Comparison of Two Postoperative Bowel Regimens in Children With Scoliosis Repair

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BACKGROUND: Orthopaedic procedures place children at risk for postoperative constipation due to combined effects of anesthesia, narcotics, and decreased physical mobility.
PURPOSE: This retrospective study analyzed medication use and stool outcomes of 36 children who received polyethylene glycol 3350 (PEG) or mineral oil (MO) after a spinal fusion.
METHODS AND RESULTS: A chart review found no statistical differences by group for number of bowel movements (BMs) before discharge ($p = .37$), time from procedure to BM, use of rescue cathartics ($p = .55$), or medication refusal ($p = .37$). In the PEG group, 90% refused the medication one or more times compared with 75% in the MO group.
CONCLUSION: Only 17% of patients had a BM before discharge. Findings suggest medication refusal may be related to the method of medication preparation, suggesting the child's choice in bowel regimens may be indicated. A prospective study with a larger, randomized sample size is needed.

Background

Constipation is a common pediatric complaint as well as a side effect related to orthopaedic surgery. Pediatric orthopaedic patients undergoing extensive surgical procedures are at risk for postoperative constipation due to combined effects of anesthesia, narcotic pain medications, and decreased physical mobility. A general consensus exists that some degree of postoperative ileus is an expected and physiologic response to surgery, regardless of type. Decreased gut motility can last between 0 and 72 hours postoperatively, and recovery time depends on the type of surgery. Normal physiologic, postoperative gastrointestinal dysmotility resulting in constipation can increase pain and discomfort, decrease patient mobility, and interfere with adequate nutrition intake. These factors may lead to prolonged hospitalization, potential acute complications, and patient dissatisfaction (Story & Chamberlain, 2009).

There is limited evidence in the literature on the best treatment option for postoperative constipation, especially in the pediatric orthopaedic population. A number of studies support the use of either polyethylene glycol 3350 (PEG) or mineral oil (MO) for children. The North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition (2006) identifies PEG and MO as medications of choice in the treatment of constipation in pediatric patients (Constipation Guideline Committee, 2006; Greenwald, 2010). However, the mechanisms of action of the two drugs are different. PEG is an osmotic laxative that works by increasing water content in the fecal matter (Auth, Vora, Farrelly, & Baille, 2012) and MO acts as a lubricant to the intestines and prevents water absorption (Gal-Ezer & Shaoul, 2006).

Literature Review

A review of literature that included an extensive search of CINAHL and PubMed found no studies in the past 10 years on best practices related to promoting the resumption of bowel function in pediatric postoperative patients. Therefore, best practices in the treatment of functional and chronic constipation in children were reviewed. Numerous studies have documented that PEG and MO are commonly used in children for management of constipation.

Harkless (2009) reviewed 28 studies and found PEG to be more effective than other treatments including lactulose, senna, and MO for functional constipation in children. However, Rafati, Karami, Salehifar, and Karimzadeh (2011) compared the clinical efficacy and safety of both PEG and MO and found both regimens 87% or more effective in increasing the frequency of stools as well as decreasing encopresis in a sample of 160 children. Gordon, Naidoo, Akobeng, and Thomas (2013) performed a Cochrane review of 18 randomized controlled trials with 1643 children published from 1977 to 2011. The review compared nine different medications including PEG, MO, lactulose, and milk of magnesia either to a placebo or to each other. PEG and MO

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were both found to be safe and effective superior treatments for pediatric constipation compared with other medications. Similarly, Phatak and Pashankar (2014) also performed a review of literature and found PEG and MO to be equally effective in the long-term treatment of pediatric constipation.

Both PEG and MO have been compared with lactulose in the treatment of functional constipation in children. Farahmand (2007) compared MO with lactulose in 247 children and found the MO group had an 85% success rate of greater than three stools a week compared with 29% success rate in the lactulose group. The study also found that patients who were treated with MO had less abdominal pain, straining, and pain with defecation than those using lactulose. Urganci, Akyildiz, and Polat's (2005) study on the efficacy of MO compared with lactulose for the management of chronic functional constipation in children found a statistically significant improvement in stool consistency, frequency, and number of stools per week in the MO group. Adherence rate in the MO group was 95% compared with 90% in the lactulose group. Gremse, Hixon, and Crutchfield (2002) performed an experimental study of 37 children with chronic constipation comparing PEG with lactulose. This study found PEG significantly reduced the total colonic transit time compared with lactulose. These studies provide evidence that both PEG and MO are more effective than lactulose in the treatment of functional constipation in the pediatric population.

PEG and MO have been found safe when used for the treatment of constipation in children. Gal-Ezer and Shaoul (2006) reported a case where a 17-year-old female adolescent took three to four times the recommended dose of MO for 5 consecutive months, yet laboratory values (vitamins A and E, calcium, phosphorus, alkaline phosphate, and prothrombin time levels) were all within normal limits. Pashankar, Loening-Baucke, and Bishop (2003) evaluated the safety of PEG for the treatment of chronic constipation in 83 children and found no major clinical adverse effects with laboratory blood results including serum electrolytes, osmolality, albumin, liver, and renal function tests. In addition, children preferred PEG to previously used therapies, and daily adherence with PEG therapy was found to be 90%.

