Bangladesh Journal of Medicine (BJM)
ISSN : 1023 - 1986
eISSN : 2408 - 8366

ORIGINAL ARTICLE

BOWEL PREPARATION FOR COLONOSCOPY WITH MANNITOL AND SODIUM PHOSPHATE: A RANDOMIZED CONTROLLED STUDY

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Abstract:

Background: *The aim and objective of this study was to compare the effectiveness between mannitol and sodium phosphate as a colonoscopic bowel cleansing agent conducted in the department of Gastroenterology of Sir Salimullah Medical College Mitford Hospital.* ***Methods:*** *In this cross-sectional study, a total number of 108 cases were randomly selected, who underwent colonoscopy from November 2019 to June 2020 in the department of Gastroenterology of Sir Salimullah Medical College and Mitford Hospital. The patients were divided into two groups based on received bowel preparations agent, either mannitol (Group MN) or sodium phosphate (group NaP).* ***Results:*** *Out of 108 patients 57 received mannitol and 51 received sodium phosphate. Thirty-two males and twenty-two females received mannitol, while 28 males and 23 females received sodium phosphate. Excellent bowel preparation was observed in 32(55%) cases of MN group and 26(45%) cases of group NaP. No statistically significant difference between two groups by Chi-square (X^2) test (p=0.793).* ***Conclusion:*** *This cross-sectional, randomized study did not show any significant statistical difference between the two agents regarding effectiveness of bowel preparation. So, both mannitol and sodium phosphate are almost equally effective in achieving excellent or good quality of bowel preparation.*

Key words*: Colonoscopy, Bowel preparation agent, Quality of bowel preparation*

Received: 15-04-2022 *Accepted: 10-08-2022*
DOI: https://doi.org/10.3329/bjm.v33i3.61372

Citation: *Chowdhury MNF, Mahbub I, Udin MK, Habib MR, Saifullah ANM, Uddin MR et al. Bowel preparation for colonoscopy with Mannitol and Sodium Phosphate: A randomized controlled study. Bangladesh J Medicine 2022; 33: 263-268.*

Introduction:

Colonoscopy is an important diagnostic tool for colonic disorders as it provides the facility of direct visualization of mucosa, vascular pattern and lumen of colon. The success of colonoscopy depends on the quality of colonic preparation. The preparation consists of emptying all the fecal contents of colon to allow complete view of mucosa. Adequate bowel preparation is essential for assuring the accuracy and quality of colonoscopy.[1-4] Sodium phosphate is widely used and well tolerated agent for bowel cleansing before colonoscopy. It acts as an osmotic laxative and draws water into the bowel lumen to stimulate peristalsis and increase bowel movements. As small quantity is needed, it is one of the preferred agents for colonoscopic preparation.[5-8]Mannitol is administered orally, which is digested specifically by *E. coli*and some other bacteria.[9] It is a non-absorbable carbohydrate, if administered in high doses, results in osmotic diarrhea. Because of rapid action, easy administration, few side effects, cheap and good patient compliance mannitol is widely used for bowel

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preparation.[10-12]The purpose of this present randomized, prospective study is to compare the quality of colonoscopic bowel preparation with mannitol and sodium phosphate.

Methods:

This current study was a cross-sectional, randomized and single center study. It was conducted in gastroenterology department of Sir Salimullah Medical College Mitford Hospital during the period from November 2019 to June 2020. A total 108 patients of more than 18 years of age who underwent colonoscopy in the department were included in this study. The exclusion criteria were emergency colonoscopy, inability to oral intake and refusal to participate in this study. After properly explaining about the study informed consent was taken from the eligible patients. The selected patients were randomly divided into two groups. Randomization was done by simple heads or tails allotment and each group received one of two bowel preparations, either mannitol (Group MN) or sodium phosphate (group NaP).Bowel preparation started three days prior to examination, with restriction on some foods, such as seeds, nuts, fresh fruits or vegetables.Patients of group MN received 500 ml of 20% mannitol in one hour, 4 hours before the Colonoscopy. Patients of NaP group were administered two doses of 45 mL oral sodium phosphate, (each containing 10.8 g disodium phosphate dodecahydrate and 24.4 g sodium dihydrogen phosphate dehydrate). First dose was given at evening (20:00 p.m.) before the procedure day and the second at the morning (8:00 a.m.) of the procedure day. Each dose was diluted in 125 mL of plain water followed by other 250mL of plain water. Patient was encouraged to drink 3 L or more clear liquids. Colonoscopies were done late in the morning. On the day of examination, patients arrived at our center with already taken bowel preparation. Before doing colonoscopy, following data were recorded by using a questionnaire: demographic data, presenting symptoms, physical examination finding, and agent used for bowel preparation and amount of ingested water.Each colonoscopy was done by an experienced endoscopist who was blinded regarding bowel preparation agent. Another questionnaire was supplied to the endoscopist consisting of question about quality of bowel preparation and colonoscopic findings. Modified Aronchick scale was used for assessing quality of bowel preparation and graded as:

