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Research Article

Risk Factors for Inadequate Bowel Preparation

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Abstract

Objectives: The effectiveness of colonoscopy depends on the quality of the examination. Inadequate bowel preparation is associated with a longer and more difficult procedure, missed pathologic lesions, and risk of complications. The predictive factors for poor bowel preparation are not well defined. The objective of our study was to determine the predictive factors of poor bowel preparation. **Methods:** This is a retrospective, descriptive and analytical study of patients who underwent colonoscopy over a period of 3 years. Patients with known Inflammatory Bowel Disease (IBD) were excluded from our study. Poor bowel preparation was defined by a Boston score of less than or equal to 5. Statistical analysis was performed by SPSS21.0 software. **Results:** Among 1143 colonoscopies performed, 39.2% had a poor preparation. After univariate analysis, the predictive factors for poor preparation were: male sex, age greater than 70 years, the presence of constipation, patients with colonic diverticulosis or colorectal process. After multivariate analysis, only age greater than 70 years [OR=1.8; p=0.038], constipation [OR=2.3; p=0.003] and the presence of colonic diverticulosis [OR=4.1; p<0.001] were statistically significantly associated with poor preparation. **Conclusion:** The rate of poor bowel preparation remains high, and the factors that seem to be associated with it are age over 70 years, the presence of constipation and patients with colonic diverticulosis.

Keywords: Bowel preparation; Colonoscopy; Poor preparation

Introduction

Given the high diagnostic sensitivity and specificity, colonoscopy had become a useful tool to detect, remove colorectal polyps and a precursor lesion of colorectal cancer [1,2]. The effectiveness of colonoscopy depends on the high-quality bowel preparation, which is essential to examine bowel mucosa clearly [3,4].

Inadequate bowel preparation affects the quality of a colonoscopy by decreasing the adenoma detection rates and increase the risk of complications, the procedure time, as well as healthcare costs related to repeated colonoscopies (more so in a limited resource setting) [5-7].

However, it is reported that the rate of inadequate bowel preparation ranges from 20 to 30% [8], and is often affected by many factors [9-14], such as elderly age[15], male gender, higher BMI, patients with comorbidities [16-19], inpatient status, type of bowel preparation, split-dose regimen, low-fiber diet, waiting time (the time between the last laxative administration and the beginning of colonoscopy)and patient compliance [15].

Therefore, it is crucial to improve the preparation adequacy rate. A variety of different bowel preparation laxatives have been validated as effective and safe methods such as high-volume polyethylene glycol (PEG), low-volume PEG plus adjuvants, magnesium citrate plus picosulfate, and oral sulfate solution, are available [20]. Therefore, the aim of this study was to investigate the predictive factors for inadequate preparation in patients receiving PEG preparation.

Materiel and Methods

A retrospective analysis and monocentric study was conducted at the department of Gastroenterology II of the Military Teaching Hospital of Mohamed V Rabat of Morocco. From January 2019 to August 2021, 1518 patients, aged over 16 years,

who underwent screening, surveillance or diagnostic colonoscopy, either as outpatients or inpatients were recruited. After eliminating missing data, 1143 patients were included in our study. Exclusion criteria were as follows: insufficient ingestion of bowel preparation and patients with known Inflammatory Bowel Disease (IBD). At the time of colonoscopy scheduling, each patient was provided with written and verbal instructions at regarding the bowel preparation regimen and fasting times. All patients in the study received 4 liters of PEG based preparation because of local availability. The split bowel preparation was self-administered, with the first dose of 2 liters of PEG solution with water taken the afternoon before the colonoscopy between 7.00 PM and 9.00 PM, the second dose of PEG solution between 10.00 PM to 00.00 PM. A low-fiber diet was recommended for 5 days before the colonoscopy, and on the day before the colonoscopy, patients were permitted a light dinner at 6 PM. Colonoscopy was performed in the morning between 8.30 AM to 13.30 AM. The bowel preparation scale was assessed according to the Boston Bowel Preparation Scale (BBPS), a validated tool for assessment of colon cleansing quality [21]. Each of the three segments of the colon (right, transverse and left) was given a score from 0 to 3. Each of the three segment scores was then summed for a total score of 0–9 (0, unprepared; 9, entirely clean). In our study, inadequate preparation was defined as a summed BBPS score <6. Descriptive statistical analyses were carried out using SPSS software, version 21.0. Data are expressed as means ± standard deviation or percentages. The patient factors analyzed include patient demographics, age (age over 50 and 70 years old), gender (male vs female), colonoscopy indication, history of colorectal cancer and results of colonoscopy. The risk factors for inadequate bowel preparation were determined using univariate and multivariate analysis. The multivariate analysis employed a binary logistic regression model, with a significance level of $p<0.05$.