Clearly, both PEG and MO are indicated and safe for the use of chronic constipation in the pediatric population. Yet the literature lacks evidence related to best treatment for the prevention of short-term postoperative constipation. The purpose of this study was to compare PEG and MO in the prophylaxis of postoperative constipation in pediatric orthopaedic patients who have undergone a posterior spinal fusion (PSF).

Methods

Design and Research Questions

A retrospective study was performed to compare the efficacy of two postoperative bowel regimens, PEG versus MO, for children undergoing PSF. The research questions included: is there a significant difference between adolescents who received PEG versus MO related to (1) documented refusal of the oral bowel regimen medications, (2) report of stool before discharge, (3) time from surgery to first postoperative stool, and (4) use of rescue enemas?

Setting and Procedure

The study was conducted in a children's hospital in the Southern United States. The standard of care at this institution included twice daily docusate and either 17 g of PEG mixed in 8 ounces of a clear liquid of the patient's preference or 30 ml of MO mixed in pudding and ice cream creating a mousse-like texture. In postoperative orders, the surgeon orders either PEG or MO and the dose begins on postoperative day 2 once the patient's diet has been advanced. The twice daily docusate typically begins on postoperative day 1 when the patient begins a clear liquid diet. In order to prevent postoperative constipation, early ambulation and increased fluid intake are encouraged in addition to the bowel regimen. A few children are placed on both PEG and MO.

Institutional review board approval was first obtained from the hospital and the university to conduct a retrospective analysis. A master list of patients was generated by the IT department who met inclusion criteria: (1) age 11–21 years, (2) diagnosis code of adolescent idiopathic scoliosis with a procedure code for PSF surgery, and (3) admission over a 12-month period (June to May). Exclusion criteria included children who had a bowel regimen with both PEG and MO, were nonambulatory, had a seizure disorder or chronic constipation, or had any postoperative complications that led to a change in the routine postoperative care. No patient identifiers were collected. The recorded variables included type of bowel regimen, number of rescue cathartics or enemas, number of hours to a bowel movement (BM), length of stay, and medication refusals. Variables that may affect time to bowel movement including amount of pain medication received, time to mobilization, time to regular diet, amount of docusate and ondansetron received, and type of anesthesia were also recorded. In addition, the demographic variables included age, insurance type, gender, race, height, weight, body mass index, and secondary diagnosis of a chronic condition. Data were recorded in an Excel file and exported into SPSS for data analysis. Chi-square analyses, nonparametric analyses, and *t* tests were performed to describe the sample and to address the research questions.

Results

A total of 36 children met the inclusion criteria with 20 (55%) in the PEG group and 16 (45%) in the MO group (Table 1). The mean age was 13.95 years (range, 11–19). The majority of subjects (83%) were female and race was evenly divided between white and African American among the two groups. The mean age for the PEG group was 14.1 and 13.8 years for the MO group. All patients received spinal anesthesia. Only 3 patients had comorbidities (metabolic syndrome/obesity or attention-deficit hyperactivity disorder).

Overall, there were no significant differences in the demographics between the two groups except for

Table 1. Adolescent Characteristics

Variable	Total	PEG Group	MO Group	Statistical Significance Statistical Test
Gender				
Male	6	5 (25%)	1 (6%)	NS Fisher's exact test
Female	30	15 (75%)	15 (94%)	
Race				
White	19	10 (50%)	9 (56%)	NS Pearson χ^2
African American	17	10 (50%)	7 (44%)	
Insurance				
Private	22	9 (45%)	13 (81%)	$p = .029$
Medicaid	14	11 (55%)	3 (19%)	Pearson χ^2
BMI				
Healthy	30	18 (90%)	12 (75%)	NS Fisher's exact test
Obese	6	2 (10%)	4 (25%)	
Age, *M* (*SD*)	13.95 (2.11)	14.1	13.8	NS Mann–Whitney *U*

Note. BMI = body mass index; MO = mineral oil; NS = no statistical significance; PEG = polyethylene glycol 3350.

insurance. Patients with private insurance were more likely to receive MO, and patients with public-supported insurance were more likely to receive PEG (Table 1). There were no statistical differences between the groups in overall length of stay, total time to mobilization, time to regular diet, or overall total amount of pain medication received (Table 2). The average length of stay for the entire sample was 123 hours or 5 days, average time to first ambulation was 44 hours, and average time to regular diet was 53 hours. Pain medication was recorded in milligrams per kilogram of acetaminophen-hydrocodone as well as morphine equivalents due to the synthetic nature of acetaminophen-hydrocodone, making it unable to be converted to morphine equivalents. Other pain medications (Morphine, Dilaudid, Percocet), both PO and IV, can be converted to morphine equivalents, making this an inclusive measurement of the total amount of pain medication received in milligrams per kilogram per patient. The number of bowel regimen doses, total amount of docusate, and total amount of ondansetron also had no statistical difference (Table 3). The average number of bowel regimen doses received for the entire sample was two doses, the average total amount of docusate received was 704 mg, and the average total amount of ondansetron received was 0.48 mg/kg. Amount of ondansetron received is important as constipation is a side effect.

