ORIGINAL RESEARCH

Evidence-based Practice of Preparing the Best Evidence for Intestinal Tract in Elderly Patients Before Colonoscopy

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ABSTRACT

Context • Adequate intestinal preparation is the key to colonoscopies. The population of older adults in China is developing rapidly, and their incidence of intestinal lesions is relatively high. The failure rate of intestinal preparation of these older adults is high.

Objective • The study intended to develop and implement an evidence-based practice program, based on the best evidence available and combined with information about an endoscopy center's clinical situation, to improve the qualified rate and quality of the intestinal preparation of older patients and to reduce the waste of medical resources.

Design • Using the method of evidence-based nursing, the research team performed a literature search for the relevant guidelines for intestinal preparation for colonoscopies, developed a program using evidence-based practices, and conducted a prospective study using the indicators developed.

Setting • The study took place at the Center for Digestive Endoscopy at Shanxi Provincial People's Hospital, a Grade-3A hospital, in Taiyuan City, Shanxi Province, China.

Participants • Participants were 120 older adults who underwent a colonoscopy between July and September 2021 and 60 older patients who did so between October and December 2021. The patients from July through September became the baseline group, and the patients from October through October became the postintervention group.

Outcome Measures • Set up an evidence-based practice group that included an evidence-based expert group and a review team, with members from the Center for Digestive Endoscopy. The practice group: (1) performed a literature review and developed the review's content; (2) conducted a baseline review of the endoscopy center's nursing procedures; (3) analyzed the promoting and hindering factors based on the review's results; (3) conducted a study with older adult patients that compared the changes between baseline and postintervention in the qualified rate of intestinal-preparation cleanliness, dietary restrictions during intestinal preparation, and the compliance rate for medications and exercise; and (4) measured patients' incidence of adverse reactions and the nurses' implementation rate of intestinal-preparation education.

Results • The postintervention group's qualified rate of intestinal cleanliness, at 48 participants (80%), was significantly higher than that of the baseline group, at 35 participants (58.3%), with $P = .010$. For the intestinal preparation, the postintervention group's compliance with dietary restrictions, use of medications, and performance of exercise was significantly higher than that of the baseline group (all $P < .001$). The postintervention group's incidence of adverse reactions, such as abdominal distension, was significantly lower ($P < .05$), while the incidence of abdominal pain, headache, dizziness, and other adverse reactions were significantly different between the groups ($P > .05$). At baseline, the implementation rate by nursing staff in the endoscopic center for the baseline group was less than 50% for four indicators, but the implementation rate for the postintervention group for those indicators was significantly higher ($P < .05$).

Conclusions • The best evidence for methods of intestinal preparation effectively reduced the adverse reactions of older patients and improved their compliance and the cleanliness of the intestinal preparation. The management of intestinal preparation using an evidence-based nursing practice can effectively standardize the process of intestinal preparation before colonoscopies and improve the cleanliness of and patients' compliance with intestinal preparation. (*Altern Ther Health Med.* 2023;29(4):224-233).

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One study on the prevalence of malignant tumors in China showed that the incidence of colorectal cancer (CRC) ranks third among them.[1] The colonoscopy is currently the gold standard for the diagnosis of intestinal diseases, and it can find early lesions for diagnosis and treatment, which can significantly reduce the risk of colorectal cancer.[2]

Adequate intestinal preparation is the key to colonoscopies.[3] If patients don't perform the intestinal preparation to the required standard. residue in the intestinal cavity covers the surface of the intestinal mucosa and any lesion sites. Clinicians can then miss the diagnosis of minor lesions, which can delay treatment of a patient's condition; the required number of examinations can increase; the patient's economic burden can grow; and the process can waste medical resources.[4] Lebwohl et al reported that inadequate intestinal preparation could lead to a rate of missed diagnoses of 27% for flat adenomas and 5% for colorectal cancer.[5]

The population of older adults in China is developing rapidly, and their incidence of intestinal lesions is relatively high. Such patients are the main group requiring colonoscopies, accounting for about 67%, which has been increasing year by year.[6] Some studies have found that the failure rate of intestinal preparation of older adults abroad was about 25.0%, while in China, it was as high as 34.6%.[7-9]

That finding was related to the poor cognitive function and memory of some older adults, who found it difficult to master the complex knowledge required for intestinal preparation. Those studies also showed that the effects of poor intestinal preparation of older patients in China weren't good.

Due to the decline in cognitive function and understanding and the decrease in gastrointestinal peristalsis, often problems arise, such as low compliance with intestinal preparation, which reduces the overall qualified rate of intestinal preparation. Johnson et al found that adequate education can have an independent effect on intestinal cleanliness.[28]

Current Study

At present, in clinical work, the creation of a standardized and effective, intestinal-preparation guidance program for older adults hasn't occurred.

The current study intended to develop and implement an evidence-based practice program, based on the best evidence available and combined with information about the endoscopy center's clinical situation, to improve the qualified rate and quality of the intestinal preparation of older patients and to reduce the waste of medical resources.

