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Original article

Real-Life Colonoscopy Preparation

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Abstract

Introduction: The quality of a colonoscopy is a key factor in clinical outcomes and largely depends on the bowel cleanliness achieved through proper preparation. The type of agent, adherence, and tolerability are factors that can influence the quality of bowel preparation and, consequently, the results of the procedure. This study aims to evaluate the factors that determine the choice of preparation agent and its impact on the quality of colonoscopy. **Methodology:** A cross-sectional observational study was conducted with a sample of 530 patients. Agents evaluated included polyethylene glycol (PEG), sodium picosulfate, and sodium-potassium-magnesium sulfate (Na-K-Mg sulfate), with their continuous and split-dose regimens, depending on the case. The reasons for selection and tolerability were assessed through a survey. Bowel cleanliness was determined by the endoscopist using the Boston scale. **Results:** The average age was 52.7 years (±13.4), with 60% being women. The most selected agent was PEG (81.9%) in the full-dose regimen (74.5%). The main determining factor was the availability of the drug, at 42.6%. Unwanted symptoms were reported in 62.6% of patients, however, 99.4% achieved adequate preparation (Boston ≥6). **Conclusion:** The primary factor related to the selection of the bowel preparation agent is availability. Objective tolerability does not significantly affect the quality of bowel cleanliness or the success of the procedure.

Keywords

Colonoscopy, Bowel preparation, Polyethylene Glycol, Sodium Picosulfate, Sodium-Potassium-Magnesium Sulfate.

INTRODUCTION

Colonoscopy is a key diagnostic and therapeutic procedure in medical practice, particularly for the prevention of colorectal cancer. Its use as a screening strategy and intervention for premalignant lesions has resulted in a 52% reduction in incidence and a 62% decrease in mortality associated with this neoplasm(1). The success of this procedure, especially for screening purposes, relies on achieving proper visualization of the mucosa, which, in addition to the operator's expertise, requires a clean bowel without visual barriers during evaluation.

The type of agent used, patient adherence, and its tolerability are factors that determine the quality of the colonoscopy. A procedure is considered adequate with an adenoma detection rate (ADR) above 25% in individuals over 50 years of

age, a global cecal intubation rate (CIR) over 90% and above 95% in screening procedures, a withdrawal time of six minutes or more, and a Boston scale score of six or higher[2]. In the United States and Western Europe, it is estimated that between 25% and 40% of colonoscopies have inadequate preparation, leading to early repeat procedures, which presents a challenge for both physicians and patients[3,4].

In our region, several agents are available for bowel preparation, each with different mechanisms of action. The most commonly used are polyethylene glycol (PEG), sodium picosulfate, and Na-K-Mg sulfate. PEG and Na-K-Mg sulfate are considered osmotic laxatives as they increase luminal water and, consequently, hydrostatic pressure, stimulating peristalsis. In contrast, stimulant or contact laxatives, like sodium picosulfate, promote intestinal motility by activating the enteric nervous system. According to the literature, the main factors influencing the choice of agent include tolerance, the volume to be ingested, taste, patient comorbidities, and the occurrence of adverse effects. The most common side effects are nausea, vomiting, sleep disturbances, abdominal distension, and electrolyte and water imbalances[5-8].

PEG passes through the intestines without net absorption or secretion, avoiding significant fluid and electrolyte shifts[3,9]. It is considered safe, even in patients at risk for electrolyte imbalances, particularly those with chronic liver disease, kidney failure, or heart failure, making it the most commonly used agent[9]. Its main drawbacks are poor palatability and the need to dissolve it in a large volume of water (four liters in the traditional regimen). The primary adverse effects are pain, abdominal distension, nausea, vomiting, headache, and sleep disturbances, which may occur in up to 80% of patients, leading 20% of them to fail to complete the preparation regimen[10-15].

Sodium picosulfate and Na-K-Mg sulfate have the advantage of better taste and a lower volume requirement for preparation[16]. However, both can cause electrolyte imbalances and dehydration, so they are not recommended for patients with liver disease, heart disease, or chronic kidney disease[15,17].