Poor: re-preparation required; large amount of fecal residue precludes a complete examination

Inadequate: inadequate but examination completed; enough feces or turbid fluid to prevent a reliable examination; less than 90% mucosa seen.

Fair–adequate: moderate amount of stool that can be cleared with suctioning permitting adequate evaluation of entire colonic mucosa; more than 90% mucosa seen

Good: small amount of turbid fluid without feces not interfering with examination; more than 90% mucosa seen

Excellent: small amount of clear liquid with clear mucosa seen; more than 95% mucosa seen.[25]

Statistical analysis was performed using SPSS (Statistical Package for Social Sciences), version 22.0. The qualitative data were analyzed by Chi-square ($\div^2$) test and quantitative data were analyzed by student's t-test. Level of significance was set at 0.05 and p-value < 0.05 was considered significant.

Results:

Out of 108 patients 57 received mannitol (Group MN) and 51 received sodium phosphate (Group NaP). Thirty two males and twenty two females received mannitol, while 28 males and 23 females received sodium phosphate (p =0.897), with no significant difference. Age and presenting symptoms between group MN and group NaP was also not significant. (Table - I)

Table - I

Parameter		Mannitol	Sodium phosphate	Total	P value
Gender	Male	32	28	60	0.897
	Female	25	23	58	
Age	18-29	10	9	19	0.794
	30-50	19	16	35	
	>50	28	26	54	
Mean age	Clinical symptom				
	Lower abdominal pain	41	36	77	0.59
	Constipation	22	21	43	
	Diarrhoea	31	27	58	
	P/R bleeding	19	21	40	
	Tenesmus	13	9	22	
	Others	24	18	42	

Excellent bowel preparation was observed in 32 cases of MN group and 26 cases of group NaP. A poor preparation was found in 2 and 3 cases for group MN and group NaP respectively. There is no statistically significant difference between two groups regarding quality of bowel preparation (Table - II).

A total 5 cases had poor quality of bowel preparation. Among them 250-500ml, 500-750ml and >750 ml fluid was taken by 2,1and 2 patients respectively. A statistically significant difference was observed between quality of bowel preparation and amount of fluid intake (Table - III).

Again, all the patients with poor quality bowel preparation had low BMI, which demonstrates statistically significant difference (Table - IV).

But there was no significant difference found between sex of the patient and quality of bowel preparation. (Table - V)

Table -II

Quality	Mannitol	Sodium Phosphate	P Value	Total
Excellent	32	26	0.793	58
Good	14	11		25
Fair adequate	5	8		13
Inadequate	4	3		7
Poor	2	3		5
Total	57	51		108

Table -III

Quality		Water taken			Total	P
		500-750 ml	>750 ml	250-500 ml		Value
	Poor	1	2	2	5	
	inadequate	4	3	0	7	
	Fair	6	7	0	13	0.000
	Good	1	24	0	25	
	Excellent	0	58	0	58	
	Total	12	94	2	108	

Table -IV

Quality		BMMI			Total	P
		Low	Normal	Obese		Value
	Poor	5	0	0	5	
	Inadequate	4	1	2	7	
	Fair	4	4	5	13	0.000
	Good	7	12	6	25	
	Excellent	5	35	18	58	
Total		25	52	31	108	

Table -V

Quality		Sex		Total	P
		Male	Female		Value
	Poor	3	2	5	
	Inadequate	2	5	7	
	Fair	8	5	13	0.690
	Good	14	11	25	
	Excellent	32	26	58	
Total		59	49	108	

Colonoscopic findings according to type of agents was displayed in table – VI.