Methods: Program Development

Using the method of evidence-based nursing, the research team performed a literature search for the relevant guidelines for intestinal preparation for colonoscopies, developed a program using evidence-based practices, and conducted a study using the indicators developed. The study took place at the Center for Digestive Endoscopy at Shanxi Provincial People's Hospital, a Grade-3A hospital, in Taiyuan City, Shanxi Province, China. The research study included participants who were older adults who underwent a colonoscopy at the center between July and September 2021 and 60 older patients who did so between October and December 2021.

Evidence-based Practice Group

Set up an evidence-based practice group that included an evidence-based expert group and a review team, with members from the Center for Digestive Endoscopy. The evidence-based expert group consisted of three members, including a senior digestive endoscopy physician, who was mainly responsible for the project's overall control and decision-making. Two gastroenterologists with deputy senior titles mainly coordinated and promoted the project.

The review team consisted of six members, among them, two head nurses, who served as the head and the deputy head of the review team and were responsible for the project's implementation and promotion. Four nursing teachers with master's degrees were responsible for the retrieval and collection of evidence and the formulation and implementation of review indicators as well as data collection and analysis.

The practice group: (1) performed a literature review and developed the review's content; (2) conducted a baseline review of the endoscopy center's nursing procedures; (3) analyzed the promoting and hindering factors based on the review's results; (3) conducted a study with older adult patients that compared the changes between baseline and postintervention in the qualified rate of intestinal-preparation cleanliness, dietary restrictions during intestinal preparation, and the compliance rate for medications and exercise; and (4) measured patients' incidence of adverse reactions and the nurses' implementation rate of intestinal-preparation education.

Nursing Issues

Identify evidence-based problems according to the PIPOST model[10]: (1) P1, the population, as older adults who underwent colonoscopies; (2) I, the intervention, as nursing measures based on the best evidence, which involved management of the nursing staff education's, dietary restrictions for patients during intestinal preparation, management of patients' medications, and exercise management during consumption of medication; (3) P2, the professional, as the stakeholder group, which was the nursing staff of the digestive endoscopy center; (4) O, the outcome, as the expected outcomes, including the required rate of intestinal-preparation cleanliness, dietary restrictions during intestinal preparation, compliance rate for patients' use of medications and exercise during consumption of medications, incidence of adverse reactions, and implementation rate of evaluation indicators, such as the nurses' education about the process of intestinal preparation for older; (4) S, the setting, as the site of the application of the evidence-based research, which was the digestive endoscopy center at a Grade 3A Hospital in Shanxi Province, China; (4) T, type of evidence, as the method of application of the research, which included a practice guide, systematic review, expert-opinion consensus, and evidence summary.

Analysis of promoting factors and obstacles. (1) interviewed the nursing staff in the endoscopic center and older patients undergoing colonoscopy, (2) observed the nurses' daily work, and (3) analyzed the promoting factors and obstacles.

The contents and outline for interviews of nursing staff should include: (1) Do you think strict intestinal preparation is important to the patient?; (2) Will you give the patient a detailed intestinal-preparation education during your work?; (3) What do you think are the reasons why a patient's intestinal preparation would be unqualified?; (4) Does your department hold regular training on intestinal preparation using the latest research and related contents?; and (5) What measures do you take to improve the quality of a patient's intestinal preparation?

The contents and outline of interviews with older patients should include: (1) Do you know what an intestinal preparation is?; (2) Do you think an intestinal preparation is important?; (3) How do you feel when you take the PEG solution for intestinal preparation?; (4) Did you finish all the configured PEG solution?; (5) What's the reason why you didn't finish your PEG solution?; (6) Does your intestinal preparation include strict dietary restrictions? What's the reason why not?; and (7) Do you think any areas of the endoscopic department's instructions need improvement in the process of preparing your intestines?

Results of analysis. After analyzing the interview data, the review team identified the promoting factors and obstacles. The promoting factors included: (1) the support of the department's managers, (2) the department's special intestinal-preparation room, (3) the willingness of the nursing staff of the endoscopic center to participate actively, and (4) the convenient ways and means of information dissemination.

The obstacles included: (1) the lack the training on the latest guidelines for intestinal preparation and evidence knowledge before colonoscopy for the medical staff in the endoscopic center; (2) the lack of a clear understanding of the process of intestinal preparation of the nurses at the central-window reservation area of the endoscopy center, and the fact that the information provided there was relatively general and unclear for the process of educating patients; (3) the nurses were busy with clinical work and had time constraints, and as a result, they prepared the intestinal preparation using methods learned through oral education and paper versions of data sheets, and that form of education was the only type, resulting in a lack of mastery of the contents of instructions for older patients; nurses also don't know patients' degree of mastery of the information; (4) the bodily function of older patients has weakened, often accompanied by a decline in comprehension and memory, resulting in poor compliance with the complicated and tedious process of intestinal preparation, including dietary restrictions, medication methods, and management of adverse reactions; wrong intestinal-preparation methods can affect the quality of a colonoscopy; (5) patients' intestinal preparation occurs mostly at home, and an evaluation of the intestinal-preparation cleanliness of older patients is lacking before a colonoscopy, and the judgment of intestinal cleanliness is mostly informed by the endoscopic center's nurses; older patients with constipation are less sensitive to volumetric stimuli and have no sense of defecation in the process of intestinal preparation, allowing more fecal water to be in the intestine during a colonoscopy, resulting in poor results of colonoscopy.

