

Split-dose bowel preparation is superior to straight-dose in hospitalized patients undergoing inpatient colonoscopy

Samantha **MAGIER**¹, Dariush **JAHANDIDEH**²,
Jonathan **POURMORADY**¹ and Amir **MASOUD**^{1,3}

¹ Yale-New Haven Hospital, Yale School of Medicine, United States. ² Griffin Hospital, Griffin Faculty Physicians Staff, United States. ³ Connecticut Gastroenterology, Hartford Healthcare, United States.

ABSTRACT – Background – There is a two-fold higher rate of failed colonoscopy secondary to inadequate bowel preparation among hospitalized versus ambulatory patients. Split-dose bowel preparation is widely used in the outpatient setting but has not been generally adapted for use among the inpatient population. **Objective** – The aim of this study is to evaluate the effectiveness of split versus single dose polyethylene glycol bowel (PEG) preparation for inpatient colonoscopies and determine additional procedural and patient characteristics that drive inpatient colonoscopy quality. **Methods** – A retrospective cohort study was performed on 189 patients who underwent inpatient colonoscopy and received 4 liters PEG as either split- or straight-dose during a 6-month period in 2017 at an academic medical center. Bowel preparation quality was assessed using Boston Bowel Preparation Score (BBPS), Aronchick Score, and reported adequacy of preparation. **Results** – Bowel preparation was reported as adequate in 89% of the split-dose group versus 66% in the straight-dose group ($P=0.0003$). Inadequate bowel preparations were documented in 34.2% of the single-dose group and 10.7% of the split-dose group ($P<0.001$). Only 40% of patients received split-dose PEG. Mean BBPS was significantly lower in the straight-dose group (Total: 6.32 vs 7.73, $P<0.001$). **Conclusion** – Split-dose bowel preparation is superior to straight-dose preparation across reportable quality metrics for non-screening colonoscopies and was readily performed in the inpatient setting. Interventions should be targeted at shifting the culture of gastroenterologist prescribing practices towards use of split-dose bowel preparation for inpatient colonoscopy.

Keywords – Inpatient colonoscopy; bowel preparation; patient outcomes; quality improvement; colorectal disease.

Received: 12 July 2022
Accepted: 8 December 2022

Declared conflict of interest of all authors: none
Source of funding: Grant funding was provided from NIH- NIDDK: DK007017

Corresponding author: Samantha Magier. E-mail: samantha.magier@yale.edu



INTRODUCTION

Colonoscopy is indicated for a variety of gastrointestinal conditions in the inpatient setting, most notably including gastrointestinal hemorrhage, acute diarrhea, and abnormal radiographic imaging findings⁽¹⁾. Approximately 14 million colonoscopies are performed annually in the United States^(2,3). The effectiveness of colonoscopy is determined by several factors that reflect how well the mucosa is visualized and inspected from the anal verge to the ileocecal valve⁽⁴⁾. These include factors related to the endoscopist, the quality of the bowel preparation, and patient characteristics⁽⁴⁻⁹⁾.

Quality of colonoscopy is largely affected by the adequacy of bowel preparation⁽⁵⁾. For outpatient screening colonoscopies, poor quality bowel preparation can increase the risk of missing adenomas, procedure time, need for repeat colonoscopy, and cost^(5,10-13). It also contributes to incomplete passage of colonoscope into the cecum in 10–20% of colonoscopies⁽¹⁴⁻¹⁷⁾. Bowel preparation is affected by pre-procedure diet, laxative regimen, and patient factors. There are various types of laxatives but there is no evidence that one is superior; however, polyethylene glycol (PEG) is commonly used as it is safe and highly effective^(4,18). PEG can be administered as a single dose (straight-dose) or in two split doses. Studies have shown that split-dose of 2 liters of PEG the night before colonoscopy and 2 liters the morning of procedure improves preparation quality, tolerance, and ADR in patients undergoing outpatient screening colonoscopy⁽¹⁸⁻²³⁾. In addition to choice of bowel preparation regimen, multiple patient characteristics have been shown to correlate with inadequate preparation, including primary language, insurance type, certain medications, and medical comorbidities⁽²⁴⁻²⁹⁾. Further human factors such as noncompliance with instructions and timing of administration, and systems-level factors such as increased pre-procedure wait times portend worse preparation^(18,27,29-31).

Per the American Society for Gastrointestinal Endoscopy and American College of Gastroenterology Taskforce on Quality in Endoscopy, every colonoscopy report should include the quality of bowel preparation. There is no discrete standardization for this reporting; however, various scaling systems have

been developed⁽³²⁻³⁹⁾. Among these are the Aronchick scale and the Boston Bowel Preparation scale (BBPS). The Aronchick scale is one of the most utilized scoring systems and is scored on a scale from 1 to 4 based on stool present and percentage of mucosa visualized⁽⁴⁰⁾. The Boston Bowel Preparatory Scale is a validated 10-point scale, using scores from three anatomical colon segments, devised to limit operator reporting variability.

