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Research paper

Impact of patient education on quality of bowel preparation in outpatient colonoscopies

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ABSTRACT

Background High-quality bowel preparation is essential for successful outpatient colonoscopy. Currently, the rate of adequate bowel preparation for outpatient colonoscopy in the USA is low. Patients often fail to adhere to recommended preparation instructions. Limited literature exists on evaluating educational intervention as a means of improving the quality of bowel preparation prior to outpatient colonoscopy.

Objective Our objective was to determine the effect of an educational intervention on the quality of outpatient colonoscopy preparation. The secondary objective was to determine whether the quality of bowel preparation improves overall colonoscopy outcomes as measured by rate of polyp detection and caecal intubation time.

Methods A single-blinded, prospective, randomised, controlled trial was conducted in two inner-city

gastroenterology clinics in the USA. One hundred and sixty-four subjects were enrolled and randomly assigned to one of two groups. The control group subjects received verbal and written instructions for colonoscopy. The intervention group subjects received the same instructions and were then asked to answer a questionnaire. The subjects' responses were reviewed and an additional explanation of the preparation process provided. An attending gastroenterologist determined the quality of each bowel preparation at the time of colonoscopy using the Universal Preparation Assessment Scale.[1]

Results The educational intervention had no impact on the overall quality of bowel preparation (P =0.12). However, the type of food (liquid vs solid) consumed during the 24 hours prior to the procedure ($P = 0.04$) and the time since the last solid meal (P= 0.03) did have an impact on preparation quality. Other significant factors included elapsed time to first bowel movement from the initiation of bowel preparation ($P = 0.05$) and age younger than 55 (P = 0.02). Adequate bowel preparation was associated with shorter total procedure ($P = 0.001$) and caecal intubation ($P = 0.01$) times.

Conclusion Our study failed to demonstrate any effect of an educational intervention on the quality of colonoscopy preparation. However, adherence to simple dietary instructions did have a significant impact on the quality of bowel preparation. Adequate bowel preparation was associated with shorter procedure time and caecal intubation time.

Keywords: colon preparation, education, intervention, quality

How this fits in with quality in primary care

What do we know?
High-quality bowel preparation is essential for successful outpatient colonoscopy but adequate bowel preparation for outpatient colonoscopy in the USA is poor with patients often failing to adhere to recommendations.

What does this paper add?
Although the study failed to demonstrate an effect of the educational intervention on the quality of colonoscopy preparation, adherence to dietary instructions did have a significant impact on the quality of bowel preparation and adequate bowel preparation was associated with shorter procedure time.

Introduction

Colonoscopy is the screening method of choice to detect and remove adenomas that may have malignant potential.[2–5] Bowel preparation remains a major deterrent to patient compliance with colorectal cancer (CRC) screening guidelines but is essential to the success of colonoscopy and proper CRC screening. Failure to complete the bowel preparation can lead to suboptimal cleansing, inadequate visualisation, increased procedural risks and unwillingness to comply with subsequent recommended colonoscopies. High-quality bowel preparation significantly reduces the cost of colonoscopy and increases the rate of polyp detection.[6,7]

The most widely used bowel preparations result in suboptimal bowel preparation between 9% and 67% of the time.[8–10] Previous studies have suggested that patient compliance is important to ensure proper bowel cleansing.[8,11] Moreover, a favourable bowel preparation experience may promote greater compliance with repeat screening recommendations.

Investigators have examined a wide variety of interventions to increase utilisation of CRC screening rates.[12] Mailed brochures have been shown to increase patients' adherence to primary care physician referral for screening colonoscopy.[13] However, there is little data examining the effect of improved patient education on the quality of colon cleansing.

The purpose of this study was to determine the effect of enhanced patient education on the quality of bowel preparation and to monitor the impact of bowel preparation quality in relation to polyp detection and caecal intubation time. The study employed a written questionnaire with the intervention group to reinforce the written and verbal instructions and determine subjects' comprehension of the instructions. Our intervention consisted of a review of each subject's responses and an additional explanation of the preparation process. In addition an assessment was utilised following bowel preparation to assess all patients' adherence to bowel preparation instructions.

Methods

Study design

A single-blinded, randomised, controlled trial was conducted to evaluate the hypothesis that enhanced patient education will improve adherence to bowel preparation instructions prior to colonoscopy and positively affect the quality of the preparation. Our local institutional review board approved the protocol and informed consent procedure. The concept of informed consent was explained to the enrolled subjects and consent was gained prior to enrolment.

Determination of the sample size

In our experience, more than 80% of our private patients, but fewer than half (45%) of our clinic patients have adequate bowel preparation. We hypothesised that our educational intervention would increase the rate of bowel preparation in clinic patients by 65%. Therefore, we calculated that 152 subjects were needed to achieve a power of 90%. We chose to enrol 182 subjects to allow for a 20% no-show on the day of the scheduled procedure.

