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# Educational Video Followed by Retelling Bowel Preparation Process to Improve Colonoscopy Bowel Preparation Quality: A Prospective Nursing Intervention Study

Authors' Contribution:  
Study Design A  
Data Collection B  
Statistical Analysis C  
Data Interpretation D  
Manuscript Preparation E  
Literature Search F  
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**Background:** This study investigated the effect of a patient education video followed by retelling the process of bowel preparation on colonoscopy bowel preparation quality.





**Material/Methods:** This was a prospective, randomized, controlled clinical trial of outpatients undergoing colonoscopy. Patients were randomized (1: 1) to the video + retelling group or the control group. The primary endpoint was to assess the bowel preparation quality using the Ottawa Bowel Preparation Quality scale (Ottawa score). Risk factors associated with poor bowel preparation were also evaluated.

**Result:** The video + retelling group had a higher percentage of patients with adequate colonoscopy bowel preparation (Ottawa score <6) than the control group ( $P < 0.001$ ). Mean Ottawa total scores significantly differed between the control group and the video + retelling group ( $4.18 \pm 1.4$  vs.  $3.05 \pm 1.3$ ,  $P < 0.001$ ). The video + retelling group showed superior cleanliness in the right, middle, and recto-sigmoid colon segments (all  $P$ s  $< 0.001$ ). Logistic regression analysis revealed that male gender (OR=2.10, 95%CI: 1.098–4.018,  $P=0.025$ ), diabetes mellitus (OR=2.830, 95%CI: 1.257–6.372,  $P=0.012$ ), and no educational video followed by retelling bowel preparation process (OR=3.02, 95%CI: 1.731–5.270,  $P < 0.001$ ) were independently associated with poor bowel preparation.

**Conclusions:** Use of an educational video followed by asking patients to retell the process of bowel preparation after receiving regular instructions is a convenient and risk-free practice that enhances the compliance with bowel preparation guidance and improves bowel preparation quality.

**MeSH Keywords:** Cathartics • Colonoscopy • Education, Nursing, Associate

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## Background

Colonoscopy is a crucial method for the diagnosis and prevention of colorectal cancer [1]. Proper bowel preparation is essential to assure complete mucosal visualization and lesion identification [2,3], which improves lesion detection and reduces perforation risk [4,5]. In contrast, inadequate bowel preparation has been shown to reduce colonoscopy quality, cause difficult viewing and longer procedure time, and to increase need for repeated colonoscopy [5–8]. In addition, inadequate bowel preparation has been estimated to result in 12–22% additional associated costs of colonoscopy compared with adequate bowel preparation [3,9]. Inadequate bowel preparation has been associated with the following factors: age >60 years old, later colonoscopy starting time, lower education, waiting time >16 weeks, poor health literacy, failure to follow preparation instructions, inpatient status, constipation, tricyclic antidepressants, male gender, diabetes, appendectomy, and cirrhosis [10–13].

Of these reasons contributing to unsatisfactory bowel cleansing, noncompliance with bowel preparation instructions is arguably one of the most important and yet modifiable factors [10,11]; therefore, numerous efforts [14,15] have been made to improve patient compliance. To achieve proper compliance, methods must remain simple and easy to implement, and patient education before examination has attracted wide interest. Reported educational interventions include nurse-delivered education with brochures [16], oral and written instructions [17,18], a novel designed patient educational booklet [19], cartoon visual aids [20,21], instructions according to questionnaire responses [22], video [23], and telephone re-education 1 day before examination [24]. However, the results were not consistent.

Our team hypothesized that designing a short video about bowel preparation followed by patients retelling the process of bowel preparation immediately after regular instructions would improve compliance and ultimately improve bowel preparation quality for colonoscopy. This method has the advantages of no extra expenses, minimal time requirement, easy implementation, and high patient acceptance. Therefore, the purpose of this clinical trial was to assess the effect of watching a simple video followed by patients retelling the process of bowel preparation on the quality of bowel preparation.

## Material and Methods

### Study design and patients

This was a randomized, controlled, and single-blinded study of consecutive outpatients undergoing colonoscopy at the

Yantai City Hospital of Traditional Chinese Medicine between May 2016 and October 2017. The study was approved by the Ethics Committee of the Yantai City Hospital of Traditional Chinese Medicine. Written informed consent was obtained from all participants.