While robust evidence exists for outpatient screening colonoscopies as above, it is important to note that there exists limited data in the literature regarding these factors in the inpatient setting for non-screening colonoscopies. This is of paramount importance as there is a two-fold higher rate of failed bowel preparation and inadequate colonoscopy in hospitalized patients as compared to outpatients⁽⁴¹⁾. This has been attributed to patients being older with more comorbidities, which theoretically contributes to issues with feasibility⁽⁴²⁾. However, some studies have shown split-dose preparation can be highly realistic in this setting⁽⁴³⁾. The purpose of our study is to utilize validated bowel preparation scores to evaluate the quality of inpatient colonoscopies for hospitalized patients and subsequently identify the patient and procedural factors that impacted these outcomes. Specifically, we hypothesized that split-dose bowel preparation would also be shown to be superior for inpatient colonoscopies with improved bowel preparation scores. This study has future implications for targetable areas of intervention to improve inpatient colonoscopy quality.

METHODS

Study design and patient population

This investigation was a retrospective study. Eligibility criteria included all adult patients 18 years of age or older who were admitted to the York Street Campus of Yale New Haven Hospital and underwent colonoscopy for any indication in the six months between April 2017 and September 2017. Patients requiring rapid bowel preparation for emergent colonoscopy were excluded. All patients otherwise meeting our inclusion criteria were included in the study. All colonoscopies were performed by a board-certified gastroenterologist (endoscopist) or gastroenterology fellow in an Accreditation Council

for Graduate Medical Education (ACGME) accredited program under direct supervision of a board-certified gastroenterologist.

Bowel preparation quality assessment

After completion of the colonoscopy, the endoscopist graded the quality of bowel preparation using one or more of the three different systems including BBPS, Aronchick scale, and or adequacy of bowel preparation.

BBPS scores the adequacy of bowel preparation after cleaning the bowel using the colonoscope. This method then looks at the three anatomical segments of the colon broken down into left, transverse, and right segments. The scoring is as follows⁽³²⁾:

- 0: the mucosa is covered with solid or thick liquid stool that could not be cleared resulting in obstruction of the endoscopist's view.
- 1: some residual stool or thick liquid is obstructing areas in one segment of the colon.
- 2: small fragments of stool or thick liquid stool are present but not obstructing visualization of the mucosa.
- 3: the entire mucosa in a colon segment was seen with no obstruction of view

Each of the three segments receives a score from 0 to 3 and the scores are then summed for the total BBPS score. BBPS score has been categorized in three different categories including "poor/fair" for total score up to five, "good" for six and seven, and "excellent" for eight and nine⁽⁴⁴⁾. In line with the literature, scores were categorized for analysis by placing patients in three groups, first with BBPS >5, second BBPS >6, and third BBPS >7 they were further subcategorized for subanalysis.

The Aronchick scale is scored from 1 to 4 based on an overall evaluation of the entire colonic mucosa as follows⁽⁴⁵⁾:

- 1: Excellent. There is only a small volume of clear liquid or more than 95% of the surface is visualized.
- 2: Good. Large volumes of clear liquid covered 5 to 25% of the surface but more than 90% of the surface was seen.
- 3: Fair. There is some semisolid stool that could be washed or suctioned away but still more than 90% of the surface can be seen.

- 4: Poor. There is stool in the colon that could not be suctioned or washed away and less than 90% of the surface could be seen.

Data collection

Research approval was obtained from Yale University's Institutional Review Board prior to commencement of data collection. The electronic medical record of each patient was reviewed by a physician (one of the investigators on the study) and the following information was obtained and recorded for each patient: age, sex, body mass index (BMI), length of stay, chronic constipation, race, presence of diabetes mellitus, stroke, dementia, Parkinsons disease, obesity, cirrhosis, colorectal surgery, tricyclic antidepressant use, history of poor bowel preparation, ASA score (as noted in anesthesia note), method of taking preparation (split versus single dose), volume of total preparation used, indication for colonoscopy, hours from start of last prep administration to start of colonoscopy (hours), duration of procedure in minutes, cecal intubation, BBPS in left/transverse/right/total colon, adequacy of prep, Aronchick prep score, interventions performed (1-biopsy, 2-clip, 3-polypectomy, 4-foreign body retrieval, 5-APC, 6-bicap, 7-stent placement, 8-epi injection, 9-gold probe, 10-stent placement, 11-tattoo), intervention success, final colon diagnosis, repeat colonoscopy recommended, reason for repeat colonoscopy rec (1=inadequate prep, 2=on anticoagulation, 3=recent GI bleed, 4=polyp surveillance, 5=other). The electronic medical record was reviewed to identify the type of bowel preparation ordered. Nursing entries in the electronic record were likewise reviewed to determine whether split or straight dose bowel preparation was administered and at what time.

Statistical analysis

Descriptive statistics are reported as proportions for categorical variables and as mean \pm standard deviation and range for continuous variables. The data set was analyzed using JMP statistical software (SAS institute). Appropriate statistical analysis methods were used including *t* test, ANOVA, logistic regression, and chi-square test. A *P* value <0.05 was considered statistically significant.

