Original Article

A Randomized Controlled Trial Comparing Polyethylene Glycol Solution Plus Prucalopride with Polyethylene Glycol Solution Alone on the Efficacy of Bowel Preparation for Colonoscopy

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Background: Colonoscopy is currently the standard method for diagnosis and treatment for a number of colonic diseases. The patient needing colonoscopy has to undertake bowel preparation before the investigation. This process is very important as it can determine diagnostic accuracy and therapeutic success in the patients. Prucalopride is a substance that helps stimulate colonic movement. This study aimed to assess the effectiveness of the combination between prucalopride and polyethylene glycol solution (PEG-P) for bowel preparation before colonoscopy relative to PEG alone.

Materials and Methods: This study used a prospective, randomized, double-blinded, controlled design. Eighty-six patients undergoing colonoscopy in Bhumibol Adulyadej Hospital were enrolled in the study (44 in PEG arm vs. 42 in PEG-P arm). The effectiveness of the colonic bowel preparation was assessed using Boston Bowel Preparation Score (BBPS), satisfaction, side effects and polyp detection rate also served as secondary outcomes.

Results: PEG-P significantly showed better bowel preparation relative to PEG, as reflected by the higher BBPS in all parts of colons: caecum (2.1±0.6 vs. 1.6±0.7, $p = 0.002$), transverse colon (2.6±0.7 vs. 2.1±0.6, $p = 0.001$), sigmoid (2.8±0.6 vs. 2.4±0.6, $p = 0.002$) and rectum (2.8±0.6 vs. 2.4±0.6, $p = 0.002$). Five out of forty-two patients in the PEG-P arm had nausea and three had vomiting. Two patients in the PEG arm group had nausea and none had vomiting. The incidence of side effects in both arms did not show a statistically significant difference. PEG-P arm showed higher polyp detection rate than the PEG arm (59.5% vs. 36.4%, $p = 0.032$).

Conclusion: PEG-P showed many preferable outcomes over PEG. These include better bowel cleansing and increasing the sensitivity of polyp detection with indifferent rate of side effects. With these advantages, the quality of life and compliance of the patients can be improved as repeated colonoscopy due to inadequate bowel preparation can be avoided.

Keywords: Prucalopride, Polyethylene glycol solution, Colonoscopy, Bowel preparation, Boston bowel preparation score

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Colonoscopy is currently the standard method for diagnosis and treatment for a number of colonic diseases. Patients undergoing colonoscopy need to have adequate bowel preparation, which is done by ingesting a colonic cleansing agent. This process is very crucial for the whole treatment course as it definitely determines diagnostic accuracy and therapeutic success[1]. Sidhu, et al[2] discovered that about one quarter of the patients did not receive colonoscopy due to inadequate bowel preparation. Tharasak and Polmanee[3] found that an addition of prokinetic agents, such as domperidone, helped increase the effectiveness of bowel preparation. Nagler et al[4] reported that an administration of bisacodyl to polyethylene glycol solution (PEG) did not clearly contribute to an improvement of the quality of life of the patients due to the increased side effects. Wu et al[5] found that simithicone was capable of treating some side effects (such as flatulence) during bowel preparation but the drug itself did not help enhance bowel cleanliness.

Prucalopride is an agent that helps stimulate colonic movement by triggering the 5-HT_4 receptor[6]. It also helps improve defecation with minimal side effects. Additionally, the quality of life of the patients is found to be improved amongst those ingesting prucalopride compared to other laxative agents.

The aim of this study is to assess the quality of bowel preparation and other clinical outcomes between the combination of prucalopride and PEG (PEG-P) and PEG alone.

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Materials and Methods

Study design and population

This study used a prospective, randomized, double-blinded, controlled design. Participants were patients who underwent colonoscopy between January 2017 and December 2017 at Bhumibol Adulyadej Hospital. A patient would be recruited into the study if he/she met all of the following criteria: (i) meeting the colon colonoscopy indication, (ii) aged 18 years or more, and (iii) willing to participate in the study. A patient would be excluded if he/she met at least one of the following criteria: (i) meeting contraindication for colonoscopy, (ii) suffering from end-stage kidney disease (ESRD) defined by the glomerular filtration rate (GFR) <30 mL/min/1.73 m^2, and (iii) having one of the following conditions-coronary heart disease, stroke, colonic surgery, ascites, intestinal obstruction, irritable bowel syndrome and constipation. In total, there were 86 patients enrolled in the study.