Literature Search

Search terms and databases. Using the 6S Research Pyramid, an evidence model, the four nursing teachers determined that the search terms: (1) colonoscopy/ endoscopy, bowel preparation/ bowel cleansing/ preparation of intestine cleaning, elderly patients, guideline and expert consensus as the English keywords, and (2) colonoscopy, colonoscopy diagnosis and treatment, intestinal preparation, elderly patients, guidelines, and consensus as the Chinese key words.

The four teachers searched the following databases: (1) BMJ Best Practice, (2) UK National Institute of Health and Clinical Optimization Guide Network of the National Institute for Health and Care Excellence (NICE), (3) Joana Briggs Institute (JBI) evidence-based health care database, (4) Cochrance database, (5) Medical Maitong Guide Network, (6) PubMed, (7) Cumulated Index to Nursing and Allied Health Literature (CINAHL) database, (8) China Knowledge Network, (9) Wanfang Medical Network, (10) Chinese Digestive Endoscope Network, and (11) Digestive Endoscopy Branch website. The team retrieved data from the establishment of the databases to January 1, 2021.

Inclusion and exclusion criteria for the retrieved data. The four teachers included research that: (1) was based on evidence-based guidelines, (2) was expert-opinion consensus, (3) was an evidence summary, (4) was a systematic review, (5) included an evidence quality classification; (6) was in Chinese or English.

The four teachers excluded research that: (1) was from foreign guides translated into Chinese, (2) had incomplete information, or (3) didn't provide access to the full text.

The final analysis of the evidence included 11 articles, including two guides,[11,12] three evidence summaries,[13-15] three expert consensuses,[16-18] and three systematic reviews.[19-21]

Evidence Evaluation

Clinical evidence. The four nursing teachers used: (1) the clinical guidelines research and evaluation system II—Appraisal of Guidelines for Research and Evaluation Instrument II (AGREE II) to evaluate the quality of the guidelines,[22] and (2) evaluation criteria from the Australian Joanna Briggs Institute (JBI) Evidence-based Health Care Center to evaluate the consensus of experts.[23]

The four teachers summarized the evidence, tracing it to the original literature, and evaluated the quality according to the document type of that original literature. who had

Table 1. Evidence Content, Review Indicator, and Examination Method of Evidence-based Nursing Plan for Intestinal Preparation of Older Patients Before Colonoscopy. The endoscopic center's nursing staff performed the tasks.

Project	Content of Evidence	Review Indicator	Examination Mode
1. Patient notification and education	Content 1: • The staff should provide oral and written detailed guidance to patients before intestinal preparation and should emphasize the importance of compliance. • Qualified units can jointly guide patients with intestinal preparation based on telephone calls, text messages, WeChat and other auxiliary methods. • When providing guidance, recommend using the patient's primary language.	• Indicator 1: The staff should explain the importance and methods of intestinal preparation to the patients, or to accompanying family members, who came to make an appointment, describing it in easy-to-understand language as far as possible, and asking them to repeat the content until they fully mastered it • Indicator 2: The staff should distribute color pictures and text brochures to patients. • Indicator 3: The staff should tell the patients to scan the WeChat QR code to view the video of the intestinal preparation process.	On-site observation
2. Dietary restriction	• Content 2: The staff should inform patients to use a low-residue / low-fiber diet one day before the operation, and the dietary restriction was generally for no more than 24 hrs.[11,18]	• Indicator 4: The staff should instruct patients to carry out dietary restrictions and asking them to repeat the content until they fully mastered it.	On-site observation
		• Indicator 5: One day before the examination at 8:00 am, the staff should inform patients about the dietary precautions.	Clerical record
3. Choice and use of method of intestinal cleaning	• Content 3: The fractionated dose scheme of 3L polyethylene glycol (PEG) electrolyte powder can provide high quality intestinal cleaning and is suitable for Chinese population.[11]	• Indicator 6: The staff should instruct patients, or family members, on the configuration and administration of the PEG solution and ask them to repeat the information until they have mastered it.	On-site observation
	• Content 4: The 3L PEG regimen included taking 1L at 8pm in the evening one day before the intestinal examination, and taking 2L 4h to 6h before the examination on the same day.[11] • Content 5: The intestinal preparation for older patients should take a fractionated-dose plan and can included appropriate auxiliary measures.[11,20] • Content 6: The interval between the examination time and the last medication time is 4: 6 hours, and should be at least 2 hours.[15-17,19]	• Indicator 7: At 20:00 pm in the evening the day before colonoscopy, the staff should instruct patients to take 1 L intestinal cleanser, 250 ml every 10: 15 min. • Indicator 8: Patients received instructions to take 2 L of intestinal cleansers at 4-6 hours before the colonoscopy, at 250 ml every 10-15 min.	Clerical record
4. Abdominal Distension or Severe Discomfort and Adverse Reactions	• Content 7: One hour after taking the medicine, the intestinal movement accelerates. If abdominal distension or severe discomfort occurs, patients can walk around properly and gently rub the abdomen to speed up excretion.[11,16]	• Indicator 9: Patients received instructions to walk properly and gently rub their abdomen clockwise to reduce abdominal distension and promote intestinal peristalsis to accelerate excretion. • Indicator 10: The staff should inform patients that adverse reactions could occur, such as nausea, vomiting, and abdominal distension, in the course of taking the medicine and tell patients to take a temporary rest and then take the medicine again and to eat candy to relieve the symptoms.	On-site observation and inquiry
5. Evaluation and remedial measures for unqualified intestinal preparation	• Content 8: The staff should perform an intestinal-cleanliness screening by asking patients about their stool characteristics before the colonoscopy.[18]	• Indicator 11: The staff should inform patients of the method of detecting intestinal cleanliness using stool characteristics.	On-site observation
	• Content 9: If the staff found that a patient's intestinal preparation was unqualified during colonoscopy, they performed active evaluation and remedial measures or rescheduled the patient for an endoscopy.[14]	• Indicator 12: If before a colonoscopy, the staff finds that the last defecation still contained fecal residue or solid feces, the staff should instruct the patient to take one bag of intestinal detergent, postpone the colonoscopy, or have lavage performed under an endoscope using a lavage pump.	Clerical record

