REVIEW

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Colon Cleaning after Inadequate Bowel Preparation: A Pooled-data Analysis

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ABSTRACT

Background & Aims: An adequate bowel preparation is essential for performing high-quality ccolonoscopy; however, it remains ineffective for a certain percentage of patients. We conducted a literature search to identify evidence on salvage strategies following inadequate bowel preparation.
Methods: The search of medical literature was conducted using Medline and Google Scholar, restricted to studies published in English as a full paper. From retrieved studies, the success rate was calculated according to the rescue approaches used, including different oral- or device-assisted procedures, and pooling data of similar approaches.
Results: By considering data of 17 studies with 2,167 patients, an adequate colon cleaning was overall achieved in 79.3% (95%CI: 77.5-80.1). By grouping data of similar approaches, the success rate was 78.1% with oral high-volume polyethylene glycol (PEG), 75.3% with low-volume PEG, 82.5% with oral sennosides, and 84.6% following colonoscope or device-assisted preparation.
Conclusions: Effective bowel cleansing is not achieved in nearly 20% of patients due to inadequate bowel preparation and although multiple approaches have been investigated, none has consistently provided adequate bowel preparation for all patients.

Key words: colonoscopy – inadequate bowel cleaning – salvage preparation.

Abbreviations: CI: confidence interval; PEG: polyethylene glycol.

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INTRODUCTION

Colonoscopy is widely performed in clinical practice for both diagnostic and screening purposes. An adequate bowel preparation is essential for achieving a high-quality colonoscopy, which enables the detection and removal of precancerous lesions (adenomas, serrated polyps) and facilitates the cancer diagnosis [1, 2]. Some bowel preparations are currently available, which differ in volume (high, low, or very low), composition [polyethylene glycol (PEG), salts, etc.], administration timing (split- or same-day), based on the colonoscopy slot (morning or afternoon), and flavor [3]. Despite all these possibilities, a large survey of more than 3.7 million colonoscopies showed that bowel cleanliness was inadequate in 5.3% of cases [2], with values widely varying from 3% and 40% (mean 22%) being reported [4], even following washing during the examination [5]. This implies that colonoscopy needs to be rescheduled in a definite portion of cases, with obvious inconveniences for patients, lengthening of waiting lists, and a waste of health resources. While several trials compared different bowel preparations before the first colonoscopy [3], only a few studies were focused on the salvage approach following inadequate bowel preparation. The current ESGE and ACG guidelines suggest either performing a same-day or next-day colonoscopy after additional preparation or postponing the colonoscopy, attempting to individualize the next regimen based on the possible reasons for failure [1, 2]. However, these recommendations were graded as weak and with a very low level of evidence. We therefore reviewed the literature searching for further available data on this clinically relevant issue.

METHODS

The search of the medical literature, restricted to the English language, was conducted using Medline and Google Scholar

froup to and including September the 30th 2025, by searching for "inadequate bowel preparation". Eligibility criteria for study inclusion were availability (or clearly extrapolable) of: a) data on salvage preparation in patients with inadequate bowel preparation; b) assessment of final colon cleanliness by using a standard scale (Boston Bowel Preparation Scale, Aronchick scale); c) data published in a full paper; d) series including ≥5 patients receiving the same approach. Bibliographies of all identified relevant studies were used to perform a recursive search. Abstracts of the papers identified by the initial search were evaluated independently and in a blinded manner for appropriateness by the two (A.Z. and V.D.F.) authors, who independently extracted the following data: 1) total number of patients included; 2) number of patients treated with each different salvage approach; 3) the success rate achieved. Any disagreement was resolved by discussion between the two authors.

The success rates and their 95% confidence intervals (CI) were calculated for each salvage regimen used, as well as for pooled estimations. Data were analyzed at per-protocol analysis, that is by considering patients who eventually underwent a repeat colonoscopy.

RESULTS

Among 650 citations, the full paper of 21 studies was retrieved, but 4 series were finally excluded. Therefore, data from 17 eligible studies with 28 therapeutic arms and 2,167 patients were eventually considered (Fig. 1) [6-22]. There were 5 randomized trials, 10 prospective, and 2 retrospective studies with different approaches, including oral solutions with PEG (n=15) or sennosides (n=3), device-assisted preparation (n=8), and others (n=2). The sample size ranged from 10 to 329 patients, with a median of 48 cases (Table I) [6-22].