In addition to the agent-specific factors, the dosing regimen during preparation also affects its tolerability. The preparation can be administered as a continuous dose, where the total dose is taken the night before or on the day of the procedure, or as a split dose, where half of the preparation is taken the night before and the remaining half on the day of the procedure. While PEG and sodium picosulfate can be administered in either regimen, Na-K-Mg sulfate is only given as a continuous dose. The split-dose regimen is generally better tolerated and is the most recommended for elective procedures. In terms of choosing the preparation, aside from the previously mentioned factors, there may be other reasons that influence the choice[16,18,19].

The present study aims to describe the factors determining the choice of an agent for bowel preparation, its tolerability, and its impact on the quality of bowel cleansing.

METHODOLOGY

Study Design and Data Collection

An analytical cross-sectional observational study was conducted. The sample size was calculated based on an estimated prevalence of 80%, with a 5% margin of error, a significance level of 80%, and an anticipated dropout rate of 10%, resulting in a total of 530 patients. These patients were selected through non-random convenience sampling from individuals scheduled for elective outpatient colonoscopy at Clínica Fundación Valle del Lili in Cali, Colombia, between May and December 2022. The standard bowel preparation agent used in the institutional protocol was PEG due to its safety profile. Sodium picosulfate or Na-K-Mg sulfate were used when recommended by the treating physician when requesting the procedure. Institutional protocols exist for both of these agents as well. At the time of scheduling and according to the procedure's timing, patients were presented with and sent the preparation options, including the corresponding protocols: continuous dosing if the procedure was scheduled for the morning and split dosing if scheduled for the afternoon.

Patients aged 18 and older who were identified as suitable for the study (by the treating gastroenterologist at the time of the procedure request) were included. They were free to choose the preparation agent, considering the physician's recommendation, previous experiences, agent availability, recommendations from other sources, or cost. Patients with specific contraindications to any of the agents under evaluation were excluded.

Data Collection

Information was gathered from the medical record, the official procedure report, and a self-administered survey evaluating factors associated with the selection and tolerability of the bowel preparation agent. Sociodemographic and clinical variables were included.

Procedure

The three bowel preparations evaluated and their respective regimens were 4L PEG in continuous and split dosing, sodium picosulfate in continuous and split dosing, and sodium sulfate in continuous dosing. Quality criteria were defined as a Boston score of six or higher and a cecal intubation rate above 90%.

Statistical Analysis

The data recorded in the database were processed using the statistical software Stata 16. Descriptive statistical analysis for categorical variables was conducted using absolute and relative frequencies, and for quantitative variables, through the calculation of means and standard deviations or medians and interquartile ranges, depending on the distribution of variables as determined by the Kolmogorov-Smirnov test for normality. Subsequently, a bivariate analysis was performed, where quantitative variables were compared using the Kruskal-Wallis test, and categorical variables were compared using the chi-square test or *F*-test.

Ethical Considerations

This study was approved by the Ethics Committee of Clínica Fundación Valle del Lili in Cali, Colombia, adhering to the ethical guidelines outlined in the Declaration of Helsinki. All patients signed informed consent forms. Privacy and confidentiality of sensitive patient information were guaranteed.

RESULTS

In the evaluated population, the average age was 52.7 years (± 13.4), and 60% of the participants were women. A history of abdominal surgery and hypertension were the main comorbidities within the population. The four most common indications for colonoscopy were abdominal pain, screening, diarrhea, and lower gastrointestinal bleeding (**Table 1**).

The most commonly used bowel preparation agent was PEG (81.9%). Neither price nor prior experiences were significant factors in the selection of the bowel preparation agent ($p > 0.05$). The availability of the preparation (42.7%) and the recommendation of the treating physician (36.8%) were the main factors considered by the patients. However, statistically significant differences were observed only in the availability of the agent as a selection factor ($p < 0.05$) (**Table 2**).

