

Enhancing Colonoscopy Preparation in Elderly Constipation Patients: A Personalized Approach with PEG and Exercise - A Case Study

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Abstract: This study aimed to optimize bowel preparation efficacy for colonoscopy in elderly constipation patients. A 71-year-old patient with chronic constipation and a history of poor bowel preparation. To address these challenges, we implemented a personalized strategy combining of PEG administration and walking exercise. The PEG was administered according to a protocol, with intermittent exercise breaks of 10 minute. Bowel cleanliness was assessed using the Boston Bowel Preparation Scale (BBPS). Adverse reactions and tolerance were closely monitored throughout the intervention. The patient's BBPS score improved from 3 to 8 post-intervention. The exercise intervention was well-tolerated (rating I), and mild nausea was observed only after the first PEG dose. No severe adverse reactions occurred. Subsequent Follow-up revealed symptom relief. The personalized approach combining (PEG and exercise intervention) successfully improved bowel preparation quality in the elderly constipation patient undergoing colonoscopy. This approach considers age-related changes in gastrointestinal function and activity level, offering an effective strategy to improve patient tolerance and reduce adverse reactions during bowel preparation. The findings underscore the importance of tailoring interventions for elderly constipation patients to optimize the colonoscopy experience.

Keywords: compound polyethylene glycol electrolyte powder, exercise intervention plan, bowel preparation, colonoscopy, elderly, constipation

Introduction

Chronic constipation is a prevalent concern among adults in China with ranges from 4% to 10%, and a prevalence that increases with age.¹ The prevalence of chronic constipation particularly in individuals over 65 years old can reach up to 17.60% and exhibiting a noteworthy gender disparity favoring females.² In Western countries, the prevalence of chronic constipation is even higher, ranging from 14% to 30%.³ Moreover, previous studies have shown that patients with functional constipation or a history of constipation have a 1.51–1.66 times higher detection rate of colon cancer patients compared to normal individuals.⁴ Colonoscopy is a widely used diagnostic and therapeutic technique in gastroenterology and is considered the gold standard for diagnosing colorectal cancer.⁵ The efficacy of colonoscopy is closely related to the quality of bowel preparation. The optimal bowel preparation ensures a smooth examination and can prevent missed diagnoses and misdiagnoses, thus improving disease detection and patient outcomes. Among the available bowel preparation options, compound polyethylene glycol electrolyte powder (PEG) is preferred for its effectiveness and safety profile.⁶ However, in elderly patients, gastrointestinal function gradually declines, and the colon may become more relaxed, leading to potential challenges in achieving optimal bowel preparation using standard PEG protocols.⁷ A literature survey indicates that about 29% of elderly patients undergoing colonoscopy exhibit chronic constipation, with an unacceptable bowel preparation rate of up to 65.45%.^{8,9} Therefore, it is recommended to use auxiliary measures to improve bowel cleanliness in elderly constipation

patients.¹⁰ Exercise intervention emerges as a promising adjunctive measure for promoting bowel preparation. While common exercise interventions include walking, enemas, and the use of laxatives and prokinetic agents, the specific application of exercise during bowel preparation remains underexplored. Research suggests that intermittent exercise during PEG intake can help achieve adequate bowel preparation standards and alleviate discomforts such as nausea and bloating, reducing the incidence of adverse reactions.¹¹ In light of these considerations, this study focuses on the innovative application of a combined approach involving PEG and exercise intervention for bowel preparation before colonoscopy in elderly constipation patients. The primary objectives are to observe the quality and safety of bowel preparation and explore a more suitable method for this specific population. This research endeavors to contribute valuable insights into optimizing colonoscopy outcomes in elderly constipation patients, considering the unique challenges posed by age-related changes in gastrointestinal function and activity levels. The study aims to pave the way for enhanced patient tolerance and reduced adverse reactions during the critical phase of bowel preparation.

Case Report

In this case, a 71-year-old patient with a history of constipation for 10 years presented with intermittent upper abdominal pain for over a month. The patient met the Rome IV diagnostic criteria for constipation.¹² Three months prior to the current visit, the patient had undergone relevant preoperative examinations in preparation for a colonoscopy. However, due to poor bowel preparation and intolerance, the procedure could not be completed. Since the symptoms did not improve significantly, the patient returned to the hospital with the goal of completing the colonoscopy for a definitive diagnosis on March 24, 2023. After thorough communication and obtaining consent, a combined approach of PEG and exercise intervention was used for bowel preparation.