Setting and participants

The study was conducted at two medium-sized, inner-city hospital clinics, in north-eastern USA. Data were gathered on 164 consecutive subjects presenting for outpatient colonoscopies between June 2007 and January 2008.

The inclusion criteria were; age older than 40 years and ability to consent to participate. Although the recommended age for CRC screening for patients at average risk is 50 years, many patients who had increased risk for reasons such as strong family history, obesity and African–American race were screened and included. As a result, we used 40 years as a lower cut-off for the CRC screening in order to include the high risk patients. Exclusion criteria included previous colonic surgery, mental impairment, illiteracy, physical disability (defined as individuals who were confined to bed or wheelchair users), failure to provide requested data and other medical conditions that precluded meaningful participation in the study.

Enrolment and randomisation

Eligible individuals were enrolled in a consecutive manner from the gastroenterology clinics and randomised into 'control' and 'educational intervention' groups. The randomisation was done using odd and even numbers starting with number one (alternate allocation). Verbal and written instructions were provided to all subjects. All subjects received identical bowel preparation instructions (Figure 1). The preparation consisted of one gallon of polyethylene glycol with electrolytes after three bisacodyl tablets. All subjects were advised not to eat past midnight on the night prior to colonoscopy.

Data collection

The following data were collected: age, sex, race, height, weight, anxiety level, antidepressant use, educational level (less than college vs college and higher), history of previous colonoscopy, indication for procedure, frequency of bowel movement, prior or current history of liver disease, prior or current history of kidney disease, haemodialysis and abdominal surgery. Written instructions in Spanish were distributed to Spanish-speaking subjects. Senior gastroenterology fellows, using interpreters for subjects who did not speak English, provided all patient instructions. After receiving written and verbal instructions, subjects were asked a series of questions by nursing personnel. Translation was provided for subjects who did not speak English.

Intervention

All subjects were given written and verbal instruction at the time of their clinic visit approximately three weeks prior to the scheduled colonoscopy. In addition

Bowel preparation instructions

1. Begin a clear liquid diet (Jello – except red Jello, clear broth, clear juices, coee, tea, soda) after breakfast the day before the exam.
2. Purchase the prescribed bowel preparation at least 48 hours prior to the exam. The Dulcolax tablets should be taken at 12.00 pm the day prior to the exam. You are to begin the bowel preparation between 4.00 and 5.00 pm the night before the exam. You are to drink eight ounces (full glass) every 10 to 15 minutes until the entire container is finished. Within one to two hours, you will begin to have diarrhea. You MUST FINISH the entire container. REMEMBER, if your colon is not well cleansed, the examination will not be useful and will need to be repeated.
3. Do not eat after midnight the night before your colonoscopy.
4. Multivitamins, aspirin, and iron supplementations should be held one week prior to the procedure.

Figure 1 Bowel preparation instructions

to receiving the written and verbal instructions the intervention group also completed a written multiple-choice questionnaire (Figure 2) at the same clinic visit. The purpose of the questionnaire was to test the subjects' comprehension of previously given verbal and written instructions. Senior gastroenterology fellows reviewed the questionnaire with subjects and incorrect answers were identified, corrected and explained to the patients during the same clinic visit. Translators were used for non-English-speaking subjects.

1 When will you last eat solid food, before the colonoscopy?
a The morning of the procedure
b 24 hours before the procedure
c The night before the procedure
d One week before the procedure

2 What type of food can you eat the day before the colonoscopy?
a Rice and fruit
b Fish and egg
c Pasta
d Liquids only
e All of the above

3 What can you eat or drink the morning of the colonoscopy?
a Liquids only
b Medications only
c A full breakfast
d Nothing by mouth

4 What medications do you need to tell the doctor about before scheduling the colonoscopy?
a Blood thinners (Aspirin, Plavix and Coumadin)
b Iron supplements
c Diabetic medications
d All of the above

5 When do you have to take the Dulcolax tablets?
a The morning of the procedure
b The night before the procedure
c Noon before the procedure
d There is no need to take them

6 How much of the bowel preparation do you have to drink?
a Stop after my first bowel movement
b When I have diarrhea
c Half of the preparation
d The entire gallon

Figure 2 Patient questionnaire

Post-bowel preparation patient assessment

On the day of the procedure, prior to colonoscopy, all subjects received a post-bowel preparation questionnaire (Figure 3) to determine their adherence to the instructions.

An attending gastroenterologist assisted by a senior gastroenterology fellow performed all colonoscopies. The quality of the bowel preparation was determined by the same attending gastroenterologist at each institution using the Universal Preparation Assessment scale[1] (Table 1). Caecal intubation time, scope withdrawal time and end of procedure time were documented.