Tolerability of the bowel preparations was measured in two ways: subjectively and objectively. In the subjective evaluation (classified as poor, bad, fair, and good), 45.1% of patients reported it as good, and 37.7% as fair. The agent with the highest subjective tolerability was sodium picosulfate, with 75.3% in a single dose, while PEG had the lowest tolerability, with 38.7% in the full-dose regimen, with statistically significant differences ($p < 0.05$). Meanwhile, objective tolerability, defined as having completed the full dose of the preparation agent, was 91.5% overall, with sodium sulfate showing the highest tolerability (100%) (**Table 3**).

Table 1. Demographic and Clinical Characteristics of the Population

Variable	n = 530 (%)
Demographic Characteristics	
- Female sex	318 (60.0)
- Age in years, mean (SD)	52.7 (13.4)
Clinical Characteristics	
- Body Mass Index	
- Underweight	8 (1.5)
- Normal Weight	250 (47.2)
- Overweight	216 (40.7)
- Obesity	56 (10.6)
Pathological History	
- Diabetes	27 (5.1)
- Constipation	16 (3.0)
- Abdominal/Gastrointestinal surgery	179 (33.7)
- Coronary heart disease	5 (0.9)
- Hypertension	105 (19.8)
- Kidney disease	9 (1.7)
- Liver disease	24 (4.5)
- Transplant	1 (0.2)
Indication for Procedure – Patient's Clinical Conditions	
- Abdominal pain	258 (48.7)
Lower gastrointestinal bleeding	45 (8.5)
Diarrhea	49 (9.3)
Colitis	9 (1.7)
Transplant protocol	10 (1.9)
Screening	102 (19.3)
Positive occult blood test	11 (2.1)
Suspected mass	1 (0.19)
Polyps	25 (4.7)
Anemia	14 (2.6)
Primary tumor	3 (0.6)
Abnormal weight loss	17 (3.2)
- History of colorectal cancer	27 (5.1)

SD: standard deviation. Author's own research.

Table 2. Reasons for Selecting the Preparation

Characteristics	Bowel Preparation			*p*-Value
	PEG (n = 434)	Sodium Picosulfate (n = 84)	Sodium Sulfate (n = 12)	
Reasons for Choosing Preparation				
Price				
Yes	27 (6.2)	11 (13.1)	1 (8.3)	0.086‡
Previous Experiences				
Yes	50 (11.5)	16 (19.1)	2 (16.7)	0.158‡
Availability of the Agent				
Yes	198 (45.7)	26 (30.9)	2 (16.7)	**0.008**‡
Treating Physician's Recommendation				
Yes	152 (35.0)	36 (42.9)	7 (58.3)	0.116‡
Recommendations from Other Sources				
Yes	72 (16.6)	22 (26.2)	2 (16.7)	0.111‡

‡ Fisher's F exact test. Author's own research.

The quality of bowel cleansing was assessed using the Boston scale and the cecal intubation rate. A total of 99.4% of patients achieved adequate bowel preparation, defined as a Boston score ≥6, and 98.3% achieved cecal intubation, with the lowest rate for PEG at 98.2% and the highest for sodium sulfate at 100%. No significant differences were observed between the agents studied.

Regarding adverse effects, the most frequent were nausea, bad taste, and headache (34.0%, 31.9%, and 22.7%, respectively). Statistically significant differences were found in relation to the type of preparation and abdominal pain and bad taste ($p < 0.05$).

The study identified an overall polyp detection rate (PDR) of 18%, without adjusting for age or indication for the procedure. When adjusted for patients over 50 years old undergoing their first screening procedure, the PDR was 20%, with an adenoma detection rate (ADR) of 15% (**Table 4**).