Table - VI

Diagnosis	Mannitol	Sodium phosphate
Normal	28	25
Haemorroids	8	7
Polyp	6	4
Colorectal carcinoma	9	7
Diverticular disease	1	2
Ulcerative colitis	4	4
Crohn's disease	0	0
Others	1	2

Discussion:

The colonoscopy is an important tool for diagnosis as well as follow up of many colonic disorders. If adequate bowel preparation is not achieved, endoscopist may not have a proper visualization of colonic mucosa and lumen. Thereby, various important lesions may be missed during the procedure. Hence, proper bowel preparation is an essential pre-requisite for a successful colonoscopy.[1-4,13]

There are various agents are being used for colonic preparation. But an ideal colonoscopic bowel preparation agent should achieve high quality of bowel clearance as well as be safe, well tolerated and easy to administer.[14-16]

This present study demonstrated that excellent or good preparation was achieved in 82% patients who used mannitol. Sodium phosphate also obtained almost similar results regarding excellent or good bowel cleansing. Previous studies also agree about highly effectiveness of mannitol or sodium phosphate as a bowel preparation agent.[5,8,17-22]

Again we observed that there is a fair relation between amount of water intake and quality of bowel preparation. Among the patients with poor preparation 40% and 20% took 250-500 ml and 500-750 ml of water respectively. Moreover, more than 750 ml of water was ingested by 100% cases with excellent preparation. Moreover, other studies also observed similar findings.[10]Therefore, patientsmay be encouraged to drink more water.The current study also showed that all the patients with low BMI had poor preparation. So, we should be more judicious while using these preparations in case of lean and thin patients. However,previous studies did not mention this.In this study, we compared sodium phosphate and mannitol in terms of quality of bowel preparation for colonoscopy. We observed both of them achieved high percentage of excellent or good bowel preparation without significant statistical difference. We found only one study which was from Brazil that compared between these two agents. They concluded that both agents are equally effective and safe for colonoscopic bowel preparation.[17]

However, number of studies comparing only between sodium phosphate and mannitol are very limited probably due to the preference of the majority of European and American medical centers to PEG.[17]Although majority of American and European medical centers prefer PEG, it has some disadvantages such as: large amount of solution (almost 4L) required to achieve desired bowel clearance, poor salty taste and 'rotten-egg' smell from standard sulfate containing PEG preparations. These affects patient's compliance to PEG terribly. Moreover, PEG is contraindicated in allergic to PEG, high grade small bowel obstruction, perforation, diverticulitis and haemodynamically unstable patients. Rarely PEG is associated with Mallory Weiss tear, toxic colitis, pulmonary aspiration, hypothermia, pancreatitis, cardiac arrhythmias and SIADH.[6]Macroscopic changes in coloic mucosa such as friability, hyperemia and apthoid injury in case of sodium phosphate was noted in a previous paper.[24] But we did not find this in our current study.

The patient's acceptance between mannitol and sodium phosphate is difficult to compare, as it is a subjective variable, only possible to report reliably if the same patient have taken both agents. In our study, no patient had this experience. However, Vanner et al. observed that sodium phosphate was more acceptable than PEG in a prospective study which included 102 patients. It was possibly due to swallowing a smaller volume of solution in case of sodium phosphate compared to PEG.[5]After taking sodium phosphate, temporary asymptomatic hypocalcemia and hyperphosphatemia has been reported in previous few studies.[5,8,19-20,23] So, it is better to avoid in patients with kidney disease.

Conclusion:

On the basis of observations of the present study, we can conclude that both mannitol and sodium phosphate are highly effective in terms of achieving excellent or good quality of bowel preparation for colonoscopy. However, we should encourage to drink more plain water to achieve excellent preparation and be judicious using these agents in lean and thin patients.

Conflicts of interest:

Fifty percent of sodium phosphate (Phosphoprep) were supplied by Unimed & Unihealth Manufacturers Limited, Bangladesh. But there is no conflict of interests regarding the publication of this paper.

Funding:

No specific funding was received for this study.

Ethical consideration:

The study was conducted after approval from the ethical review committee. The confidentiality and anonymity of the study participants were maintained

Acknowledgement:

Thankful to all doctors, nurses and medical stuff of Department of Gastroenterology, Sir Salimullah Medical College Mitford Hospital; Dhaka, Bangladesh for their best and kind support for collection of data for this study.

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