Figure 1: Pathogenesis of functional constipation

The initiating event in functional constipation is a painful bowel movement which leads to voluntary withholding of stools by the child who wants to avoid unpleasant defecation<sup>17</sup>. Events that lead to initial painful defecation are change in routine like timing of defecation or diet, stressful events, inter-current illness, nonavailability of toilets (during traveling), child's postponing defecation because he or she is too busy (morning school). All these events give rise to large, hard stool and passage of such stool leads to stretching of the pain sensitive anal canal, and that frightens the child. Such children respond to the urge to defecate by contracting their external anal sphincter and gluteal muscles, in an attempt to withhold stool. Withholding of feces leads to prolonged fecal stasis in the rectum, with resultant absorption of fluids and harder stools. Successive retention of stools in rectum makes them larger. As the cycle is repeated, successively greater amounts of larger and harder stools are built up in the rectum and passed with even greater pain accompanied by severe "stool withholding maneuvers". Thus a vicious cycle sets in. With time, such retentive behavior becomes an automatic reaction. Eventually, liquid stool from the proximal colon may percolate around hard retained stool and pass per rectum involuntarily (fecal incontinence). Sometimes this fecal incontinence is mistaken as diarrhea. In fact almost 30% children with functional constipation develop fecal incontinence<sup>18</sup>. Eventually, with more and more stasis, the rectum becomes dilated and redundant, and the sensitivity of the defecation reflex and the effectiveness of peristaltic contractions of rectal muscles decrease. This is the stage when it becomes more difficult to have a normal defecation due to fecal impaction.

#### ASSESSMENT OF A CHILD WITH CONSTIPATION

A careful history and thorough physical examination (including digital rectal examination) are all that is required to diagnose functional constipation provided there are no "red flags" like fever, vomiting, bloody diarrhea, failure to thrive, anal stenosis, and tight empty rectum<sup>19</sup>. Abnormal physical findings, which help to distinguish organic causes of constipation from functional, are failure to thrive, lack of lumbo-sacral

curve, sacral agenesis, flat buttock, anteriorly displaced anus, tight and empty rectum, gush of liquid stool and air on withdrawal of finger, absent anal wink and cremasteric reflex. The most important features in the history, which help to distinguish Hirschsprung disease from functional constipation, are onset in first month of life and delayed passage of meconium beyond 48 hours and the most important examination finding is empty rectum on digital rectal examination. It has been shown that 99% healthy, term neonates pass meconium in first 48h of life<sup>20</sup>. In fact, in a classical case of functional constipation, no investigation is required to make the diagnosis. There is no need to do barium enema in all cases of constipation to rule out Hirschsprung disease. If the clinical suspicion of Hirschsprung disease is strong (based on history of delayed passage of meconium and empty rectum on digital rectal examination) then only one may consider getting barium enema done. However, to diagnose Hirschsprung disease, rectal biopsy is a must. The interpretation of barium enema should be on the basis of reversal of rectosigmoid ratio (sigmoid becomes more dilated than rectum) and documentation of transition zone and not on mere presence of barium in rectum after 24 hours.

#### MANAGEMENT

Most children with functional constipation get benefited from a precise, well-organized treatment plan, which includes cleaning of fecal retention, prevention of further retention and promotion of regular bowel habits. The general approach includes the following steps:

- Determine whether fecal impaction is present, and treat if present,
- Initiate maintenance treatment with oral laxative, dietary modification, toilet training, and
- Close follow up and medication adjustment as necessary<sup>19</sup>.

Study subjects were in otherwise good health as judged by a physical examination. Study subjects were excluded if they had allergy or sensitivity to study medications, prior gastrointestinal (GI) surgery, known or suspected GI obstruction, ileus, heart failure, renal failure, ascites, other known chronic bowel, liver or cardiopulmonary disorders, if they were pregnant or lactating, or if they



were taking medications known to affect bowel function. Patients were excluded if loose stools were present and if there were sufficient criteria for irritable bowel syndrome. Study subjects returned to their study centre at 2, 4, 6, 9 months. Following the diagnosis of constipation, PEG therapy was initially prescribed at the dose of 0.8 g/kg per day, based on our previous study<sup>10</sup> and all other laxative treatments were stopped. Parents were instructed to dissolve 17 g of PEG powder in 240 mL of water or other beverage and to give the prepared solution in 2 divided doses. Families were allowed their choice of beverage to suit each child's preference. Parents were asked to adjust the dose of PEG solution as required to yield 2 soft painless stools per day. Over time, parents were

instructed to gradually decrease the dose of PEG if symptoms of constipation and encopresis showed improvement.