Statement of ethics

This study protocol was reviewed and approved by the Yale School of Medicine Institutional Review Board on 11/12/2019, approval number MOD00026209.

RESULTS

Demographics

A total of 189 hospitalized patients were evaluated in this study. The average age was 65.8 ± 14.4 (range: 20–96) years, 48% were female, and 68% self-reported as Caucasian. The average BMI was 28.1 ± 6.9 (range: 13.3–54.5) kg/m^2 ; 38% had a BMI greater than or equal to 30 and were considered to be obese. Hospital length of stay was 7.8 ± 7.7 (range: 1–47) days. Regarding medical comorbidities, 47% had a diagnosis of diabetes mellitus, 40% self-reported chronic constipation, 17% had prior CVA, 10% had dementia, 12% had cirrhosis, and 14% had previous colorectal surgery. None of these patients carried a diagnosis of Parkinson's disease. Only one patient had a history of previous poor bowel preparation (TABLE 1).

TABLE 1. General demographics.

Factors	Values
Age (mean \pm SD) (range) years	65.8 ± 14.4 (20–96)
Sex (female %)	48%
Race (white%, black %)	68% (126) – 24% (45)
BMI (mean \pm SD) (range) kg/m^2	28.1 ± 6.9 (13.3–54.5)
Obesity %	38% (72)
LoS (mean \pm SD) (range) days	7.8 ± 7.7 (1–47)
Diabetes mellitus %	47% (89)
Chronic constipation %	40% (75)
Stroke	17% (33)
Dementia	10% (18)
Cirrhosis	12% (22)
Colorectal surgery	14% (27)

BMI: body mass index.

Procedure characteristics

Among the colonoscopies performed, 26% occurred in the morning versus 74% in the afternoon. The overall average procedure duration time was 33 minutes ± 16 (10–97) minutes. Cecal intubation was achieved in 95% of patients while only 75% were reported to have adequate bowel preparation, with

60% receiving straight dose PEG versus 40% receiving split-dose. Mean hours from the last dose of PEG regardless of split vs straight dose was 10.6 hours. Mean BBPS score was 6.9 ± 1.9 (3–9) points. Aronchick Score was 2.6 ± 1.1 (1–4) points. Adequacy of bowel preparation was reported in all patients, while BBPS was assessed in 135 patients and Aronchick scale in 54 patients. Aronchick score was in complete concordance with total BBPS ($P < 0.0001$). In the initial analysis, patients with adequate bowel preparation had significantly higher rates of cecal intubation ($P < 0.0028$) (TABLE 2).

TABLE 2. Procedure characteristics.

Factors	Values
AM/PM colonoscopy	48 (26%) – 140 (74%)
Straight/split	114 (60%) – 75 (40%)
Hours from last dose of PEG (mean \pm SD) (range)	10.6 ± 4.2 (4–22)
Procedure duration (mean \pm SD) (range)	33 ± 16 (10–97)
Cecal intubation	95% (176)
BBPS (mean \pm SD) (range)	6.9 ± 1.9 (3–9)
Adequate preparation	75% (142)

The most common indication reported for colonoscopy was GI bleeding (48%), anemia (23%), diarrhea (14%), suspicion for malignancy (7%) and abdominal pain (6%). The most common findings on colonoscopy were polyps (42%), diverticulosis (35%), hemorrhoids (31%), colitis (8%), appearance consistent with malignancy (8%), vascular lesions (8%). Colonoscopy was reported normal in 15% of cases (29 cases). No diagnosis was reported in 3% of cases (7 cases) due to poor bowel preparation. Intervention was performed in 100 patients with biopsy being the most common, followed by polypectomy. Repeat colonoscopy was recommended in 41 patients (22%) with polyp surveillance being the most common reason (26 patients), followed by inadequate bowel preparation (15 patients).

Factors affecting BBPS

A subgroup analysis was performed to evaluate the 135 patients who were evaluated for bowel preparation with BBPS. Age was inversely related to BBPS in total and individual colon segments but was not statistically significant (total score: $P = 0.0919$,

left colon score: $P=0.0876$, transverse colon score: $P=0.1681$, right colon score: $P=0.3157$). Duration in hours between last administration of bowel preparation and procedure start time was inversely related to BBPS score ($P<0.0046$), though did not affect procedure duration ($P=0.1122$). Successful cecal intubation was positively associated with higher left colon score ($P=0.0446$), transverse colon score ($P=0.0467$), total BBPS ($P=0.0392$), but it was not associated with right colon score ($P=0.1122$).

There was no relationship between BBPS and BMI, length of stay, need for repeat procedure, or self-reported chronic constipation. Further, history of chronic constipation did not clinically or statistically affect duration of procedure with a total difference between

the two groups less than one minute ($P=0.7321$). However, opiate use significantly reduced the adequacy of bowel preparation ($P=0.0001$) and inversely affected cecal intubation, but did not reach statistical significance ($P=0.5967$). This resulted in decreased total and all subsegment BBPS ($P<0.0001$).

