


Constipation in Children with Cerebral Palsy: Prevalence, Clinical Manifestations, and Polyethylene glycol vs. Lactulose Efficacy

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ABSTRACT

Objectives: Cerebral palsy (CP) is a neurological disorder causing impaired movement control. Constipation is a common issue among these patients, with the prevalence ranging from 26% to 74%. This study aims to investigate the prevalence of constipation, examine associated symptoms, and compare the effects of commonly used drugs, including Lactulose and Polyethylene Glycol (PEG), in children with CP. These drugs can improve constipation management in this population and prevent serious complications, such as intestinal obstruction and bleeding.

Materials & Methods: The present research was a prospective cross-sectional study of 48 children and adolescents aged 1 to 15 with CP. According to our definition of constipation based on the ROME IV criteria, the prevalence of constipation in children with CP was calculated. Patients were randomly divided into two groups: Group 1 received treatment with PEG, while Group 2 received treatment with Lactulose. The patients were followed up one month later and then every three months to assess treatment response and monitor clinical symptoms.

Results: At both 12 and 24 weeks following the initiation of the treatment, a significant increase in the frequency of defecation per week was observed, accompanied by a notable decrease in the frequency of fecal incontinence in both groups. After 24 weeks of treatment, the defecation frequency increased from 1.5 to 6.3 in Group 1 (PEG group) and 1.6 to 5.7 in Group 2 (Lactulose group). Fecal incontinence reduced from initial values of 1.8 and 1.9 to 1.2 and 1.5 in Groups 1 and 2, respectively.

Conclusion: This study confirms that constipation is a common problem among children with CP. According to the obtained findings, PEG appeared to be more effective than Lactulose in managing constipation in children with CP.

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Introduction

Cerebral palsy (CP) is a group of permanent disorders of movement development, causing activity limitations resulting from non-progressive disturbances that occurred in early development (1). CP is often accompanied by sensory, cognitive, communication, and seizure disorders (2). The prevalence of CP ranges from 2 to 2.5 cases per 1000

live births, making it the most common physical disability in childhood (3, 4).

Constipation is recognized as a prevalent non-motor manifestation in individuals with CP (5). Depending on the definition and diagnostic methods used, the prevalence of constipation in this population ranges from 26% to 74% (6). Constipation in CP can lead to severe complications, such as intestinal obstruction and

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bleeding, causing significant challenges for both the affected individuals and their caregivers (7).

The underlying causes of constipation in CP patients are multifactorial; factors such as concomitant anticonvulsant medication use, inadequate fluid and fiber intake, reduced mobility, and dysfunction of oral movements further exacerbate constipation in these individuals (7). Some studies revealed that neurological disorders, primarily stemming from central nervous system damage, exhibit the strongest and most frequent associations with constipation (8).

Diagnosing constipation in children with neurological disabilities presents challenges, particularly regarding fecal incontinence and the limited use of digital rectal examinations (6). Previous studies have primarily relied on the frequency of defecation or changes in laxative use for constipation diagnosis. However, a symptom-based definition consistent with standardized criteria is needed to accurately diagnose this population. Functional constipation (FC) diagnosis currently relies on utilizing the most recent Rome IV criteria, serving as an updated version of the previous Rome III criteria (9).

The treatment approach for constipation in children with CP involves assessing fecal accumulation, if present, and initiating oral drug treatment while providing parental education, close follow-up, and medication adjustment as necessary (10). Commonly used drugs for constipation management include Lactulose, polyethylene glycol (PEG), and milk of magnesia (MOM) (11). However, limited comparative studies have been conducted on these medications in patients with CP, highlighting the need for further research to evaluate and compare their efficacy.

Given the higher prevalence of CP in developing countries and the limited global research, this study is essential for improving constipation management in children with CP. Therefore, this study aims to investigate the prevalence of constipation in children with CP based on standardized criteria, examine the clinical symptoms, and compare the effects of commonly used medications.

Materials & Methods

Study Design and Setting

The present study was a 12-month prospective cross-sectional study (January–December 2022) on 48 patients at the Zahra Mardani Azar Children's Training, Research & Treatment Center outpatient clinic and sub-specialized clinics of Tabriz University of Medical Sciences. The study was approved by the Ethics Committee (IR.TBZMED.REC.1400.1107).

Participants

The inclusion and exclusion process involved obtaining a detailed medical history for each

participant to identify those who met the following inclusion criteria:

Inclusion Criteria:

- Aged 1–15 years
- Diagnosis of CP.
- Constipation meeting Rome IV criteria.
- Parental consent.

Exclusion Criteria:

- Progressive neurological diseases.
- Non-CP neurological disorders.
- Age <1 or >15 years

The research questionnaire was explained to the parents, and after obtaining their permission, it was provided to them. The clinical variables collected included age, gender, type of delivery, and symptoms. The patient's symptoms were then assessed using the Rome IV criteria for constipation diagnosis.

