



ORIGINAL ARTICLE

Efficacy of bowel preparation for colonoscopy with olive oil plus low volume polyethylene glycol-electrolyte lavage solution versus conventional volume polyethylene glycol-electrolyte lavage solution.

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ABSTRACT... Objective: To compare the efficacy of bowel preparation with an olive oil plus low volume (2 liters) polyethylene glycol-electrolyte lavage solution (PEG-ELS) and conventional volume (4 liters) PEG-ELS solution. **Study Design:** Randomized, Controlled Trial. **Setting:** Lahore General Hospital. **Period:** September 2017 and November 2018. **Material & Methods:** Patients were randomly assigned to two groups. Group A patients were given olive oil plus low volume (2 liters) PEG-ELS and Group B patients were given conventional volume (4 liters) PEG-ELS solution. Achievement of the adequate preparation was assessed using the Boston Bowel Preparation Scale (BBPS). A questionnaire was used in assessing the ease or difficulty of ingesting the bowel-cleansing preparation. All analysis was conducted with SPSS 20.0. **Results:** Of the total 162 patients randomized, 24 were excluded due to various reasons. Of 138 studied patients, mean age was 40.88 ± 13.75 years, 90 (65.21%) were male and 48 (34.78%) were female. Overall, 42 (30.4%) patients had Boston Bowel Preparation Score (BBPS) 8 and 9 indicating excellent bowel preparation, 38 (27.5%) had good bowel preparation with score 6 and 7, 30 (21.7%) patients had poor bowel preparation with score 3-5, and 28 (20.3%) patients had inadequate bowel preparation with score 0-2. The mean BBPS was 6.11 ± 2.6 with the olive oil preparation and 4.63 ± 2.81 with conventional PEG-ELS preparation ($P = <0.005$). More patients in Olive Oil group had excellent bowel preparation as compared to conventional group (43% versus 15%, $p <0.005$). The mean time of examination was 23.2 minutes in Group A and 21.85 in Group B ($P <0.05$). Mean time for colonoscopy was much higher (28.75 min.) in patients with a BBPS score of < 3 . 61% of patients in Olive Oil group experienced no side effects as compared to 43% in the conventional PEG-ELS group ($p < 0.05$). Abdominal pain was the most common side effect observed, more frequent in the conventional PEG-ELS group (30% versus 4.9%, $p <0.05$). **Conclusion:** Low volume PEG plus olive oil is a valid alternative and more applicable to bowel preparation for colonoscopy than conventional volume PEG, with superior efficacy, better compliance and tolerability and better safety profile.

Key words: Bowel Preparation, Boston Bowel Preparation Scale, Colonoscopy, Polyethylene Glycol-electrolyte Lavage Solution.

INTRODUCTION

Colonoscopy is an endoscopic test for visualizing the colon. Major indications for colonoscopies are abdominal pain, anemia, weight loss, rectal bleeding, irritable or inflammatory bowel symptoms and colorectal carcinoma.¹

Performance of colonoscopy varies among different endoscopists and this variation may impact the effectiveness of this procedure.² Multiple indicators are suggested by different

gastrointestinal societies for defining the quality of a colonoscopy in order to optimize the performance and to decrease inter-observer variation between endoscopists. These quality assessment indicators include the adenoma and polyp detection rates, cecal intubation rates and withdrawal times.^{3,4}

For a quality colonoscopy, a good bowel preparation is the utmost prerequisite which results in optimal visualization of the colon and

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thus affects the efficacy, safety and diagnostic accuracy of a colonoscopy.⁵ Studies have shown that up to 25-35% of incomplete or failed colonoscopies are attributed to suboptimal bowel preparation.⁶ Inadequate bowel preparation results in decreased polyp/adenoma detection, lesser cecal intubation rates, prolonged procedure time, more frequent screening colonoscopies due to concerns about missed lesions, increased patient discomfort and need for repeat procedures.⁷

An appropriate bowel preparation and cleansing should be adopted to overcome the aforementioned concerns. An ideal method of colon cleansing should be fast, safe and effective with a minimal discomfort for the patient.⁵ Among the various reasons for suboptimal colonic preparations, failure to complete the colon preparation is a strong influence⁸, with large volume of the bowel preparation being the most common deterrent to colonoscopy.⁹

In the present study, we compared the efficacy of bowel preparation with an olive oil plus low volume (2 liters) PEG-ELS and conventional volume (4 liters) PEG-ELS solution in two groups of patients who were candidate for colonoscopy in our setup.