Patients were further subdivided into BBPS <6 and ≥ 6 , as well as BBPS >7 and BBPS >8 . Patients who had taken split dose bowel preparation had statistically significantly higher BBPS in all three groups, and the duration of time from last dose of bowel preparation was inversely related to total BBPS. However, there was no statistical difference between the duration of the procedure or cecal intubation among the subgroups (TABLE 3).

TABLE 3. Categorized BBPS score.

Factor	General	BBPS ≥ 6	BBPS <6	P-value	BBPS ≥ 7	BBPS <7	P-value	BBPS ≥ 8	BBPS <8	P-value
Age	65.8 \pm 14.4	65.3 \pm 14.9	66.9 \pm 8.9	0.463	64.4 \pm 16.2	67.3 \pm 9.9	0.192	63.5 \pm 16.5	67.6 \pm 10.8	0.087
Sex (F)	48%	50%	39%	0.395	50%	46%	0.727	51%	46%	0.607
Race (W)	68%	74%	61%	0.0379	69%	74%	0.669	66%	76%	0.830
BMI	28.1 \pm 6.9	28.9 \pm 7	29.3 \pm 7.2	0.789	29.5 \pm 7.2	28.5 \pm 6.8	0.421	28.8 \pm 8.5	29.3 \pm 7.1	0.694
Obesity	38%	43%	43%	0.989	44%	42%	1.000	42%	44%	0.862
Length of Stay (LoS)	7.8 \pm 7.7	7.6 \pm 7.5	9.4 \pm 11.2	0.419	7.7 \pm 7.9	8.5 \pm 9.1	0.612	8.2 \pm 8.5	7.8 \pm 8.4	0.759
DM	47%	44%	57%	0.287	41%	54%	0.162	42%	51%	0.301
Opioids	12%	6%	43%	<0.0001	5%	25%	0.0016	6%	20%	0.0224
CC	40%	35%	50%	0.188	42%	32%	0.214	46%	30%	0.982
Stroke	17%	18%	21%	0.784	19%	18%	0.827	20%	17%	0.824
Dementia	10%	10%	3%	0.458	13%	4%	0.071	14%	4%	0.069
Cirrhosis	12%	10%	21%	0.121	8%	19%	0.064	9%	16%	0.305
Colorectal Surgery	14%	12%	21%	0.227	9%	21%	0.077	11%	17%	0.329
AM %	26%	26%	21%	0.807	29%	21%	0.422	32%	19%	0.078
Straight %	60%	50%	82%	0.002	45%	72%	0.0027	43%	68%	0.0033
Hours since last dose	10.6 \pm 4.2	10 \pm 3.9	11.7 \pm 4.5	0.088	9.7 \pm 3.9	11.1 \pm 4.2	0.033	9.2 \pm 3.7	11.4 \pm 4.2	0.0029
Duration	33 \pm 16	35 \pm 14	34 \pm 23	0.832	36 \pm 15	33 \pm 19	0.323	36 \pm 14	34 \pm 18	0.515
Cecal intubation	95%	100%	96%	0.203	100%	98%	0.421	100%	99%	1.000

BBPS: Boston Bowel Preparation Score; DM: diabetes mellitus; CC: chronic constipation; BMI: body mass index; AM: morning.

135 were scored using BBPS. 28 people had BBPS <6 while 107 were above, 57 with BBP <7 and 78 above, and 65 with BBPS <8 and 70 above.

Bolded P-values indicate those that were statistically significant ($P<0.05$).

Split dose versus straight dose PEG

The final subgroup analysis compared the 114 patients who took straight dose PEG versus the 75 patients who took split-dose PEG. Patient demographics varied in these two groups, with patients administered split-dose PEG significantly younger (62.3±16.4 versus 68.1±12.4 years, $P=0.0057$), more likely male (61% versus 46% $P=0.0382$), and less likely to have dementia (4% versus 13%, $P=0.0429$).

The duration between the last dose of PEG and procedure start time was significantly longer in straight dose versus split dose (12.1±4.3 hours versus 8.5±2.9 hours, $P<0.0001$). However, procedure duration was longer by an average of 7 minutes in the split dose group ($P=0.0197$). Bowel preparation was reported as adequate in 89% of the split dose group versus 66% in the straight dose ($P=0.0003$). Inadequate bowel preparations were documented in 34.2% of the straight-dose group and 10.7% in the split-dose group ($P<0.001$). BBPS was higher in split dose compared to straight dose (7.7±1.5 versus 6.3±0.7, $P<0.0001$). Aronchick score was likewise higher in the split dose group (2.7±1.2 versus 2.4±0.7, $P<0.0001$) (TABLE 4).