After obtaining parental consent from participants who met the criteria for constipation, 50 patients were included in the study. Two cases were excluded at the beginning of the study due to non-adherence to medication and unwillingness to continue treatment. The study was continued with 48 patients. The patients were divided into two groups. The allocation to each group was done randomly using computer-generated numbers. Group 1 received treatment with PEG at 1 gr/kg/day (max 17 g/day), dissolved in 100 mL water, while Group 2 received treatment with Lactulose at 1 ml/kg/day (max 40 mL/day), split into two doses (Dosages were based on ESPGHAN guidelines (12)). The patients were followed up one month later and then every three months to assess treatment response and monitor clinical symptoms. All patients' symptoms and their responses to constipation treatment were carefully examined.

The overall success of the treatment was defined as a frequency of defecation more than twice a week and a frequency of fecal incontinence less than once a week. This was evaluated in the 4th, 12th, and 24th weeks after initiating treatment.

The Statistical analysis was performed using SPSS version 26 software (SPSS Inc., Chicago, IL, USA). The chi-square test, Student's t-test, and logistic regression were used for statistical analysis.

Rome IV criteria:

According to the Rome IV criteria, constipation is diagnosed when the patient meets two or more of the following criteria, occurring at least once a week and for at least once a month, and these criteria are not sufficient to diagnose irritable bowel disease:

- ≤ 2 bowel movements per week
- ≥ 1 fecal incontinence per week
- History of retentive posturing or voluntary retention of excessive stool

- History of painful or hard bowel movements
- Presence of a large stool mass in the rectum
- History of defecation with a large diameter, which may lead to toilet clogging (13).

Results

This study included 48 patients. Twenty-four patients in Group 1 were treated with PEG, and 24 in Group 2 were treated with Lactulose. The characteristics of the studied patients are listed in the table. According to our definition of constipation based on the ROME IV criteria, the prevalence of constipation in children with CP was calculated based on the total number of patients with CP referred during the study period, which was 15.6%.

Table 1: The characteristics of the studied patients

Average age	8.13 [3-14.5]
Gender	48
Male	26
Female	22
Level V GMFCS	3
Average mental disability	10
Severe mental disability	2
Tube feeding	3
Gastrostomy	1
NGT	2
Toilet trained	39
Natural vaginal delivery	22
Difficult natural vaginal delivery	8
Cesarean delivery	26

At the beginning of the study, 35 (73%) patients reported having two bowel movements per week or

fewer, and seven (14%) had experienced at least one episode of encopresis. The history of fecal retention, the presence of a large mass of fecal mass in the rectum, and painful defecation were noted in 28 (58%), 8 (16%), and 9 (19%) cases, respectively. Fifteen patients (31%) reported irritability, 26 (54%) decreased appetite, and 14 (29%) early satiety among the accompanying symptoms that were resolved by the resolution of constipation (Table 2).

Table 2: The number of symptoms related to constipation in all patients.

≤2 bowel movements per week	35 (73%)
≥1 episode of incontinence per week	7 (14%)
History of restraining posture or excessive voluntary retention of feces	28 (58%)
Presence of a large fecal mass in the rectum	8 (16%)
History of painful defecation	9 (19%)
Irritability resolved with constipation resolution	15 (31%)
Anorexia resolved with constipation resolution	26 (54%)
Early satiety resolved with constipation resolution	14 (29%)

The prevalence of constipation in children with a more severe motor disability defined by GMFCS level V and tube-fed children was 67% and 100%, respectively.

No correlation was found between constipation with age, gender, type of delivery, intellectual disability, and toilet training.

Table 3: Comparison of defecation frequency, incontinence, and success rate in the two study groups.

	Group 1	Group 2 lactulose PEG	P-value
Defecation frequency			
Initial	1.5	1.6	-
4th week	4.7	4.3	-
12th week	5.3	5	0.01 >
24th week	6.3	5.7	0.01
Encopresis frequency			
Initial	2.5	2.5	-
4th week	1.8	1.9	-
12th week	1.2	1.5	0.02
24th week	0.7	0.9	-
Success rate			
4th week	45%	32%	0.13
12th week	57%	33%	0.04
24th week	62%	37%	0.02

A significant increase in the frequency of defecation per week and a significant decrease in the frequency of fecal incontinence was observed at 12 and 24 weeks after the start of treatment in both groups (Table 3).