Subjects eligible for the study were outpatients ages 18–80 years who were scheduled for colonoscopy. The indications for colonoscopy were: 1) routine screening; and 2) colorectal symptoms such as lower abdominal pain, changes of stool characteristics (e.g., constipation and diarrhea), weight loss, and anemia. The exclusion criteria were: 1) history of prior colonic resection; 2) inflammatory bowel disease, colorectal tumor, or infectious colitis; 3) suspected colonic obstruction, ischemic bowel disease, gastrointestinal stenosis, active gastrointestinal bleeding, or toxic megacolon; 4) severe renal diseases (creatinine clearance <30 ml/min); 5) symptomatic heart failure (NYHA class III or IV); 6) pregnancy or menstruations; or 7) poor compliance, insufficient cognition to understand the study protocol, or refusing to participate in the study.

### Randomization and blinding

Patients were randomized (1: 1) to either the video + retelling group or the control group. The allocation sequence was generated using a computer-generated random number table by an independent statistician and was sealed in sequentially numbered, opaque envelopes by an independent nurse (H.H.). The sealed envelopes were opened at the time of the colonoscopy appointment and after eligibility of the participants were confirmed. The colonoscopy physicians who evaluated the results of bowel preparation quality and the study data analyst were blinded to grouping.

### Bowel preparation

Patients were prescribed polyethylene glycol electrolyte powder (Ipsen Pharma Biotech, Boulogne-Billancourt, France) for bowel preparation. Each sachet (64 g of polyethylene glycol 4000, 5.7 g of anhydrous sodium sulphate, 1.68 g of sodium bicarbonate, 1.46 g of sodium chloride, and 0.75 g of potassium chloride) was dissolved in 2 liters of water for administration.

All patients were instructed to eat a regular meal for lunch and only clear liquids for dinner at 16: 00–17: 00 the day before the colonoscopy. They were instructed to drink 2 sachets of polyethylene glycol electrolyte powder at 18: 00–20: 00 within 2 h on the day before the colonoscopy and another 2 at 5: 00–7: 00 within 2 h on the day of the colonoscopy. Patients were asked not to drink any liquids after the purgatives. All colonoscopies were performed at 09: 00–12: 00.

## Colonoscopy

All patients received regular bowel preparation instructions at their appointment for colonoscopy. One nurse provided education about colonoscopy, including detailed preparation instructions, the importance of bowel preparation, and the potential adverse effects of the agents used. All patients also received a booklet with clearly written instructions. The same nurse (C.L.) provided routine instructions for all patients to ensure the education quality and consistency.

All colonoscopies were conducted by 1 of the 4 colonoscopists, each with a minimum experience of 2500 procedures. A CV-260 colonoscope (Olympus, Tokyo, Japan) was used for colonoscopy procedure. All of the colonoscopists were trained for approximately 2 weeks on the classical images of the Ottawa Bowel Preparation Quality Scale (OBPQS) before the enrollment of study subjects [25]. All examinations were conducted under moderate propofol sedation.

## Intervention

Our team designed the bowel preparation video (about 6 minutes long), including video, figures, and captions, which could supplement the instruction booklet. This video provided photos of both optimal and poor bowel preparation to make patients realize its clinical significance through visual presentation. Patients in the video + retelling group were scheduled to watch the educational video the day before the colonoscopy.

After watching the video, these patients were required to retell the bowel preparation process in their own words, including the following key content: 1) proper food choice; 2) start time of purgatives administration; 3) method of purgatives administration; and 4) potential adverse effects of purgatives. The same nurse (C.L.) was allowed to provide hints or correction when the patients had missed some important steps or made mistakes. When the patient forgot a step and could not continue, the nurse could provide key words or ask an open question, in order to help the patients recall the whole protocol. The retelling process continued until the patient could retell the whole protocol within 3 minutes without any hints or correction.