systematically studied and taught courses related to evidence-based nursing, independently evaluated the included literature. If the evaluation results were inconsistent, the evidence-based expert group discussed the evidence and decided whether to include it or not.

Determination of indicators. On the basis of the best evidence and after two rounds of stakeholder analysis, all the nursing staff in the endoscopic center and three older patients undergoing a colonoscopy determined the indicators. Basing the evaluation on the framework for prospective, adaptive meta-analysis (FAME) model,[20] the evidence-based expert team discussed and evaluated the evidence from four perspectives: feasibility, suitability, clinical significance, and effectiveness.

Finally, the team included nine types of evidential content, based on the grading standard for evidence quality of Oxford University Center for Evidence-based Medicine 2011. The team also evaluated the reliability of the included evidence according to the research design of the evidence, the rigor of the implementation of the scheme, and the application of statistical methods. The team divided the evidence into projects 1 to 5, transformed it into 12 review indicators, and determined the review mode for each review indicator (Table 1).

Examination Indicators

Project 1: Patient Notification and Education. Two nurses should observe nurses on site to determine if they have complied with the instructions.

Content 1, Indicator 1. The nursing staff should provide detailed, oral and written guidance to patients before intestinal preparation and should emphasize the importance of compliance. Qualified units can jointly guide patients in intestinal preparation by telephone, text message, WeChat, or other auxiliary methods; when providing the guidance, the program recommends use of the patient's primary language.[11-16,20-21]

The endoscopic center's nursing staff explained the importance and methods of intestinal preparation to the patients, or to accompanying family members, who came to make an appointment, and asked them to repeat the content until they fully mastered it, and describe it in easy-to-understand language as much as possible.

Content 1, Indicator 2. The nursing staff should distribute color pictures and text brochures to patients.

Content 1, Indicator 3. The nursing staff should tell patients to scan the WeChat QR code to view a video about the intestinal-preparation process. Guan et al found that using WeChat to guide intestinal preparation can improve the compliance of patients.[29]

Project 2. Dietary Restrictions

Content 2, Indicator 4. The nursing staff should instruct patients to eat a low-residue / low-fiber diet one day before the colonoscopy; the dietary restriction was generally no more than 24 hours.[11,18] The staff should ask patients to repeat the information until they have mastered it. The two nurses should observe nurses on site to determine if they have complied with the instructions.

Content 2, Indicator 5. One day before the colonoscopy at 8:00 am, the nursing staff informed patients about dietary precautions. The two nurses should determine nurses' compliance based on the clerical record.

Project 3. Method of Intestinal Cleaning

Content 3, Indicator 6. The fractionated dose scheme of 3L polyethylene glycol (PEG) electrolyte powder can provide high-quality intestinal cleaning and is suitable for Chinese population.[11] The guidelines of the Professional Committee of Digestive Endoscopy of Chinese Medical Association and the Professional Committee of Oncology of China Anti-Cancer Association. Guidelines indicate that PEG is the preferred intestinal cleaner at home and abroad because of its high safety, and is suitable for older patients [30] However, PEG requires a lot of water in the process of intestinal preparation. If older patients use incorrect methods, they can experience nausea, vomiting, and other adverse reactions because their poor gastrointestinal function. The correct method of taking PEG can reduce the adverse reactions during intestinal preparation.[31]

The intestinal preparation of older patients should use a fractionated dose plan, and the older patient can take appropriate auxiliary measures. [11,20] The nursing staff should instruct patients, or family members, on the configuration and administration of the PEG solution, the 3L PEG regimen. The staff should ask them to repeat the instructions until they have mastered them. The two nurses should observe nurses on site to determine if they have complied with the instructions.