The data collected comprised (i) patient's characteristics (age, sex, underlying diseases, and indication of colonoscopy), (ii) patient's satisfaction, (iii) side effects, (iv) post-colonoscopic diagnosis, and (v) Boston Bowel Preparation Score (BBPS). The main dependent variable was BBPS and the independent variable was the type of laxative agents (PEG-P vs. PEG). The protocol for bowel preparation consisted of the following steps; (i) two days prior to colonoscopy, only soft diet is allowed; (ii) one day prior to colonoscopy, only clear liquid diet is permitted, and (iii) at 6 PM of the following day, the patient was required to take 137 g of PEG mixed with 2 litres of water in 10 minutes, followed by one tablet of 2 mg of prucalopride or placebo 1 hour later. All patients were informed about the protocol before undergoing colonoscopy.

Measurement of bowel preparation quality

The investigator recorded all of the procedures and asked the patients to answer the questionnaire on side effects and their satisfaction involved with colonoscopy. The investigator rated the quality of bowel preparation by BBPS which ranged from 0 to 3 for each section of the colon (caecum, transverse colon, sigmoid and rectum). A score of zero meant that the mucosa of the colon could not be seen properly. A score of 1 meant that the portion of mucosa was well seen but there were retained materials. A score of 2 denoted there was minor residual staining or fragment of stool but in general the segmental mucosa was well seen. A score of 3 implied that the entire mucosa was well seen after cleansing. These scores were independently rated by 2 gastroenterologists.

Statistical analysis

This study employed descriptive statistics to describe basic information of the participants. Results were presented in the forms of mean, median, and percentage. Inferential statistics, namely, Chi-square and unpaired t-test were used to assess the adequacy of bowel preparation, patients' satisfaction and experienced side effects between the PEG-P arm and the PEG arm.

Results

The patients in PEG-P arm had an average age of 59 years. The underlying diseases and indications for colonoscopy were not different between PEG-P arm and PEG. Basic characteristics of both groups are similar and shown in Table 1.

With regards to BBPS, the patients in PEG-P arm had better cleansing outcomes in all parts of colon relative to the PEG counterparts. A statistical significance was observed

Table 1. Patient characteristics

	PEG alone (n = 44)	PEG-P (n = 42)	*p*-value
Gender, n (%)			
Male	23 (52.3)	29 (69.0)	0.112
Female	21 (47.7)	13 (31.0)	
Age (years), mean (SD)	63 (11.9)	59.4 (11.5)	0.149
Underlying diseases, n (%)			
Type-2 diabetes	4 (9.1)	1 (2.4)	0.184
Dyslipidaemia	5 (11.4)	7 (16.7)	0.478
Hypertension	19 (43.2)	18 (42.9)	0.976
Heart diseases	0	1 (2.4)	0.303
Others	2 (4.5)	1 (2.4)	0.585
Indications, n (%)			
Colon cancer surveillance	21 (47.7)	22 (52.4)	0.666
Abnormal tumor marker	6 (13.6)	5 (11.9)	0.810
Abdominal pain	6 (13.6)	5 (11.9)	0.810
Anemia	5 (11.4)	2 (4.8)	0.263
Gastrointestinal bleeding	5 (11.4)	5 (11.9)	0.938
Chronic diarrhea	1 (2.3)	3 (7.1)	0.284

PEG = polyethylene glycol solution, PEG-P = polyethylene glycol solution plus prucalopride

with details as follows: caecum (2.1±0.6 vs. 1.6±0.7, p = 0.002), transverse colon (2.6±0.7 vs. 2.1±0.6, p = 0.001), sigmoid (2.8±0.6 vs. 2.4±0.6, p = 0.002), and rectum (2.8±0.6 vs. 2.4±0.6, p = 0.002). Figure 1 provides detailed information of BBPS in both arms.