## RESULTS

A total of 200 children (130 with constipation and 70 with constipation and encopresis) were enrolled in the study. Previous therapy for constipation was attempted in 164 children (82%), and 74 of them had received multiple medications. At visit 1 (about 2 months) and thereafter, about 80% of participants reported a successful response to treatment at each subsequent visit.

**Table 2: Assessments of the patients**

Table 2: Assessments of the patients								
	Visit 0	Visit 1	Visit 2		Visit 3		Visit 4	
	Enrolled	2 month	4 month		6 month		9 month	
Completely relieved		72	72+51 = 123	123	123+ 26 = 149	149	149+10=159	159
Considerably relieved		64	64-51 = 13	46	46 -26 = 20	24	24-10=14	15
			13+33 = 46		20+4= 28		14+1=15	
Somewhat relieved		42	42- 33= 9	16	16 -4= 12	17	17-1=16	17
			9+7=16		12+5=17		16+1=17	
Unchanged		22	22-7=15	15	15-5=10	10	10-1=9	9
Worse		0	0	0	0	0	0	0
Total	200	200	200		200		200	

At visit 1 (about 2 months) 72 children were completely relieved, 64 children were considerably relieved, 42 children were somewhat relieved and 22 children were Unchanged. In next visit 2 (at 4 month) additional 51 children were completely relieved (total 123), 33 children were considerably relieved (total 46), 7 children were somewhat relieved (total 16) and 15 children were Unchanged. In next visit 3 (at 6 month) additional 26 children were completely relieved (total 149), 4 children were considerably relieved (total 24), 5 children were somewhat relieved (total 17) and 10 children were Unchanged. In next visit 4 (at 9 month) additional 10 children were completely relieved (total 159), 1 child was considerably relieved (total 15), 1 child was somewhat relieved (total 17) and 9 children were Unchanged. Effectively 174 out of 200 patients with Constipation as cause of abdominal pain get relieved by laxatives. Dependent on month of observation, 80–88% of subjects were rated as successfully treated. Clinical adverse effects of PEG therapy were minor and acceptable over the mean duration of months of PEG therapy. 20 patients (10%) reported frequent watery stools sometime during therapy. The diarrhea disappeared with reduction of the dose. Other adverse effects reported were bloating or flatulence in 12 children (6%) and abdominal pain in 4 children (2%). Thirst, fatigue, and nausea after receiving PEG solution on an empty stomach were reported in 2 patients (1%). None of the patients stopped treatment due to

adverse effects, and all were willing to continue PEG therapy. The general physical examination findings revealed no new significant abnormalities compared with the pretreatment examination in all children.

### Maintenance therapy

To prevent re-accumulation after removing impaction maintenance therapy in the form of dietary modification, toilet training and laxatives needs to be started immediately.

### Dietary Modification

The diet of most children with functional constipation lacks fiber. Many of them are predominantly on milk with very little complementary food. The children with functional constipation should be encouraged to take more fluids, absorbable and nonabsorbable carbohydrate as a method to soften stools. Non-absorbable carbohydrate (Sorbitol) is found in some fruit juices like apple, pear and prune juices. A balanced diet that includes whole grains, fruits and vegetables is advised. The recommended daily fiber intake is age (in years) + 5 in g/day. In our practice, where most children are predominantly on milk diet, we counsel the parents to restrict milk so that the child starts eating solid foods.

### Toilet training

The child is encouraged to sit on the toilet for 5 to 10 minutes, 3 to 4 times a day immediately after major meals for initial months<sup>12</sup>. Parents are encouraged to maintain a daily record (*stool diary*) of bowel movements, fecal

soiling, pain or discomfort, consistency of stool and the laxative dose. This helps to monitor compliance and to make appropriate adjustment in the treatment program. Parents are instructed to follow a reward system.

#### Follow-up schedule

A close and regular follow-up is a key to the success of treatment of functional constipation. Initial follow-up should be monthly till a regular bowel movement is achieved. After that it should be 3 monthly for 2 years and then yearly<sup>12</sup>. On each visit, by reviewing stool records and repeating abdominal and (if required) rectal examination, progress should be assessed. If necessary, dosage adjustment is to be made. Once a regular bowel habit is established, the laxative dosage is to be decreased gradually before stopping.

