REVIEW

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Korean clinical practice guidelines for bowel preparation before colonoscopy

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Appropriate bowel cleansing is essential for successful and safe colonoscopy. Inadequate bowel cleansing can lead to poor visualization of the delicate mucosa, leading to missed precancerous lesions, increased risk of procedure-related complications, and increased medical costs due to re-examination. Several types of bowel cleansing agents that improve ease of administration have been developed in recent years, and the clinical outcomes have been published. Bowel cleansing efficiency can differ between races due to differences in socio-environmental factors, including dietary patterns. This paper is the first Korean clinical guideline for bowel preparation for colonoscopy, formulated by the Korean Society of Gastrointestinal Endoscopy. These guidelines were developed using adaptation methods and the findings of studies on Korean patients; recently published studies were considered to the extent possible. These guidelines will be revised as and when new data regarding bowel preparation are accumulated.

Keywords: Cathartics; Colonoscopy; Patient safety; Practice guidelines as topic

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INTRODUCTION

Colonoscopy is the most important modality for early detection and prevention of colorectal cancer (CRC), and adequate bowel preparation is essential for a successful and safe procedure. High-quality bowel preparation allows optimal visualization of the colonic mucosa, thereby facilitating the detection of adenomas and precancerous lesions. In contrast, inadequate bowel preparation limits mucosal inspection, resulting in diminished adenoma and early cancer detection rates, increased risk of procedure-related complications, and unnecessary repeat examinations with associated increases in healthcare costs.[1-6] Prolonged procedure time due to poor bowel preparation also increases patient discomfort and may ultimately reduce patient adher-

ence to CRC screening programs.[3,7-10]

In recent years, new bowel preparation agents, including low-volume formulations and preparations containing adjunctive components, have been developed to improve patient tolerability and convenience, and numerous studies have evaluated their efficacy and safety. In the United States and Europe, clinical practice guidelines have been updated in accordance with this emerging evidence.[11-14] However, direct application of these guidelines to clinical practice in Korea is limited by differences in dietary patterns, demographic characteristics, medication availability, and healthcare insurance systems. Korean populations differ from Western ones in rice-based dietary habits, body mass index distribution, prevalence of comorbidities such as advanced age, diabetes mellitus, and chronic kidney disease, and adherence to pre-procedure dietary restrictions. In addition, the regulatory approval status and insurance coverage of certain bowel preparation agents differ in Korea.

Several studies have generated accumulating evidence regarding the efficacy and safety of bowel preparation regimens in Korea; however, a comprehensive clinical practice guideline integrating this evidence is yet to be established. Therefore, this guideline was developed to provide evidence-based recommendations that reflect both the latest scientific evidence and the realities of clinical practice in Korea, to improve the quality and safety of colonoscopy.

The objective of this clinical practice guideline is to provide evidence-based recommendations that are applicable in routine clinical practice with the aim to minimize missing clinically significant lesions, procedural delays, and unnecessary use of healthcare resources, while improving the diagnostic accuracy of colonoscopy and patient safety. In addition, this guideline provides standardized bowel preparation strategies that reflect the clinical environment and demographic characteristics of the Korean population.

This guideline was developed for clinicians performing colonoscopy in primary, secondary, and tertiary healthcare settings in Korea. It may also serve as a useful reference for nurses and endoscopy assistants involved in bowel preparation, as well as for healthcare professionals in training, including medical students and residents. In addition, this guideline is intended to provide balanced and appropriate information for patients and healthcare policymakers, thereby improving their understanding of bowel preparation processes and decision making. The target population includes adult patients scheduled to undergo colonoscopy, encompassing special clinical situations such as older adults, patients with chronic constipation, and those with inflammatory bowel disease (IBD). Pediatric patients are excluded from the scope of this guideline. The scope of this guideline covers clinical decision-making related to bowel preparation in the pre-colonoscopy period, including dietary restriction, patient education, use of adjunctive medications, dosing regimens and selection of bowel preparation agents, and considerations for special patient populations.

This guideline was developed based on the best available evidence; however, several limitations should be acknowledged. Few randomized controlled trials (RCTs) have been conducted in Korea, and evidence for certain special populations, such as older adults and patients with chronic kidney disease, is insufficient. Consequently, some recommendations are presented as conditional or based on expert consensus rather than high-certainty evidence. Uniform application of the recommendations may be constrained by factors such as the cost and availability of bowel preparation agents, differences in insurance coverage, and variability in patient education and adherence. Therefore, individual patient characteristics, comorbidities, and preferences should remain paramount in clinical decision-making. Furthermore, although the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) framework was applied to assess the certainty of evidence and guide the strength of recommendations, Summary of Findings (SoF) tables were not presented for each key question. This may limit transparency regarding the synthesis of evidence and the rationale for the assigned recommendation strength. Future large-scale multicenter studies and real-world clinical data in Korea will be important to strengthen the evidence base and inform future updates of this guideline.

Patient preferences regarding bowel preparation—including the method of administration, type of educational materials, and degree of dietary restriction—have a direct impact on adherence and overall preparation quality. Although a formal patient survey was not conducted during the development of this guideline, patient values and preferences were indirectly considered through a comprehensive review of relevant domestic and international literature. This review addressed factors such as convenience of medication intake, acceptability of dietary restrictions, and willingness to undergo repeat colonoscopy in cases of inadequate bowel preparation. Recognizing that these factors substantially influence patient adherence and clinical outcomes, they were incorporated into the formulation of the recommendations. Future studies, including empirical research

and structured surveys targeting Korean patients, are warranted to better characterize patient-centered preferences, develop tailored educational materials, and evaluate real-world applicability and acceptability of this guideline.

METHODS

Guideline development group

The guideline development group consisted of a Steering Committee and a Working Committee. The Steering Committee oversaw the entire guideline development process, including defining the scope and objectives of the guideline, establishing the development plan and timeline, organizing committee membership, and managing conflicts of interest.

The Working Committee was responsible for core development activities, including selecting key clinical questions based on clinical relevance and unmet needs in routine practice, conducting systematic literature searches, synthesizing and summarizing the evidence, assessing the certainty and strength of the evidence, and drafting the initial recommendations. To ensure methodological rigor and consistency throughout the development process, a methodology expert participated in evidence appraisal, determination of recommendation strength, and all major stages of guideline development.

Guideline development process

This guideline was developed under the leadership of the Guideline Committee of the Korean Society of Gastrointestinal Endoscopy, with eight gastroenterology experts and one guideline methodology expert. The development process comprised three phases: planning, development, and review and dissemination. The recommendations were formulated through seven sequential steps: (1) selection of key clinical questions; (2) literature search and study selection; (3) evidence appraisal and summarization; (4) evidence synthesis; (5) determination of evidence certainty and recommendation strength; (6) drafting of recommendation statements; and (7) consensus building.

This clinical practice guideline was developed based on an adaptation of previously published international guidelines, with further analysis of domestic and international studies published after the release of the selected guidelines. The international guidelines were qualitatively appraised using the Korean Appraisal of Guidelines for Research and Evaluation II (K-AGREE) II instrument and were used as reference materials after careful comparison with the domestic clinical context. The recommendations were subsequently revised and supplemented by integrating recent domestic literature and international evidence. Key clinical questions were initially generated through a review of existing international guidelines and issues frequently encountered in routine clinical practice. These candidate questions were then refined and finalized through discussions within the Steering Committee and the Working Committee, resulting in a total of 15 key questions.

Systematic literature searches were conducted in major databases, including PubMed, Embase, the Cochrane Library, and KoreaMed, with the search period from January 1, 2018, to November 26, 2024. This time frame was chosen to avoid duplication of evidence already incorporated into previous international guidelines published before 2018 and to focus on recent evidence regarding low-volume bowel preparations and novel dosing regimens. Searches were limited to studies published in English or Korean languages. Database-specific search strategies were developed by combining free-text terms and controlled vocabulary (MeSH or Emtree) related to bowel preparation (such as bowel preparation, bowel cleansing, colonoscopy preparation), combined with Boolean operators (AND, OR) (Supplementary Table 1).

Study selection was conducted in accordance with the principles of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement. After removal of duplicate records, two reviewers independently performed an initial screening based on titles and abstracts. Full-text articles were then assessed to determine eligibility. Discrepancies between reviewers were resolved through discussion; a third reviewer adjudicated when consensus could not be reached. All stages of the search, screening, and selection processes were systematically documented.

Eligible studies included systematic reviews, RCTs, and prospective observational studies. Case reports, narrative reviews, editorials, and conference abstracts were excluded. International clinical practice guidelines were appraised using the K-AGREE II instrument and were used as reference materials to evaluate differences between international recommendations and the Korean clinical context. Recommendations were developed via an integrated analysis of domestic evidence and the most up-to-date international literature.

The certainty of evidence was rated as high, moderate, low, or very low based on a comprehensive assessment of study design, methodological quality, consistency, and magnitude and direction of effects, following consensus among committee mem-

bers; the definitions are provided in Table 1. Recommendation strength was determined according to the GRADE methodology, taking into account the certainty of evidence, balance of benefits and harms, resource use and costs, and patient values and preferences. Recommendations were classified into five categories, with definitions summarized in Table 2.

Consensus development and review process

The guideline development committee formulated draft recommendations through a series of online and in-person meetings and finalized a total of 15 recommendations through iterative review and consensus-building processes. Subsequently, 18 specialists in the field of gastrointestinal endoscopy were consulted to obtain feedback on the clarity of recommendation statements, the appropriateness of recommendation strength, and the suitability of target populations.

During the expert consultation process, both quantitative consensus on each recommendation and qualitative narrative comments were obtained. The experts provided suggestions regarding refining the wording, adjusting recommendation strength, further specifying the target population, and clarifying safety-related considerations for selected key questions. The guideline development committee carefully reviewed all feedback and revised the recommendation statements and accompanying explanatory text accordingly. Details of the expert consultation and feedback incorporation are presented in Supplementary Table 2.

The final recommendations were formally approved by the executive board of the Korean Society of Gastrointestinal Endoscopy.

Table 1. Levels of evidence and definitions

Level of evidence	Definition
High	The estimated effect is considered to be close to the true effect.
Moderate	The estimated effect is probably close to the true effect; however, it could be substantially different.
Low	Limited confidence in the estimated effect; the true effect may be substantially different from the estimate.
Very low	Very limited confidence in the estimated effect; the true effect is possibly substantially different from the estimate.