After 24 weeks of treatment, defecation frequency was 6.3 in the PEG group (Group 1) and 5.7 in the Lactulose group (Group 2). This difference was statistically significant (P-value = 0.01). In the fourth

week of treatment, the success rate for the PEG group was 45%, while the success rate for the Lactulose group was 32%, but the difference was not statistically significant (P -value = 0.13). The success rate was 57% and 33% for the 12th week and 62% and 37% for the 24th week for the PEG and Lactulose Groups, respectively. This difference in success rate was statistically significant for weeks 12 and 24 between the two groups (Table 3).

Considering the patient's age and condition, along with their limited cooperation and inconsistent parental reports about stool consistency, it was impossible to provide accurate statistics on this matter. No significant side effects were reported in either group during the first four weeks of treatment. Abdominal pain, bad taste in the mouth, flatulence, diarrhea, nausea, and vomiting were examined as non-serious side effects (CHART).

Discussion

The current research conducted a study with 48 patients diagnosed with CP, comparing PEG and Lactulose's effectiveness and possible complications in treating constipation. The prevalence of constipation in children with CP in this study was 15.6%. This study revealed that the PEG Group had a 62% success rate in treating constipation, compared to 37% for the Lactulose Group in the 24th week. This difference in success rate was statistically significant.

Veugelers et al. studied 152 children with severe generalized CP to investigate constipation prevalence and clinical manifestations. They found that constipation was present in 57% of the patients (6). However, in this study, the prevalence of constipation in children with CP was 15.6%, but it was more prevalent with the progression of motor disability.

In another study, Jarzebicka et al. compared the clinical effectiveness and tolerability of two medications, PEG 3350 and Lactulose, in treating functional constipation in 102 children over 12 weeks of treatment and a four-week follow-up period. At the end of week 12, the PEG group had more bowel movements per week, but the frequency of bowel movements with pain, stool retention, and large or hard stools was almost similar. Furthermore, PEG was more effective and caused fewer side effects, primarily bloating and abdominal pain, than Lactulose (14).

Similarly, Gheibi et al. investigated the effects of three medications, PEG, Lactulose, and MOM, on 468 children between the ages of 1 and 15 with chronic constipation. The dose used for all three drugs was 1ml/kg/day, increased up to three times depending on the patient's response. After eight weeks of treatment, the PEG group had more bowel movements and less pressure to defecate than the other two groups. The

adherence to treatment in the PEG group was higher than in the other two groups. The side effects of all three medications were reported to be negligible (15).

According to Voskuijl's study, both PEG and Lactulose improved bowel movements and significantly reduced fecal incontinence in children aged six months to 15 years. However, the success rate in the PEG group was higher than that in the Lactulose group (56% and 29%, respectively) (16).

In another study by Imanieh et al., the effects of three therapeutic regimens on constipation in children with CP were assessed during a clinical trial. They examined PEG in the first group, PEG and Motilium (domperidone) in the second group, and Motilium alone in the third group. Results showed that the group receiving the combined treatment had the highest rate of improvement in constipation. Moreover, patients who only took Motilium for two weeks had the lowest success rate. They concluded that the combination of PEG and Motilium had the best therapeutic effect for constipation in the study group (17).

Although constipation is common in children with CP or severe motor disabilities, no standard treatment regimen is recommended (6). This is because patients with neurological disorders may not respond well to conventional drugs (18).

Moreover, these patients often experience language and communication problems, making a general view of their condition and defecation pattern limited and dependent on caregivers' opinions (6). For the reasons mentioned above, a standard treatment protocol for these patients is needed, and this study was also conducted in this direction. Still, it was insufficient and required more extensive research.

One limitation of these studies is the failure to consider effective lifestyle factors. The intake of fluids and fiber in the population of patients with neurological disabilities has been reported to be insufficient in 53% of cases (19). Some studies have shown that increasing fiber intake leads to a reduction in laxative consumption and an improvement in bowel frequency (20-22). In contrast, some other studies have only indicated improved stool consistency and size (23). Other limitations of this study are the lack of examination of the patient's drug and family history of constipation, which should be paid more attention to in future studies. Besides, the sample size of 48 participants in this study was insufficient to estimate prevalence accurately at the population level. While the study title mentions "prevalence" specifically within this context, notably, constipation was observed among children with CP in this study. A larger sample size is recommended for future research to provide more robust and generalized prevalence estimates.

In Conclusion

This study confirms that constipation is a common problem among children with CP. According to the obtained findings, PEG appeared to be more effective than Lactulose in treating constipation in children with CP.

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Authors' Contribution

Shahram Sadeghvand designed the study concept, Ali Taghizadeh Orangi analyzed data and prepared the manuscript. Sophia Mansouripour and Erfan Golshan Shali drafted the manuscript. Gisou Erabi Sara Fazeli Danesh involved in drafting the manuscript and preparing the final revision of the manuscript.

Conflict of Interest

The authors declared no conflicts of interest.

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