Content 4, 5, and 6; Indicator 7. The nursing staff should tell patients to take 1L of the intestinal cleanser at 8 pm in the evening of the day before the intestinal examination, 250 ml every 10 to 15 min. The two nurses should determine nurses' compliance based on the clerical record.

Content 4, 5, and 6; **Indicator 8.** The nursing staff should tell patients to take 2L on the day of the examination, at 4h-6h before it, 250 ml every 10-15 min.[11] The interval between the examination time and the last medication time should be 4 to 6 hours before the examination, but at least 2 hours prior to it.[15-17,19] The two nurses should determine nurses' compliance based on the clerical record.

Project 4. Abdominal Distension or Severe Discomfort and Adverse Reactions

Content 7, Indicator 9. At one hour after taking the medicine, intestinal movement accelerates. If patients have abdominal distension or severe discomfort, they can walk around properly and gently rub their abdomens to speed up excretion.[11,16]

The nursing staff should instruct patients to walk properly and gently rub their abdomens clockwise to reduce abdominal distension and promote intestinal peristalsis to accelerate excretion. The two nurses confirm the nurses' compliance with the instructions through on-site observation and inquiry.

Content 7, Indicator 10. The nursing staff should inform patients that adverse reactions can occur, such as nausea, vomiting, and abdominal distension, in the course of taking the medicine, and if they do, to take a temporary rest and take the medicine again and take candy to relieve the symptoms. The two nurses should confirm the nurses' compliance with the instructions through on-site observation and inquiry.

Project 5. Evaluation and Remedial Measures for Unqualified Intestinal Preparation

Content 8, Indicator 11. The nursing staff should inform patients about the method of detecting intestinal cleanliness using stool characteristics. Before a colonoscopy, if the last defecation still contains fecal residue or solid feces, the patient should take one bag of intestinal detergent, postpone the colonoscopy, or have lavage under an endoscope through lavage pump. The two nurses should confirm nurses' compliance with the instructions through on-site observation.

Content 9, Indicator 12. The nursing staff should perform an intestinal-cleanliness screening by asking patients' about their stool characteristics before the colonoscopy.[18] If the nurses find that a patient's intestinal preparation is unqualified before the colonoscopy, they should perform an active evaluation and take remedial measures or reschedule the patient for the endoscopy.[14] The two nurses should determine nurses' compliance based on the clerical record.

Actions for Change

Based on the obstacles and the department's situation, and the review the review team formulated corresponding measures to reform the clinical practice.

Strengthen the training for learning of evidence-based knowledge. This goal included guidelines for intestinal preparation before colonoscopy for the nurses in the endoscopy center. Delivery of information by medical staff is the most direct way for patients undergoing colonoscopy to acquire knowledge of intestinal preparation.

At the time of the current study, most nurses in the endoscopy center hadn't learned about the latest evidence about intestinal preparation. A knowledge reserve, such as that of the nursing staff, stays at the level of experience, and at the same time, a lack of communication can occur between doctors and nurses in the intestinal preparation of patients.

As the solution to the obstacle, the practice team carried out training in evidence-based knowledge and provided the latest knowledge of intestinal preparation for the whole department. Doctors with doctoral degrees or above, with three graduate students, gave lectures, including on the incidence of digestive diseases, the interpretation of the latest guidelines for intestinal preparations, consensus, the importance of intestinal preparation, and dietary restrictions. The department scheduled the lectures for Friday afternoon in the first week of each month. After completion of the lectures, the attendees have a discussion to improve the communication and exchange between doctors and nurses.

Establish an intestinal-preparation educational system for older patients before colonoscopy. The department led this goal to formulate a informational plan about intestinal preparation before colonoscopy, which involves the importance of an intestinal preparation, the methods of dietary restriction, the procedures for taking drugs, the handling of common adverse reactions, and the judgment of cleanliness. The department improved the black-and-white paper version of the data sheet on intestinal preparations by providing a color version of the sheet.

In addition to the explanation of process, the sheet provides detailed pictures and text about the edible and avoided foods; drug dispensing methods, using common containers for daily use as examples; medication methods; and self-assessment methods of intestinal cleanliness.

At the same time, the department made an educational video about intestinal preparation, created a circular broadcast of the video in the reservation hall of the Endoscopy Center, and developed WeChat Mini Programs, showing the video during the programs, and shared it with the patients.

In addition to oral notification when patients make an appointment, the education also includes issuing a colorful, intestinal-preparation flow sheet with pictures and texts and telling them in detail that patients are taught to use WeChat Mini Programs. Those programs have a detailed process video of intestinal preparation and an online question and answer module.

During the baseline review phase, the practice team learned that the nurses in the colonoscopy appointment room, due to a busy schedule and time constraints, didn't give a comprehensive oral education to patients. Therefore, the center instructed nurses to combine oral and written education with one-on-one education when giving oral education to patients. As older patients often have a decline in listening comprehension, nurses were to provide information to the patient's accompanying family members. At the end of the instructions, patients, or family members, had to repeat them, and the nurses corrected any problems and improved the knowledge.