MATERIAL & METHODS

All ethical issues were followed after taking approval from the institutional review committee of Lahore General Hospital. The study was carried out after taking approval from the institutional review board of the hospital (AMC/PGMI/LGH/ARTICLE NO:0021-18).

The study was conducted at endoscopic suite, department of gastroenterology, Lahore General Hospital, Lahore between September 2017 and November 2018. This was a randomized, controlled trial. Study included all adult patients between 18-70 years undergoing elective colonoscopy for routine indications. Prior to enrolment in the study, informed consent was taken from all patients fulfilling the inclusion criteria. Patients were excluded from the study if they had: congestive heart failure/ Ischemic

Heart Disease (heart failure beyond New York Heart Association Class III), acute or chronic renal failure with serum creatinine > 2 mg/dl, intestinal obstruction, intestinal perforation, previous colorectal surgery/ileostomy, massive ascites, or dysphagia. Pregnant females and patients requiring urgent colonoscopy were also excluded.

Two bowel preparations were used: 1) 60ml olive oil plus two liters of PEG lavage solution and 2) four liters of PEG lavage solution. The patients were randomly divided into 2 groups, Olive oil arm and conventional arm. All persons involved in randomization were blinded to data collection and analysis.

Patients in both arms were asked to take soft diet in breakfast followed by a clear liquid diet for lunch and dinner a day before the procedure. A day before the procedure, participants in olive oil arm (Group A) were asked to take 60ml of olive oil 2 hours after breakfast (10AM) followed 2 hours later by preparation with 2 liters of PEG lavage solution (250 ml of PEG at one and a half hour intervals) to finish by 12 PM, while participants in conventional arm (Group B) were asked to begin drinking the 4 liters of PEG lavage solution preparation at 10 AM the day before procedure (200ml of PEG at half hour interval) and to finish by 12 PM. All patients were encouraged to drink water, soft drinks or clear juices if they experience hunger or thirst.

Primary endpoints in our study were achievement of adequate bowel preparation and an overall Boston Bowel Preparation Scale (BBPS)¹⁰ score of ≥ 6 , both of which were reported by blinded investigators. The secondary endpoints of our study were patient compliance, acceptance, tolerability, and safety, which were assessed by a questionnaire/survey.

Quality of colon cleansing was assessed at the time of insertion of the colonoscope, prior to suction of the bowel content. Quality was assessed in three segments of the colonic i.e. (i) right sided colon (cecum and ascending colon), (ii) transverse colon and (iii) left sided colon (descending colon,

sigmoid colon, and the rectum).

The bowel cleansing status was evaluated using the Boston Bowel Preparation Scale (BBPS) as follows: 0 = Unprepared colon segment in which mucosa cannot be visualized due to presence of unclear solid stool, 1 = Some part of the mucosa of the colon segment visualized, but some portion of colon segment not well visualized due to staining and/or residual stool, 2 = Mucosa of the colon is well visualized but small amount of residual staining, small fragments of stool and/or opaque liquid seen, 3 = Entire mucosa of colon segment well visualized with no residual staining, small fragments of stool or opaque liquid.¹⁰

Overall cleansing score of the colon was calculated by adding up the scores of each segment. For the purpose of analysis, quality of bowel cleansing was graded into four different classes based on overall cleansing score (ranging from 0 to 9):

- Excellent (overall BBPS 8-9)
- Good (overall BBPS 6-7)
- Poor (overall BBPS 3-5)
- Inadequate (overall score 0-2)

Review of the literature was used to assemble the survey about the tolerability, acceptance and safety of the bowel preparation.^{11,12} Before undergoing colonoscopy, survey questionnaire was completed by the participants. Questionnaires included in survey were used in assessing the ease or difficulty of ingesting the bowel-cleansing preparation, comparison with previous bowel preparation regime (if any), whether the quantity of the fluid acceptable, the taste of the preparation, occurrence of any side effects and the overall experience when using the preparation. Patients response to questions was noted with a binary 'yes' or 'no' response or a three/five-point scale.