## Data collection

Baseline demographic and clinical variables of the patients were recorded, including age, gender, education level, income level, previous colonoscopy history, and health behavior (smoking and alcohol consumption). These data were recorded on the day of the colonoscopy examination by the nurse (X.S.), who had intermediate qualifications, with 5 years of experience working in the endoscopy room. During the procedure,

the endoscopist, who was blinded to the grouping of the patients, evaluated and recorded the quality of bowel preparation using the Ottawa bowel preparation scale [26].

## Definition of primary and secondary endpoints

The primary endpoint of the study was the quality of bowel preparation as assessed by the Ottawa bowel preparation scale [26]. The Ottawa score is a validated scale that requires the endoscopist to rate colonic cleansing separately in 3 segments (right colon, middle colon, and recto-sigmoid colon) on a scale of 0 to 4 (0=perfect cleansing; 1=minimal turbid fluid; 2=suction liquid stool for adequate visualization; 3=both suction and wash necessary; and 4=solid stool/colonic wall not visualized) and an overall fluid quantity on a scale of 0 to 2 (0=no fluid, 1=moderate, and 2=large) [26]. The individual scores were summed to generate a total score (range: 0–14) [26]. Poor bowel preparation was defined by a total Ottawa score of  $\geq 6$  [24].

Secondary outcomes, including insertion time, withdrawal time, and colonoscopic findings (number of polyps and adenomas detected), were also recorded by the endoscopist. The insertion time was defined as the interval between the start of insertion of scope and arrival at the cecum. Withdrawal time was defined as the interval between withdrawal from the cecum and removal of the scope from the patient.

## Sample size

A sample size was calculated to achieve an 80% power at a two-sided type I error of 0.05 to detect a 10% difference in the rate of good colonic preparation. The 10% difference estimation was based on a previous trial evaluating the effect of education on bowel preparation [27]. The calculated sample size required was  $\geq 189$  patients for each arm. The expected dropout rate was 20% for early withdrawals and incomplete colonoscopies. Therefore, we expanded our target sample size to a total of 500 patients.

## Statistical analysis

The distribution of continuous data was assessed using the Kolmogorov-Smirnov test. Normally distributed data were presented as mean  $\pm$  standard deviation and analyzed using the *t* test. Non-normally distributed data are presented as median (range) and analyzed using the Mann-Whitney U test. Categorical variables are presented as frequencies and were analyzed using Fisher's exact test. Logistic regression was performed to analyze factors associated with poor bowel preparation (Ottawa score  $\geq 6$ ). SPSS 17.0 (IBM, Armonk, NY, USA) was used for all analyses. Two-sided P-values  $< 0.05$  were considered to be statistically significant.

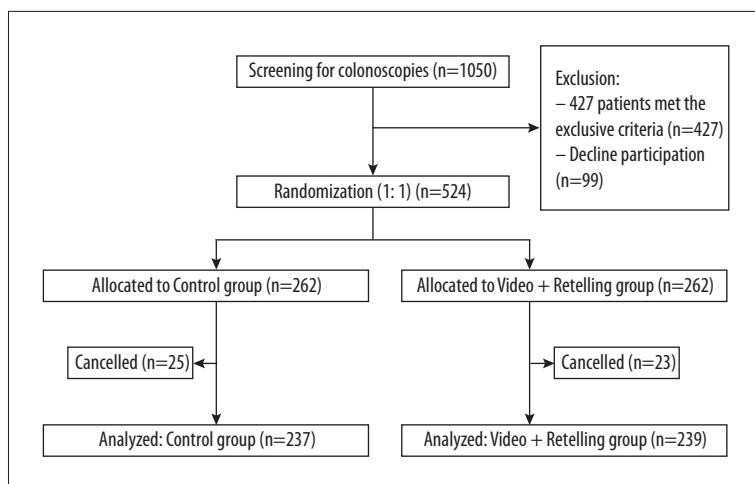


Figure 1. The flowchart of this study.

## Results

### Patient characteristics

The study flowchart is shown in Figure 1. A total of 1050 outpatients were screened between May 2016 and October 2017. Among them, 427 were excluded for history of prior colonic operation (n=77), inflammatory bowel disease, colorectal carcinoma, and infectious colitis (n=52), gastrointestinal stenosis (n=30), active gastrointestinal bleeding (n=65), severe renal diseases (n=15), symptomatic heart failure (n=25), mental disease (n=5), uncontrolled hypertension (n=97), pregnancy or menstruations (n=16), ischemic bowel disease (n=31), toxic megacolon (n=4) and refusal to participate (n=99), resulting in 524 patients randomized into either the control (n=262) or the video+retelling (n=262) groups.