Statistical analysis

Analysis was conducted using the SPSS 15 Statistical Software, SPSS Inc. For the purpose of analysis, we dichotomised the results for colon preparation to 'adequate' preparation (excellent and good results pooled) and 'inadequate' preparation (fair, poor and inadequate results pooled). This decision was justified on the basis that the fair, poor and inadequate categories were described as 'unsatisfactory visualisation

1 When did the patient last eat solid food?
2 What time did the patient take the Ducolax tablets?
3 When did the patient begin drinking the bowel preparation?
4 Time elapsed between preparation consumption and first BM
5 How much of the bowel preparation did the patient drink?
6 If the patient did not finish the entire prep, why?
7 List the foods the patient has consumed in the past 24hours?
8 What did the patient's last bowel movement look like?
a Clear liquid
b Yellow liquid
c Dark liquid
d Semi solid/loose stool
e Solid stool
9 What is the patient's level of anxiety for this procedure?
a Not anxious at all
b Slightly anxious
c Moderately anxious
d Very anxious

Figure 3 Post-bowel preparation questionnaire

Table 1 The Universal Preparation Assessment scale[1]

Bowel preparation scale	Bowel preparation quality
0 = excellent	low volume, clear stool
1 = good	larger volume, clear to semi-clear liquid stool
2 = fair	coloured liquid, semi-solid stool
3 = poor	semi-solid stool, unable to suction
4 = inadequate	procedure aborted secondary to solid stool

of all or part of the colon'. Each variable was tested for association with adequate preparation quality. The chi-squared test was utilised to evaluate association for categorical variables and means were evaluated using an independent *t*-test (continuous variables). An alpha of 0.05 was considered significant.

Results

Patient characteristics

A total of 182 subjects were enrolled. We excluded 18 subjects from final analysis due to incomplete data collection. Analysis was completed on 164 subjects. There were 84 subjects (51.2%) in the intervention group and 80 subjects (48.7%) in the control group (Table 2).

Assessment of bowel preparation quality

The intervention was not associated with adequate bowel preparation (χ^2 (1, n = 164) = 2.36, P = 0.13). In the intervention group 58 (56%) subjects had adequate bowel preparation compared with 46 (44%) in the control group.

Table 2 Comparisons of patient characteristics

Patient characteristics	Intervention group n = 84	Control group n = 80	P value*
Age			
Mean year (SD)	57.9 (+/–9.1)	57.3 (+/–9.1)	0.60
Sex			0.23
Female *n* (%)	46 (55)	53 (62)	
Race			0.26
Hispanic *n* (%)	59 (70)	46 (58)	
White *n* (%)	9 (11)	8 (10)	
African–American *n* (%)	14 (17)	22 (28)	
Other *n* (%)	2 (2)	4 (5)	
Education			0.38
Less than college *n* (%)	70 (83)	71 (89)	
College or more *n* (%)	14 (17)	9 (11)	
Anxiety level			0.81
No anxiety *n* (%)	42 (50)	37 (46)	
Mild anxiety *n* (%)	28 (33)	26 (33)	
Moderate anxiety *n* (%)	9 (11)	9 (11)	
Severe anxiety *n* (%)	5 (6)	8 (10)	
Antidepressant use *n* (%)	5 (6)	9 (11)	0.25
Body mass index kg/m^2 (SD)	30.2 (+/–7.0)	28.53 (+/–5.8)	0.09
History of abdominal surgery *n* (%)	41 (49)	34 (43)	0.47
History of colonoscopy *n* (%)	9 (11)	17 (21)	0.06

* Calculated using χ^2 for categorical variables and *t* test for continuous variables

Factors associated with the quality of bowel preparation

Although educational intervention did not significantly improve the quality of bowel preparation, compliance with dietary instructions did have an impact on the quality of preparation. There was an association between time of last solid meal (>24 hours vs <24 hours) and quality of preparation (χ^2 (1, n = 162) = 4.49, P = 0.03), and there was a significant difference when comparing liquid to solid diet during 24 hours prior to the procedure (χ^2 (1, n = 162) = 4.39, P = 0.04).

Being aged younger than 55 years was associated with adequate bowel preparation (χ^2 (1, n = 164) = 5.12, P = 0.02). There was a trend for adequate bowel preparation in younger subjects of all nationalities. On average the group with inadequate colon preparation (M = 82.67 minutes, SD = 8.82) had their first bowel movements later than those with adequate colon preparation ((M = 62.36 minutes, SD = 5.06), t (98.12) = 2.0, P = 0.05). Equal variances were not assumed. Of the adequately prepared group 46.2% (n = 48) had their first bowel movement within 45 minutes, compared with 26.6% (n = 16) of the subjects with an inadequately prepared colon.