Next, the data for the research questions were examined. There were no significant differences by group. The bowel regimen was refused one or more times in 18 of the 20 patients (90%) in the PEG group and in 12 of the 16 patients (75%) in the MO group (Fisher's exact test, $p = .374$). A total of six of the 36 patients (17%) had a BM before discharge, two of the 20 patients (10%) of the PEG group and four of the 16 patients (25%) of the MO group (Fisher's exact test, $p = .374$). The mean number of hours from surgery to BM was 84.5 hours ($SD = 23.4$). None of the patients in either group received an enema. Rescue cathartics were required in three of the 20 patients (15%) in the PEG group and three of the 16 patients (19%) in the MO group. Of these six patients, one received an oral laxative and five received a suppository. All of the patients who received a suppository had a subsequent BM.

Discussion

This study did not find a significant difference between PEG and MO in the prophylaxis of postoperative constipation. Only 17% of children had a BM before discharge.

Table 2. Postoperative Clinical Characteristic Descriptions

Variable	Total *M* (*SD*)	PEG Group *M*	MO Group *M*	Statistical Significance Statistical Test
Length of stay (hours)	123 (17.67)	122.5	123.8	NS *t* test
Time to mobilization (hours)	44 (3.44)	44.6	44.0	NS *t* test
Time to regular diet (hours)	53 (13.44)	48.8	57.4	NS *t* test
Acetaminophen/hydrocodone (mg/kg)	1.8 (0.84)	1.6	2.0	NS Mann–Whitney *U*
Morphine equivalent usage	2.02 (0.73)	1.87	2.2	NS Mann–Whitney *U*

Note. MO = mineral oil; NS = no statistical significance; PEG = polyethylene glycol 3350.

Table 3. Bowel Regimen Outcomes.[a]

Variable	PEG Group	MO Group	Statistical Significance Statistical Test
Number of bowel regimen doses received	2 (1–3)	2 (1.25–3)	NS Mann–Whitney *U*
Docusate total mg received	750 (600–937.5)	750 (462.5–857)	NS Mann–Whitney *U*
Number of days docusate received	4.5 (3.5–5)	4.25 (3.5–5)	NS Mann–Whitney *U*
Number of times docusate refused	1 (1–1.5)	2 (1–3)	NS Mann–Whitney *U*
Ondansetron total mg/kg received	0.42 (0.36–0.57)	0.49 (0.36–0.708)	NS Mann–Whitney *U*

Note. MO = mineral oil; NS = no statistical significance; PEG = polyethylene glycol 3350.
[a]Because of the small sample size, nonparametric statistics (Mann–Whitney *U*) were used for these variables and no significance was found. The results are reported in median (and interquartile range).

Of interest, 90% of the children in the PEG group refused a dose one or more times as compared with 75% in the MO group. This may be due to the way each drug was prepared for administration. PEG was mixed in 8 ounces of a liquid of the child's preference, and MO was mixed in 4 ounces of pudding and ice cream in the child's preferred flavor.

Medication adherence is a common problem noted in the literature in patients with chronic conditions. Steiner et al. (2014) performed a descriptive study on children with chronic functional constipation and found that the medication adherence rate was 38% in the first month and 30% in the sixth month. Children who took PEG had greater adherence than those who took other laxatives including MO. However, the method of medication administration was not described.

The review of literature found PEG to be favored over MO for chronic functional constipation; however, this may not be the case for postoperative constipation. The postoperative course after a PSF includes slow advancement to a regular diet. It may be that MO was preferred as it is mixed with pudding and ice cream and forms a mousse-like texture that may be more appealing to the postoperative child because PEG is mixed in a clear liquid of the child's preference. Additional amounts of clear liquids may not appeal to the postoperative child. Also, postoperative patients may not have an appetite for the volume of either medication, which may account for not consuming the entire dose, therefore, affecting the results of the study. Therefore, providing the patient with a choice of either medication may improve acceptance and compliance with a postoperative bowel regimen.

Study Limitations

Because of the retrospective design, there was no follow-up after discharge to determine time of the first BM. There is also a possibility that patients had a BM on the day of discharge that did not get recorded. Also, the accuracy of charting BMs by various nurses is not known and could affect the results. There have been multiple protocol changes for postoperative scoliosis patients within the institution; therefore, this study was limited to 1 year, which led to a small sample size. Also, because of the retrospective design, subjects were not randomized to the groups and received either medication per surgeon preference.

Conclusion

The care of the postoperative pediatric orthopaedic patient who undergoes PSF surgery is extensive and must include an approach to managing postoperative constipation. Suppositories, although successful, are not welcomed in children and adolescents; therefore, oral preparation products may provide greater compliance and reduce postoperative constipation leading to greater satisfaction with recovery. Parents, children, nurses, and staff must be educated on proper administration and consumption of these medications to prevent constipation. Giving the child the option of either medication may promote independence and involvement in care and lead to greater adherence with the doses in their entirety. A prospective, randomized study with a larger sample size is needed.

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