Bowel Preparation Method

Before the examination, the patient was instructed to avoid a high-fibre diet and consume a liquid diet the day before. At 8:00 PM, the patient was given 1 litre of PEG solution (Hengkang Zhengqing, approval number: H20020031, specification: 3 bags) to be taken at a recommended rate of 250mL every 10–15 minutes until completed within 1 hour. On the day of the colonoscopy at 4:00 AM, an additional 2 litres of PEG were administered within 2 hours. The patient was instructed to engage in walking exercise for 5–10 minutes between each dose of PEG, with the level of exercise intensity controlled to maintain a fatigue level of less than 14 according to the Rating of Perceived Exertion (RPE) scale.¹³

Outcomes

Bowel Preparation Efficacy: The Boston Bowel Preparation Scale (BBPS) was used to assess the patient's bowel preparation effectiveness.¹⁴ The BBPS scores ranged from 0 to 9, with scores for the left colon, transverse colon, and right colon ranging from 0 to 3. Scores of 0 indicated the presence of unremovable solid faeces, 1 indicated partial mucosal visibility with unclear regions due to faeces or opaque liquid, 2 indicated clear mucosal visibility with small faecal remnants, and 3 indicated complete mucosal visibility without faeces or opaque liquid residues. The total bowel cleanliness score was the sum of the scores for the three segments of the colon, with a maximum score of 9 and a minimum score of 0. A total score of 6 or higher was considered acceptable bowel preparation, while a total score of less than 6 or any individual segment score of less than 2 indicated inadequate bowel preparation. In this case, three months prior, the patient had undergone a colonoscopy with a BBPS score of 3 (Figure 1). The combined approach of PEG and exercise intervention resulted in successful bowel preparation for the colonoscopy (Figure 2). The patient's BBPS score improved from 3 to 8, indicating a significant enhancement in bowel cleanliness on March 27, 2023.

Colonoscopy Adverse Reactions and Tolerance: Adverse reactions that occurred during the bowel preparation process were recorded, including nausea, vomiting, bloating, abdominal pain, and dizziness as per our hospital standard protocol. The degree of patient tolerance to the bowel preparation process was assessed as follows: I. Full tolerance, II. Partial tolerance, and III. Intolerance. The patient had experienced nausea, vomiting, bloating, and abdominal pain, and the tolerance rate was III three months prior. The exercise intervention was well tolerated by the patient, with a tolerance rating of I. The patient experienced mild nausea only after the first dose of PEG, and subsequent doses were well tolerated.

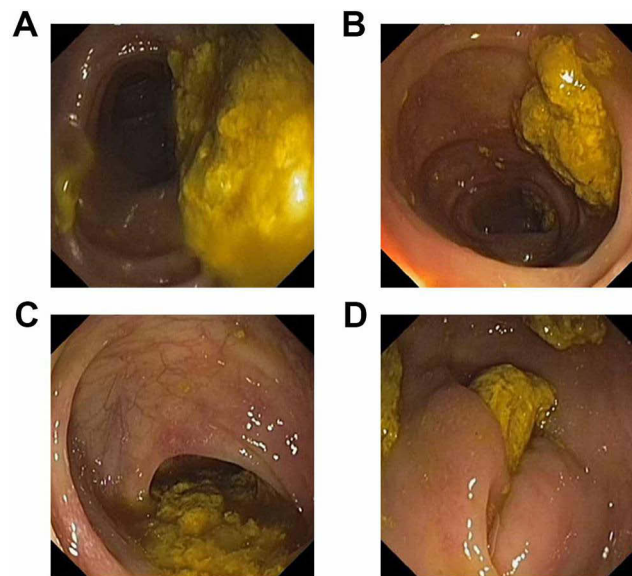


Figure 1 Quality of bowel preparation on December 27, 2022. No report only pictures because of the poor bowel preparation. **(A and B)** Right colon; **(C)**: Transverse colon; **(D)** Left colon. The Boston Bowel Preparation Scale (BBPS) score for this session was recorded as 3. The score indicated the presence of unremovable solid feces, suggestive of inadequate bowel preparation.

