ORIGINAL ARTICLE

Polyethylene Glycol 4000 for Fecal Disimpaction in Cerebral Palsy Children

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Abstract

Objectives

This study evaluated the efficacy of Polyethylene glycol 4000 for fecal disimpaction in children with cerebral palsy.

Materials & Methods

A randomized control trial study was conducted on children with cerebral palsy between February – March 2017 in the pediatric neurology outpatient clinic Dr. Soetomo Hospital. Children aged 2-16 years with fecal impaction randomly assigned into polyethylene glycol 4000 (PEG 4000) and saline enema group. Polyethylene glycol 4000 was given at a dosage of 0.7 g/kg and enema using normal saline 15ml/kg twelve hourly. Constipation was diagnosed using ROME IV criteria, and abdominal palpation identified fecal impaction. Efficacy was evaluated by clinical observation and adverse symptom monitoring. Data were analyzed by statistical software using an independent t-test ($p<0,05$).

Results

Thirty-two children were randomized into the study. Muscle relaxant was discovered in 17/32 patients. Sex, age, and body weight were not statistically different between groups. The resolution of fecal impaction was significantly different between PEG 4000 and saline enema (21.69 hours and 39 hours respectively; $p=0.001$). Application of muscle relaxant and severity of the disease did not involve treatment efficacy. There was no adverse symptom reported during treatment.

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Conclusion

Polyethylene glycol 4000 results in fecal disimpaction faster than enema in constipated children with cerebral palsy.

Keywords: cerebral palsy, constipation, fecal impaction, PEG4000, child health

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Introduction

Constipation is one of the most common co-morbidities in children with cerebral palsy.1 Prevalence estimates range from 26% to 74% depending on the definition of constipation, diagnostic method, and participant selection. In cerebral palsy, constipation is generally believed to be the result of both neurological factors and lifestyle factors.2 Previous study reported that constipation was significantly more frequent among children with level V GMFCS (gross motor functional classification system).3as data in this area are scarce. METHOD A cross-sectional observational study was performed in specialized day-care centres and schools in the Netherlands. The study included 152 children (81 males, 71 females; mean age 9 y 6 mo, SD 4 y 6 mo Constipation in cerebral palsy is usually reported after months or years or has resulted in fecal impaction, which contributes to a decrease in the quality of life.4 Constipation causes some complications, such as anal fissure, rectal bleeding, and pain due to fecal retention. Resulting impaired in patient's mental and physical health.2

Various types of remedies such as lactulose, senna, bisacodyl, docusate sodium, sodium picosulphate, and polyethylene glycol have been used to manage constipation in cerebral palsy. However, the treatment failure rate still reaches approximately 40%, especially in patients with mega rectum and persistent abnormalities of persistent defect and fecal impaction processes.4 Recently, lactulose is still the primary choice for constipation management in Indonesia. However, it can not release fecal impaction.5 Lavament as the main choice of fecal disimpaction often leads to discomfort and trauma to children and parents. Polyethylene Glycol 4000 is an osmotic laxant that can be used for disimpaction in patients with cerebral palsy,3as data in this area are scarce. METHOD A cross-sectional observational study was performed in specialized day-care centres and schools in the Netherlands. The study included 152 children (81 males, 71 females; mean age 9 y 6 mo, SD 4 y 6 mo but the efficacy in Surabaya children has not been investigated. The objective of this study was to compare the efficacy of PEG 4000 to saline enema in treating fecal impaction in constipated children with cerebral palsy.

Materials & Methods

Study design

This was a randomized, single-blind, parallel-group study of a PEG 4000 laxative vs a saline enema to resolve fecal impaction.The study was reviewed by Dr. Soetomo General Hospital's