Of the 262 patients randomized to the video + retelling group, 23 patients had to cancel their appointments by themselves for unsuitable bowel preparation (solid stool on the morning of colonoscopy) or other reasons (e.g., acute upper respiratory tract infection or start of menstruation). Of the 262 patients randomized to the control group, 25 patients had to cancel their appointments due to inappropriate bowel preparation or other reasons. Therefore, 239 patients in the video + retelling group and 237 patients in the control group underwent colonoscopy examination.

### Baseline data

Patient characteristics for the control group and the video + retelling group are shown in Table 1. All documented variables were comparable between the 2 groups, with no significant difference observed.

### Bowel preparation

Bowel preparation outcomes are shown in Table 2. The video + retelling group had a higher proportion of patients with appropriate colonoscopy bowel preparation (Ottawa score <6) than in the control group [215 (90.0%) vs. 178 (75.1%),  $P<0.001$ ]. Total scores also significantly differed between the control group and the video + retelling group ( $4.18\pm 1.4$  vs.  $3.05\pm 1.3$ ,  $P<0.001$ ). According to individual segment cleanliness scores, the video + retelling group had superior cleanliness in the right, mid, and recto-sigmoid colon (all  $P<0.001$ ). However, no difference in fluid levels was observed between the 2 groups ( $P=0.218$ ).

### Risk factors associated with poor bowel preparation

Univariate regression analysis showed that gender (OR=1.82, 95%CI: 1.046–3.166,  $P=0.034$ ), diabetes mellitus (OR=2.72, 95%CI: 1.134–6.525,  $P=0.025$ ), and no educational video followed by patient retelling bowel preparation process (OR=2.39, 95%CI: 1.510–3.783,  $P<0.001$ ) were associated with poor colonoscopy bowel preparation. Multivariate analysis further revealed that male gender (OR=2.10, 95%CI: 1.098–4.018,  $P=0.025$ ), diabetes mellitus (OR=2.83, 95%CI: 1.257–6.372,  $P=0.012$ ), and no educational video followed by retelling bowel preparation process (OR=3.02, 95%CI: 1.731–5.270,  $P<0.001$ ) were independently associated with poor bowel preparation. The details are listed in Table 3.

### Polyp detection and colonoscopy time

Polyp detection rates did not show significant difference between the video + retelling group and the control group [19.8% (47/237) vs. 20.9% (50/239),  $P=0.768$ ]. Compared with the control group, the insertion time was shorter in the video + retelling group ( $5.1\pm 4.8$  vs.  $6.0\pm 4.2$  min,  $P=0.023$ ). The results are shown in Table 4.

**Table 1.** Characteristics of the patients between control group and video + retelling group.

Characteristics	Control group (n=237)	Video + retelling group (n=239)	P
Age (years), mean ±SD	54.4±8.6	55.1±6.3	0.312
Gender			
Male n (%)	154 (65.0%)	147 (61.5%)	0.432
Female n (%)	83 (35.0%)	92 (38.5%)	
Body mass index (kg/m <sup>2</sup> )	24.6±2.8	24.3±3.5	0.302
Previous colonoscopy (%)			
Yes	142 (60.0%)	148 (61.9%)	0.653
No	95 (40.0%)	91 (38.1%)	
Diabetes mellitus			
Yes	15 (6.3%)	20 (8.4%)	0.394
No	222 (93.7%)	219 (91.6%)	
Smoking History (%)			0.539
No smoker	126 (53.2%)	131 (54.8%)	
Past smoker	47 (19.8%)	38 (15.9%)	
Current smoker	64 (27.0%)	69 (28.9%)	
Alcohol History (%)			0.161
None	57 (24.1%)	76 (31.8%)	
Moderate drinking	119 (50.2%)	105 (44.0%)	
Heavy drinking	61 (25.7%)	58 (24.2%)	
History of abdominal surgery other than colon surgery, n (%)			0.486
Yes	36 (15.2%)	31 (13.0%)	
No	201 (84.8%)	208 (87.0%)	
Education level, n (%)			0.114
<Middle school	2 (0.8%)	4 (1.7%)	
Middle school	7 (3.0%)	17 (7.1%)	
High school	95 (40.1%)	86 (36.0%)	
Graduate	107 (45.1%)	115 (48.1%)	
Postgraduates	26 (11.0%)	17 (7.1%)	
Annual income level, \$ (%)			0.758
<10,000	3 (1.3%)	5 (2.1%)	
10,000–20,000	8 (3.4%)	13 (5.4%)	
>20,000–30,000	31 (13.1%)	28 (11.7%)	
>30,000–40,000	40 (16.9%)	41 (17.2%)	
>40,000	155 (65.4%)	152 (63.6%)	
Colonoscopy appointment waiting time (days)	3.3±0.8	3.4±0.2	0.062
Indication for colonoscopy, n (%)			
Screening	59 (24.9%)	48 (20.1%)	0.209
Symptomatic	178 (75.1%)	191 (79.9%)	
Patients cancelling appointment of colonoscopy, n (%)	25 (10.5%)	23 (9.6%)	0.817
Bad bowel preparation	5 (2.1%)	4 (1.7%)	
Other reasons	20 (8.4%)	19 (7.9%)	