In the intervention group 23 (25%) of the subjects failed to follow the instructions for bowel preparation (measured by last solid meal ingestion) compared with 29 (32.2%) of the subjects in the control group.

Secondary outcomes

Colonoscopy was completed to the caecum in 163 of the 164 subjects (99.3%). The group with inadequate bowel preparation had longer total procedure times (M = 25.83, SD = 9.15) compared with the group with adequate colon preparation (M = 20.13, SD = 9.21), t (162) = 3.83, P = 0.001. The inadequate bowel preparation group had longer caecal intubation times (M = 12.65, SD = 5.61) compared with the group with adequate colon preparation (M = 10.06, SD = 6.52), t (162) = 2.58, P = 0.01. When examining scope withdrawal time there was no difference between the group with inadequate colon preparation (M = 13.17, SD = 7.03) and adequate colon preparation (M = 10.95, SD = 10.87), t (162) = 1.415, P = 0.16.

A total of 44 subjects (26.8%) had polypoid lesions, of whom 28 subjects (15.8%) had adenomas, χ^2 (1, n = 153) = 1.68, P = 0.20 (missing n = 11).

Discussion

There is little published literature evaluating educational intervention as a means to improve the quality of bowel preparation. We report the results of an educational intervention on the quality of bowel preparation in a randomised group of outpatients in two inner-city hospitals.

Statistically, there was no difference in the quality of bowel preparation outcome between the groups, but there was a trend towards high-quality bowel preparation in the intervention group (56%) compared with the control group (44%).

Although the intervention was not significantly associated with increased adherence to instructions there was a definite tendency towards increased adherence to dietary instructions in the intervention group compared with the control group. Our study supports the findings in other studies that demonstrate failure to follow preparation instructions[8,14] as an independent predictor of inadequate bowel cleansing.

In a recent study of inpatients undergoing colonoscopy, a clear liquid diet before administration of the bowel preparation was the only diet modification that improved the quality of preparation.[15] Our findings further support the importance of a liquid diet compared with solid diet for 24 hours prior to procedure to improve the quality of bowel preparation. The findings also demonstrated that a 24-hour time interval since the last solid meal prior to elective colonoscopy was associated with adequate bowel preparation. The American Society of Gastroenterology currently recommends 'dietary regimens that characteristically incorporate clear liquids and low residue foods during one to four days' prior to colonoscopy.[16]

The majority of the subjects (n = 143, 93%) had a bowel movement frequency of at least once every day and only four patients (2.1%) reported constipation as an indication for colonoscopy. In our cohort the time elapsed from the initiation of bowel preparation to first bowel movement was significantly associated with adequate bowel preparation. This finding suggests that intestinal transit time may be a factor in the quality of bowel preparation. The general applicability of this finding needs to be validated.

Bowel cleansing quality critically affects the quality, difficulty, speed and completeness of the colonoscopy.[7] Other studies have shown that poor bowel preparation prolongs the caecal intubation time.[17,18] Our results support the findings that high-quality bowel preparation is significantly associated with shorter total procedure and caecal intubation times.

In this study, time elapsed from initiation of bowel preparation to first bowel movement and age younger than 55 years were also significantly associated with high-quality bowel preparation. The rate of polyp detection was not affected by the quality of bowel preparation in this study. Other studies have identified multiple negative predictors of bowel preparation including history of cirrhosis, inpatient status, constipation as an indication for colonoscopy, antidepressant use, and past history of polyps, stroke and dementia.[8] In our study none of these factors was associated with the quality of the bowel preparation. This may be due to our small sample size and the fact that most of the patients were healthy outpatients.

Our study has several important limitations. The sample size was small. Lack of adequate data resulted in the exclusion of 11% of subjects from primary data analysis. Additionally, the lapsed time between the educational intervention and initiation of bowel preparation may have resulted in decreased adherence to dietary instructions.

Conclusion

Although there was a trend towards increased adherence to diet and higher quality bowel preparation in the intervention group, the educational intervention had no significant impact on the overall quality of the bowel preparation. However, this study did demonstrate that compliance with simple dietary instructions, specifically, adherence to a liquid diet and avoidance of solid foods for 24 hours prior to procedure resulted in higher quality bowel preparation. These findings suggest that an educational intervention that improves compliance with simple dietary instructions prior to colonoscopy would improve the quality of the preparation. Further studies are needed to determine if different educational methods can improve the quality of outpatient colonoscopy preparation by increasing adherence to simple dietary instructions prior to elective colonoscopy.

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PEER REVIEW

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CONFLICTS OF INTEREST

None.

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