In addition, the practice team drew up an implementation list of intestinal-preparation education for nurses, and members of the review team carried out an evaluation and observation of the activities, so as to establish and improve the assessment mechanism and improve the nurses' implementation of the methods.

Increase social support and improve patients' compliance with intestinal preparation. Based on older patients' poor compliance with intestinal preparation before enteroscopy, the nursing staff of the endoscopic center, in addition to detailed education, were to mobilize young family members of the patients to participate in the intestinal preparation, inform family members by telephone and WeChat at the critical time for the intestinal preparation, and guide the older patients to carry out the intestinal preparation.

Specifically, the measures included: (1) at 8:00 am on the day before the colonoscopy,to eat a low-fiber or low-residue diet, giving patients detailed instructions on which foods were edible and which weren't; and (2) the nurses were to instruct the patients to take the medicine at 8 pm on the day before the colonoscopy and at 4 hours before the colonoscopy; told that they might encounter adverse reactions, such as nausea or vomiting, and informed them of the methods of relief, such as massaging the abdomen clockwise, walking, slowing down, or stopping the taking of medicine; and told them continue to take it after the symptoms improved, giving patients encouragement and support.

Establish evaluation mechanism and remedial measures for intestinal preparation before colonoscopy. In the process of intestinal preparation, the nurses were to require the patients to take pictures of their last defecation to show its characteristics. One hour before the patient's colonoscopy, the nursing staff judged whether the intestinal preparation was qualified by checking the color and characteristics of the patient's last excreta. If the intestinal preparation wasn't qualified, the nurses instituted measures such as taking laxatives or delaying the examination. For older patients who had been bedridden for a long time, nurses used measures such as abdominal massage, to help.

METHODS: RESEARCH STUDY

Participants

For the evaluation of the nurses' implementation of the indicators, the research team included and analyzed the data of nurse at the endoscopy center.

For the other outcome measures, the research included and analyzed the data of older patients who underwent a colonoscopy between July and September 2021 and older patients who did so between October and December 2021.

The study included prospective participants if they were: (1) aged 60 and above, (2) using PEG electrolyte powder as the intestinal cleanser, and (3) conscious and able to communicate normally.

The study excluded prospective participants if they had: (1) severe abnormal heart, brain, or kidney function, or (2) had a colectomy.

Procedures

Groups. The data from the group undergoing a colonoscopy between July and September 2021 became the baseline data and that from the group undergoing a colonoscopy between October and December 2021 became the postintervention data.

Outcome Measures

Implementation rate of indicators. The practice team measured the nursing staff's implementation of education for older patients about intestinal preparation before a colonoscopy. By means of conducting on-the-spot observations, consulting relevant data, and interviewing patients, the head and deputy head of the review team determined the implementation rate of the 12 indicators by the nurses who were available in the appointment window of the endoscopy center, finding whether it met the standard.

Guiding patients as required and providing comprehensive content met the standard; otherwise the performance wasn't up to the standard. Execution rate (%) = the number of items that meet the standard / the total number of instances × 100%. The higher the number of items that meet the standard, the better the execution rate.

Qualified rate of intestinal-preparation cleanliness. The practice team used the Boston Bowel Preparation Scale (BBPS) to score the participants' intestinal cleanliness.[24] The scale scores the intestinal cleanliness, where 0 = a large amount of solid feces in the intestinal cavity and inability to see the intestinal mucosa; 1 = residual feces or opaque liquid in the intestinal cavity, with part of the intestinal mucosa being seen clearly; 2 = a small amount of feces or opaque liquid in the intestinal cavity; and 3 = no feces or opaque liquid in the intestinal lumen, with the intestinal mucosa being seen clearly.

The intragroup correlation coefficient of the scale is 0.891, and its reliability and validity are good.[25] The endoscopic physician scored the patient's right colon, transverse colon, and left colon during the colonoscopy. The total score was the sum of the three intestinal segments, which could range from 0 to 9. A total score of ≥ 6 indicated that the intestinal preparation was qualified, and a total score of <6 or a score for any segment of the colon of < 2 was regarded as unqualified for intestinal preparation.[26]

Qualified rate of intestinal preparation cleanliness in elderly patients = number of patients qualified for colonoscopy / total number of patients undergoing colonoscopy × 100%.

Patients' compliance rate with diet, medication and exercise during intestinal preparation. The practice team evaluated patients' compliance with instructions about diet, medication, and exercise in the intestinal preparation using a self-made questionnaire. At the end of the colonoscopy, the nursing staff collected the questionnaire and recorded the compliance rates. When a patient had one of the following behaviors, the practice team considered the intestinal preparation to be noncompliant: (1) during the intestinal preparation, the patient didn't observe the dietary requirements, or (2) the walking time during each dose of medication was <30min, and the dosage was less than 80% of the total dose.[27]

Compliance rate % = number of cases of complete compliance with intestinal preparation of patients undergoing colonoscopy / total number of patients undergoing colonoscopy × 100.