DISCUSSION

In this study we investigated the effects of various factors on the quality and outcomes of inpatient colonoscopies with a specific focus on the role of split versus straight dose preparation and subsequent bowel preparation scores. We also sought to address the paucity of data regarding optimal preparation for inpatient colonoscopies compared to outpatient screening colonoscopies given there is a two-fold higher rate of failed bowel preparation in hospitalized patients reported in the literature⁽⁴¹⁾.

There were several patient factors associated with poorer bowel preparation in the inpatient setting that were similar to the data on bowel preparation in outpatient colonoscopies. Use of opiates was associated with significantly reduced bowel preparation. This is likely secondary to reduced motility from binding of opioid receptors in the gastrointestinal tract, as has been extensively documented in the literature⁽⁴⁶⁾. African-American patients were found to have lower BBPS scores; however, this is confoun-

TABLE 4. Demographics and BBPS in split versus straight dose preparation groups.

	Straight	Split	P-value
Age (mean ±SD) (range) years	68.1±12.4	62.3±16.4	0.0057
Sex (female %)	54%	39%	0.0382
Race (white%)	72%	63%	0.450
BMI (mean ±SD) (range) kg/m ²	28±6.4	28.4±7.6	0.689
Obesity %	39%	36%	0.649
LoS (mean ±SD) (range) days	7.2±7	8.7±8.6	0.213
Diabetes mellitus %	48%	45%	0.766
Chronic constipation %	40%	39%	0.879
Stroke	18%	17%	1.000
Dementia	13%	4%	0.0429
Cirrhosis	12%	11%	0.819
Colorectal surgery	15%	13%	0.834
Opioids	11%	13%	0.644
AM colonoscopy	26%	24%	0.864
Hours from last dose of PEG (mean ±SD) (range)	12.1±4.3	8.4±2.9	<0.0001
Procedure duration (mean ±SD) (range)	30±16	37±16	0.0197
Cecal intubation	96%	95%	0.740
Total BBPS (mean ±SD) (range)	6.3±2	7.7±1.5	<0.0001
BBPS >7	37%	63%	0.0033
BBPS >6	46%	73%	0.0027
BBPS >5	70%	92%	0.0024
Aronchick score	2.7±1.2	2.4±0.7	<0.0001
Adequate prep	66%	89%	0.0003

BBPS: Boston Bowel Preparation Score; PEG: polyethylene glycol; BMI: body mass index; AM: morning.

Bolded P-values indicate those that were statistically significant ($P<0.05$).

ded by the sample population having increased rates of inpatient opiate use. Chronic constipation was self-reported by 40% of our patients without use of Bristol stool chart, which is higher than the 16% prevalence in the general population; however, this did not affect BBPS or duration of procedure in contrast to this association with outpatient colonoscopies⁽⁴⁷⁾. The prevalence of diabetes mellitus, cirrhosis, and previous colorectal surgery were higher among patients with lower quality bowel preparation, but this did not reach statistical significance. Lastly, patients with dementia unexpectedly had higher quality pre-

paration scores, though not statistically significant. This could potentially be explained by closer observation by clinical staff to ensure ingestion of PEG, but this has not been validated.

The procedure characteristic associated with improved bowel preparation was shorter duration between last administration of PEG. This study in particular had a longer duration between the last dose of PEG and procedure initiation (10.6 hours) compared to other similar studies, which is likely attributable to 74% of procedures being performed in the afternoon^(18,30,31). Patients receiving split-dose PEG were shown to have significantly shorter durations between administration of the last dose of PEG.

Split-dose PEG was also independently associated with higher bowel preparation adequacy, BBPS, and Aronchick scores in all subgroups. Rates of cecal intubation were consequently higher in patients with higher preparation scores, and thus increased in patients who received split-dose. Of note, patients who received split-dose PEG were statistically younger by 7 years. It is unclear whether this is clinically significant, but it could reflect a selection bias due to perceived tolerability predicted by the ordering providers. Conversely, inadequate bowel preparations were documented in the straight-dose group at a three-fold higher rate than the split-dose group. Based on this study population, split-dose preparation was not adopted as gastroenterologists' choice of preparation, as it was only ordered for 40% of patients. These data were limited by inconsistencies in nursing documentation and medication reconciliation orders and thus a concrete determination of feasibility cannot be assessed. However, the fact that split-dose was administered to 40% of patients as confirmed by nursing notes and order reconciliation and yielded profoundly improved bowel preparation

in hospitalized patients shows that it is preferable and anecdotally suggests it may be more feasible than previously considered. Overall, this data demonstrates that split-dose bowel preparation with PEG is superior to straight dose preparation for inpatient colonoscopies.

While there were some minor differences in the demographics of the patients evaluated in this study which could affect generalizability, the data overwhelmingly shows that split-dose PEG is efficacious, leading to enhanced bowel preparation and subsequent quality indices of successful colonoscopies. Given these findings, it is germane that interventions should be developed to increase the use of split-dose bowel preparation for inpatient colonoscopies and shift the culture of ordering practices among gastroenterologists regarding bowel preparation in hospitalized patients.

ACKNOWLEDGEMENTS

We thank Grant Funding from NIH- NIDDK: DK007017 for financial support.