Values are presented as mean ± standard deviation,%, or number.

**Table 2.** Outcomes of bowel preparation.

Characteristics	Control group (n=237)	Video + retelling group (n=239)	P
Segment (mean ±SD)			
Right colon	1.28±0.6	0.92±0.3	<0.001
Mid-colon	1.21±0.5	0.83±0.5	<0.001
Recto-sigmoid	1.15±0.7	0.82±0.3	<0.001
Fluid	0.72±0.4	0.68±0.3	0.218
Total scope	4.18±1.4	3.05±1.3	<0.001
Good bowel preparation for colonoscopy (OBPS <6), no, (%)	178 (75.1%)	215 (90.0%)	<0.001

**Table 3.** Logistic analysis of factors for the poor bowel preparation (Ottawa score ≥6).

Factor	Univariate regression analysis			Multivariate regression analysis		
	OR	95%CI	P value	OR	95%CI	P value
Age (years), mean ±SD	0.89	0.707–1.120	0.321			
Gender						
Female	1	Reference	–	1	Reference	–
Male	1.82	1.046–3.166	0.034	2.1	1.098–4.018	0.025
Body mass index (kg/m <sup>2</sup> )	1.05	0.857–1.286	0.637			
Previous colonoscopy						
No	1	Reference	–			
Yes	0.72	0.103–5.050	0.741			
Abdominal operation history						
No	1	Reference	–			
Yes	0.83	0.276–2.495	0.74			
Diabetes mellitus						
No	1	Reference	–			
Yes	2.72	1.134–6.525	0.025	2.83	1.257–6.372	0.012
Education level, n (%)						
<Middle school	1	Reference	–			
Middle school	1.15	0.384–3.448	0.803			
High school	0.82	0.500–1.344	0.431			
Graduate	1.94	0.453–8.311	0.372			
Postgraduates	0.95	0.792–1.140	0.581			
Annual income level, \$ (%)						
<10,000	1	Reference	–			
10,000–20,000	0.82	0.373–1.801	0.621			

**Table 3 continued.** Logistic analysis of factors for the poor bowel preparation (Ottawa score  $\geq 6$ ).

Factor	Univariate regression analysis			Multivariate regression analysis		
	OR	95%CI	P value	OR	95%CI	P value
>20,000–30,000	0.74	0.063–8.730	0.811			
>30,000–40,000	0.57	0.253–1.282	0.174			
>40,000	0.63	0.094–4.245	0.635			
Group						
Video + retelling group	1	Reference	–	1	Reference	–
Control group	2.39	1.510–3.783	<0.001	3.02	1.731–5.270	<0.001

**Table 4.** Procedure time and polyp detection rate.

Patients, n	Control group (n=237)	Video + retelling group (n=239)	P
Insertion time, minutes (mean $\pm$ SD)	6.0 $\pm$ 4.2	5.1 $\pm$ 4.8	0.023
Withdrawal time, minutes (mean $\pm$ SD)	7.0 $\pm$ 3.2	6.8 $\pm$ 2.5	0.448
Patients with polyps, n (%)	31 (13.1%)	32 (13.4%)	0.921
Total number of polyps, n (%)	47 (19.8%)	50 (20.9%)	0.768