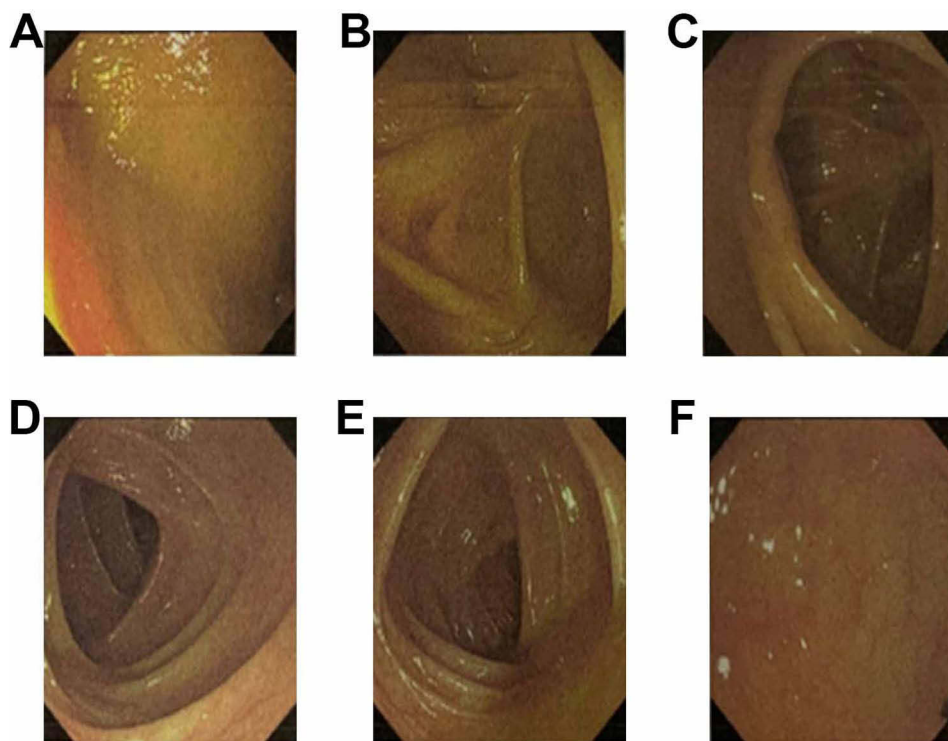


Figure 2 Quality of bowel preparation on March 27, 2023. **(A)** Terminal ileum, **(B)** appendix Opening; **(C)** ileocecal lesion; **(D)** Transverse colon; **(E)** Descending Colon; **(F)** Rectum. The BBPS score significantly improved from 3 to 8 on March 27, 2023. This enhancement indicates successful bowel preparation, with clear mucosal visibility and minimal to no residual fecal matter across all three colon segments.

Follow-Up

Three months following the colonoscopy on June 30, 2023, the patient underwent a re-evaluation to assess their symptoms and disease-related indicators, in order to determine the effectiveness of the intervention plan. The follow-up was conducted via phone, during which the patient reported that they experienced relief from their initial symptom of

intermittent upper abdominal pain. As a result of this improvement, it was determined that another colonoscopy was unnecessary at this time.

Discussion

Physical activity significantly influences the efficacy of bowel preparation for elderly constipation patients has been underscored in several studies. A randomized controlled study involving 383 hospitalized individuals revealed that intermittent exercise, specifically walking for at least 5 minutes every 10 minutes, during PEG consumption resulted in notable enhancements in bowel cleanliness compared to the control group. Importantly, this exercise regimen did not result in heightened discomfort, aligning with the safety concerns raised in the context of the elderly population's diminished organ function, balance, and physical capacity. Hassan et al's investigation into factors influencing bowel preparation among 312 elderly subjects indicated that a substantial 85.15% refrained from physical activity during the preparation phase, emphasizing the potential impact of exercise on the quality of bowel preparation.¹⁵ Arya et al further substantiated these findings through objective measurements, demonstrating that exercise enhances gastrointestinal emptying, reduces transit time, and elucidates the physiological correlation between exercise and bowel cleanliness.¹⁶ Consequently, pre-bowel preparation exercise interventions are a current research focal point. The focus on walking as a modality for exercise intervention is particularly relevant for the elderly population due to its accessibility and effectiveness. It positively influences intestinal motility and colonic propulsion, addressing challenges such as water reabsorption in the intestines and facilitating smoother stool passage. This, in turn, mitigates adverse reactions such as abdominal pain and nausea.¹⁷ Given the elderly population's diminishing organ function, balance, and physical capacity, safety during exercise interventions is paramount; precautions against falls are essential during walking activities.¹⁸ This study Employed the Rating of Perceived Exertion (RPE) scale, this study enabled self-assessment of exercise fatigue, this approach allowing elderly patients to engage in exercise commensurate with their endurance levels, thus augmenting the safety of exercise interventions during bowel preparation. However, it is crucial to acknowledge the limitations of this case study, which focused on a single patient with limited medical history. While demonstrating efficacy, further exploration is warranted, particularly considering the potential additional risk factors for inadequate bowel preparation prevalent among many elderly constipation patients. Additionally, the limited consideration or differentiation of baseline gastrointestinal motility among subjects in most studies might contribute to the ongoing debate on the impact of exercise on bowel preparation. To consolidate these findings and address the limitations inherent in this case study, forthcoming large-scale studies are imperative. These studies should aim for comprehensive observation and analysis, incorporating diverse patient populations and considering variations in baseline gastrointestinal motility to provide a more nuanced understanding of the impact of exercise on bowel preparation.

Conclusion

This case illustrates the successful application of a combined approach involving PEG and exercise intervention for bowel preparation in an elderly constipation patient undergoing colonoscopy. The results suggest that this personalized approach can improve the quality of bowel preparation, enhance patient tolerance, and reduce the incidence of adverse reactions. This approach takes into consideration factors such as age, gastrointestinal motility, and activity level, providing an optimal choice for bowel preparation in elderly constipation patients. Further studies with larger sample sizes are warranted to validate these findings and establish evidence-based guidelines for bowel preparation in this population.

Data Sharing Statement

The data and materials used in this study are available upon request. Researchers interested in accessing the dataset or related materials for academic and non-commercial purposes can contact the corresponding author for further information.

Ethics Approval and Consent to Participate

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and was approved by Fuyong People's Hospital of Baoan District, Shenzhen, Guangdong Province, 518103, China by letter KY-2023-25.

Consent for Publication

Written informed consent was obtained from the patient for the publication of case details and accompanying images.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare no conflicts of interest in this work.

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