COMPARATIVE ANALYSIS OF COLON PREPARATION USING POLY ETHYLENE GLYCOL (PEG) WITH LACTULOSE FOR COLONOSCOPY

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ABSTRACT

Objective: To compare the adequacy of preparation for colonoscopy using polyethylene glycol with lactulose.
Study Design: Quasi experimental study.
Place and Duration of Study: Department of Gastroenterology, Combined Military Hospital Lahore, from Jul 2019 to Dec 2019.
Methodology: The enrolled patients were randomized into two equal groups. Group A received polyethylene glycol (PEG) formulation containing 13.125g x 24 sachets with 4 liters of water over 24 hours, group B received lactulose 600ml (66.7g/100ml) with 4 liters of water over 24 hours. Quality of bowel preparation was assessed using Ottawa scoring system (OBPS). A designed questionnaire was used for recording patients' tolerability toward the preparation method. Questionnaire was filled pre and post-procedure for socio-demographic data and scores. Patients were also assessed for tolerability of procedure and palatability of the solutions by questionnaire.
Results: The median age of patients in group A was 49 (26 IQR) years and in group B was 48 (18.5 IQR) years. Out of 100 patients 60% were males and 40% were females. The most common indication of colonoscopy was anemia (32%), followed by diarrhea (26%), bleeding per-rectum (24%) and constipation (18%). Polyethylene glycol showed better bowel cleansing score compared with lactulose (p<0.001). Tolerability and palatability for polyethylene glycol were statistically superior to the same volume of lactulose.
Conclusion: Polyethylene glycol is superior to lactulose in terms of bowel preparation, tolerability and palatability.

Keywords: Bowel preparation, Colonoscopy, Lactulose, Ottawa score, Polyethylene glycol (PEG).

INTRODUCTION

Colonoscopy is one of the most commonly performed procedures in the field of gastroenterology[1]. Common indications are screening for colorectal carcinoma, evaluation of bleeding per rectum, microcytic anemia and diarrhea[2].

Major goal of screening colonoscopy is adenoma detection and adenoma detection rate marks the credibility of endoscopist as well as the department. It is defined as the proportion of all colorectal carcinoma screening colonoscopies performed by a physician that reveal at least one adenoma[3]. Likewise failure to detect early lesions or arteriovenous malformations in patients presenting with unexplained microcytic anemia cannot be ignored. Success of procedure is dependent on multiple factors including patient's anxiety, compliance of patient with the instructions for preparation, body habitus of patient, endoscopist's competence and bowel preparation quality[4,5]. Not only does inadequate bowel preparation affect the detection of important findings it also affects the performance of the colonoscopist reflected in total procedure time and cecal intubation rate[6,7]. Quality of bowel preparation is assessed and documented using various scoring systems. These include Aronchick Scale, Ottawa Bowel Preparation Scale (OBPS), Boston Bowel Preparation Scale (BBPS). Ottawa Bowel Preparation Scale was used in this study for assessment of bowel cleansing quality. The OBPS measures mucosal cleanliness by colon segment, including

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the right colon, mid-colon, and recto-sigmoid colon, on a scale of 0 (excellent) to 4 (inadequate) for each (table-I) and is scored before washing or suctioning. The OBPS measures fluid quantity separately, with scores ranging from 0 (small volume) to 2 (large volume) for the total colon[8].

Commonly used methods for bowel preparation are using polyethylene glycol (PEG), lactulose, bisacodyl, sodium phosphate[9]. Good bowel preparation is of paramount importance in detection of lesion especially polps[10]. The aim of this study was to compare the adequacy of PEG and lactulose for preparation and also assess and compare the tolerability toward procedure and palatability of the two agents.

METHODOLOGY

This quasi experimental study was carried out at Combined Military Hospital (CMH) Lahore, department of Gastroenterology. A total of 180 patients underwent colonoscopy from July 2019 to December 2019 at department of Gastroenterology CMH Lahore. Out of these patients 100 patients undergoing routine colonoscopy by appointments were recruited after the ethics approval from the Institutional Review Board (reference number 453/ERC/CMH LMC). The sample size was calculated using WHO calculator with 5% level of significance (α), 90% power of test (1-β), and 15 as test value of population mean.

Patients of 18 to 80 years old, male or female, willing to sign consent form and able to apprehend and complete the questionnaires, good performances status 0 (fully active, able to carry on all performance without restriction) or 1 (restricted in physically strenuous activity but ambulatory and able to carry out work of a light or sedentary nature) were included in the study.