Results

A total of 1143 patient were included in the analysis, of these 448 had inadequate preparation, a rate of 39%. The mean age of patient with inadequate bowel preparation was 57.8±16,2 years old and 58.9% were male. Among the 448 patients, 28.2% were 70 years of age and older. 38% had an history of colorectal cancer. Constipation and bleeding per rectum was the leading indication for colonoscopy in respectively 34.8% and 27.5% patients. Colonoscopy was pathological in 41.8% of cases. The results were dominated by polyps in 39.5% of cases, neoplastic lesions in 16.4%, colitis or rectocolitis in 15.8% and 28.8% had diverticulosis (Table 1).

Characteristics	N=1080
Age (years)[b] (N= 993)	57.8 ± 16.2
Sex[a]	
Female	184 (41.1)
Male	264 (58.9)
Age > 70 years old[a]	126 (28.2)
Indications for colonoscopy[a]	
Constipation	156 (34.8)
Rectorrhagia	123 (27.5)
Diarrhea	88(19.6)
Iron deficiency anemia	79 (17.6)
Melena	58 (13.1)
Colonoscopy results[a]	
Normal	260 (58.2)
Pathologic	188 (41.8)
Main results[a]	
Polyps	177(39.5)
Neoplastic lesion	73(16.4)
Colitis/rectocolitis	71(15.8)
Angiodysplasia	53(11.9)
Diverticulosis	129(28.8)
[a] expressed as number (percentage); [b] expressed as mean ± standard deviation	

Table 1: Clinical features.

In the univariate analysis, the predictive factors associated inadequate bowel cleansing were male gender (p=0.001, OR=1.524), age over 70 years (p<0.001, OR=2.777), the presence of constipation (p<0.001, OR=1.676) and having diverticulosis (p=0.001, OR=5.391). After multivariate analysis, age over 70 years old (p=0.039, OR=1.834), constipation ((p=0.003, OR=2.318) and diverticulosis (p<0.001, OR=4.145) were the variables significantly associated with inadequate bowel preparation (Table 2).

Factors	Univariate analysis			Multivariate analysis		
	OR	IC à 95%	p value	OR	IC à 95%	p value
Age >50 years	1.373	1.024-1.842	0.059			
Age >70 years	2.777	1.948-3.961	<0.001	1.834	1.032-3.261	0.039
Male gender	1.534	1.199-1.937	0.001	0.962	0.582-1.590	0.880
History of colorectal cancer	1.100	0.713-1.697	0.666			
Diarrhea	0.755	0.565-1.009	0.058			
Constipation	1.676	1.291-2.175	<0.001	2.318	1.327-4.047	0.003
Diverticulosis	5.391	3.136-9.267	<0.001	4.145	2.073-8.286	<0.001

Table 2: Factors associated with poor bowel preparation.

Discussion

The effectiveness of colonoscopy depends on the quality of the preparation. A good preparation is essential for a good visualization of the colonic mucosa; the rate of good preparation should be >90%. Whereas poor preparation is associated with a decreased detection rate of adenoma, and an increased risk of complications, procedure duration and health care costs related to repeat colonoscopies especially in low-income countries.