### DISCUSSION

Chronic abdominal pain is a common ailment presenting to pediatric surgical and pediatric medical clinics. It involves a lot of parent's worry and also scholastic absence of the child. Although every case is judiciously examined and investigated by the practitioners, it usually requires a lot of trial of clinical suspicion and sometimes investigations. It is many times followed by a course of antibiotics and symptomatic treatment. In this study we could infer that a single suspicion of chronic constipation in majority of pediatric chronic abdominal pains with its rightful evaluation and a singular therapy with a chosen laxative can cure much of problems and anxiety too. Although the study also infers that common cause of chronic abdominal pain in children is chronic constipation we aimed at studying its correlation with the therapy which can be uniformly applied. The range of functional constipation can range from mere anorexia to abdominal pain to encopresis, detrusor spincter dyssynergia and even its complications like appendicitis, fissure in ano etc. Each case needs a pertaining evaluation. They might require fecal disimpaction, enemas, dietary advice and proper toilet training too. However in majority of cases an initial intensive therapy followed by maintenance of laxative for some weeks can take care of the recurring and chronic abdominal pain. 200 children with chronic abdominal pain between age group of 4 years to 12 years were retrospectively evaluated. There was no significant difference in the frequency and causes of abdominal pain in boys and girls. We found that in 95 % the abdominal pain was due to a functional gastrointestinal disorder, most often due to functional constipation in 87%, due to childhood functional abdominal pain in 5% and due to colic in 3%. A total of 200 children (130 with constipation and 70 with constipation and encopresis) were enrolled in the study. Previous therapy for constipation was attempted in 164 children (82%), and 74

of them had received multiple medications. Patients visited the clinic approximately every 2 months. Patients were also asked to complete a symptom questionnaire reported as 'completely relieved' or 'considerably relieved'. Dependent on the month of observation, 80–88% of enrolled patients and 84–94% of elderly subjects were rated as successfully treated over the course of the study. Overall patient compliance with study medication administration was good averaging about 73%. For the evaluation of a child with chronic abdominal pain, details of defecation and a thorough examination, including a rectal examination is necessary. A plain abdominal X-ray may be necessary in some cases. These patients were relieved by adequate laxative treatment. Constipation as a major cause of chronic abdominal pain in children, from toddler age to the preteen years, has been previously reported<sup>21,22,23</sup>. Constipation is a common problem in children and an estimated prevalence of functional constipation is 3% worldwide<sup>24</sup>. In taking the history and examining the child, it is necessary to rule out the wide range of organic disorders that may present with chronic abdominal pain. The prevalence rates of organic disease ranged from 5% in the general population to 40% in a paediatric gastroenterology practice<sup>25</sup>. The prevalence for chronic abdominal pain due to underlying organic disease in our children was only 3%. Kokkonen *et al*<sup>26</sup> reported a much higher rate of organic disease in Finnish 10- to 11-year old children, including milk protein intolerance, lactose intolerance, celiac disease and *Helicobacter pylori* infection. In a study from Khanna V, Poddar U, Yachha SK reported 138 cases of constipation diagnosed over a period of six years and 85% of them were functional<sup>16</sup>. Hence, constipation is not uncommon in the Indian subcontinent. It is commonly seen among toddlers and preschool children, and in 17% to 40% of cases, constipation starts in first year of life<sup>12,18</sup>. Constipation with or without encopresis is often a chronic problem in children. In one long-term study from the United States<sup>12</sup>, 37% of children continued to have symptoms of constipation 3 to 12 years after initial diagnosis. In another study from Italy<sup>27</sup>, constipation persisted in 52% of children 5 years after initial diagnosis. Adequate doses of laxatives and treatment compliance are the most important factors for successful resolution of chronic constipation<sup>12</sup>. Long-term treatment is required for children with chronic constipation, as relapse is common after premature discontinuation of laxatives<sup>12</sup>. Therefore, there is a need for an ideal laxative that is safe, effective, and acceptable to children over the long-term. In our study, long-term PEG therapy did not have any major clinical adverse effects. The most common clinical adverse effect was excessively loose or frequent stools that resolved with reduction of the PEG dose.