Exclusion criteria included any psychiatric or neurologic disorder affecting ability to follow instructions; any severe metabolic disorder, liver or renal failure; any condition that might affect gut motility like scleroderma , diabetes, hypothyroidism; any history or gastrointestinal malignancies or abdominal surgeries; any history of drugs affecting gut motility like prokinetics, thyroxine, calcium channel blockers, morphine and its derivatives and no history of gastrointestinal malignancies or abdominal surgeries.

The patients were randomized into two groups by lottery method. Group A was subjected to polyethylene glycol preparation (24 sachets of PEG 3350 ± sodium chloride ± sodium bicarbonate ± potassium chloride; strength; 13.125 g/0.3507g/0.1785g/0.0466g manufactured by Genix Pharma) were given in two divided doses 8 hours apart along with 4 liters of fluids in the form of water and clear fluids). Group B was given lactulose syrup (600ml with 4 liters of fluid containing plain water and clear fluids. Lactulose

Table-I: Ottawa bowel preparation scale.

Scale Parameter	Score	Rating/description
Ottawa Bowel Preparation Scale (by Colon) Segment	0	Excellent: Mucosal detail clearly visible, almost no stool residue; clear fluid
	1	Good: Some turbid fluid or stool residue, but mucosal detail still visible without need for washing/suctioning
	2	Fair: Some turbid fluid of stool residue obscuring mucosal detail; however, mucosal detail becomes visible with suctioning, washing not needed
	3	Poor: Stool present obscuring mucosal detail and contour; a reasonable view is obtained with suctioning and washing
	4	Inadequate: Solid stool obscuring mucosal detail and not cleared with washing and suctioning
Ottawa Bowel preparation Scale (by Total Colon Fluid)	0	Small amount of fluid
	1	Moderate amount of fluid
	2	Large amount of fluid

by name of Duphalac by Abbot was used for all case). Solids and opaque fluids with particulate material were stopped at least 24 hours prior to intended time of procedure. Method of preparation was explained verbally by a resident doctor dedicated for the sole purpose and was also provided with instruction leaflet.

All procedures were performed between 0900 hrs and 1200 hrs, patient were made to lie in left lateral position and procedure was carried out under conscious sedation according to departmental protocol administered by an experienced nurse. It comprised of midazolam iv 2mg and propofol 20mg at the beginning of procedure and 1mg of midazolam and 10mg of propofol boluses were used as required. Blood pressure and oxygen saturations were monitored and resuscitation trolley with endotracheal tube (ETT) was kept by the site. Procedures were performed by an experienced colonoscopist performing >100 procedures a year. Patients were moved to recovery room after procedure where they were detained for one hour on average.

Bowel preparation was assessed using Ottawa Bowel Preparation Scale (OBPS) and documented on report form for the three segment and amount of fluid in colon. A total score was calculated and incorporated in study.

Continuous data were reported as median and interquartile range (IQR). Quantitative data were summarized as frequencies and percentages. The comparison between medians was assessed using Mann Whitney U-test and chi square or fischer exact test was used for descriptive data. A *p*-value was considered to be significant if ≤0.05. Statistical analysis was done using SPSS 16.0.

RESULTS

A total of 100 patients were recruited for the study with 50 in group A (50%) and group B (50%), each. Males contributed to 60 (60%) of the total study population with 32 (53%) in group A and 28 (46%) in group B. Females accounted for 40 (40%) of the total study population with 18 (45%) in group A and 22 (55%) in group B. The median age for group A was 49 with Interquartile ratio of 26 (IQR) and for that of group B was 48 with IQR of 18.5 (table-II).

Anemia (32%) accounted for the most common indication for colonoscopy referral, followed by diarrhea (26%), bleeding per rectum (PR) (24%) and constipation (18%) (table-II).

Seventy four percent (37) of participants from group A reported the palatability of pre-

Table-II: Comparison of different test variables between the two groups.