Incidence of adverse reactions. The nursing staff of the endoscopy center collected questionnaires from patients before the colonoscopy, while the patients were in the process of intestinal preparation. Adverse reactions occurred when patients had one of the following symptoms: nausea, vomiting, abdominal pain, abdominal distension, dizziness, and headache.

Incidence of adverse reactions % = number of patients with adverse reactions during intestinal preparation / total number of patients undergoing intestinal preparation × 100%.

Statistical Analysis

The research team use SPSS21.0 software to analyze the results. The team: (1) expressed measurement data as means ± standard deviations (SDs) and compared the groups using the *t* test, and (2) expressed counting data as frequencies (N) and percentages (%) and compared the groups using the chi-squared test (χ^2). $P < .05$ indicates statistical significance.

RESULTS

Participants

For the implementation of education for older patients about intestinal preparation, the research team included and analyzed the data of 11 nurses, including two deputy chief nurses (18.1%), six supervisors (54.5%), and three nurses (27.2%). For education, eight had a bachelor's degree (72.7%) and three a college degree (27.3%).

For the other outcome measures, the research team included and analyzed the data of 120 participants in the endoscopy center. Their ages ranged from 29 to 51 years, with a mean of 32 ± 7.4 years, and their working years ranged from 5 to 33 years, with a mean of 7.2 ± 8.5 years (data not shown).

The baseline group included 60 older patients, aged 60 to 78 years, and the postintervention group included 60 older patients, aged 60 to 75, with a mean of 61.13 ± 4.92years (data not shown). No significant differences existed between the groups in age, gender, BMI, education, defecation habits, smoking, drinking history, disease history, or other factors affecting intestinal preparation.

Implementation of Examination

Before implementation of the evidence-based practice, the baseline review found four indicators with less than a 50% implementation rate for patient guidance by nursing staff in the endoscopic center. The review indicators were 1, 9, 10, and 12. Indicators with an implementation rate of more

Table 2. Comparison of the Implementation Rate of Education for Intestinal Preparation Among Nurses in the Endoscopic Center for the Baseline and Intervention Groups

Review Indicator	Baseline, n = 60			Postintervention, n = 60			χ^2/t	*P* value
	Executed n (%)	Not Executed n (%)	Execution Rate n (%)	Executed n (%)	Not Executed n (%)	Execution Rate n (%)		
1	3 (5.00)	57 (95.00)	3 (5.0)	60 (100.00)	0 (0.00)	60 (100.00)	---	.000[a]
9	14 (23.33)	46 (76.67)	14 (23.3)	54 (90.00)	6 (10.00)	54 (90.00)	54.299	<.001[a]
10	11 (18.33)	49 (81.67)	11 (18.3)	53 (88.33)	7 (11.67)	53 (88.33)	59.063	<.001[a]
12	12 (20.00)	48 (80.00)	12 (20.0)	57 (95.00)	3 (5.00)	57 (95.00)	69.084	<[a].001[a]

[a]$P < .05$, indicating that the nurses' implementation of the four indicators had increased significantly between baseline and postinterventon

Table 3. Comparison of Qualified Rate and BBPS Scores for Intestinal Preparation Between the Baseline and Intervention Groups

Group	n	Qualified Rate n (%)	BBPS Score Mean ± SD
Pre-intervention group	60	35 (58.3)	4.2 ± 0.277
Post-intervention group	60	48 (80.0)	6.8 ± 1.70
χ^2/t		6.604	-11.645
P value		.010[a]	.000[a]

[a]$P < .05$, indicating that the postintervention group's qualified rate and BBPS scores were significantly higher than those of the baseline group

Abbreviations: BBPS, Boston Bowel Preparation Scale.

Table 4. Comparison of Participants' Compliance With Diet, Medication, and Exercise Between the Baseline and Intervention Groups

Group	n	Intestinal Preparation Compliance		
		Diet n (%)	Medicine n (%)	Exercise n (%)
Pre-intervention group	60	38 (63.3)	48 (80.0)	32 (53.3)
Post-intervention group	60	58 (96.7)	58 (96.7)	56 (93.3)
χ^2/t		20.833	8.086	24.545
P value		<.001[a]	<.001[a]	<.001[a]

[a]$P < .05$, indicating that postintervention group's compliance with diet, medication, and exercise were significantly higher that those of the baseline group

Table 5. Comparison of Participants' Adverse Reactions to Intestinal Preparation Between the Baseline and Postintervention Groups

Groups	n	Adverse Reaction					
		Nausea	Vomiting	Abdominal Pain	Abdominal Distension	Dizziness	Headache
Baseline	60	25 (41.7)	33 (55.0)	11 (18.3)	36 (60.0)	5 (8.3)	7 (11.7)
Postintervention	60	12 (20.0)	13 (21.7)	2 (3.3)	22 (36.7)	2 (3.3)	2 (3.3)
χ^2 Value		6.604	14.101	2.596	1.541	1.365	3.003
P value		.010[a]	<.001[a]	.107	.011[a]	.243	.083

[a]$P < .05$, indicating that postintervention group's incidence of nausea, vomiting, and abdominal distension were significantly lower than those of the baseline group

than 50% were 2, 3, 4, 4, 5, 6, 7, 8, and 11 (data not shown). The study focused on items with an implementation rate of less than 50%.