DISCUSSION

There is no prior national literature that identifies the reasons patients choose between the different bowel preparation options available on the market. In our population, availabi-

Table 3. Subjective and Objective Tolerability According to Type and Regimen of Bowel Preparation

Characteristics	Bowel Preparation					*p*-Value
	PEG (n = 434)		Sodium Picosulfate (n = 84)		Sodium Sulfate (n = 12)	
	4-Liter Regimen (n = 398)	Split-Dose Regimen (n = 36)	Single-Dose Regimen (n = 73)	Two-Dose Regimen (n = 11)	Single-Dose Regimen (n = 12)	
Tolerability						
- Subjective Tolerability			n (%)			
Poor (extremely difficult)	37 (9.3)	1 (2.8)	2 (2.7)	0 (0)	0 (0)	**0.00**
Bad (difficult)	41 (10.3)	1 (2.8)	6 (8.2)	1 (9.1)	2 (16.7)	
Fair (partially difficult)	166 (41.7)	18 (50.0)	10 (13.7)	3 (27.3)	3 (25.0)	
Good (very easy)	154 (38.7)	16 (44.4)	55 (75.3)	7 (63.6)	7 (58.3)	
- Total Tolerability			n (%)			
Complete full regimen	364 (91.5)	33 (91.7)	67 (91.8)	9 (81.8)	12 (100.0)	0.625
Incomplete regimen	34 (8.5)	3 (8.3)	6 (8.2)	2 (18.2)	0 (0)	

Author's own research.

Table 4. Boston Scale, Cecal Intubation, and Adverse Effects

Characteristics	Bowel Preparation			*p*-Value
	PEG (n = 434)	Sodium Picosulfate (n = 84)	Sodium Sulfate (n = 12)	
Procedure Intervention				
Cecal Intubation		**n (%)**		
Yes	426 (98.2)	83 (98.8)	12 (100.0)	0.822‡
Colon Cleansing				
Total Boston Scale Score				
≤5 ≥6	2 (0.5) 432 (99.5)	1 (1.2) 83 (98.8)	0 (0) 12 (100.0)	0.452‡
Adverse Effects				
Nausea		**n (%)**		
Yes	156 (35.9)	20 (23.8)	4 (33.3)	**0.089**‡
Abdominal Distention		**n (%)**		
Yes	88 (20.3)	12 (14.5)	4 (33.3)	0.321‡
Headache				
Yes	101 (23.3)	19 (22.9)	0 (0.00)	0.165‡
Abdominal Pain		**n (%)**		
Yes	55 (12.7)	12 (14.5)	5 (41.7)	**0.015**‡
Bad Taste		**n (%)**		
Yes	154 (35.5)	9 (10.8)	6 (50.0)	**0.00**‡
Allergy to the Agent		**n (%)**		
Yes	1 (0.2)	0 (0)	0 (0)	> 0.9‡

‡ Fisher's F exact test. Author's own research.

lity and physician recommendation were the primary factors influencing that choice. Although price was considered by only 7.4% of patients, PEG, the most affordable agent on the market, was by far the most commonly used.

In terms of tolerability, national literature reports similar results to ours, with a high frequency of adverse effects, but without affecting adherence to the bowel preparation, as the majority of patients were able to complete it.

Regarding the quality of bowel cleansing, our results align with previous studies that indicate no significant differences in the effectiveness of bowel cleansing among the different agents available. Notably, only two procedures had a Boston score of 0 (zero) in one or more colonic segments, leading to the recommendation to repeat the procedure within one year.

Although not the primary objective of the study, and considering that only 20% of the procedures performed were for screening and that 33.7% of the patients had a history of prior abdominal surgery, the polyp detection rate identified falls within the range described in national literature (14%-17%)[20,21]. However, it is noteworthy that the polyp detection rate in various national studies differs from that reported internationally, highlighting the need to delve deeper into the local epidemiology to establish the

prevalence of polyps in Colombia and to determine optimal quality indicators.

CONCLUSIONS

The study results suggest that the primary factor related to the choice of bowel preparation is the availability of the agent. The findings indicate that there are no significant differences in objective tolerability or the quality of the preparation among the various substances. Therefore, it is essential for healthcare personnel to become familiar with the different available agents to provide appropriate recommendations.

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Conflict of Interest

The authors declare no conflicts of interest.

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