Adequate bowel preparation for efficient colonoscopy is not easy in clinical practice, because most preparation regimens can cause patient discomfort including nausea, vomiting, or abdominal distension/pain [22], in particular as in our country where only the preparation based on 4 liters of PEG is available which does not leave a huge choice to the patient.

In this retrospective study, we proposed a single-center study to evaluate the risk factors associated with inadequate bowel preparation. Our findings show that age over 70 years old, and diverticulosis are factors associated with inadequate bowel preparation. Increased age has been associated with inadequate bowel preparation [23,24]. Decreased tolerance of bowel preparation material [25], slow motility of the gastro-intestinal tract, and overall decreased mobility are mechanisms that can contribute toward poor bowel preparations in the elderly population [26].

In a prospective study done in 2015, the mean Boston score was significantly lower in subjects ≥65 years in the right colon, the left colon, and in the sum of the three segments [27]. This was also found in a more recent multicenter prospective cohort in Italy [28]. Reports with regard to the impact of sex on bowel preparation are inconsistent. Some researchers observed that female sex is associated with poor bowel preparation [29], whereas others have associated male sex with inadequate bowel preparation [30]. Although the mechanism remains unclear, one study showed that male patients are less compliant with bowel preparation instructions [29]. In our study the sex was not associated with inadequate preparation.

Constipation is one of the risk factors for inadequate preparation in several studies, notably in a meta-analysis of risk factors associated with inadequate preparation, including 486 articles with a total of 49,868 patients, constipation was associated with poor preparation (OR: 0.61) [15]. But the problem that really arises is whether additional preparation is needed for chronically constipated patients. Since 2013, only five studies have addressed special preparations and diets for constipated patients [9,31-33]. However, these few studies are heterogeneous, comparing different preparations, volumes, timings and treatments. There is no meta-analysis or multicenter studies. Therefore, due to lack of evidence, according to European Society of Gastrointestinal Endoscopy (ESGE) patients with constipation does not require a specific preparation or regimen [20].

However, it seems that the most important factor influencing the quality of preparation is the time lapse between the last dose and colonoscopy, which should not exceed 5 hours [20,34]. In

a retrospective study in Australia in 2019, the highest rate of good preparation was achieved by those who had a colonoscopy between 4-5 hours after the last dose of preparation [35]. The same results were found in a meta-analysis, that added that preparation decreased after 4-5 hours; and it was neither the type nor the dose of laxative, but the 5-hour delay that was critical for colonoscopy [36]. Therefore, the American College of Gastroenterology (ACG) recommends a period of 4 to 6 hours before the start of colonoscopy from the end of the last dose of preparation [37]. ESGE recommends that the second dose of the preparation should be started 5 hours before the colonoscopy and finished at least 2 hours before the examination [20].

This factor, unfortunately, could not be evaluated in our study, as all patients received the preparation doses at the same time and all of them underwent colonoscopy within a time frame that exceeded 6 hours. This could explain the high rate of poor preparation in our study, and of course the first element to be corrected in order to improve the quality of the preparation.

Conclusion

The prediction of poor preparation before colonoscopy is important, several factors seem to be associated with it such as age, comorbidities, constipation, inpatient status... Age is one of the factors with a significant impact, and the 5-hour delay between the last dose of the purge and the colonoscopy is essential for a better quality of the preparation. In our study, the rate of poor preparation remains high, and the factors that seem to be associated are age >70 years, constipation and patients with colonic diverticulosis.

Ethical Issues

Our study was reviewed by a responsible review committee and the procedures used followed the Declaration of Helsinki as revised in 2013. Our study was done retrospectively for the collection of registry data respecting the anonymity of the patients. Only the number, type of procedures performed and their indications were retained in our study, which is why the institutional review committee explicitly approved the questionable aspects of the study.

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