ethical committee and given ethical clearance No 230/ Panke.KKE/III/2017 with clinical trial number TCTR20220310002 from Thai Clinical Trial Registry and carried out according to Good Clinical Practice. The informed consent was obtained from the parents/ legal guardians of the subject. Children with cerebral palsy, aged 2 to 16 years and diagnosed with constipation according to Rome IV criteria, and showing fecal impaction on physical examination were eligible. The ROME IV criteria were used to diagnosed constipation, which included at least 2 of the following symptoms: 2 or fewer defecations per week, history of excessive stool retention, history of painful or hard bowel movements, history of large-diameter stools, presence of a large fecal mass in the rectum, at least 1 episode of incontinence per week after the acquisition of toileting skills and. history of large-diameter stools that may obstruct the toilet and have been presented for at least 2 months.6 Exclusion criteria included children with critically ill, chromosomal abnormalities, Hirschprung's disease, spina bifida, hypothyroidism, and gastrointestinal obstruction. We used PEG 4000 (Niflec® powder for oral solution 118-g sachet, Meiji Japan), dosage 0.7g/kg every twelve-hour until resolution and saline enema (Ecosol NaCl 500ml/kolf, Braun Malaysia), dosage 15ml/kg every twelve-hour until resolution. Randomization was conducted using a computer-generated randomized list. Blinding of the participants was impossible due to obvious differences in treatment appearance. The doctor performing the evaluation was not involved in the allocation of treatment and remained blinded to the type of treatment received by patients during the study. Patient was considered as loss to follow up if the patient did not complete the full treatment in this study. We evaluated the efficacy of disimpaction through physical examination and Bristol stool chart for fecal's stool consistency. Adverse events which occurred during this study, such as vomiting, abdominal discomfort, diarrhea, and anal erosion, were collected. Baseline characteristics had been summarized using the usual descriptive statistic and performed normality test using Kolmogorov-Smirnov. Treatment comparison was carried out using dependent and independent t-test. All tests were considered two-tailed with a significance level of 0.05; 95% confidence intervals were also measured.

Result

Of the 35 children enrolled, three children dropped out, two of them (PEG 4000) due to inappropriate dosage, one (saline enema) due to enema procedure. Therefore, 16 children in each group were included in the per-protocol analysis (figure 1). The baseline and clinical characteristics of patients were similar for the two groups and are reported in table 1. Fecal disimpaction was achieved in all patients in both groups. The patients or their parents did not report the secondary parameters (painful stools, abdominal pain) (table 2). Only one patient reported anal pain due to rectal tube insertion, and he refused to continue the treatment. During the study, there was no patient complaint about vomiting, abdominal discomfort, and diarrhea. Overall, all patients showed no difficulties associated with the treatment.

Table 1: Clinical characteristic of the patients

	PEG 4000		Saline Enema	
	N	P value	N	P value
Age (years)	6.44 ±3.65	0.46	5.38 ± 3.15	0.2
Gender **Male** **Female**	 7 9	0.2	 9 7	0.2
GMFCS **I-III** **IV-V**	 11 6	0.2	 8 8	0.1
Muscle relaxant	8	0.2	9	0.2
Constipation (hours)	103.63 ± 37.2	0.2	104.25 ± 25.82	0.2

Table 2: Efficacy Outcome Analysis at Per Protocol and Intention to Treat

Variable	PEG 4000 (%)	Saline enema (%)
Per protocol population	16	16
Successful disimpaction	16 (100)	16 (100)
Time to disimpaction (hours)	21.69	39
Painful stool (Bristol 1-2)	0	0
Abdominal pain	0	0
Intention-to-treat population	18	17
Successful disimpaction	16 (88.9)	16 (94.1)