Overall, an adequate colon cleaning was achieved in 1,718 (79.3%; 95%CI: 77.5-80.1) out 2,167 patients. By grouping data of similar approaches, there were 5 studies (n=1,232) in which oral high-volume PEG was used, with success rates ranging from 72% to 100% (78.1%; 95%CI: 75.8-80.4) [7, 10-13], 6 studies (n=408) in which low-volume PEG was used, with success rates ranging from 61.9% to 90.1% (75.3%; 95%CI: 70.8-79.2) [6, 7, 9, 11, 15, 17], 2 studies (n=137) where oral sennosides achieved a success rate ranging from 72.9% to 92.5% (82.5%; 95%CI: 72.1-88.8) [8, 16], whilst from 72.9% to 92.5% (84.6%; 95%CI: 80.5-88-7) the colon cleaning was achieved following a colonoscope or device-assisted preparation in 7 studies (n=299) (Table II) [9, 17-22].

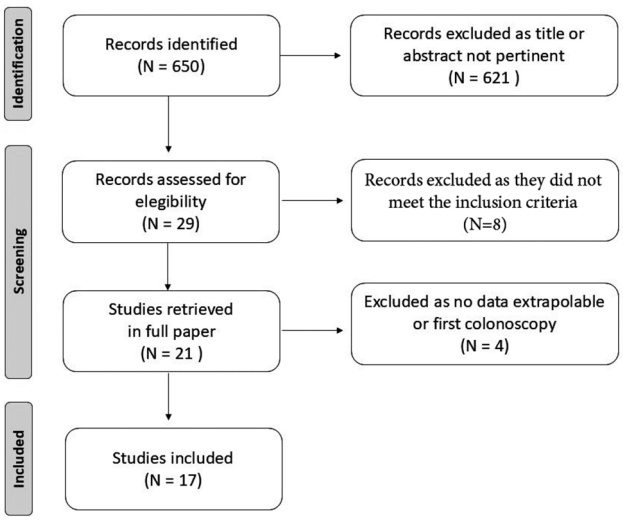

Fig. 1. Flow-chart of literature review.

By considering only data of those studies in which oral PEG preparation was used, namely the most used approach, the success rate ranged from 67.4% and 88.3% (n=867; 78%; 95%CI: 75.2-80.7) and from 70.1% and 94.9% (n=689; 80.4%; 95%CI: 77.4-83.4) in randomized [6, 7, 9, 10] and case-series studies [11-15, 17], respectively. By comparing same-day and rescheduled colonoscopy approach, the colon cleaning was judged adequate in 70.1-88.3% (n=246; 76.1%; 95%CI: 70.1-81.3) [6, 11, 12] and in 61.9-100% (n=1,230; 85.8%; 95%CI: 83.9-87.8) [7, 10-15], respectively. Finally, among the same-day salvage procedures, the success rate was 79.8% (95%CI: 72.1-85.9) when the additional purgative solution was given through-the-scope [9, 18-20] and 81.1% (95%CI: 76.2-85.3) when given orally [6, 8, 9, 11, 16, 17]. A flow-chart with proposal for salvage bowel preparation according to different settings was provided in Fig. 2.

DISCUSSION

Adequate colon cleaning is the pivotal requirement to perform a high-quality colonoscopy. This allows a successful identification and removal of even small lesions on the colon mucosa, and it is essential for recommending the appropriate screening or surveillance intervals [1, 2]. Undeniably, bowel preparation formulations have undergone substantial improvements, including a reduction in required volume to 1 liter and enhanced palatability, compared with earlier preparations [3]. Moreover, the split administration of preparation further improves patients' compliance. Despite these improvements, the colon remains inadequately prepared in a definite portion of patients requiring further same- or next-day cleaning or rescheduling the procedure [1, 2]. Several factors predicting bowel preparation failure were identified, such as hospitalization, diabetes, neurological disorders, opioid or tricyclic antidepressant use, chronic constipation, and prior bowel resection, among others [23]. However, these factors only rarely were considered for tailoring the bowel preparation before the first examination, because colonoscopy is largely performed as open access in routine practice. Even by conservatively considering an overall 5% failure [2], it could be estimated that thousands of patients everyday, require a salvage approach and the examination will need to be repeated. In face of this diffuse and relevant problem for both clinical and economic aspects, only a few studies were performed searching for the more effective solution for these patients. IIndeed, the present review identified only a few randomized trials that used diverse approaches, thereby preventing the conduct of a meta-analysis. Moreover, some differences do exist also among the available case-series. Based on these limitations, we grouped data of similar approaches, including high- and low-volume oral PEG solutions, sennosides-based preparations, and device-assisted procedures, and from these findings, a number of remarks can be drawn.