Authors' contribution

Magier S data analysis, primary manuscript author. Jahandideh D data analysis, secondary manuscript author. Pourmorady J grant recipient, project conception and design, data collection, data analysis. Masoud A manuscript author, project oversight, data analysis, project mentor.

Orcid

Samantha Magier: 0000-0003-1968-4863.

Dariush Jahandideh: 0000-0002-2402-0407.

Jonathan Pourmorady: 0000-0002-0347-3343.

Amir Masoud: 0000-0002-5890-7938.

Magier S, Jahandideh D, Pourmorady J, Masoud A. O preparo intestinal em dose dividida é superior à dose direta em pacientes hospitalizados submetidos à colonoscopia hospitalar. *Arq Gastroenterol.* 2023;60(1):39-47.

RESUMO – Contexto – Há uma taxa duas vezes maior de colonoscopia com falha secundária ao preparo intestinal inadequado entre pacientes hospitalizados versus ambulatoriais. O preparo intestinal em dose dividida é amplamente utilizado em ambulatório, mas geralmente não foi adaptado para uso entre a população hospitalar. **Objetivo** – O objetivo deste estudo é avaliar a eficácia da preparação do intestino de polietilenoglicol (PEG) em dose única versus doses separadas para colonoscopias hospitalares e determinar características adicionais do procedimento e do paciente que promovam a qualidade da colonoscopia do paciente internado. **Métodos** – Um estudo de coorte retrospectivo foi realizado em 189 pacientes que foram submetidos a colonoscopia hospitalar e receberam 4 litros de PEG como dose dividida ou direta durante um período de 6 meses em 2017 em um centro médico acadêmico. A qualidade do preparo intestinal foi avaliada usando-se o *Boston Bowel Preparation Score* (BBPS), o Aronchick Score, e relatório sobre a adequação do preparo. **Resultados** – O preparo intestinal foi relatado como adequado em 89% do grupo de dose dividida versus 66% no grupo de dose direta ($P=0,0003$). Preparações intestinais inadequadas foram documentadas em 34,2% do grupo de dose única e 10,7% do grupo de dose dividida ($P<0,001$). Apenas 40% dos pacientes receberam PEG em dose fracionada. O BBPS médio foi significativamente menor no grupo de dose direta (total: 6,32 vs 7,73, $P<0,001$). **Conclusão** – O preparo intestinal em dose dividida é superior ao preparo de dose única em todas as métricas de qualidade relacionadas para colonoscopias sem triagem e foi adequadamente realizado no ambiente de internação. As intervenções devem ser direcionadas para mudar a cultura das práticas de prescrição de gastroenterologistas para o uso de preparação intestinal em dose dividida para colonoscopia hospitalar.

Palavras-chave – Colonoscopia hospitalar; preparo intestinal; resultados do paciente; melhoria da qualidade; doença colorretal.