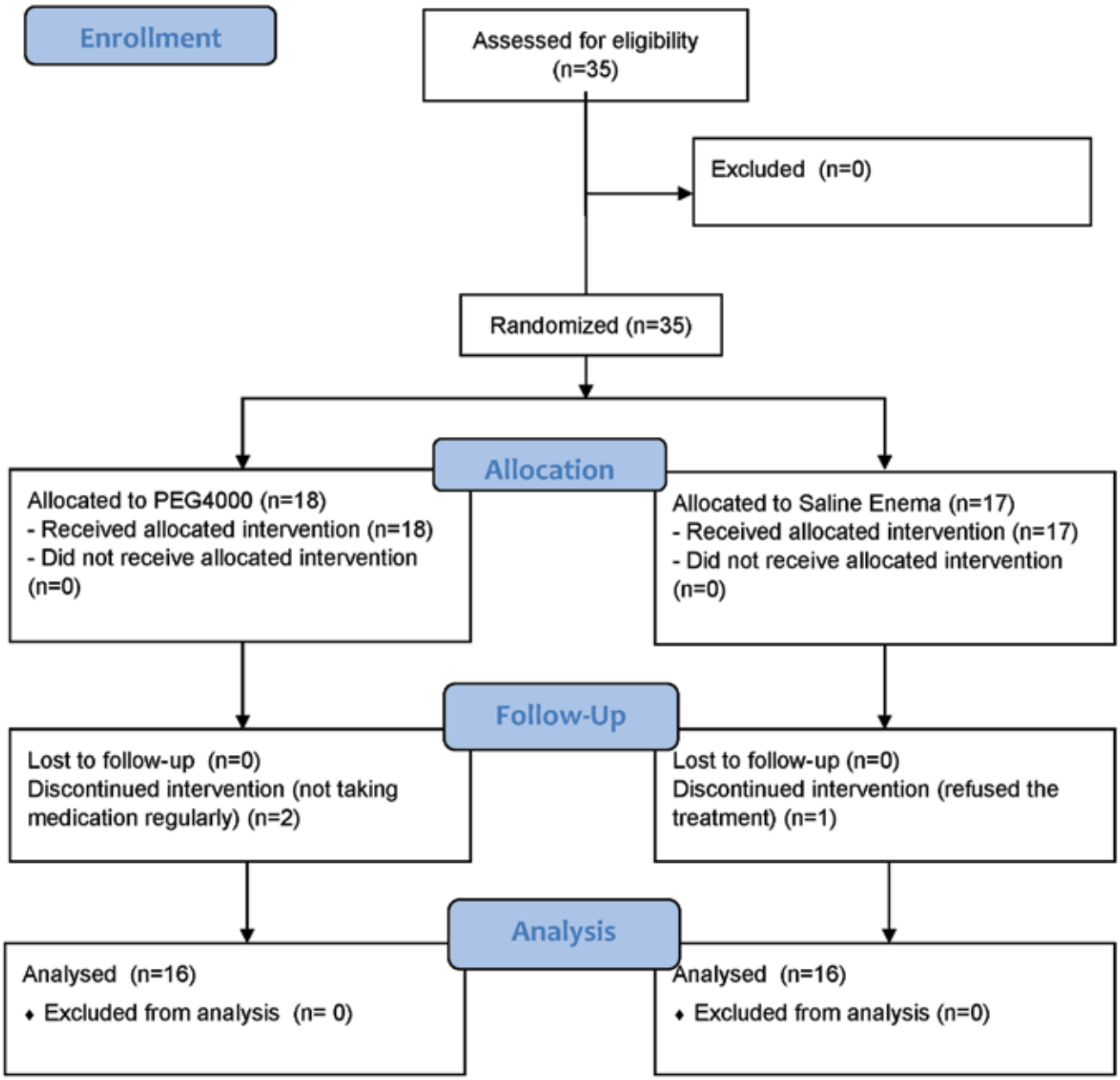

Figure 1. *Consort diagram of this study*

Discussion

This is the first prospective, randomized, controlled study in Surabaya, Indonesia, demonstrating that saline enema and PEG 4000 are equally effective in treating fecal impaction in children with cerebral palsy. Successful disimpaction was achieved in 100% children. These results were in accordance with other studies in which success with high doses of orally administered PEG was reached in 92% to 97% cases.7–10 In a retrospective chart review of clinical outcomes in 5 hospitals in England and Wales found that enemas were successful for 73% children with fecal impaction, compared with 97% for PEG.9

Polyethylene glycol is a soluble inert polymer that acts by hydrogen-bonding water molecules to expand the volume in the large intestine, resulting in softer and more-watery stools.11,12 PEG acts as an osmotic agent which increases the water content of stools and hence stimulates colonic peristaltic and transit of softened stools making bowel evacuation easier. PEG is not absorbed and metabolized by human intestinal enzymes and colonic bacteria. 13,14

The dose of PEG 4000 used in this study was 0.7g/kg twelve hourly until disimpaction was achieved. Polyethylene glycol with or without electrolytes is given at a dose of 1–1.5 g/kg/d over 4 hours in 3 days as home disimpaction had similar efficacy to enemas in six days.12 In 2002, Youssef et al. analyzed in a prospective, double-blinded, randomized study the efficacy of different doses of PEG (0.25, 0.5, 1, 1.5 g/kg/day) during three days to achieve disimpaction in children between 3.3 and 13.1 years of age. The authors concluded that high doses (1 and 1.5 g/kg/day) were significantly more efficacious ($p < 0.005$, 95% of success) than lower doses (55%).7 In 2006, Candy et al. evaluated in a prospective, open study of PEG + E the efficacy of stepwise doses during seven days, according to age (2-4 years: 13.8-55.2 g/day; 5-11 years: 27.6-82.8 g/day), in order to achieve disimpaction in children between two and eleven years of age. The dose was always low on the first day, whereas on days 6 and 7, the doses achieved the maximum level. Then, 89% of the 28 2-4 years-old children and 94% of the 5-11 years-old children achieved disimpaction between days 3 and 7. 8