Table 2 shows that the implementation rate of the indicators postintervention had increased significantly from baseline: 1 ($P = .000$), 9 ($P < .001$), 10 ($P < .001$), and 12 ($P < .001$) .

Qualified Rate

Table 3 shows that the postintervention group's qualified rate of intestinal cleanliness was significantly higher, at 48 participants (80.0%), than that of the baseline group, at 35 participants (58.3%), with $P = .010$. The postintervention group's mean BBPS score was also significantly higher, at 6.8 ± 1.70, than that of the baseline group, at 4.2 ± 0.277 ($P = .000$).

Compliance With Diet, Medication, and Exercise

The postintervention group's compliance rates with diet, medication, and exercise were significantly higher, at 58 participants (96.7%), 58 participants (96.7%), and 56 participants (93.3%), respectively, than those of the baseline group, at 38 participants (63.3%), 48 participants (80.0%), and 32 participants (53.3%), respectively, with all $P < .001$.

Adverse Reactions

Table 5 shows that the postintervention group's incidence of nausea during intestinal preparation was significantly lower, at 12 participants (20.0%), than that of the baseline group, at 25 participants (41.7%), with $P = .010$. The postintervention group's incidence of vomiting was also

significantly lower, at 13 participants (21.7%), than that of the baseline group, at 33 participants (55.0%), with $P < .001$. In addition, the postintervention group's incidence of abdominal distension was significantly lower, at 22 participants (36.7%), than that of the baseline group, at 36 participants (60.0%), with $P = .011$. No significant difference exists between the groups in the symptoms of abdominal pain, dizziness, or headache.

DISCUSSION

The implementation of an evidence-based program can improve the implementation rate of intestinal-preparation education for patients by nursing staff in an endoscopic center.

As Johnson et al's study also found,[28] the current study found that adequate education can have an independent effect on intestinal cleanliness. Before the implementation of new procedures based on the evidence obtained, the education of nurses in the endoscopic center was limited to general and broad information, such as drug use and colonoscopy-examination time, and most older patients had deviations from and errors in their understanding of the information. The strengthening of the training of nursing staff in the department and establishment of a corresponding assessment mechanism, the nursing staff strengthened and standardized their informational and educational behavior.

After the implementation of the new procedures, nurses were able to explain to patients the importance and methods of intestinal preparation, inform patients how to deal with adverse reactions during intestinal preparation, and take positive measures to take remedial measures for older patients with unqualified intestinal preparation, which increased the correct rate of intestinal preparation and improved the quality of intestinal preparation. The implementation of an evidence-based program can improve the compliance rate and qualified rate of intestinal preparation in older patients before a colonoscopy.

On the basis of evidence-based nursing methodology, the current study worked out a nursing plan for intestinal preparation that gave patients' special guidance at critical times during intestinal preparation by strengthening the education and execution of nurses. The nurses encouraged patients' families to participate in the process of intestinal preparation of older patients and gave them corresponding encouragement and support.

In the current study, WeChat Mini Programs, with the help of video, online questions, color pamphlets. and other informational methods, the endoscopy center was able to guide patients with intestinal preparation and to deepen patients' understanding of intestinal preparation. After the implementation of the new procedures, the qualified rate of intestinal-preparation cleanliness in the postintervention group was significantly higher than that of the baseline group ($P < .05$), and compliance also improved.

Also, the implementation of an evidence-based program can reduce the adverse reactions from intestinal preparation for older patients before colonoscopy. Under the detailed guidance of the nursing staff, the older patients took the PEG solution strictly in accordance with the recommendations of the guidelines and cooperated with walking and abdominal massage, better relieving nausea, abdominal distension, and other uncomfortable symptoms.

The implementation of the new procedures significantly reduced adverse reactions, such as nausea, vomiting, and abdominal distension in the process of intestinal preparation ($P < .05$). However, the implementation of the new program didn't alleviate discomfort symptoms, such as abdominal pain, dizziness, and headache, which may have been due to a strong subjective consciousness of abdominal pain, dizziness, headache, and other symptoms, because individual differences in perception exist.

The current study had some limitations. The use of a small sample and a nonsimultaneous control design inevitably affected the results due to the individual heterogeneity of the participants. At the same time, older patients are often sensitive about providing details about their experiences, so limitations existed in access to information. The current research team suggests that researchers should perform a controlled study with a large sample to explore the effectiveness of an evidence-based scheme in the future.

CONCLUSIONS

The best evidence for methods of intestinal preparation effectively reduced the adverse reactions of older patients and improved their compliance and the cleanliness of the intestinal preparation. The management of intestinal preparation using an evidence-based nursing practice can effectively standardize the process of intestinal preparation before colonoscopies and improve the cleanliness of and patients' compliance with intestinal preparation.

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