REFERENCES

1. Non-bleeding Indications for Inpatient Colonoscopy: 2041: Official journal of the American College of Gastroenterology | ACG. LWW. Available from: https://journals.lww.com/ajg/Fulltext/2013/10001/Non_bleeding_Indications_for_Inpatient.2041.aspx.
2. Rees CJ, Bevan R, Zimmermann-Fraedrich K, Rutter MD, Rex D, Dekker E, et al. Expert opinions and scientific evidence for colonoscopy key performance indicators. *Gut.* 2016;65:2045-60. doi:10.1136/gutjnl-2016-312043
3. Seeff LC, Manninen DL, Dong FB, Chattopadhyay SK, Nadel MR, Tangka FK, et al. Is there endoscopic capacity to provide colorectal cancer screening to the unscreened population in the United States? *Gastroenterology.* 2004;127:1661-9. doi:10.1053/j.gastro.2004.09.052
4. Belsey J, Epstein O, Heresbach D. Systematic review: oral bowel preparation for colonoscopy. *Aliment Pharmacol Ther.* 2007;25:373-84.
5. Froehlich F, Wietlisbach V, Gonvers JJ, Burnand B, Vader JP. Impact of colonic cleansing on quality and diagnostic yield of colonoscopy: the European Panel of Appropriateness of Gastrointestinal Endoscopy European multicenter study. *Gastrointest Endosc.* 2005;61:378-84.
6. Ko CW, Riffle S, Shapiro JA, Saunders MD, Lee SD, Tung BY, et al. Incidence of minor complications and time lost from normal activities after screening or surveillance colonoscopy. *Gastrointest Endosc.* 2007;65:648-56.
7. Rex DK. Maximizing detection of adenomas and cancers during colonoscopy. *Am J Gastroenterol.* 2006;101:2866-77.
8. Singh H, Nugent Z, Demers AA, Bernstein CN. Rate and predictors of early/missed colorectal cancers after colonoscopy in Manitoba: a population-based study. *Am J Gastroenterol.* 2010;105:2588-2596.
9. Wexner SD, Beck DE, Baron TH, Fanelli RD, Hyman N, Shen B, et al. A consensus document on bowel preparation before colonoscopy: prepared by a task force from the American Society of Colon and Rectal Surgeons (ASCRS), the American Society for Gastrointestinal Endoscopy (ASGE), and the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES). *Gastrointest Endosc.* 2006;20:1147-60.
10. Aranda-Hernández J, Hwang J, Kandel G. Seeing better-Evidence based recommendations on optimizing colonoscopy adenoma detection rate. *World J Gastroenterol.* 2016;22:1767.
11. Lebwahl B, Kastrinos F, Glick M, Rosenbaum AJ, Wang T, Neugut AI. The impact of suboptimal bowel preparation on adenoma miss rates and the factors associated with early repeat colonoscopy. *Gastrointest Endosc.* 2011;73:1207-14.
12. Martin D, Walayat S, Ahmed Z, Dhillon S, Asche CV, Puli S, Ren J. Impact of bowel preparation type on the quality of colonoscopy: a multicenter community-based study. *J Community Hosp Intern Med Perspect.* 2016;6:31074.
13. Rex DK, Imperiale TF, Latinovich DR, Bratcher LL. Impact of bowel preparation on efficiency and cost of colonoscopy. *Am J Gastroenterol.* 2002;97:1696-1700.
14. Harewood GC, Sharma VK, de Garmo P. Impact of colonoscopy preparation quality on detection of suspected colonic neoplasia. *Gastrointest Endosc.* 2003;58:76-9.
15. Rex DK, Bond JH, Winawer S, Levin TR, Burt RW, Johnson DA, et al. Quality in the technical performance of colonoscopy and the continuous quality improvement process for colonoscopy: recommendations of the US Multi-Society Task Force on Colorectal Cancer. *Am J Gastroenterol.* 2002;97:1296-308.
16. Rembacken B, Hassan C, Riemann JF, Chilton A, Rutter M, Dumonceau JM, et al. Quality in screening colonoscopy: position statement of the European Society of Gastrointestinal Endoscopy (ESGE). *Endoscopy.* 2012;44:957-68.
17. Sherer EA, Imler TD, Imperiale TF. Imperiale, The effect of colonoscopy preparation quality on adenoma detection rates. *Gastrointest Endosc.* 2012;75:545-53.
18. Hassan C, East J, Radaelli F, Spada C, Benamouzig R, Bisschops R, et al. Bowel preparation for colonoscopy: European Society of Gastrointestinal Endoscopy (ESGE) guideline-update 2019. *Endoscopy.* 2019;51:775-94.
19. Gurudu SR, Ramirez FC, Harrison ME, Leighton JA, Crowell MD. Increased adenoma detection rate with system-wide implementation of a split-dose preparation for colonoscopy. *Gastrointest Endosc.* 2012;76:603-8.e1.
20. Horton N, Garber A, Hasson H, Lopez R, Burke CA. Impact of single-vs. split-dose low-volume bowel preparations on bowel movement kinetics, patient inconvenience, and polyp detection: a prospective trial. *Am J Gastroenterol.* 2016;111:1330-7.
21. Martel M, Barkun AN, Menard C, Restellini S, Kherad O, Vanasse A. Split-dose preparations are superior to day-before bowel cleansing regimens: a meta-analysis. *Gastroenterology.* 2015;149:79-88.
22. Radaelli F, Paggi S, Hassan C, Senore C, Fasoli R, Anderloni A, et al. Split-dose preparation for colonoscopy increases adenoma detection rate: a randomised controlled trial in an organised screening programme. *Gut.* 2017;66:270-7.