In general, to a lesser extent, PEG formulation can be associated, with nausea, bloating and sour taste which can cause problems with compliance.14 In our study, there was no complication associated with the treatment and no adverse event complained by the patients. Two children were dropped out because they took only half-dose from the reccommended. Adverse effects of PEG 4000 reported in 7 clinical trials in a meta-analysis by Chen et al. included diarrhea, abdominal pain, nausea or vomiting, pain and tension during bowel movement, bloating, poor palatability, and rectal bleeding.15 Savino et al. through his study on constipated children did not get any side effects of using PEG 4000 for disimpaction. 14

Our study reported that fecal disimpaction was achieved in all children who received saline enema 15 cc/kg twelve hourly. Saline enema was the first choice for fecal disimpaction. Sodium phosphate, saline, and mineral oil enema may be used for rectal disimpaction.16,17 Saline enema can be administered using a dose of 10 to 15 ml/kg. However, enemas are invasive and may be difficult to administer to an uncooperative or fearful child.

One child was dropped out during this study because of rejection for rectal tube insertion.16

Children in PEG 4000 groups results in fecal disimpaction faster than saline enema (21.69 hours and 39 hours respectively; p=0.001). In most situations, oral PEG may replace rectal laxatives (suppositories and enemas), used to evacuate stools from rectum and distal sigmoid colon but are inconvenient for children and their careers. Oral medications may help the child feel in control16 and also are particularly valuable for children with a history of painful defecation, perineal trauma, or difficulty tolerating enemas.18,19 It is worth adding that in our experience, resolution of fecal impaction with oral PEG was achieved in a relatively short time in clinical practice.

Chronic constipation is one of the most common gastrointestinal problems in cerebral palsy. It is caused by delayed colonic transit time 1,20,21 and medication known to slow intestinal motility. Tube feeding was also significantly correlated with constipation, 20 but this was no longer the case when motor disabilities and side-effects of medications were taken into account.3 Muscle relaxant was discovered in 17/32 patients in this study. However, it was not significantly correlated to fecal impaction and had no impact on PEG 4000 effectivity.

As the two treatments are different in appearance, procedure, and dosage instruction, our study could not be carried out as double-blind. We are aware of a potential source of bias, particularly for subjective evaluations, so the examiner in this study was kept blind at the treatment modalities until the result was issued.

In conclusion

This randomized comparative study suggests that PEG 4000 is effective and well-tolerated for fecal impaction and faster than saline enema in resulting disimpaction. Further studies in children are necessary to evaluate the efficacy, tolerability, and compliance of PEG 4000 in longer-term studies and future challenges in relieving constipation in cerebral palsy.

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Author's Contribution

AD was the principal investigator of the study. AD, AFA, KRS, PIG, RGR, SMS, DS were involved in the study design and supervised data collection and analysis. SF was in responsible of gathering and analyzing data. The final manuscript was read and approved by all of the writers.

Conflict of Interest

None

References

1. Del Giudice E, Staiano A, Capano G, Romano A, Florimonte L, Miele E, et al. Gastrointestinal manifestations in children with cerebral palsy. Brain Dev 1999 Jul;21(5):307–11. Available from: https://linkinghub.elsevier.com/retrieve/pii/

S038776049900025X

2. Sullivan PB, Lambert B, Rose M, Ford-Adams M, Johnson A, Griffiths P. Prevalence and severity of feeding and nutritional problems in children with neurological impairment: Oxford Feeding Study. Dev Med Child Neurol 2000 Oct;42(10): S0012162200001249. Available from: http://doi.wiley.com/10.1017/S0012162200001249

3. Veugelers R, Benninga MA, Calis EAC, Willemsen SP, Evenhuis H, Tibboel D, et al. Prevalence and clinical presentation of constipation in children with severe generalized cerebral palsy. Dev Med Child Neurol 2010;52(9):e216-21. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20497454

4. Elawad MA, Sullivan PB. Management of constipation in children with disabilities. Dev Med Child Neurol 2001 Dec 18;43(12):829. Available from: http://doi.wiley.com/10.1017/S0012162201001505

5. Agarwal J. Chronic Constipation. Indian J Pediatr 2013 14;80(12):1021–5. Available from: http://link.springer.com/10.1007/s12098-013-1133-5

6. Zeevenhooven J, Koppen IJN, Benninga MA. The New Rome IV Criteria for Functional Gastrointestinal Disorders in Infants and Toddlers. Pediatr Gastroenterol Hepatol Nutr 2017;20(1):1.

7. Youssef NN, Peters JM, Henderson W, Shultz-Peters S, Lockhart DK, Di Lorenzo C. Dose response of PEG 3350 for the treatment of childhood fecal impaction. J Pediatr. 2002;141(3):410–4.