Almost all patients in PEG-P arm expressed high satisfaction on the intervention (97.6%). Nausea was the most common side effect (11.9%). About 59.5% of the patients were detected with polyps. The findings in PEG arm were quite similar to those in PEG-P arm. Patient satisfaction in PEG arm was 100%. Nausea and abdominal pain were the most common side effect (4.5% each), and approximately one-third of the patients were diagnosed with polyps (36.4%). The differences in side effects between the both groups did not yield a statistical significance. However, patients in PEG-P arm had significantly greater detection rate of colonic polyps relative to the PEG counterparts. More details are elaborated in Table 2.

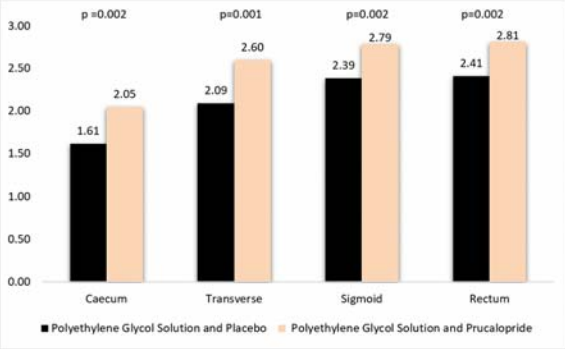

Figure 1. Boston Bowel Preparation Score in PEG-P arm and PEG arm.

Discussion

Overall, this study found that PEG-P provided better bowel cleansing outcomes than PEG alone. This discovery was consistent with the finding in many previous studies. For example, Tharasak and Polmanee[3] found that adding a second prokinetic agent into PEG produced a more favourable cleansing effect compared to routine bowel preparation. The side effects from PEG-P were trivial. Only five patients (11.9%) in PEG-P arm suffered from nausea and only three (7.1%) had vomiting. These results were not significantly different from the side effects found in PEG arm. The findings were also in line with a study by Camilleri, et al[7], which pointed to a negligible adverse effect of prucalopride. Gurudu, et al[8] pointed to the same direction, indicating that, a single dose regimen of PEG-P (like the intervention in this study) was relatively more convenient than the conventional regimen. Besides, this research also showed that PEG-P helped increase the chance of polyp detection, which can be partly explained by a more favourable outcome on bowel cleansing.

This study faced some limitations. First, the study period was quite short and second, it was carried out only in one tertiary care centre. These accounts more or less compromised the generalizability power of the study. The interpretation of the results from this study in other settings should be done with caution. Further research that involves more patients from diverse settings is recommended.

Conclusion

The administration of PEG-P helps stimulate movement of colon and provides better bowel cleansing outcome relative to the routine use of PEG alone. Moreover, PEG-P yields minimal side effects, on par with PEG. The detection rate of polyp was greater amongst the patients undertaking PEG-P. This implied that PEG-P likely helped

Table 2. Satisfaction, side effects and polyp detection in each patient group

	PEG-P (n = 44)	PEG (n = 42)	p-value
Satisfaction, n (%)			
Yes	44 (100)	41 (97.6)	0.303
No	0	1 (2.4)	
Side effects, n (%)			
Nausea	2 (4.5)	5 (11.9)	0.212
Vomiting	0	3 (7.1)	0.071
Abdominal pain	2 (4.5)	0	0.162
Abdominal distension	0	1 (2.4)	0.303
Sleeplessness	1 (2.3)	0	0.326
Others	0	3 (7.1)	0.071
Diagnoses, n (%)			
Inflammatory bowel disease	14 (31.8)	6 (14.3)	0.054
Colonic polyp	16 (36.4)	25 (59.5)	0.032
Colonic cancer	4 (9.1)	2 (4.8)	0.431
Colonic ulcer	3 (6.8)	3 (7.1)	0.953
Others	7 (15.9)	6 (14.3)	0.834

PEG = polyethylene glycol solution; PEG-P = polyethylene glycol solution plus prucalopride

improve the patient's compliance and quality of life as repeated colonoscopy due to inadequate bowel preparation could be avoided.

What is already known on this topic?

Bowel preparation is essential in colonoscopy. The best bowel preparation regimen is yet to be defined. PEG is one of the widely accepted bowel preparation solution. Prucalopride is proven treatment for constipation.

What this study adds?

Adding prucalopride in PEG for bowel preparation improved quality of bowel preparation and polyp detection rate over PEG alone without increasing side effects.

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Potential conflicts of interest

The authors declare no conflicts of interest.

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