Variables	Groupsn(%)		*p*-value
	Group A (n=50)	Group B (n=50)	
Age (years) (median with IQR)	49 (26)	48 (18.5)	0.83
Gender			
Males (60)	32 (64)	28 (56)	0.44
Females (40)	18 (36)	22 (44)	
Indication of Procedure			
Anemia (32)	20 (40)	12 (24)	0.12
Diarrhoea (26)	10 (20)	16 (32)	
Bleeding PR (24)	9 (18)	15 (30)	
Constipation (18)	11 (22)	7 (14)	
Palatability of Laxative Preparation			
Good (52)	37 (74)	15 (30)	<0.001
Tolerable (21)	10 (20)	11 (22)	
Poor (27)	3 (6)	24 (48)	
Tolerability			
Easy (45)	40 (80)	5 (10)	<0.001
Tolerable (30)	10 (20)	20 (40)	
Difficult (25)	-	25 (50)	

Table-III: Comparison of colonic preparation during procedure for the two groups.

Colonic preparation (Ottawa classification)	Group A (n=50)	Group B (n=50)	*p*-value
0 (9)	8 (16)	1 (2)	<0.001
1 (7)	7 (14)	-	
2 (11)	11 (22)	-	
3 (11)	11 (22)	-	
4 (18)	10 (20)	8 (16)	
5 (5)	2 (4)	3 (6)	
6 (18)	1 (2)	17 (34)	
7 (4)	-	4 (8)	
8 (11)	-	11 (22)	
9 (6)	-	6 (12)	

pping solution as good, 10 (20%) as tolerable and 3 (6%) as poor in comparison to group B where 15 (30%), 11 (22%) and 24 (48%) reported the palatability as good, tolerable and poor, respectively. The figures for palatability of PEG versus Lactulose were statistically significant table-II.

The tolerability towards the prepping solution was also found to be statistically significant for the two groups with 40 (80%), 10 (20%) and 0% reporting easy, tolerable and difficult respectively for group A on the questionnaire provided as compared to 5 (10%), 20 (40%) and 25 (50%) reporting easy, tolerable and difficult respectively for group B.

The colonoscopist score for the colonic preparation, calculated during the procedure (i.e. Ottawa Score) was statistically significant between the two groups, showing poor colonic prep with lactulose solution (group B) as compared to group A (table-III).

DISCUSSION

Colonoscopy with histological examination is considered gold standard for many of the gut pathologies[11], the success of which depends on the quality of bowel preparation which directly affects the correct diagnosis, rate of complications, cost and patient compliance. Quality of preparation also affects the performance of endoscopist and overall duration of procedure[12]. An ideal preparation solution should be easy to administer/use, quick to act and cause purgation with minimal side effects and electrolyte imbalance, keeping in consideration the patients' tolerability towards the solution[11,13].

PEG is an iso-osmotic solution which in addition to being non-absorbable, passes through the gut without any histological changes and no net gain or loss of fluid and electrolytes[14]. Lactulose on the other hand is a synthetic disaccharide that is broken down by β-galactosidase producing intestinal bacteria causing osmotic diarrhea[14,15].

A study from China showed superior bowel cleaning with lactulose as compared to PEG and the cleansing scored higher for all segments of the large bowel[13]. This also helped the researchers with obtaining a high adenoma detection rate as pointed out in the same study. These results were in contrast to our findings where PEG scored high as compared to Lactulose. Similarly, a study from Germany reported better bowel preparation scores for PEG as compared to other solutions used[16].

A study from Brazil by Menacho *et al*, showed that palatability and tolerability for PEG was statistically superior to lactulose[11]. A multicenter study by Schanz *et al*, showed better tolerability, compliance, palatability and a lesser degree of reluctance towards using PEG for a repeat colonoscopy if need arises[17]. A similar study from China by Xia *et al*, showed poor tolerance towards PEG as compared to lactulose due to unfavorable palatability[13], which is in contrast to our study.

A thorough search was done for local data regarding comparison of the two prepping solutions. Though widely used at many centers, no such comparison was seen in the local data base. A single indigenous interventional study comparing 2L of PEG with 4L of PEG for bowel cleansing was found[18]. Therefore this is a unique study comparing two different preparation methods in our population in terms of bowel cleansing, tolerability and palatability.

The limitations of the study include non-matched study population, adenoma detection rate (which would have made the study theoretically stronger) and the time to cecal intubation (which would have been an indirect measure of the degree of gut preparation). Further research is required to cover these lacunae.