Table 2. Strength of recommendation and definitions

Strength of recommendation	Definition
Strong recommendation	After considering the balance between benefits and harm, certainty of evidence, values and preferences, and resource use, the intervention is recommended in most clinical situations, as the benefits clearly outweigh the harm.
Conditional recommendation	The intervention is suggested in certain clinical situations, as the balance between benefits and harm may vary depending on clinical circumstances or patient or societal values.
Conditional recommendation against	Routine use of the intervention is not recommended, as the potential harm may outweigh the benefits in certain clinical situations or under specific conditions.
Strong recommendation against	The intervention is not recommended in most clinical situations, as the harm clearly outweigh the benefits.
Inconclusive	The certainty of evidence is insufficient, or the balance between benefits and harm is highly uncertain or variable; therefore, no recommendation for or against the intervention can be made, and clinical judgment should guide decision-making.

Updating plan and conflicts of interest

This guideline is scheduled to be updated every 5 years. Earlier updates will be considered if clinically meaningful new evidence, such as RCTs, systematic reviews, or meta-analyses, becomes available.

All members of the guideline development committee and reviewers declare no financial or academic conflicts of interest related to this guideline. Although this guideline was financially supported by the Korean Society of Gastrointestinal Endoscopy, the recommendations were developed and formulated independently.

RECOMMENDATIONS AND EVIDENCE SUMMARY

To achieve high-quality bowel preparation, various strategies have been investigated and applied in clinical practice, including dietary modification, interventions to improve medication adherence, use of adjunctive agents, dosing regimens, and selection of bowel preparation agents.

Based on the available evidence, these recommendations are organized into five domains: (1) pre-preparation measures before bowel preparation, (2) adjunctive medications, (3) dosing regimens of bowel preparation agents, (4) selection of specific bowel preparation agents, and (5) selection of bowel preparation strategies according to special patient populations.

The summary of recommendations for bowel preparation before colonoscopy is presented in Table 3.

Table 3. Summary of recommendations for bowel preparation before colonoscopy

Domain	KQ and recommendation	Direction	Strength of recommendation	Certainty of evidence
Pre-preparation before bowel cleansing	KQ1. In patients scheduled for colonoscopy, does a low-residue diet on the day before the procedure improve bowel cleansing efficacy and safety compared to a regular diet or any other dietary restrictions?			
	Recommendation 1. We recommend a low-residue diet on the day before colonoscopy.	For	Strong	Moderate
	KQ2. In patients scheduled for colonoscopy, do enhanced educational tools (such as visual materials, smartphone applications, social media platforms, telephone or text-message reminders) improve bowel preparation quality and patient adherence compared to conventional verbal or printed instructions?			
	Recommendation 2. We recommend providing instructions regarding bowel preparation using various enhanced educational tools before colonoscopy.	For	Strong	Moderate
Adjunctive agents	KQ3. In patients scheduled for colonoscopy, does adding simethicone during bowel preparation improve bowel cleansing quality, endoscopic visibility, adenoma detection rate, patient discomfort, or adverse events compared to bowel preparation without simethicone?			
	Recommendation 3. We recommend adding oral simethicone during bowel preparation.	For	Strong	Moderate
	KQ4. In patients scheduled for colonoscopy, does the addition of prokinetic agents during bowel preparation improve bowel cleansing quality, adenoma detection rate, patient discomfort, or adverse events compared to bowel preparation without prokinetics?			
	Recommendation 4. We do not recommend the routine use of prokinetic agents during bowel preparation.	Against	Conditional against	Low
Timing and method of bowel preparation	KQ5. In patients scheduled for colonoscopy, does split-dose bowel preparation improve bowel cleansing quality and adenoma detection rate compared to non-split dosing?			
	Recommendation 5. We recommend split-dose bowel preparation for colonoscopy.	For	Strong	High
	KQ6. In patients scheduled for an afternoon colonoscopy, does same-day bowel preparation improve bowel cleansing quality and adenoma detection rate compared to split-dose preparation?			
	Recommendation 6. For afternoon colonoscopy, we recommend same-day bowel preparation as an alternative to split-dose preparation.	For	Strong	High
	KQ7. In patients scheduled for colonoscopy, are bowel cleansing quality and procedure-related complications affected by the interval between the last dose of bowel preparation and colonoscopy?			
	Recommendation 7. To optimize bowel cleansing and minimize procedure-related complications, colonoscopy should be performed at least 2 h and within 5 h after completing the last dose of bowel preparation.	For	Strong	Moderate
Choice of bowel preparation agents	KQ8. In patients scheduled for colonoscopy, do different bowel preparation agents (such as high-volume PEG, low-volume PEG plus ascorbic acid, SPMC, OSS, OST) differ in bowel cleansing efficacy and safety compared to conventional PEG-only regimens?			
	Recommendation 8. For bowel preparation before colonoscopy, we recommend the use of high-volume PEG (e.g., 4 L), low-volume PEG-based regimens (e.g., 2 L or 1 L PEG plus ascorbic acid), and non-PEG agents (such as SPMC, OSS, OST). In patients at high risk of electrolyte imbalance, the choice of bowel preparation agent should be individualized based on clinical status.	For	Strong (PEG)/ Conditional (non-PEG)	Moderate

(Continued on the next page)

Table 3. Continued

Domain	KQ and recommendation	Direction	Strength of recommendation	Certainty of evidence
	KQ9. In patients scheduled for colonoscopy, does OSP differ from PEG-based regimens in bowel cleansing efficacy and safety?			
	Recommendation 9. We recommend against the use of OSP for bowel preparation before colonoscopy.	Against	Strong against	Low
Bowel preparation in special populations	KQ10. In patients with chronic constipation, does any specific bowel preparation strategy improve bowel cleansing efficacy and safety compared to PEG alone?			
	Recommendation 10. Based on current evidence, we do not recommend any specific bowel preparation strategy over PEG alone in patients with chronic constipation.	Against	Conditional against	Low
	KQ11. In patients with IBD, does PEG-based bowel preparation differ from non-PEG agents in bowel cleansing efficacy and safety?			
	Recommendation 11. We recommend PEG-based bowel preparation for patients with IBD. However, in patients with quiescent or asymptomatic disease, non-PEG agents may be considered based on patient adherence and convenience.	For	Strong (PEG)/ Conditional (non-PEG)	Moderate
	KQ12. In pregnant or breastfeeding women undergoing colonoscopy, do specific bowel preparation methods differ in efficacy and safety compared to PEG-based regimens?			
	Recommendation 12. There is insufficient evidence to recommend a safe and effective bowel preparation method for colonoscopy during pregnancy or breastfeeding.	—	Inconclusive	Very low
	KQ13. In older patients, does PEG-based bowel preparation differ from non-PEG agents in bowel cleansing efficacy and safety?			
	Recommendation 13. In older patients undergoing colonoscopy, PEG-based bowel preparation should be preferentially considered. However, in clinically stable older patients, low-volume hyperosmotic agents (e.g., OSS) may be used based on patient condition and adherence, as some studies have shown comparable efficacy and safety.	For	Strong	Moderate
Management of inadequate bowel preparation	KQ14. In patients with inadequate bowel preparation, does same-day or next-day additional bowel preparation improve bowel cleansing quality and adenoma detection compared to delayed repeat colonoscopy?			
	Recommendation 14. In patients with inadequate bowel preparation, we recommend repeat colonoscopy following same-day or next-day additional bowel preparation. The re-preparation strategy should be individualized based on the cause of failure, patient adherence, and comorbidities.	For	Conditional	Low
	KQ15. In patients with inadequate bowel preparation, does repeat colonoscopy within 1 year improve adenoma detection rate compared to repeat colonoscopy after 1 year?			
	Recommendation 15. In patients with inadequate bowel preparation, we recommend repeat colonoscopy within 1 year.	For	Strong	Moderate

KQ, key question; PEG, polyethylene glycol; SPMC, sodium picosulfate–magnesium citrate; OSS, oral sulfate solution; OST, oral sulfate tablet; OSP, oral sodium phosphate; IBD, inflammatory bowel disease.
Inadequate bowel preparation was defined using validated bowel cleansing scales reported in the included studies. When the Boston bowel preparation scale (BBPS) was used, inadequate preparation was defined as a score <2 in any colonic segment or a total BBPS score <6.

Pre-preparation before bowel cleansing

Key question 1. In patients scheduled for colonoscopy, does a low-residue diet on the day before the procedure improve bowel cleansing efficacy and safety compared to a regular diet or other dietary restriction strategies?

Recommendation 1. We recommend a low-residue diet on the day before colonoscopy (strength of recommendation: strong; certainty of evidence: moderate).

A recent meta-analysis including 20 RCTs with a total of 4,323 participants compared a low-residue diet (LRD) with a clear-liquid diet (CLD) for dietary restriction before colonoscopy. No significant differences were found between the two groups in the proportion of patients achieving adequate bowel preparation (odds ratio [OR], 0.96; 95% confidence interval [CI], 0.72–1.29; p=0.79) or in adenoma detection rate (ADR) (OR, 1.03; 95% CI, 0.86–1.23; p=0.78). Patients in the LRD group experienced significantly fewer adverse symptoms, including nausea, vomiting, hunger, and headache, found the diet easier to comply with, and were more willing to repeat the same dietary regimen.[15] Similar findings have been reported in subsequent studies. In an RCT involving 195 patients, those assigned to a 1-day LRD before colonoscopy had a higher rate of adequate bowel preparation than those assigned to a 1-day CLD, with less hunger, nausea, and abdominal bloating, and higher overall satisfaction with bowel preparation. A study of 136 Brazilian patients using sodium picosulfate/magnesium citrate (SPMC) for bowel preparation reported comparable results.[16,17]

Several RCTs have evaluated the optimal duration of an LRD before colonoscopy with consistent findings.[18-22] A Spanish RCT including 390 patients found no significant difference between a 1-day and a 3-day LRD with respect to adequate bowel preparation rate (intention-to-treat [ITT]: 82.7% for 1 day vs. 85.6% for 3 days; OR, 1.2; 95% CI, 0.72–2.15; per-protocol [PP]: 85.0% vs. 88.6%; OR, 1.4; 95% CI, 0.88–2.52). No differences were noted in patient satisfaction regarding bowel preparation, LRD, or ADR.[18] Similarly, a Portuguese RCT involving 412 patients demonstrated no significant difference in adequate bowel preparation between 3-day and 1-day LRD regimens (ITT: 91.7% vs. 94.7%; OR, 0.5; 95% CI, 0.23–1.11; PP: 93.5% vs. 96.5%; OR, 0.52; 95% CI, 0.20–1.32); however, adherence to the LRD was significantly poorer in the 3-day group.[22] In a Chinese RCT including 321 patients, bowel cleanliness, assessed using the Boston bowel preparation scale (BBPS), did not differ significantly between 1-day and 2-day LRD groups (6.48±1.59 vs. 6.42±1.06, p=0.69), while adherence to the prescribed diet and willingness to repeat the same regimen were significantly higher in the 1-day group.[19] Another Spanish RCT with 836 patients demonstrated that a 1-day LRD was non-inferior to a 3-day regimen in terms of bowel preparation quality and was easier for participants to comply with.[20] Although data from Korean populations are lacking, the available evidence suggests that a 1-day LRD before colonoscopy is sufficient to achieve adequate bowel preparation.[23]

More recently, a study using a low-volume polyethylene glycol (PEG)-based regimen reported that allowing an unrestricted diet did not result in inferior bowel preparation quality compared to 1-day LRD; however, additional evidence is required before this approach can be routinely recommended.[24]

A summary of the evidence supporting this recommendation is presented in Supplementary Table 3.