8. Candy DCA, Edwards D, Geraint M. Treatment of Faecal Impaction with Polyethelene Glycol Plus Electrolytes (PGE + E) Followed by a Double-blind Comparison of PEG + E Versus Lactulose as Maintenance Therapy. J Pediatr Gastroenterol Nutr 2006 Jul;43(1):65–70. Available from: https://journals.lww.com/00005176-200607000-00011

9. Guest JF, Candy DCA, Clegg JP, Edwards D, Helter MT, Dale AK, et al. Clinical and economic impact of using macrogol 3350 plus electrolytes in an outpatient setting compared to enemas and suppositories and manual evacuation to treat paediatric faecal impaction based on actual clinical practice in England and Wales. Curr Med Res Opin 2007 Sep 9;23(9):2213–25. Available from: http://www.tandfonline.com/doi/full/10.1185/030079907X210462

10. Candy D, Belsey J. Macrogol (polyethylene glycol) laxatives in children with functional constipation and faecal impaction: a systematic review. Arch Dis Child 2008 Sep 18;94(2):156–60. Available from: https://adc.bmj.com/lookup/doi/10.1136/adc.2007.128769

11. Bernier JJ, Donazzolo Y. [Effect of low-dose polyethylene glycol 4000 on fecal consistency and dilution water in healthy subjects]. Gastroenterol Clin Biol 1997;21(1):7–11. Available from: http://www.ncbi.nlm.nih.gov/pubmed/8761138

12. Bekkali N-L-H, van den Berg M-M, Dijkgraaf MGW, van Wijk MP, Bongers MEJ, Liem O, et al. Rectal Fecal Impaction Treatment in Childhood Constipation: Enemas Versus High Doses Oral PEG. Pediatrics 2009 Dec 1;124(6):e1108 –15. Available from: https:// publications. aap. org/pediatrics/article/124/6/e1108/72199/Rectal-Fecal-Impaction-Treatment-in-Childhood

13. Davis GR, Santa Ana CA, Morawski SG, Fordtran JS. Inhibition of water and electrolyte absorption by polyethylene glycol (PEG). Gastroenterology 1980 Jul;79(1):35–9.

Available from: http://www.ncbi.nlm.nih.gov/pubmed/7380220

14. Savino F, Viola S, Erasmo M, Di Nardo G, Oliva S, Cucchiara S. Efficacy and tolerability of peg-only laxative on faecal impaction and chronic constipation in children. A controlled double blind randomized study vs a standard peg-electrolyte laxative. BMC Pediatr [Internet]. 2012 Nov 15;12:178. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23152962

15. Chen S-L, Cai S-R, Deng L, Zhang X-H, Luo T-D, Peng J-J, et al. Efficacy and complications of polyethylene glycols for treatment of constipation in children: a meta-analysis. Medicine (Baltimore) 2014 Oct;93(16):e65. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25310742

16. Tabbers MM, Dilorenzo C, Berger MY, Faure C, Langendam MW, Nurko S, et al. Evaluation and treatment of functional constipation in infants and children: Evidence-based recommendations from ESPGHAN and NASPGHAN. J Pediatr Gastroenterol Nutr 2014;58(2):258–74.

17. Abi-Hanna A, Lake AM. Constipation and encopresis in childhood. Pediatr Rev 1998 Jan;19(1):23–30; quiz 31. Available from: http://www.ncbi.nlm.nih.gov/pubmed/9439166

18. Gleghorn EE, Heyman MB, Rudolph CD. No-Enema Therapy for Idiopathic Constipation and Encopresis. Clin Pediatr (Phila) 1991 Dec 2;30(12):669–72. Available from: http://journals.sagepub.com/doi/10.1177/000992289103001203

19. Schonwald A, Rappaport L. Consultation with the specialist: encopresis: assessment and management. Pediatr Rev 2004 Aug;25(8):278–83. Available from: http://www.ncbi.nlm.nih.gov/pubmed/15286273

20. Staiano A, Del Giudice E. Colonic transit and anorectal manometry in children with severe brain damage. Pediatrics 1994 Aug;94(2 Pt 1):169–73. Available from: http://www.ncbi.nlm.nih.gov/pubmed/8036068

21. Park ES, Park C Il, Cho S-R, Na S-I, Cho YS. Colonic transit time and constipation in children with spastic cerebral palsy. Arch Phys Med Rehabil 2004 Mar;85(3):453–6. Available from: http://www.ncbi.nlm.nih.gov/pubmed/15031832