CONCLUSION

PEG was found superior to lactulose for bowel cleansing and was more palatable as well as easily tolerated by the patients.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

REFERENCES

1. Edwards BK, Ward E, Kohler BA. Annual report to the nation on the status of cancer, 1975–2006, featuring colorectal cancer trends and impact of interventions (risk factors, screening, and treatment) to reduce future rates. Cancer 2010; 116(6): 544–73.
2. Schreuders EH, Ruco A, Rabeneck L, Schoen RE, Sung JJ, Young GP, et al. Colorectal cancer screening: a global overview of existing programmes. Gut 2015; 64(10): 1637-49.
3. Rex DK, Schoenfeld PS, Cohen J, Pike IM, Adler DG, Fennerty MB, et al. Quality indicators for colonoscopy. Gastrointest Endosc 2015; 81(7): 31–53.
4. Johnson DA, Barkun AN, Cohen LB, Dominitz JA, Kaltenbach T, Martel, et al. Optimizing adequacy of bowel cleansing for colonoscopy: recommendations from the US multi-society task force on colorectal cancer. Gastroenterology 2014; 147(2): 903-24.
5. Saltzman JR, Cash BD, Pasha SF, Early DS, Muthusamy VR, Khashab MA, et al. Bowel preparation before colonoscopy. Gastrointest Endosc 2015; 81(11): 781-94.
6. Rees CJ, Gibson ST, Rutter MD, Baragwanath P, Pullan R. British Society of Gastroenterology, the Joint Advisory Group on GI Endoscopy, the Association of Coloproc-tology of Great Britain and Ireland. UK key performance indica-tors and quality assurance standards for colonoscopy. Gut 2016; 65(4): 1923-29.
7. Koido S, Ohkusa T, Nakae K, Yokoyama T, Shibuya T, Sakamoto N, et al. Factors associated with incomplete colonoscopy at a Japanese academic hospital. World J Gastro 2014; 20(8): 6961-67.
8. Kastenberg D, Bertiger G, Brogadir S. Bowel preparation quality scales for colonoscopy. World J Gastro 2018; 24(26): 2833–43.
9. Bechtold ML, Mir F, Puli SR, Nguyen DL. Optimizing bowel preparation for colonoscopy: a guide to enhance quality of visualization. Ann Gastroenterol 2016; 29(2): 137–46.
10. Jang JY, Chun HJ. Bowel preparations as quality indicators for colonoscopy. World J Gastro 2014; 20(2): 2746–50.
11. Menacho A, Reimann A, Hirata L, Ganzerella C, Ivano F, Sugisawa R. Double-blind prospective randomized study comparing polyethylene glycol to lactulose for bowel preparation in colonoscopy. ArquivosBrasileiros de Cirurgia Digestiva 2014; 27(1): 9-12.
12. Alvi H, Rasheed T, Shaikh MA, Ali FS, Zuberi BF, Samejo AA. Impact of bowel preparation on caecal intubation time during colonoscopy. Pak J Med Sci 2019; 35(6): 1516-19.
13. Li C, Guo Y, Zhu Y, Zhu J, Xiao Q, Chen D, et al. Comparison of Polyethylene Glycol versus Lactulose Oral Solution for Bowel Preparation prior to Colonoscopy. Gastro Res Practice 2019; 2019(6): 1-6.
14. Zhai S, Zhu L, Qin S, Li L. Effect of lactulose intervention on gut microbiota and short chain fatty acid composition of C57 BL /6J mice. Microbiology Open 2018; 7(6): e00612-15.
15. Schanz S, Kruis W, Mickisch O, Küppers B, Berg P, Frick B, et al. Bowel preparation for colonoscopy with sodium phosphate solution versus polyethylene glycol-based lavage: a multicenter trial. Diag Therap End 2008; 2008(5): 1-6.
16. Ell C, Fischbach W, Keller R, Dehe M, Mayer G, Schneider B, et al. A Randomized, blinded, prospective trial to compare the safety and efficacy of three bowel-cleansing solutions for colonoscopy (HSG-01). Endos 2003; 35(4): 300-04.
17. Parada A, Ribas C, Venco F, Ardengh J, Reis M, Degiovani M, et al. Comparative analysis of endoscopic and histopathological features of superficial elevated lesions resected by endoscopic mucosal resection in the distal and proximal colon. Revista do ColégioBrasileiro de Cirurgiões 2016; 43(3): 178-84.
18. Khattak AK, Ahmad S, Hassan MK, Khan H, Masood A, Ahmad M. Efficacy of two litres polyethylene glycol versus four litres polyethylene glycol solution for bowel cleansing for colonoscopy. J Med 2018; 25(1): 76-79.