Key question 2. In patients scheduled for colonoscopy, do enhanced educational tools (such as visual materials, smartphone applications, social media platforms, telephone or text-message reminders) improve bowel preparation quality and patient adherence compared to conventional verbal or printed instructions?

Recommendation 2. We recommend using various enhanced educational tools to provide instructions regarding bowel preparation before colonoscopy (strength of recommendation: strong; certainty of evidence: moderate)

Appropriate dietary restriction before administration of bowel preparation agents is an important for achieving adequate bowel cleansing before colonoscopy.[25] Accordingly, most endoscopy units instruct patients to avoid foods that may adversely affect bowel preparation in the days preceding the procedure, although patient adherence remains a major limitation in real-world practice. Outside the controlled setting of RCTs, adherence rate is reportedly approximately 30%–40%, with particularly low compliance observed in studies conducted in Korea.[25-27] In addition, the effectiveness of patient education regarding dietary restriction and bowel preparation regimens tends to diminish over time.[28,29]

With advances in information technology, educational strate-

gies to improve patient adherence have diversified. Traditionally, patient education regarding bowel preparation relied primarily on passive methods, such as written instructions provided by hospitals. More recently, however, the widespread use of personal communication devices, including smartphones, has enabled education via videos, text messages, and digital content without the need for in-person hospital visits. A meta-analysis of eight RCTs including 3,795 patients demonstrated that patients who were educated on enhanced pre-procedure bowel preparation achieved significantly better bowel preparation quality than those who received standard education (OR, 2.35; 95% CI, 1.65–3.35; $p<0.001$).[30] Although no significant difference in polyp detection rate (PDR) was observed, the enhanced education group showed a higher cecal intubation rate (97.0% vs. 92.4%; OR, 2.77; 95% CI, 1.73–4.42; $p<0.001$) and a greater willingness to undergo repeat colonoscopy (90.5% vs. 83.1%; OR, 1.91; 95% CI, 1.20–3.04; $p=0.006$). Another meta-analysis of nine RCTs including 3,836 patients evaluated the effect of telephone-based education and found that patients receiving telephone education were more likely to achieve adequate bowel preparation (relative risk [RR], 1.17; 95% CI, 1.05–1.30; $p<0.01$). While no significant difference was observed in ADR (RR, 1.37; 95% CI, 0.97–1.94; $p=0.08$), PDR was significantly higher in the telephone education group (RR, 1.58; 95% CI, 1.23–2.04; $p<0.01$).[31] Notably, subgroup analysis showed that telephone-based education within 1 week prior to colonoscopy was associated with significant improvements in bowel preparation quality compared to control groups, whereas education provided more than 1 week before the procedure yielded no significant difference, indicating that the its effectiveness diminishes over time.

Enhanced educational interventions include visual materials, social media applications, telephone calls, text messaging services, and smartphone applications. Studies evaluating these approaches have consistently shown improvements in bowel preparation quality regardless of the type of agent used or the specific dosing regimen.[32-42] Several RCTs assessing smartphone application–based education demonstrated superior bowel preparation quality and higher ADR compared to conventional printed instruction materials, along with improved adherence to bowel preparation regimens and dietary restrictions.[43,44] In addition, a meta-analysis of 21 studies evaluating the impact of various supplementary educational tools confirmed that enhanced education significantly increased the proportion of patients achieving adequate bowel preparation (79.9% vs. 72.9%; RR, 1.14; 95% CI, 1.08–1.20; $p<0.00001$), reduced withdrawal time, and improved patient acceptance of repeat colonoscopy when needed (91.9% vs. 81.4%; RR, 1.14; 95% CI, 1.04–1.25; $p=0.004$).[45]

Although many studies support the effectiveness of enhanced educational interventions, some reports showed no significant difference in bowel preparation quality between enhanced methods and conventional education using printed instructions alone.[46,47] Furthermore, access to or preference for technology-based educational tools may be limited in certain patient populations. Therefore, traditional written instructions should remain an available and acceptable option, allowing patients to select the educational method best suited to their individual circumstances and preferences.

A summary of the evidence supporting this recommendation is presented in Supplementary Table 4.

Adjunctive agents

Key question 3. In patients scheduled for colonoscopy, does adding simethicone during bowel preparation improve bowel cleansing quality, endoscopic visibility, ADR, patient discomfort, or adverse events compared to bowel preparation without simethicone?

Recommendation 3. We recommend adding oral simethicone during bowel preparation (strength of recommendation: strong; certainty of evidence: moderate).

Air bubbles formed within the intestinal lumen during bowel preparation can obscure the colonic mucosa and compromise visualization during colonoscopy. Simethicone is commonly used to eliminate intraluminal foam and improve endoscopic visibility. In a recent meta-analysis including 10,505 patients, orally administered simethicone significantly increased the rate of adequate bowel preparation (total BBPS ≥6) (RR, 1.13; $p<0.0001$), improved acceptance of repeat colonoscopy (RR, 1.15; $p=0.01$), and significantly reduced abdominal bloating (RR, 0.64; $p<0.0001$). Simethicone use did not have a significant effect on ADR, cecal intubation rate, or withdrawal time. However, subgroup analysis demonstrated significantly improved adenoma detection among endoscopists with below-average baseline ADR (<31%), suggesting that simethicone may be particularly beneficial for less-experienced endoscopists or in settings with lower adenoma detection performance.[48] A domestic

comparative study of orally administered sulfate tablet containing simethicone (PBK-1701TC; Orafang) versus a sulfate solution found no significant difference in overall bowel preparation quality; however, intraluminal bubbles were reduced endoscopic visibility was improved in the simethicone-containing tablet group.[49]

Studies have also evaluated the optimal timing of simethicone administration. In a domestic RCT with 240 patients, participants undergoing split-dose bowel preparation with 2 L PEG plus ascorbic acid were randomized into three groups: simethicone administered the evening before colonoscopy, simethicone administered on the day of colonoscopy (200 mg diluted in 500 mL of water), and a control group without simethicone. Overall bowel preparation quality (total BBPS score) and bubble score were highest in the group receiving simethicone the evening before colonoscopy. Although ADR and PDR did not differ significantly among the three groups, the detection rate of diminutive adenomas (≤5 mm) was significantly higher in the evening-before administration group.[50] Similar findings were reported in a Chinese RCT with 419 patients. Compared to same-day administration, simethicone administered the evening before colonoscopy had a shorter cecal intubation time (3.80±1.81 vs. 4.42±2.03, $p<0.001$), better bubble score in the right colon (2.95±0.26 vs. 2.88±0.38; $p=0.04$), and a significantly higher detection rate of diminutive adenomas (≤5 mm) in the right colon (62.5% vs. 38.6%, $p=0.022$).[51] In contrast, a recent domestic RCT involving 204 patients reported opposing results, showing that same-day administration of 200 mg simethicone yielded superior bubble scores and overall bowel preparation quality compared to administering it the evening before colonoscopy.[52] Taken together, the available evidence regarding the optimal timing of simethicone administration remains inconsistent. Therefore, further well-designed studies are required, and until more robust evidence becomes available, a definitive recommendation cannot be provided on the optimal timing of simethicone use.

Since 2016, concerns have been raised regarding potential infection risks associated with simethicone use during endoscopic procedures. Simethicone is an inert, hydrophobic substance that is not easily removed during standard endoscope reprocessing. In addition, sugars and thickeners contained in simethicone solutions have the potential to promote biofilm formation and microbial growth.[53-55] Therefore, concerns that simethicone use may increase the risk of endoscopy-related infections remain; however, a clear causal relationship between simethicone use and exogenous infections transmitted via endoscopy has not yet been established. Given the well-documented benefits of simethicone in improving mucosal visualization, its use during endoscopy is not prohibited in the United States, Europe, or Australia. Instead, current recommendations emphasize minimizing both the concentration and frequency of simethicone use. In particular, simethicone administration via the water-jet channel is discouraged, and its use through the working channel—where mechanical brushing can be performed during the cleaning process—is recommended.[12,56,57] Furthermore, considering that oral simethicone administration significantly reduces the need for intraprocedural flushing through the working channel, oral simethicone use may have important clinical implications from the perspective of endoscope reprocessing and infection control as well.[52,58]

The summary of evidence supporting this recommendation is presented in Supplementary Table 5.

Key question 4. In patients scheduled for colonoscopy, does the addition of prokinetic agents during bowel preparation improve bowel cleansing quality, ADR, patient discomfort, or adverse events compared to bowel preparation without prokinetics?

Recommendation 4. We do not recommend the routine use of prokinetic agents during bowel preparation (strength of recommendation: conditional against; certainty of evidence: low).