23. Lebwohl B, Kastrinos F, Glick M, Rosenbaum AJ, Wang T, Neugut AI. The impact of suboptimal bowel preparation on adenoma miss rates and the factors associated with early repeat colonoscopy. *Gastrointest Endosc.* 2011;73:1207-14.
24. Wexner SD, Beck DE, Baron TH, Fanelli RD, Hyman N, Shen B, et al., A consensus document on bowel preparation before colonoscopy: prepared by a task force from the American Society of Colon and Rectal Surgeons (ASCRS), the American Society for Gastrointestinal Endoscopy (ASGE), and the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES). *Surg Endosc.* 2006;20:1147-60.
25. Chung YW, Han DS, Park KH, Kim KO, Park CH, Hahn T, et al. Patient factors predictive of inadequate bowel preparation using polyethylene glycol: a prospective study in Korea. *J Clin Gastroenterol.* 2009;43:448-52.
26. Dik VK, Moons LM, Hüyük M, van der Schaar P, de Vos Tot Nederveen Cappel WH, Ter Borg PC, et al. Predicting inadequate bowel preparation for colonoscopy in participants receiving split-dose bowel preparation: development and validation of a prediction score. *Gastrointest Endosc.* 2015;81:665-72.
27. Hassan C, Fuccio L, Bruno M, Pagano N, Spada C, Carrara S, et al. A predictive model identifies patients most likely to have inadequate bowel preparation for colonoscopy. *Clin Gastroenterol Hepatol.* 2012;10:50:1-6.
28. Ness RM, Manam R, Hoen H, Chalasani N. Predictors of inadequate bowel preparation for colonoscopy. *Am J Gastroenterol.* 2001;96:1797-802.
29. Nguyen DL, Wieland M, Wieland M. Risk factors predictive of poor quality preparation during average risk colonoscopy screening: the importance of health literacy. *J Gastrointest Liver Dis.* 2010;19:369-72.
30. Bucci C, Rotondano G, Hassan C, Rea M, Bianco MA, Cipolletta L, et al. Optimal bowel cleansing for colonoscopy: split the dose! A series of meta-analyses of controlled studies. *Gastrointestinal endoscopy.* *Gastrointest Endosc.* 2014;80:566-576.e2.
31. Kilgore TW, Abdinoor AA, Szary NM, Schowengerdt SW, Yust JB, Choudhary A, et al. Bowel preparation with split-dose polyethylene glycol before colonoscopy: a meta-analysis of randomized controlled trials. *Gastrointest Endosc.* 2011;73:1240-5.
32. Lai EJ, Calderwood AH, Doros G, Fix OK, Jacobson BC. The Boston bowel preparation scale: a valid and reliable instrument for colonoscopy-oriented research. *Gastrointest Endosc.* 2009;69:620-5.
33. Aronchick CA, Lipshutz WH. Validation of an instrument to assess colon cleansing [abstract]. *Am J Gastroenterol* 1999;94:2667.
34. Gerard DP, Foster DB, Raiser MW, Holden JL, Karrison TG. Validation of a new bowel preparation scale for measuring colon cleansing for colonoscopy: the Chicago bowel preparation scale. *Clin Transl Gastroenterol.* 2013;4:e43.
35. Halphen M, Heresbach D, Gruss HJ, Belsey J. Validation of the Harefield Cleansing Scale: a tool for the evaluation of bowel cleansing quality in both research and clinical practice. *Gastrointest Endosc.* 2013;78:121-31.
36. Salimi Q, Nasereddin T, Patel N, Hashemipour R, Tawadros A, Brelvi Z, et al. The New Jersey Bowel Preparation Scale: A More Objective and Detailed Scoring System for Screening Colonoscopies. *Gastroenterol Res Pract.* 2019;2019:8319747.
37. Rostom A, Jolicoeur E. Validation of a new scale for the assessment of bowel preparation quality. *Gastrointest Endosc.* 2004;59:482-6.
38. Calderwood AH, Jacobson BC. Comprehensive validation of the Boston bowel preparation scale. *Gastrointest Endosc.* 2010;72:686-92.
39. Clark BT, Laine L. High-quality bowel preparation is required for detection of sessile serrated polyps. *Clin Gastroenterol Hepatol.* 2016;14:1155-62.
40. Clark BT, Rustagi T, Laine L. What level of bowel prep quality requires early repeat colonoscopy: systematic review and meta-analysis of the impact of preparation quality on adenoma detection rate. *Am J Gastroenterol.* 2014;109:1714-23;1724.
41. Almadi MA, Alharbi O, Azzam N, Altayeb M, Thaniah S, Aljebreen A. Bowel preparation quality between hospitalized patients and outpatient colonoscopies. *Saudi J Gastroenterol.* 2018;24:93-9.
42. Yang D, Summerlee R, Rajca B, Williamson JB, LeLaurin J, McClellan L, et al. A pilot study to evaluate the feasibility of implementing a split-dose bowel preparation for inpatient colonoscopy: a single-center experience. *BMJ open gastroenterology.* 2015;1:e000006. doi:10.1136/bmjgast-2014-000006
43. Dezfoli S, Berry S, Spiegel B, Almario C. Taking an Old Standard to New Places: Split-Dose Preps. *AJG.* 2018;113:S626-S627. Available from: https://journals.lww.com/ajg/fulltext/2018/10001/taking_an_old_standard_to_new_places_split_dose.1086.aspx
44. Adike A, Buras MR, Gurudu SR, Leighton JA, Faigel DO, Ruff KC, et al. Is the level of cleanliness using segmental Boston bowel preparation scale associated with a higher adenoma detection rate? *Ann Gastroenterol.* 2018;31:217-23.
45. Aronchick CA. Bowel preparation scale. *Gastrointest Endosc.* 2004;60:1037-8. doi: 10.1016/s0016-5107(04)02213-8.
46. Kushnir VM, Bhat P, Chokshi RV, Lee A, Borg BB, Gyawali CP, et al. The Impact of opiate pain medications psychoactive drugs on the quality of colon preparation in outpatient colonoscopy. *Dig Liver Dis.* 2014;46:56-61.
47. Wald A, Scarpignato C, Kamm MA, Mueller-Lissner S, Helfrich I, Schuijt C, et al. The burden of constipation on quality of life: results of a multinational survey. *Aliment Pharmacol Ther.* 2007;26:227-36.