All analyses were conducted with SPSS 20.0. Mean, standard deviation, median, and range were calculated for continuous variables, while frequency and percentage were calculated for categorical variables. A two-tailed *p*-value was calculated for all tests taking $p \leq 0.05$ as statistically significant.

RESULTS

In this study, a total of 162 patients (74 in olive oil group and 64 in the conventional PEG-ELS group) were enrolled of the total 162 patients randomized, 24 were excluded: failure to complete bowel preparation as advised ($n = 14$; 6 in olive oil group and 8 in split dose regimen); miscommunication regarding bowel preparation ($n=1$); cancellation of the examination ($n=2$); bowel lesion/stricture hampering completion colonoscopy ($n=4$), spastic colon ($n=2$) and perforation ($n=1$).

Of the 138 patients studied, age range was 17-67 years with a mean age of 40.88 ± 13.75 years, 90 (65.21%) were male and 48 (34.78%) were female. Patients were divided into two groups based on the type of bowel preparation used, those who had taken olive oil plus low volume (2 liters) PEG-ELS were assigned Group A and those prepared with conventional volume (4 liters) PEG-ELS were assigned Group B. Demographic data was comparable among two different bowel preparation groups Table-I.

Quality of Bowel Preparation

Overall, 42 (30.4%) patients had excellent bowel preparation {Boston Bowel Preparation Score (BBPS) 8 and 9}. Thirty-eight patients (27.5%) had BBPS score of 6 and 7 indicating good bowel preparation, 30 (21.7%) patients had score of 3-5 indicating poor bowel preparation, and 28 (20.3%) patients had inadequate bowel preparation having score 0-2. The mean BBPS was 6.11 ± 2.6 with the olive oil preparation and 4.63 ± 2.81 with conventional PEG-ELS preparation ($P = <0.005$) as shown in Figure-1. Mean BBPS in each segment of colon is shown in Figure-2.

The quality of bowel cleansing in both groups is shown in Table-II.

The mean time of examination was about 22.53 ± 4.22 min. (Group A = 23.2, Group B = 21.85, $P < 0.05$). Mean time for colonoscopy was much higher (28.75 min.) in patients with a BBPS score of < 3 .

In Group A, of the 16 patients who had previous

colonoscopy history, 22.0% of the patients found this regimen easier than their previous bowel preparation regimen. While in Group B, of the 20 patients with previous colonoscopy history, 20% of the patients found no difference in this and the previous bowel preparation regimen. A result of the patients' questionnaire regarding tolerability in two groups is shown in in Table-III.

Of all patients studied, 52.5 % of the patients experienced no side effect with the bowel

preparation regimen. Commonly reported side effects were nausea, vomiting and abdominal cramps. Results of the patients' questionnaire regarding tolerability in two groups are shown in Table-IV Sixty-one percent of patients in Olive Oil group experienced no side effects as compared to 43% in the conventional PEG-ELS group ($p < 0.05$). Most commonly observed side effects was abdominal pain which was more frequent in the conventional PEG-ELS group (30% versus 4.9%, $p < 0.05$).

Item	All Population N= 138	Group A (Olive Oil Arm)	Group B (Conventional Arm)	P-Value
Mean age (years)	40.69 ± 14.833	39.07	42.35	>0.05
Gender				
M	90 (65.21%)	46 (51.1%)	44 (48.9%)	>0.05
F	48 (34.78%)	28 (58.3%)	20 (41.7%)	
Mean time for colonoscopy	22.53	23.2	21.85	<0.05
Indication				
Chronic diarrhea	52 (37.68%)	35.2%	40.6%	>0.05
Bleeding PR	24 (17.39 %)	18.5	17.0	
Abdominal pain	27 (19.56 %)	18.5	21.7	
Anemia	11 (7.97 %)	9.3	6.6	
CRC surveillance	6 (4.34%)	5.6	3.8	
Others	18 (13.04 %)	13.0	10.4	