Studies have evaluated the use of gastrointestinal prokinetic agents for improving bowel preparation quality, with heterogeneous results across agents and study designs. Of four RCTs that assessed lubiprostone, only two demonstrated a significant improvement in bowel preparation quality. Of these, one used a non-standard regimen with 2 L PEG, and the other did not impose dietary restriction prior to bowel preparation.[59-62] In a Thai RCT involving 78 patients, PEG-ELS plus lubiprostone compared to PEG-ELS alone showed no significant differences in bowel preparation quality (50.0% vs. 52.9%, $p=0.81$), PDR (58.8% vs. 64.7%, $p=0.62$), or ADR (41.2% vs. 35.3%, $p=0.62$).[63] In contrast, a Korean RCT with 152 patients evaluating split-dose 4 L PEG with or without itopride (200 mg) found that the itopride group had significantly improved bowel preparation quality (Ottawa bowel preparation scale [OBPS], 3.51±2.16 vs. 5.22±2.42; $p<0.001$), while ADR and adverse events did not differ between the groups.[64] In Japan, mosapride has been

primarily evaluated using non-split regimens.[65,66] In an RCT of 613 patients receiving non-split 2 L PEG or 1.8 L magnesium citrate, mosapride did not significantly improve bowel preparation quality compared to control, although it reduced abdominal discomfort. In another RCT of 249 patients, mosapride improved bowel preparation only in the left colon, without any significant abdominal discomfort. A Korean study involving 257 patients aged ≥65 years reported that adding mosapride (30 mg) to split-dose 2 L PEG plus ascorbic acid resulted in better overall bowel preparation (total BBPS, 8.53±0.92 vs. 8.24±1.26; p=0.033) and significantly less abdominal bloating (11.9% vs. 30.5%, p<0.001).[67] For prucalopride, a meta-analysis based on two RCTs suggested that non-inferior bowel preparation quality could be achieved with a reduced volume of bowel preparation solution compared to standard dosing; however, given the small sample sizes, further studies are required to confirm these findings.[68] The use of linaclotide was also evaluated by recent RCTs. In a Chinese RCT, patients receiving 3 L PEG plus linaclotide achieved a significantly higher mean BBPS than those receiving 3 L PEG alone (7.91±1.48 vs. 6.70±1.67, p<0.001), but showed similar willingness to reuse the regimen (87.69% vs. 87.3%, p=0.947).[69] Another RCT showed that adding linaclotide to 4 L PEG improved mean BBPS (6.90±1.28 vs. 6.00±1.62, p<0.001) and resulted in higher PDR (32.5% vs. 21.4%, p<0.001) and ADR (25.0% vs. 16.7%, p=0.001).[70]

Several studies have examined whether linaclotide allows for PEG dose reduction. In one Chinese RCT, 2 L PEG plus linaclotide showed a modest improvement in mean OBPS compared to 3 L PEG (3.3±2.1 vs. 3.7±2.1, p=0.021), but bowel preparation quality, PDR, and ADR were similar, and adverse events were more frequent (78.2% vs. 68.9%, p=0.044).[71] In a comparison of 3 L PEG plus linaclotide versus 4 L PEG, the combination regimen resulted in higher mean BBPS (7.03±0.95 vs. 6.57±1.25, p<0.001) and a higher bowel preparation success rate (89.4% vs. 73.6%, p<0.001); subgroup analysis also demonstrated a higher success rate among older adults (82.2% vs. 52.5%, p=0.003).[72] In another study comparing 2 L PEG plus linaclotide with 4 L PEG, bowel preparation success rates were similar, but adverse events were significantly less frequent in the 2 L PEG plus linaclotide group (15.5% vs. 50.9%, p<0.001).[73] A comparison of 1 L PEG plus linaclotide versus 2 L PEG showed no difference in bowel preparation success or mean BBPS, while willingness to reuse the regimen was higher in the combination group (95.2% vs. 82.2%, p<0.001).[74] Taken together, these findings suggest that gastrointestinal prokinetic agents may be useful in certain clinical situations; however, the current evidence is insufficient to support their routine use as part of bowel preparation for colonoscopy

The summary of evidence supporting this recommendation is presented in Supplementary Table 6.

Timing and method of bowel preparation

Key question 5. In patients scheduled for colonoscopy, does split-dose bowel preparation improve bowel cleansing quality and ADR compared to non-split dosing?

Recommendation 5. We recommend split-dose bowel preparation for colonoscopy (strength of recommendation: strong; certainty of evidence: high).

A large-scale meta-analysis including 47 RCTs with a total of 13,478 participants demonstrated that regardless of the type or volume of bowel preparation agent used, split-dose regimens provided significantly superior bowel cleansing compared to day-before single-dose regimens (OR, 2.51; 95% CI, 1.86–3.39). Subgroup analyses of bowel preparation agents yielded consistent results (PEG: OR, 2.60; 95% CI, 1.46–4.63; oral sodium phosphate [OSP]: OR, 9.34; 95% CI, 2.12–41.11; SPMC: OR, 3.54; 95% CI, 1.95–6.45). In addition, patients receiving split-dose regimens were more likely to agree to repeat colonoscopy in the future (OR, 1.90; 95% CI, 1.05–3.46).[75] In this meta-analysis, no significant differences were observed between the two regimens in terms of PDR or ADR; however, this analysis was limited to only two RCTs, precluding definitive conclusions. In contrast, large observational studies have consistently reported higher PDR and ADR with split-dose regimens compared to day-before single-dose regimens.[76-78] Furthermore, an RCT including 690 patients showed that a split-dose regimen of 2 L PEG plus ascorbic acid resulted in significantly higher detection rates of adenomas and advanced adenomas than a day-before single-dose regimen.[79] A subsequent meta-analysis focusing specifically on lesion detection compared seven RCTs and found that split-dose regimens were associated with significantly higher ADR (RR, 1.26; 95% CI, 1.10–1.44; 4 RCTs, 1,258 patients), advanced ADR (RR, 1.53; 95% CI, 1.22–1.92; 3 RCTs, 1,155 patients), and sessile serrated PDR (RR, 2.48; 95% CI, 1.21–5.09; 2 RCTs, 1,045 patients) compared to day-before single-dose regimens, with notably improved detection of sessile

serrated lesions.[80] Although not using identical bowel preparation regimens, an RCT including 393 patients demonstrated that split-dose administration of 2 L PEG plus ascorbate significantly improved PDR and ADR in the right colon compared to a day-before single-dose regimen.[81] Collectively, these findings indicate that split-dose bowel preparation not only improves bowel cleansing quality but also enhances detection of colorectal lesions.

The summary of evidence supporting this recommendation is presented in Supplementary Table 7.

Key question 6. In patients scheduled for an afternoon colonoscopy, does same-day bowel preparation improve bowel cleansing quality and ADR compared to split-dose preparation?

Recommendation 6. For afternoon colonoscopy, we recommend same-day bowel preparation as an alternative to split-dose preparation (strength of recommendation: strong; certainty of evidence: high).

When colonoscopy is scheduled for the afternoon, a same-day single-dose bowel preparation regimen may be considered. Meta-analyses comparing split-dose regimens with same-day bowel preparation have shown comparable outcomes between the two approaches in terms of overall bowel cleansing quality, ADR, patients' willingness to repeat the procedure, and overall tolerability.[82,83] However, same-day regimens were associated with less abdominal bloating (RR, 0.68; 95% CI, 0.40–0.94)[83] and better sleep quality (OR, 0.44; 95% CI, 0.24–0.82).[82]

Domestic studies further support the utility of same-day bowel preparation. In an RCT including 339 patients that compared split-dose versus same-day single-dose administration of 4 L PEG, no significant difference was observed in bowel preparation success rates between the two groups (same-day: 98.8% vs. split-dose: 98.2%; p=0.681). No cases of hemodynamic instability or aspiration were observed, and tolerability—including overall satisfaction and willingness to reuse the regimen—was similar between the groups.[84]

In a more recent comparative study using 2 L PEG (192 patients in the same-day group and 192 in the split-dose group; colonoscopy scheduled between 11:00 AM and 1:00 PM), the same-day group achieved significantly better bowel preparation quality (BBPS ≥6, 86% vs. 73.4%; p=0.002). No significant differences were found in tolerability, assessed by nausea, vomiting, bloating, or abdominal pain, and overall satisfaction with bowel preparation. However, sleep disturbance was significantly more frequent in the split-dose group (14.5% vs. 54%, p<0.001).[85]

Similarly, studies comparing same-day and split-dose regimens using SPMC for afternoon colonoscopy have demonstrated that same-day preparation yields bowel cleansing outcomes that are superior to or comparable to that of split-dose regimens across multiple scoring systems, including the Aronchick scale, OBPS, BBPS, and bubble score.[86]

Most of the abovementioned studies predominantly evaluated same-day bowel preparation in patients undergoing afternoon colonoscopy. In contrast, two RCTs that compared same-day single-dose preparation with split-dose regimens for morning colonoscopy showed that the bowel cleansing quality of same-day preparation was similar to or slightly inferior to that of split-dose regimens. In addition, medication adherence and tolerability were lower in the same-day group, indicating that same-day bowel preparation did not yield favorable outcomes for morning colonoscopy.[87,88] However, both of these studies used 2 L PEG regimens. In a domestic retrospective chart review including 291 patients, same-day administration of 4 L PEG (4 L ingested between 5:00 and 7:00 AM for morning colonoscopy; for afternoon colonoscopy, 2 L ingested at 7:00 AM followed by 2 L ingested 3 h before the procedure) was evaluated. There were no significant differences between morning and afternoon colonoscopy groups in bowel preparation quality (BBPS, 7.3±0.8 vs. 7.3±0.8; p=0.68), adverse events, or tolerability. These findings suggest that same-day preparation may also be feasible for morning colonoscopy; however, additional prospective studies are required to confirm this possibility.[89]

Meanwhile, an RCT comparing split-dose 4 L PEG with same-day single-dose administration in 300 patients undergoing afternoon colonoscopy showed no significant difference in bowel preparation quality between the two groups (p=0.47); however, the same-day group had a lower completion rate of the bowel preparation regimen (88.6% vs. 76.2%, p=0.009) and a higher incidence of vomiting (12.2% vs. 22.1%, p=0.036). Conversely, sleep disturbance was significantly less frequent in the same-day group (33.6% vs. 9.8%, p=0.001). Based on these findings, same-day single-dose bowel preparation can be recommended for afternoon colonoscopy.[90]

The summary of evidence supporting this recommendation is presented in Supplementary Table 7.

Key question 7. In patients scheduled for colonoscopy, are bowel cleansing quality and procedure-related complications affected by the interval between the last dose of bowel preparation and colonoscopy?