## Discussion

Inadequate patient compliance to bowel preparation instructions is an important factor affecting the quality of colonoscopy. The results of interventional studies aiming to ameliorate compliance are inconsistent. Therefore, the objective of this randomized controlled trial was to evaluate the efficacy of the educational video followed by patient retelling on the quality of bowel preparation. Our results showed that the educational video followed by patient retelling bowel preparation process is a convenient and risk-free intervention that increases colonoscopy quality by enhancing patient compliance with bowel preparation guidance.

In the present study, watching the educational video made the bowel preparation process easier for patients to understand with easy words, explanations, and visual aids. Simply asking the patients to retell the process of bowel preparation immediately after video education turned out to be an effective and handy way to improve bowel preparation quality. In addition, it took less than 10 minutes and required no specific material. The present study showed that the bowel preparation was better in the video + retelling group than in the routine instruction group, suggesting that conventional preparation manuals might have confused participants and failed to enhance patients' bowel preparation. Moreover, patients could ignore or neglect important parts of the bowel preparation procedures in the manual or booklets.

One recent study has shown that almost half of patients underwent colonoscopy with inadequate bowel preparation [24]. Poor compliance should be considered as inaccurate time for starting purgatives intake, noncompliance with dietary limitation, and incorrect use of purgatives [24]. Therefore, watching an educational video followed by retelling bowel preparation process of bowel preparation may enhance their memory.

Previous studies indicated that gender, comorbidity such as diabetes mellitus, literacy level, and low family income were correlated with poor bowel preparation, and adults with lower education levels were twice as likely to have poor bowel preparation [10,17]. Another study pointed out that understanding the colonoscopy procedure may exert significant influence on bowel preparation quality for patients with limited education level [28]. Our results are consistent with these previous reports. Logistic regression analysis showed that gender, patients with comorbidity such as diabetes mellitus, and those without extra video and retelling educational intervention were more prone to have poor bowel preparation. However, educational level and family income did not significantly affect bowel preparation quality.

This study showed that the detection rate of polyps was 20.4% (97/476), which was lower than that in previous reports (>30%) [27,29,30]. It could be assumed that most patients had a history of colonoscopy examination. Therefore, the rate of

polyp detection and removal was lower than that in the population without colonoscopy history. In addition, the polyp detection rate gradually increases with age [31], and the patients in our study were relatively younger. Advantages of our intervention were that the educational video followed by retelling the bowel preparation process had no additional economic cost, was not time-consuming (less than 10 minutes), was easy to implement, and was readily accepted by the patients. Our results suggest that this method should be implemented widely.

The present study was not without limitations. Firstly, this study was performed in a single center in a developing country; whether it is suitable for developed countries where patient education level is higher needs more study. Secondly, the lesion miss rate was not evaluated. However, previous studies have shown that poor bowel preparation is an important factor for clear viewing of the intestinal mucosa, which could decrease the polyp detection rate [20,32]. Thirdly, the time from making the appointment to the day of the appointment in our center is 3–4 days, which is relatively short, while the time in some other centers may be 2 weeks or even longer. With the passage of time, details of the bowel preparation instructions may be forgotten or misinterpreted; therefore, more studies should be performed among patients with longer appointment

times to determine the effect of the educational video followed by retelling bowel preparation process. Fourthly, the present study was only performed on sedated patients with split-dose regimens as the bowel preparation method. Finally, different bowel preparation methods yield different compliance and outcomes [14,15,33], and the educational video followed by retelling bowel preparation process should be studied among different preparation protocols.

## Conclusions

In conclusion, an educational video followed by asking the patient to retell the process of bowel preparation immediately after regular instructions at the colonoscopy appointment is a convenient and feasible intervention, which could enhance patient compliance with bowel preparation instructions and improve bowel preparation quality. Moreover, gender and comorbidity such as diabetes mellitus were independent risk factors for poor bowel preparation.

## Conflict of interests

None.

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