Table-I. Demographics of study population

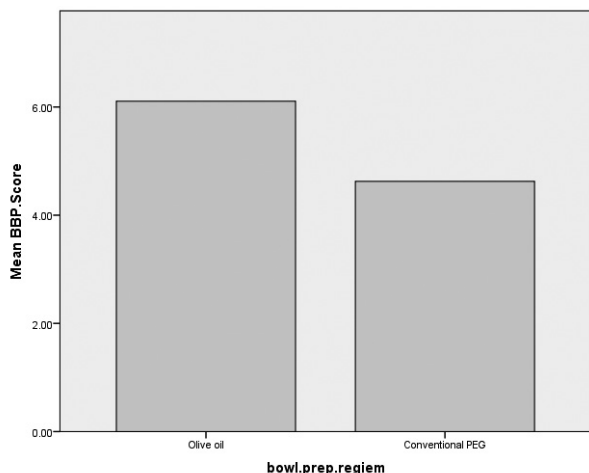


Figure-1. Comparison of Mean Boston Bowel Preparation Score (BBPS) between the Olive Oil (group A) and Conventional Preparation (group B).

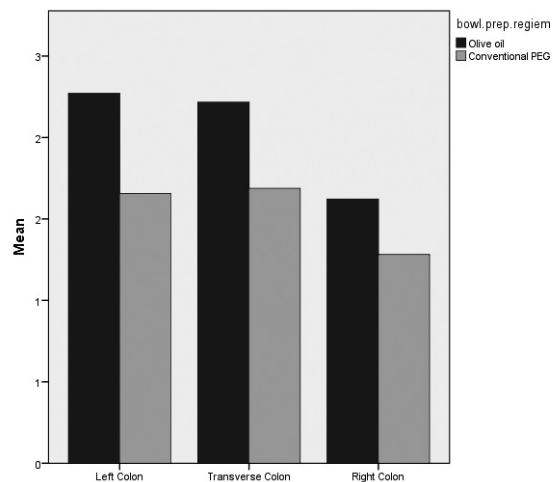


Figure-2. Mean Boston Bowel Preparation Score (BBPS) score in individual segments of the colon.

Bowel Cleansing	Group A	Group B	P-Value
Excellent (score 8-9)	32 (43.2%)	10 (15.6%)	<0.005
Good (score 6-7)	18 (24.3%)	20 (31.2%)	
Poor (score 3-5)	14 (18.9%)	16 (25.0%)	
Inadequate (score 0-2)	10 (13.5%)	18 (28.1%)	

Table-II. Comparison of bowel cleansing in both groups

Questions		Olive Oil	PEG	P-Value
How did you feel about this bowel preparation agent compared with a previous preparation (if any) This preparation was	Easier	22.0%	35.0%	<0.05
	Harder	26.8%	35.0%	
	Cannot compare because I do not remember	12.2%	10.0%	
	Cannot evaluate because experience was the same or not much different	39.0%	20.0%	
How easy or difficult was it to consume the preparations?	Very easy	4.9%	0.0%	<0.05
	Easy	34.1%	30.0%	
	Tolerable	19.5%	30.0%	
	Difficult	41.5%	35.0%	
	Very difficult	0.0%	5.0%	
How did you feel about the fluid volume?	Not too much	42.7%	20.0%	<0.05
	A little too much	50.0%	65.0%	
	Too much	7.3%	15.0%	
In the future, if you needed a colonoscopy, would you ask your doctor for the same preparation reagent again?	Hope for the same preparation	24.4%	20.0%	>0.05
	Hope for the other preparation	31.7%	22.5%	
	Do not know for sure	26.8%	42.5%	
	No	17.1%	15.0%	

Table-III. Bowel preparation tolerability of the two groups

Side Effect Profile		Olive Oil	PEG	P-Value
Did you feel a change in your physical condition?	Yes	65.9%	52.5%	>0.05
	No	34.1%	47.5%	
What kind of side effects did you experience?	None	61.0%	43.8%	<0.05
	Nausea	12.2%	12.5%	
	Vomiting	14.6%	10.0%	
	Abdominal pain	4.9%	30.0%	
	Abdominal distension	2.4%	1.2%	
	Any others	4.9%	2.5%	