Recommendation 7. To optimize bowel cleansing and minimize procedure-related complications, colonoscopy should be performed at least 2 hours and within 5 hours after completion of the last dose of bowel preparation (strength of recommendation: strong; certainty of evidence: moderate).

Because bowel cleanliness may deteriorate after completion of bowel preparation due to the accumulation of mucous secretions and bile, the timing of colonoscopy initiation is a critical determinant of preparation quality. Observational studies have demonstrated an inverse relationship between the interval from the last dose of bowel preparation to start of colonoscopy and bowel cleanliness, with optimal bowel preparation quality observed when colonoscopy is initiated 3–5 hours after the final dose.[91,92] A meta-analysis further showed that the clinical benefits of split-dose regimens were most pronounced when colonoscopy was performed within 3 hours after the last dose. These benefits gradually diminished after 4–5 hours, and beyond 5 hours bowel cleanliness worsened to the extent that no significant difference was observed between split-dose regimens and non-split day-before regimens.[93] Consistent with these findings, a domestic RCT involving 504 patients demonstrated superior bowel preparation quality when the interval between the final dose and colonoscopy was 2–4 hours compared to 4–8 hours.[94]

Concerns have been raised that a shorter interval between completion of bowel preparation and colonoscopy may increase the risk of aspiration pneumonia due to residual bowel preparation fluid. However, a meta-analysis found no association between a shorter interval before colonoscopy and an increased risk of pulmonary aspiration.[95] Moreover, observational studies have shown that when a split-dose regimen is used for bowel preparation, the volume of residual gastric contents is comparable to or even lower than that observed in patients who have fasted without bowel preparation.[96-98]

The recently published sedation guidelines of the Korean Society of Anesthesiologists recommend a minimum fasting period of at least 2 hours for clear liquids prior to procedural sedation.[99] Similarly, the American Society of Anesthesiologists allows the intake of clear liquids up to 2 h before anesthesia or sedation. Current bowel preparation guidelines in the United States and Europe have adopted this principle and recommend completion of bowel preparation 2 h before colonoscopy.[12,13,100] The present guideline adopts the same recommendation. In a recent Korean study, patients receiving split-dose 1 L PEG (TJP-008) had a significantly higher volume of residual gastric contents than those receiving split-dose 2 L PEG (52.26±65.33 vs. 23.55±22.99 mL; $p<0.001$). Notably, a substantial proportion of participants (33.9%) exhibited residual gastric volumes ≥50 mL, exceeding the levels commonly reported in previous studies (approximately 20–25 mL).[101] The risk of having residual gastric volumes ≥50 mL was higher among patients who consumed water within 5 hours of the procedure and among those who reported difficulty completing bowel preparation due to the volume of the preparation solution. These findings suggest that tailored and careful instructions regarding bowel preparation are necessary, considering individual patient characteristics and tolerance.[101]

A summary of the evidence supporting this recommendation is presented in Supplementary Table 7.

Choice of bowel preparation agents

Key question 8. In patients scheduled for colonoscopy, do different bowel preparation agents (such as high-volume PEG, low-volume PEG plus ascorbic acid, SPMC, oral sulfate solution [OSS], oral sulfate tablet [OST]) differ in bowel cleansing efficacy and safety compared to conventional PEG-only regimens?

Recommendation 8. For bowel preparation before colonoscopy, we recommend the use of high-volume PEG (e.g., 4 L), low-volume PEG-based regimens (e.g., 2 L or 1 L PEG plus ascorbic acid), and non-PEG agents (e.g., SPMC, OSS, OST). In patients at high risk of electrolyte imbalance, the choice of bowel preparation agent should be individualized based on clinical status (strength of recommendation: strong (PEG)/conditional (non-PEG); certainty of evidence: moderate).

1) PEG-based bowel preparation agents

(1) High-volume PEG preparations: 4 L PEG–electrolyte lavage solution and 4 L sulfate-free PEG-ELS

PEG is an inert polymer of ethylene oxide that is not absorbed

systemically and passes through the colon unchanged. PEG–electrolyte lavage solution (PEG-ELS) is formulated to maintain electrolyte balance, thereby minimizing fluid exchange across the intestinal mucosa and preventing clinically significant physiological disturbances, including changes in body weight, vital signs, biochemical parameters, electrolyte levels, or metabolic abnormalities. Therefore, PEG-ELS is relatively safe in patients who are at high risk of electrolyte imbalance or sodium overload, such as older adults, patients with chronic kidney disease or cardiovascular disease, and those with chronic liver disease along with ascites. In addition, PEG causes minimal mucosal injury during bowel preparation and is therefore recommended as a first-line option in patients with IBD.[12,102] In a previous meta-analysis, split-dose high-volume PEG demonstrated superior bowel cleansing efficacy compared to non–split-dose regimens (OR, 2.60; 95% CI, 1.46–4.63) and split-dose low-volume PEG regimens (OR, 1.89; 95% CI, 1.01–3.46).[75] Four-liter PEG has long served as the reference standard bowel preparation against which the efficacy and safety of newly developed agents are evaluated. Subsequent comparative studies of various low-volume preparations have demonstrated equivalent or non-inferior bowel cleansing compared to 4 L PEG. Sulfate-free (SF) PEG-ELS was developed to improve the unpleasant odor and taste of PEG-ELS by removing sodium sulfate, thereby enhancing patient tolerability. Both international and domestic studies have reported higher patient preference for SF PEG-ELS compared to PEG-ELS, although other studies have found no significant difference, suggesting that preference may vary according to individual subjective perception.[103-106] Despite these advantages, high-volume PEG preparations require ingestion of at least 2 L of solution and are often associated with poor palatability, which can limit patient acceptance. Consequently, low-volume bowel preparation agents, including low-volume PEG-based formulations, have been increasingly adopted in routine clinical practice.

(2) 2 L PEG plus ascorbic acid

To improve PEG palatability and increase osmotic activity while reducing the total volume required, PEG plus ascorbic acid formulations have been developed. This hyperosmotic preparation requires the addition of 1 L of water, resulting in a total intake volume of 3 L. A meta-analysis of 11 RCTs compared 2 L PEG plus ascorbic acid with 4 L PEG and found that the proportion of patients achieving adequate bowel preparation with 2 L PEG plus ascorbic acid was non-inferior to that achieved with 4 L PEG (OR, 1.08; 95% CI, 0.98–1.28). Moreover, gastrointestinal adverse events such as nausea and vomiting were less frequent, leading to better medication adherence with 2 L PEG plus ascorbic acid (OR, 2.23; 95% CI, 1.67–2.98). Subsequent meta-analyses including additional studies have reported consistent findings.[107-109] RCTs conducted in Korean populations have also confirmed the efficacy of 2 L PEG plus ascorbic acid, demonstrating that split-dose administration remains effective even in older adults (≥65 years).[110,111] In domestic studies, split-dose 2 L PEG plus ascorbic acid led to fewer mild adverse events—including nausea, vomiting, abdominal discomfort, and anal irritation—compared to split-dose 4 L PEG, while the incidence of abdominal pain and sleep disturbance was similar between regimens.[110] An RCT conducted in China compared 2 L PEG-ELS plus ascorbic acid with 3 L PEG-ELS and found that although mean BBPS was significantly lower in the 2 L PEG-ELS plus ascorbic acid group than in the 3 L PEG-ELS group (6.99±1.50 vs. 7.48±1.30, p=0.007), no significant differences were found in adequate bowel preparation rate (85.0% vs. 90.8%, p=0.166), PDR (63.3% vs. 65.0%, p=0.788), or ADR (39.2% vs. 45.8%, p=0.296) between the groups.[112]

(3) 1 L PEG plus ascorbic acid

Recently, formulations with reduced PEG 3350 and increased ascorbic acid content (such as 1 L PEG plus ascorbate [NER1006]) have been introduced in the market. In Korea, a sodium-reduced 1 L PEG plus ascorbic acid formulation (TJP-008) has been formulated and applied in clinical practice. To date, all RCTs have shown that 1 L PEG-based regimens have efficacy and safety comparable to those of 2 L PEG plus ascorbic acid, SPMC, and OSS.[113-116] In a Korean multicenter study involving 360 patients, split-dose 1 L PEG (NER1006) was shown to be non-inferior to split-dose 2 L PEG plus ascorbic acid in terms of bowel preparation success (93.10% vs. 91.86%; p for non-inferiority <0.001; p for superiority=0.661). Although the incidence of mild adverse events was slightly higher with 1 L PEG (65.71% vs. 52.91%, p=0.015), the proportion of excellent bowel preparation in the overall colon and the right colon were significantly higher (overall BBPS=9 or segmental BBPS=3: 49.43% vs. 37.79%; p=0.029; right colon: 60.92% vs. 48.84%; p=0.024). PDR was higher in the 1 L PEG group (48.85% vs. 37.79%, p=0.038), whereas ADR was not significantly different between the groups (24.71% vs. 20.35%, p=0.331).[117] Another Korean study with 314 patients compared 1 L PEG (TJP-008) with 2 L PEG plus ascorbic acid, and found that both split-dose and

same-day single-dose administration of TJP-008 were non-inferior to split-dose 2 L PEG plus ascorbic acid (bowel preparation success, 99.0% vs. 95.9% vs. 94.9%). In the split-dose comparison, 1 L PEG achieved superior right-colon cleansing compared to 2 L PEG plus ascorbic acid (83.2% vs. 62.5%, p=0.005).[118] Another Korean RCT comparing 1 L PEG plus ascorbic acid (TJP-008) with 2 L PEG plus ascorbic acid confirmed non-inferior bowel preparation quality (BBPS ≥6; 92.5% vs. 90.8%; 95% CI, −0.054 to 0.087; p for non-inferiority <0.001), with no significant differences in adverse event rates (68.3% vs. 60.0%, p=0.178), tolerability, or adherence.[119] In a Korean RCT comparing 1 L PEG plus ascorbic acid (NER1006) with OST, bowel preparation quality did not differ between groups (95.4% vs. 96.4%, p=0.736), although residual bubble scores favored OST (0.2±0.9 vs. 1.9±1.7; p<0.001).[120] An RCT conducted in Spain showed that 1 L PEG plus ascorbic acid (NER1006) provided superior bowel cleansing compared to SPMC (BBPS: 8.0 [7–9] vs. 6.5 [6–8]; p<0.001; bowel preparation success: 90.8% vs. 77.7%; p<0.001).[121] Another study similarly demonstrated better bowel preparation with 1 L PEG plus ascorbic acid than with SPMC (57.3% vs. 33.9%, p<0.001).[122] In an Italian RCT, 1 L PEG plus ascorbic acid (NER1006) outperformed 4 L PEG in both bowel preparation quality (91.8% vs. 83.6%, p=0.009) and the proportion of excellent preparation (39.1% vs. 27.7%, p=0.012).[123] A study comparing 1 L PEG (TJP-008) with SPMC also reported high bowel preparation success in both groups (97.4% vs. 97.3%), with a higher proportion of excellent cleansing in the 1 L PEG group (Harefield cleansing scale A, 87% vs. 77%; p=0.05).[124] In a Korean head-to-head comparison of two 1 L PEG formulations (TJP-008 vs. NER1006), no differences were observed in overall bowel preparation quality or patient satisfaction.[125] However, two RCTs evaluating patient satisfaction and preference reported slightly lower satisfaction with 1 L PEG plus ascorbic acid (NER1006 or TJP-008) compared to 2 L PEG plus ascorbic acid or SPMC, possibly reflecting additives-related discomfort among Korean patients.[117,124] In summary, 1 L PEG plus ascorbic acid demonstrates non-inferior bowel cleansing efficacy with acceptable safety and tolerability compared to established low-volume regimens and may be considered an effective alternative for bowel preparation.