Polyethylene glycol does not ferment by colonic bacterial flora and, therefore, does not cause excessive gas production that leads to flatulence or bloating<sup>28</sup>. Long-term PEG therapy does not adversely affect fluid and electrolyte balance despite improvement in stool frequency and consistency. There are several effective medications available for long-term treatment of constipation in children, including milk of magnesia, lactulose, and mineral oil<sup>5</sup>. However, these medications have either poor palatability or adverse effects such as abdominal pain, flatulence, or anal leakage, which may limit patient acceptance and compliance<sup>10, 12</sup>. Most children in our study had tried other laxatives before. They all preferred PEG to other laxatives because of its palatability. Therefore, compliance with PEG and patient acceptance was excellent. In a retrospective chart review of 223 children, Guest, *et al*<sup>29</sup> have shown that 97% children treated with PEG were successfully disimpacted compared to 73% of those who received enemas and suppositories ( $P < 0.001$ ). In a randomized controlled trial, Bekkali, *et al*<sup>30</sup> have compared 6 days enemas with dioctylsulfosuccinate sodium (60 mL in  $<6$  years and 120 mL in  $\geq 6$  years) in 46 children with PEG in 44 children and showed that both were equally effective for disimpaction. However, two retrospective studies have shown that the reimpaction rate after initial disimpaction with enemas was much more than that with PEG<sup>29</sup>. For infants, glycerine suppositories are to be used for disimpaction as enemas and lavage solution are not indicated in them<sup>19</sup>. It has been shown that lactulose, sorbitol, milk of magnesia (magnesium hydroxide), and mineral oil (castor oil), all are equally effective in children. Milk of magnesia and mineral oil are unpalatable and due to the risk of lipoid pneumonia mineral oil is contraindicated in infants. The commonly used laxative in children so far was lactulose, until the introduction of PEG. The study by Loening-Baucke<sup>12</sup> has shown that low volume (0.5 to 1g/kg/day) polyethylene glycol (PEG) without electrolytes is as effective as milk of magnesia in the long-term treatment of constipation in children. Low volume PEG has been compared with lactulose in the treatment of childhood functional constipation and a meta-analysis of five RCTs comprising of 519 children has shown that PEG was more effective than lactulose with equal tolerability and fewer side effects<sup>31</sup>. Side effects, especially bloating and pain are less with PEG. With long term use, lactulose loses its efficacy due to change in gut flora but PEG does not<sup>32</sup>. The dose of laxative should be adjusted to have one or two soft stools/day without any pain or soiling. Once this target is achieved, the same dose should be continued for at least 3 months to help the distended bowel to regain its function. In a long-term follow up study (mean  $6.9 \pm 2.7$

years) on 90 children, who were  $<4$  years at diagnosis, Loening-Baucke<sup>12</sup> showed that 63% had recovery but symptoms of chronic constipation persisted in one third of cases 3 to 12 years after initial evaluation and treatment. In another study, it has been shown that 50% of patients were off laxative at 1 year, another 20% at 2 years and the remaining 30% were on laxative for many years<sup>12</sup>. Von Ginkel, *et al*<sup>33</sup> in a long-term follow up (mean 5 years) study on 418 cases have also shown that 60% were successfully treated at one year but 30% of cases in the 16 years or older age group continued to have constipation. They found that age at onset of constipation ( $<4$  years) and associated fecal incontinence were poor prognostic factors. In a large study on 300 children, Clayden<sup>34</sup> has shown that 22% required laxative for  $<6$  months, 44% for  $<12$  months and 56% for  $>12$  months. By summarizing all these studies it can be said that half to two thirds of children with functional constipation had successful outcome with laxative therapy for 6 to 12 months but the remaining one thirds require long-term therapy and they may continue to have constipation as an adult. Recurrence of constipation after initial recovery is common (50% may have relapse within a year of stopping therapy) but they respond well to retreatment<sup>18</sup>. Poor prognostic factors are; early onset ( $<4$  years), associated with fecal incontinence, and longer duration of symptoms ( $>6$ months)<sup>19</sup>.

## LIMITATIONS OF OUR STUDY

1. Medications for functional abdominal pain are often prescribed judiciously as an individual approach to relieve symptoms and disability.
2. Treatment suggestions for functional abdominal pain have included acid-reduction therapy and osmotic laxatives even though none have been evaluated in a double-blind randomized trial.
3. Diagnoses such as Gastroesophageal reflux disease and even constipation may have been given to allow for a treatment trial with acid suppressive therapy or laxative.

If constipation predominant irritable bowel syndrome was a cause of abdominal pain, it could not be determined because of the similarity of symptoms with functional constipation<sup>35</sup>.

## CONCLUSIONS

We found that functional constipation was the most frequent cause of chronic abdominal pain in children and should be considered first in a child complaining of recurrent or chronic abdominal pain presenting to a primary care physician. Constipation is quite common in Asia, and most often of functional origin. Detailed history and proper physical examination, including digital rectal

examination, can easily differentiate functional from organic constipation. There is no need to do any investigation before starting treatment in functional constipation. Disimpaction with oral polyethylene glycol is the main step in the management of constipation. Long-term PEG therapy is safe and is well accepted by children with chronic constipation with and without encopresis. PEG seems to be a safe medication for long-term treatment of constipation in children. It should be considered a favorable option for long-term therapy for children, particularly because of excellent patient acceptance. In most cases, prolonged (months to years) laxative therapy is required and early withdrawal leads to recurrence.

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Source of Support: None Declared  
Conflict of Interest: None Declared