Table-IV. Side effect profile of the two study groups

DISCUSSION

Currently, the most common cause of failure to perform or detect pathology in a colonoscopy examination is poor bowel preparation. Inadequate bowel preparation has significant impact on efficiency of colonoscopy and on the other hand also increase in patient's suffering and cost related to the procedure.⁷ The major hindrances in a quality colonoscopy remain low

level of patient compliance⁷, embarrassment of procedure⁷ and the bowel preparation regime.¹³

Of the various preparations for bowel cleansing before colonoscopy, conventional volume (3-4 liters) PEG-ELS has been found to be an effective and safe cleansing preparation.^{13,14} However, poor compliance, incomplete consumption and discomfort owing to large volume of this

conventional volume PEG-ELS preparation remain the most common deterrent to colonoscopy. Moreover, more side effects with this large volume regime also limits its usefulness. To reduce the number of non-compliance with this large volume preparation, several small volume preparation have been tested.¹⁵⁻¹⁷

A previous study¹⁶ of the combining low volume PEG-ELS with olive oil reported comparable efficacy and better tolerability of this low volume regime compared with conventional (large volume) PEG-ELS regime. To further elaborate the results this research, we also compared the efficacy, tolerability, patient's acceptance and safety of this low volume regime with conventional volume PEG-ELS regime.

In our study, more adequate bowel cleansing was achieved in the olive oil plus low volume group compared to conventional volume of PEG-ELS (mean BBPS 6.11 of olive oil preparation versus 4.63 of PEG-ELS preparation, p value <0.005). Mixed results were found in previous studies comparing small volume with large volume preparations for colonoscopy.^{16,18-20} Abut et al¹⁶ described that more adequate bowel cleansing was achieved in low-volume PEG plus olive oil regimen in right colon compared with that of the conventional volume of PEG-ELS but no difference was observed in the left colon. In a study conducted by lida et al²⁰ excellent results were achieved in patients prepared with low-volume PEG plus stimulant laxative, but due to lack of a control group and missing data on over 40% of patients, conclusions based on this data was difficult. DiPalma et al¹⁸ described no difference in efficacy of stimulant laxative plus low-volume PEG and full-volume PEG. A meta-analysis was performed by Qingsong et al¹⁹ to compare the efficacy of low-volume PEG plus stimulant/osmotic laxative with conventional-volume PEG as bowel preparation for colonoscopy. Results of this meta-analysis showed that out of eleven studies, six reported better bowel preparations compared with that of conventional-volume PEG, two studies found no difference and three studies found the opposite result.

As an adequately prepared bowel is necessary for detection of pathology, inadequate cleansing of bowel owing to failure to consume complete preparation may result in reduced screening efficacy.²¹ The patient's preference of a bowel preparation is that it should not only be low volume but also palatable, and easy-to-complete regimen.²² Our study concluded that olive oil plus low-volume PEG-ELS not only has significantly better effectiveness, but also has better compliance and tolerance than conventional-volume PEG. These results were similar to results of different studies comparing the compliance and tolerability of the two regimens.^{17,23-26} All these studies^{17,23-26} reported that a majority of the patients in the low-volume preparation group had better compliance and tolerability compared to patients in standard-volume preparation group.

LIMITATION

Our study has limitations of having a low sample size, being carried out in a single center, and having a difference in the starting time of two regimens.

CONCLUSION

In summary, optimal bowel preparation regimen before colonoscopy should be effective, tolerable and safe for all patients. We have concluded that low volume PEG and olive oil is a valid alternative and a better choice for bowel preparation before colonoscopy than conventional volume PEG, with superior efficacy, better compliance and tolerability and better safety profile.

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
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2	Muhammad Asif Gul	Statistical analysis & makeup result.	
3	Farooq Mohyud Din Chaudhary	Writing, Discussion.	
4	Bilal Hameed	Data collection.	
5	Muhammad Amjad	Data collection.	
6	Usman Hameed	Data collection.	