Safety of low-volume PEG-based bowel preparations

Ascorbic acid and aspartame are contraindicated in patients with glucose-6-phosphate dehydrogenase deficiency or phenylketonuria. In addition, the use of low-volume PEG-based preparations is not recommended in patients with severe heart failure (New York Heart Association class III–IV) or in those with a creatinine clearance <30 mL/min.[12] Because the sodium content of these formulations may contribute to hypernatremia, adequate fluid intake during bowel preparation is strongly recommended.

In a retrospective observational study of individuals undergoing health screening in Korea, a higher proportion of patients developed reduced renal function (glomerular filtration rate <60 mL/min/1.73 m^2) with 2 L PEG-based regimens than with 4 L PEG-based regimens (1.3% with 4 L PEG vs. 3.2% with 2 L PEG).[126] Therefore, when low-volume PEG preparations are used, closer monitoring and greater caution are warranted in patients with pre-existing electrolyte disturbances or risk factors for renal function deterioration.

2) Hyperosmotic non-PEG-based preparations

(1) SPMC

SPMC is a combination of a stimulant laxative (sodium picosulfate) and an osmotic agent (magnesium citrate), which induces bowel movements by stimulating colonic peristalsis while promoting intraluminal water retention. Although substantial heterogeneity across studies warrants cautious interpretation, a meta-analysis including 25 RCTs demonstrated that SPMC was non-inferior to PEG-based regimens in terms of bowel cleansing quality, with no significant differences in ADR or PDR.[127] In addition, the overall incidence of adverse events was lower in the SPMC group (RR, 0.78; 95% CI, 0.66–0.93; p=0.004), while bowel preparation completion (RR, 1.08; 95% CI, 1.04–1.13; p<0.001) and willingness to repeat the same regimen (RR, 1.44; 95% CI, 1.25–1.67; p<0.001) were significantly higher. In Korean RCTs comparing split-dose SPMC with 2 L PEG plus ascorbic acid, although bowel cleansing quality did not differ significantly between regimens, gastrointestinal symptoms, tolerability, and willingness to repeat the preparation were inconsistent. One study reported better tolerability and fewer adverse events with SPMC, whereas another showed superior tolerability and less nausea with 2 L PEG plus ascorbic acid.[128,129] These discrepancies may reflect variability in dosing schedules and administration protocols for SPMC, underscoring the need for cautious interpretation. A Canadian RCT comparing SPMC with 4 L PEG showed that PEG had significantly better bowel cleansing quality than SPMC in both split-dose and day-before regimens (OBPS, 4.14±2.64 vs. 5.11±3.44; p=0.019). In both treatment arms, split dosing resulted in superior bowel

cleansing compared to day-before dosing (OBPS, 3.68±2.82 vs. 5.69±3.06; $p<0.001$).[130] A large population-based study from Poland involving 13,497 individuals compared split-dose 0.3 L SPMC with 4 L PEG and found that low-volume regimens did not improve participation or adherence. Moreover, the rate of adequate bowel preparation was significantly lower with SPMC than with 4 L PEG (entire colon: 79.0% vs. 86.4%; $p<0.001$; proximal colon: 80.1% vs. 87.3%; $p<0.001$). Detection rates of advanced adenomas and advanced serrated lesions were also higher in the 4 L PEG group.[131] In a Chinese RCT comparing SPMC with 3 L PEG, overall bowel cleansing quality and adequacy were similar between groups (mean BBPS: 7.52±1.44 vs. 7.47±1.56; $p=0.686$; adequate preparation: 92.8% vs. 91.1%; $p=0.519$). However, both PDR and ADR were significantly higher in the 3 L PEG group (PDR: 71.8% vs. 56.1%; $p<0.001$; ADR: 47.4% vs. 36.9%; $p=0.02$).[132] Korean studies comparing OSS and 1 L PEG plus ascorbic acid found that bowel preparation success rates (defined as BBPS ≥2 in all segments or Harefield cleansing scale A/B) did not differ significantly (OSS, 96.3% vs. SPMC 94.9%; 1 L PEG, 97.4% vs. SPMC, 97.3%).[124,133] However, the SPMC group had a significantly lower proportion of high-quality bowel cleansing (Harefield cleansing scale A) than the 1 L PEG plus ascorbic acid group (87.0% vs. 77.0%, $p=0.005$).[124]

Safety

SPMC is most commonly associated with mild gastrointestinal adverse events, including abdominal cramping, pain, nausea, and vomiting. Rarely, electrolyte disturbances such as hyponatremia or hypermagnesemia related to magnesium content have been reported; however, serious adverse events are exceedingly uncommon.[124,127,134-136] Due to its hyperosmotic properties and magnesium content, SPMC is contraindicated in patients with congestive heart failure, hypermagnesemia, rhabdomyolysis, gastric ulcer disease, or severe renal impairment. Adequate fluid intake during administration is essential and should be strongly emphasized.

(2) OSS (trisulfate) and OST

Sulfate is a non-absorbable anion, and bowel preparation regimens based on sulfate salts have been developed using combinations of sodium sulfate, potassium sulfate, and magnesium sulfate (trisulfate). In Korean patients, OSS demonstrated superior bowel cleansing efficacy compared to 4 L PEG and 2 L PEG plus ascorbic acid, without any serious adverse events.[137-141]

In an RCT comparing split-dose OSS with SPMC, OSS achieved significantly better bowel cleansing quality than SPMC, while the incidence of adverse events did not differ significantly between the two regimens (excellent or good preparation: 94.7% vs. 85.7%; $p=0.006$; excellent preparation: 54% vs. 26%; $p<0.001$).[142] A Chinese RCT comparing OSS with 3 L PEG found similar bowel preparation success rates between groups (98.22% vs. 97.66%, $p=0.24$), with no significant difference in the overall incidence of adverse events (50.88% vs. 44.51%, $p=0.237$).[143]

To improve patient convenience, tablet-based sulfate preparations have recently been developed in Korea. PBK-1701TC is an oral sulfate tablet containing 320 mg of simethicone that was non-inferior to liquid OSS in bowel cleansing efficacy (OST vs. OSS: 95.5% vs. 98.2%; difference, −2.7%, lower bound of the 97.5% CI, −8.1%). In addition, the inclusion of simethicone significantly reduced intraluminal bubbles during bowel preparation (OST vs. OSS, 0.9% vs. 81.3%; $p<0.001$).[49] A study conducted in the United States compared split-dose OST (SUTAB; Braintree Laboratories Inc.) with 2 L PEG plus ascorbic acid, and found that OST was non-inferior to 2 L PEG in terms of bowel preparation efficacy (OST vs. 2 L PEG: 92.4% vs. 89.3%; 95% CI for the difference, −1.6% to 8.0%). No clinically significant electrolyte disturbances or serious adverse events were observed.[144] A recent study compared mini-sized OST formulation (CTP0303) developed in Korea with conventional OST (PBK-1701TC), and found high bowel preparation success rates with both regimens (Harefield cleansing scale, 100% vs. 97.7%; $p=0.167$). Patient satisfaction scores were numerically higher in the mini-OST group (102.5±72.9 vs. 83.7±53.4; $p=0.188$); however, the incidence of adverse events was significantly higher with mini-OST (68.3% vs. 41.9%, $p=0.015$).[145]

Safety

Hyperosmotic trisulfate-based preparations are contraindicated in patients with congestive heart failure, ascites, or severe renal impairment (glomerular filtration rate <30 mL/min). Although most studies have not reported clinically significant electrolyte abnormalities, acute kidney injury, or creatinine elevation associated with OSS, a Korean study involving older adults (65–80 years) reported cases of clinically significant hyponatremia and creatinine elevation following OSS administration. Therefore, careful monitoring is required when OSS is used in older patients with impaired baseline renal function.[141,146] OSS is a low-volume hyperosmotic preparation, with a potential risk of

dehydration, and adequate fluid intake during administration is essential. In addition, transient increases in serum uric acid levels have been reported; thus, caution is advised in patients with hyperuricemia or a history of gout.[12]

The summary of evidence supporting this recommendation is presented in Supplementary Table 8.

Key question 9. In patients scheduled for colonoscopy, does OSP differ from PEG-based regimens in bowel cleansing efficacy and safety?

Recommendation 9. We recommend against the use of OSP for bowel preparation before colonoscopy (strength of recommendation: strong against; certainty of evidence: low).

A meta-analysis comparing OSP with PEG found no significant difference between the two regimens in the proportion of patients achieving adequate bowel preparation (7 RCTs, 1,128 participants; OR, 1.05; 95% CI, 0.40–2.74; p=0.92). However, in studies using the OBPS (6 RCTs, 1,164 participants), OSP achieved significantly better bowel preparation scores than PEG (weighted mean difference, −0.78; 95% CI, −1.32 to −0.23; p=0.005).[147] OSP was also associated with higher patient compliance and acceptability, better palatability, and lower rates of nausea, vomiting, and abdominal pain. No statistically significant differences were observed between OSP and PEG in terms of electrolyte disturbances or changes in serum creatinine levels. A meta-analysis including seven RCTs likewise failed to demonstrate a clear association between OSP use and renal injury.[148] However, these meta-analyses included heterogeneous RCTs and were limited in their ability to detect rare but serious adverse events. Notably, between January 2006 and December 2007, the U.S. Food and Drug Administration received 171 reports of renal failure or nephrocalcinosis associated with OSP use, but only 10 cases associated with PEG during the same period.[149] In a retrospective cohort study conducted in Iceland, the risk of biopsy-confirmed acute phosphate nephropathy was estimated at approximately 1 case per 1,000 OSP prescriptions (15 cases among 17,651 prescriptions; 0.085%).[150] Renal impairment caused by acute phosphate nephropathy was found to be largely irreversible in most cases.[149,151] In addition, OSP is associated with acute electrolyte disturbances, including hyperphosphatemia, hypocalcemia, hypokalemia, hypernatremia, and hyponatremia, which may develop rapidly and, in rare cases, lead to fatal outcomes.

For these reasons, both U.S. and European clinical practice guidelines do not recommend the routine use of OSP for bowel preparation.[12,13]

Bowel preparation in special populations

Key question 10. In patients with chronic constipation, does any specific bowel preparation strategy improve bowel cleansing efficacy and safety compared to PEG alone?

Recommendation 10. Based on the current evidence, we do not recommend any specific bowel preparation strategy over PEG alone in patients with chronic constipation (strength of recommendation: conditional against; certainty of evidence: low).

Chronic constipation is considered a risk factor for inadequate bowel preparation, and in clinical practice, additional laxatives are often prescribed for these patients. Two RCTs conducted in China reported that the addition of bisacodyl or lactulose resulted in better bowel preparation quality than PEG alone. However, these studies had important limitations, including the inclusion of patients who did not meet conventional definitions of chronic constipation (e.g., enrollment limited to patients with Bristol Stool Form Scale types 1 or 2 for only 7 days) or the use of non-standardized bowel preparation regimens (2 L PEG).[152,153] In an Italian RCT involving 400 patients with chronic constipation defined according to the Rome III criteria, a regimen of 2 L PEG plus citrate and simethicone combined with a 2-day bisacodyl-enhanced protocol (15 mg/day) was compared with a split-dose 4 L PEG regimen; no significant difference in bowel preparation quality was observed between the two groups.[154] Previous RCTs reported higher bowel preparation success rates with OSP compared to PEG in patients with constipation (OSP 45 mL plus bisacodyl 20 mg vs. 4 L PEG; bowel preparation success rate 95% vs. 66%; p=0.03).[155] A more recent meta-analysis focusing on constipated patients also showed superior bowel preparation quality with OSP compared to PEG (OR, 1.87; 95% CI, 1.06–3.32; p=0.003).[156] However, the RCTs included in this meta-analysis were characterized by low methodological quality, heterogeneous OSP dosing regimens, and well-recognized safety concerns related to OSP use, which limits the applicability of these findings to routine clinical practice. Although recent RCTs have reported that administration

of linaclotide for several days prior to colonoscopy can improve bowel preparation quality in patients with chronic constipation,[69,72] current evidence is inadequate to support a generalized recommendation for any specific bowel preparation regimen that can replace or is superior to PEG-based preparations in this patient population.

The evidence supporting this recommendation is summarized in Supplementary Table 9.

Key question 11. In patients with IBD, does PEG-based bowel preparation differ from non-PEG agents in bowel cleansing efficacy and safety?

Recommendation 11. We recommend PEG-based bowel preparation for patients with IBD. However, in patients with quiescent or asymptomatic disease, non-PEG agents may be considered based on patient adherence and convenience (strength of recommendation: strong (PEG)/conditional (non-PEG); certainty of evidence: moderate).

IBD is a global health burden, with increasing incidence and prevalence in Asia, including Korea.[157] Adequate bowel preparation in patients with IBD is essential for accurate assessment of disease activity and detection of dysplasia during colonoscopic examination.[158] However, acute disease exacerbation following bowel preparation has been reported in some patients with ulcerative colitis (UC); therefore, bowel preparation agents should be selected with caution in patients with IBD.[159,160]

In a Korean study involving patients with UC, a comparison between split-dose 2 L PEG plus ascorbic acid and 4 L PEG demonstrated no significant difference in bowel preparation quality; however, willingness to undergo repeat colonoscopy was higher in the 2 L PEG plus ascorbic acid group.[160] Similarly, an Italian study comparing 2 L PEG plus 10 mg bisacodyl with 4 L PEG in patients with UC reported comparable bowel preparation quality between the two regimens, while tolerability and willingness for repeat examination were greater in the 2 L PEG group.[161] Although RCTs evaluating 1 L PEG preparations in patients with IBD remain limited, observational studies have reported favorable bowel preparation quality, safety, and tolerability in this population.[162,163] Based on available evidence, PEG-based bowel preparation regimens can be recommended for patients with IBD regardless of volume; however, evidence supporting the use of 1 L PEG preparations remains lacking.

In non-IBD populations, OSP or SPMC increase mucosal inflammation by more than 10-fold compared to 4 L PEG-based regimens.[164] However, a prospective observational study conducted in France reported favorable outcomes with SPMC-based bowel preparation in patients with IBD. In this study, 278 patients with IBD underwent bowel preparation according to routine clinical practice (4 L PEG 15%, 2 L PEG 42%, SPMC 29%, and other regimens 14%). The 4 L PEG group had the lowest completion rate (4 L PEG, 59.5%; 2 L PEG, 82.9%; SPMC, 93.8%) and bowel preparation quality (proportion with BBPS ≥7: 4 L PEG, 48.8%; 2 L PEG, 76.7%; SPMC, 79.7%). Overall, SPMC was the most favorable in terms of efficacy, tolerability, and safety.[165] A Korean RCT including 110 patients with inactive IBD found that OST (PBK-1701TC) and split-dose 2 L PEG plus ascorbic acid both achieved high rates of successful bowel preparation (Harefield cleansing scale grade A or B, 98.1% vs. 98.1%). The OST group showed significantly less intraluminal bubble formation (94.5% vs. 50.0%, $p<0.001$), while the incidence of vomiting and abdominal distension did not differ between the groups. Ease of intake, palatability, and patient willingness to undergo repeat colonoscopy was greater in the OST group. Post-colonoscopy increases in disease activity were observed in 14% of patients in the OST group and 21% in the 2 L PEG plus ascorbic acid group, with no significant difference ($p=0.451$). However, acute symptom flare-ups occurred in two patients in the OST group, both of whom required therapy escalation with increased 5-aminosalicylic acid dosing or corticosteroids.[166] Similarly, a Korean RCT comparing split-dose OSS with split-dose 2 L PEG plus ascorbic acid in patients with UC in remission found no significant differences between the two regimens in terms of bowel preparation quality or safety.[167] Taken together, these findings suggest that low-volume hyperosmotic bowel preparation agents may be considered in asymptomatic patients with IBD. However, additional studies focusing on safety outcomes are required before such regimens can be formally recommended in clinical practice guidelines.

A summary of the evidence supporting this recommendation is presented in Supplementary Table 9.

Key question 12. In pregnant or breastfeeding women undergoing colonoscopy, do specific bowel preparation methods differ in efficacy and safety compared to PEG-based regimens?

Recommendation 12. There is insufficient evidence to recommend a safe and effective bowel preparation method for colonoscopy during pregnancy or breastfeeding (strength of recommendation: inconclusive; certainty of evidence: very low).

Studies evaluating the safety of colonoscopy during pregnancy and its effects on maternal and fetal outcomes are inherently limited, as experimental studies are not feasible; consequently, the available evidence is largely derived from case reports and retrospective observational studies. Based on accumulated reports and meta-analyses, colonoscopy or sigmoidoscopy may be performed relatively safely during pregnancy when there is a strong clinical indication.[168-171] Evidence regarding the safety of bowel preparation agents during pregnancy remains insufficient. However, low-dose PEG, commonly used for treating constipation, is generally considered to be relatively safe during pregnancy.[172,173] Therefore, when colonoscopy is absolutely necessary, PEG-based bowel preparation may be an option, although definitive evidence regarding its fetal safety is lacking.[174] For these reasons, when sigmoidoscopy can adequately address the clinical indication, sigmoidoscopy following tap water enema is preferred over full colonoscopy. The effects of bowel preparation agents in breastfeeding women also remain unconfirmed. Because PEG is minimally absorbed through the gastrointestinal tract, the amount excreted into breast milk is presumed to be negligible. Nevertheless, if colonoscopy is unavoidable, temporary interruption of breastfeeding during bowel preparation and for a short period thereafter may be considered as an alternative approach.[12]

A summary of the evidence supporting this recommendation is presented in Supplementary Table 9.

Key question 13. In older patients, does PEG-based bowel preparation differ from non-PEG agents in bowel cleansing efficacy and safety?

Recommendation 13. In older patients undergoing colonoscopy, PEG-based bowel preparation should be preferentially considered. However, in clinically stable older patients, low-volume hyperosmotic agents (e.g., OSS) may be used based on patient condition and adherence, as some studies have shown comparable efficacy and safety (strength of recommendation: strong; certainty of evidence: moderate).

In older adults, age-related physiological decline in renal function and reduced gastrointestinal motility are common, and comorbid conditions such as cardiovascular or neurological diseases are more prevalent, necessitating greater caution during bowel preparation. For these reasons, iso-osmotic PEG-based regimens have traditionally been preferred in older patients (≥65 years), as they are theoretically considered the safest option.[12,13,175] Recently, however, an increasing number of studies have evaluated the efficacy and safety of low-volume hyperosmotic bowel preparations in older populations. A Korean RCT involving 347 older patients aged 60–79 years compared 2 L PEG plus ascorbic acid with 4 L PEG and found similar bowel preparation success rates in the two groups (2 L PEG plus ascorbic acid: 92% vs. 4 L PEG: 96%; p=0.118). However, overall patient satisfaction and willingness to reuse the preparation were significantly higher in the 2 L PEG plus ascorbic acid group, and no serious adverse events were reported.[176] Another Korean RCT comparing OSS with split-dose 4 L PEG in 193 older patients aged 65–75 years showed comparable bowel preparation success rates between the two groups (OSS: 95.9% vs. 4 L PEG: 94.8%; p=0.747). However, the mean BBPS score was significantly higher in the OSS group. Patient satisfaction and tolerability were also superior with OSS, and no clinically significant electrolyte disturbances were observed.[138] In an RCT involving 189 patients aged 65–80 years, split-dose OSS was compared with split-dose 2 L PEG plus ascorbic acid; no significant difference was observed in successful bowel preparation rates between the two groups (OSS: 89.5% vs. 2 L PEG plus ascorbic acid: 93.6%; p=0.306). The 2 L PEG plus ascorbic acid group reported better palatability and a lower incidence of vomiting. However, in the OSS group, mild increases in baseline serum creatinine levels were observed in two patients (1.37 mg/dL and 1.30 mg/dL), along with hyponatremia or increased creatinine, suggesting the need for caution when using OSS in older patients with impaired baseline renal function.[141] A Korean RCT evaluating OST in older patients found that bowel preparation quality was comparable to that achieved with 2 L PEG plus ascorbic acid (mean BBPS score: OST, 8.07±1.56 vs. PEG, 7.38±1.29; p=0.62). Patient satisfaction was higher in the OST group, and the incidence of adverse events was similar between the two regimens. However, the sample size was limited (n=61), indicating that further studies are needed to establish the efficacy and safety of OST in older populations.[177]

Although studies evaluating the efficacy and safety of low-volume hyperosmotic bowel preparations in older adults

have reported promising results, the overall evidence remains insufficient; most studies have focused on relatively healthy older populations. Therefore, when considering the use of low-volume hyperosmotic agents in older patients, decisions should be individualized, taking into account the patient's comorbidities and overall clinical condition.

A summary of the evidence supporting this recommendation is presented in Supplementary Table 9.

Management of inadequate bowel preparation

Key question 14. In patients with inadequate bowel preparation, does same-day or next-day additional bowel preparation improve bowel cleansing quality and adenoma detection compared to delayed repeat colonoscopy?

Recommendation 14. In patients with inadequate bowel preparation, we recommend repeat colonoscopy using same-day or next-day additional bowel preparation. The re-preparation strategy should be individualized based on the cause of failure, patient adherence, and comorbidities (strength of recommendation: conditional; certainty of evidence: low).

Key question 15. In patients with inadequate bowel preparation, does repeat colonoscopy within 1 year improve ADR compared to repeat colonoscopy after 1 year?

Recommendation 15. In patients with inadequate bowel preparation, we recommend repeat colonoscopy within 1 year (strength of recommendation: strong; certainty of evidence: moderate).

Inadequate bowel preparation significantly increases the risk of missing clinically relevant lesions, including premalignant polyps; therefore, repeat colonoscopy is strongly recommended in such cases. Current guidelines from the United States and Europe recommend repeat colonoscopy within 1 year when bowel preparation is inadequate, with an even shorter interval if advanced adenomas are identified.[12-14] In addition, in patients with alarm symptoms or a positive fecal occult blood test, repeat colonoscopy should be performed promptly, regardless of the general recommendation for repeat examination within 1 year, taking into account the timing of symptom onset or the initial positive test result. To reduce the burden associated with repeating the full bowel preparation regimen, an alternative approach may be considered, whereby an additional reduced-volume bowel preparation is administered to allow repeat colonoscopy on the same day or the following day. Given the high accessibility of endoscopic services in Korea, same-day or next-day repeat colonoscopy following supplemental bowel preparation may represent a practical and appropriate alternative strategy.

Meta-analyses have identified a variety of predictors of inadequate bowel preparation, including sociodemographic factors (older age, male sex, and lower educational level), comorbid conditions (obesity, constipation, liver cirrhosis, hypertension, diabetes mellitus, stroke, and dementia), and medication use (opioid analgesics and tricyclic antidepressants).[178] In addition, several studies have attempted to develop predictive models to identify patients at risk for inadequate bowel preparation based on these factors.[179,180] However, these predictive models have not yet been sufficiently validated in prospective studies and currently demonstrate suboptimal predictive accuracy.

Studies evaluating the optimal timing of repeat colonoscopy after inadequate bowel preparation have reported inconsistent results. In one retrospective observational study, repeat colonoscopy performed the following day was associated with a significantly lower rate of inadequate bowel preparation compared to repeat examinations performed at a later time point (OR, 0.31; 95% CI, 0.10–0.92; p=0.03).[181] In contrast, another retrospective observational study found no significant differences between next-day repeat colonoscopy and delayed repeat colonoscopy in rate of inadequate bowel preparation (29.8% vs. 23.3%, p=0.48), ADR (38.6% vs. 36.8%, p=0.73), or PDR (45.6% vs. 51.2%, p=0.31).[182] A study on patient adherence reported that compliance was highest when repeat colonoscopy was performed on the day following the initial inadequate examination (OR, 4.4; 95% CI, 1.6–12.3; p=0.005).[183] In another study involving patients with inadequate bowel preparation after ingestion of 4 L PEG, no significant difference in bowel preparation was observed between those who received an additional 2 L PEG on the same day and those who underwent repeat colonoscopy 7 days later after receiving 4 L PEG plus bisacodyl 20 mg (OR, 0.68; 95% CI, 0.16–2.95). Notably, even among patients who adequately complied with the initial 4 L PEG regimen (≥75% of the prescribed volume and appropriate timing), the risk of inadequate bowel preparation at repeat colonoscopy remained high (OR, 4.05; 95% CI, 1.04–15.75).[184] In an RCT involving patients with a history of inadequate bowel preparation, enhanced

preparatory regimen (3-day LRD and bisacodyl 10 mg administered the day before the procedure) was applied prior to repeat colonoscopy, and split-dose 4 L PEG was compared with split-dose 2 L PEG plus ascorbic acid. The proportion of patients achieving adequate bowel preparation at repeat examination was significantly higher in the 4 L PEG group than in the 2 L PEG plus ascorbic acid group (81.1% vs. 67.4%; OR, 2.07; 95% CI, 1.163–3.689). These findings suggest that intensive pre-procedural preparation combined with high-volume PEG may be effective strategies for repeat bowel preparation.[185]

Small-scale studies have suggested that in cases of inadequate bowel preparation during colonoscopy, direct administration of a laxative into the proximal colon via the endoscopic working channel, followed by a period of bowel evacuation, can achieve adequate bowel cleansing in most patients.[186,187] However, in an RCT conducted in Korea involving 131 patients with poor bowel preparation, the effectiveness of colonoscopic administration of a 1 L PEG enema was compared with additional oral ingestion of 2 L PEG. The rate of adequate bowel preparation was significantly lower in the 1 L PEG enema group than in the 2 L PEG oral supplementation group (53.0% vs. 81.5%; difference, −28.5%, 95% CI, −44.1 to −12.9%; p=0.001).[188] The difference in bowel preparation quality varied by colonic segment, with the largest disparity observed in the right colon (57.8% vs. 86.9%, p<0.001), followed by the transverse colon (85.9% vs. 98.4%, p=0.017) and the left colon (90.6% vs. 96.7%, p=0.274).[188]

Evidence regarding optimal bowel preparation strategies in patients with previously inadequate bowel preparation remains limited; however, in such patients, it is essential to carefully assess risk factors for preparation failure, such as prior vomiting during bowel preparation, incomplete adherence to the prescribed regimen, or other barriers to successful intake. Identifying the primary cause of preparation failure is critical. Based on this assessment, an individualized bowel preparation strategy should be developed, which may include selection of an alternative bowel preparation agent, implementation of enhanced patient education (including the use of multimodal educational tools), and stricter dietary modification.

A summary of the evidence supporting this recommendation is presented in Supplementary Table 9.

CONCLUSIONS

Although the incidence of CRC has declined in recent years, it still remains widely prevalent. High-quality colonoscopy is essential for prevention, early detection, and treatment of CRC. Optimal bowel preparation regimen should therefore ensure effective colonic cleansing while minimizing mucosal injury, maintaining patient safety, and offering acceptable tolerability and convenience.

This clinical practice guideline was developed to provide practical, evidence-based guidance for gastroenterologists and endoscopy personnel on the selection and use of bowel preparation regimens, based on the most up-to-date evidence. The recommendations emphasize individualized selection of bowel preparation according to patient characteristics and clinical conditions, address management strategies following inadequate bowel preparation, and provide guidance for special patient populations. In older adults and patients with significant comorbidities, isotonic PEG-based regimens remain the safest and most preferred option. Although the utility of low-volume hyperosmotic agents has been suggested, current evidence supporting their routine use remains insufficient. In patients with IBD, bowel preparation regimen should be selected with particular caution, and evidence regarding the use of bowel preparation agents during pregnancy and breastfeeding remains inconclusive.

Recently developed bowel preparation agents with novel formulations have improved patient convenience and tolerability; however, further studies are required to establish their efficacy and safety across diverse clinical settings. In cases of inadequate bowel preparation, careful evaluation of the underlying causes is essential, followed by repeat colonoscopy using an individualized strategy that incorporates enhanced patient education and appropriate selection of bowel preparation agents.

In conclusion, this guideline is expected to improve the quality of colonoscopy and support the safe and effective use of bowel preparation regimens tailored to individual patient needs. Ongoing updates will be necessary as new evidence and clinical experience continue to accumulate.

Supplementary Material

Supplementary Table 1. Search strategy.

Supplementary Table 2. Results of expert consultation.

Supplementary Table 3. Summary of recently published trials on dietary control for bowel preparation (2018–2024).

Supplementary Table 4. Summary of recently published trials on the effects of enhanced education on bowel preparation (2018–2024).

Supplementary Table 5. Summary of recently published trials on the use of simethicone for bowel preparation (2018–2024).

Supplementary Table 6. Summary of recently published trials on prokinetic agents for bowel preparation (2018–2024).

Supplementary Table 7. Summary of recently published trials on split-dose or same-day regimens for bowel preparation (2018–2024).

Supplementary Table 8. Summary of recently published trials on low-volume laxatives for bowel preparation (2018–2024).

Supplementary Table 9. Summary of studies on the risks of inadequate bowel preparation and specific patient populations (2018–2024).

Supplementary materials related to this article can be found online at https://doi.org/10.5946/ce.2026.053.

Conflicts of Interest

Jong-Jae Park is a Senior Consultant and a member of the Editorial Board; however, he was not involved in the review or decision process of this manuscript. The other authors have no potential conflicts of interest.

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