Table I. Characteristics of considered studies

Ref.	Study design	Cases (N)	Rescue approach	Low-residue diet	Other compound	Success (%)	p
[6]	Randomized;	43	1-L PEG + Asc; same-day	No	No	88.4	NS
	Investigator-blinded	47	0.5- L PEG + Asc; same-day	No	No	80.9	
[7]	Randomized;	127	4-L PEG; split; rescheduled	3-day	Bisacodyl	81.1	0.01
	Investigator-blinded	129	2-L PEG + Asc; split; rescheduled	3-day	Bisacodyl	67.4	
[8]	Randomized;	40	150 mL sennoside + 1.5-L water; same day	1-3 days	No	92.5	0.02
	Investigator-blinded	37	150 mL sennoside + 3-L water; split; rescheduled	1-3-day	No	72.9	
[9]	Randomized;	61	2-L PEG; same-day	No	No	86.9	0.001
	Investigator-blinded	64	Through-the-scope 1-L PEG; same-day	No	No	54.7	
[10]	Randomized;	329	4-L PEG; split; rescheduled	7-day	Bisacodyl	72	0.001
	Investigator-blinded	267	4-L PEG + Educational; split; rescheduled	7-day	No	83.5	
[11]	Prospective;	43	4-L PEG; split or full; rescheduled	7-day	Bisacodyl	84	NS
	Patients' preference	42	2-L PEG; same-day	No	No	73.8	
[12]	Retrospective	114	4-L PEG; split; next day	No	Gatorate	70.1	NS
		283	4-L PEG; split; rescheduled	2-day liquid	Mg citrate	76.7	
[13]	Prospective	59	4.5-L; split; rescheduled	3-day	Gatorate	94.9	NS
		10	6-L PEG split; rescheduled	3-day	Gatorate	100	
[14]	Prospective	42	PEG; split; rescheduled*	No	No	61.9	0.001
		30	400 mL saline water + Yoga	No	No	96.6	
[15]	Prospective	51	3-L PEG; split, rescheduled	2-day	Bisacodyl	90.2	-
[16]	Prospective	60	250 mL sennoside + 1.5-L water; same day	Yes/Not	No	81.7	-
[17]	Retrospective	54	2-L PEG; same-day	No	No	87	NS
		55	Colon hydrotherapy device; same-day	No	No	80	
[18]	Prospective	10	Through-the-scope phosphate+bisacodyl; same-day	No	No	100	-
		11	Through-the-scope bisacodyl; same-day	No	No	100	
[19]	Prospective	40	Through-the-scope sodium phosphate; same-day	No	No	82	-
[20]	Prospective	26	Through-the-scope 0.5-L PEG; same-day	No	No	100	-
[21]	Prospective	49	Colon hydrotherapy over-the-scope; same-day	No	No	97.9	-
[22]	Prospective	44	Colon hydrotherapy over-the-scope; rescheduled	2-day	No	88.6	-

*Volume of PEG solution not reported.

Table II. Success rate achieved following different approaches

Ref.	Rescue approach	Cases (N)	Success (%)
PEG ≥4 Liters			
[7]	4-L PEG; split; rescheduled	127	81.1
[10]	4-L PEG; split; rescheduled	329	72
	4-L PEG + Educational; split; rescheduled	267	83.5
[11]	4-L PEG; split or full; rescheduled	43	84
[12]	4-L PEG; split; next day	114	70.1
	4-L PEG; split; rescheduled	283	76.7
[13]	4.5-L; split; rescheduled	59	94.9
	6-L PEG split; rescheduled	10	100
PEG ≤3 Liters			
[6]	1-L PEG + Asc; same-day	43	88.4
	0.5- L PEG + Asc; same-day	47	80.9
[11]	2-L PEG; same-day	42	73.8
[17]	2-L PEG; same-day	54	87
[9]	2-L PEG; same-day	42	61.9
[7]	2-L PEG + Asc; split; rescheduled	129	67.4
[15]	3-L PEG; split, rescheduled	51	90.2
Sennosides			
[8]	150 mL sennoside + 1.5-L water; same day	40	92.5
	150 mL sennoside + 3-L water; split; rescheduled	37	72.9
[16]	250 mL sennoside + 1.5-L water; same day	60	81.7
Device-assisted			
[20]	Through-the-scope 0.5-L PEG; same-day	26	100
[9]	Through-the-scope 1-L PEG; same-day	64	53
[18]	Through-the-scope phosphate+bisacodyl; same-day	10	100
	Through-the-scope bisacodyl; same-day	11	100
[19]	Through-the-scope sodium phosphate; same-day	40	82
[21]	Colon hydrotherapy over-the-scope; same-day	49	97.9
[22]	Colon hydrotherapy over-the-scope; rescheduled	44	88.6
[17]	Colon hydrotherapy without colonoscope; same-day	55	80

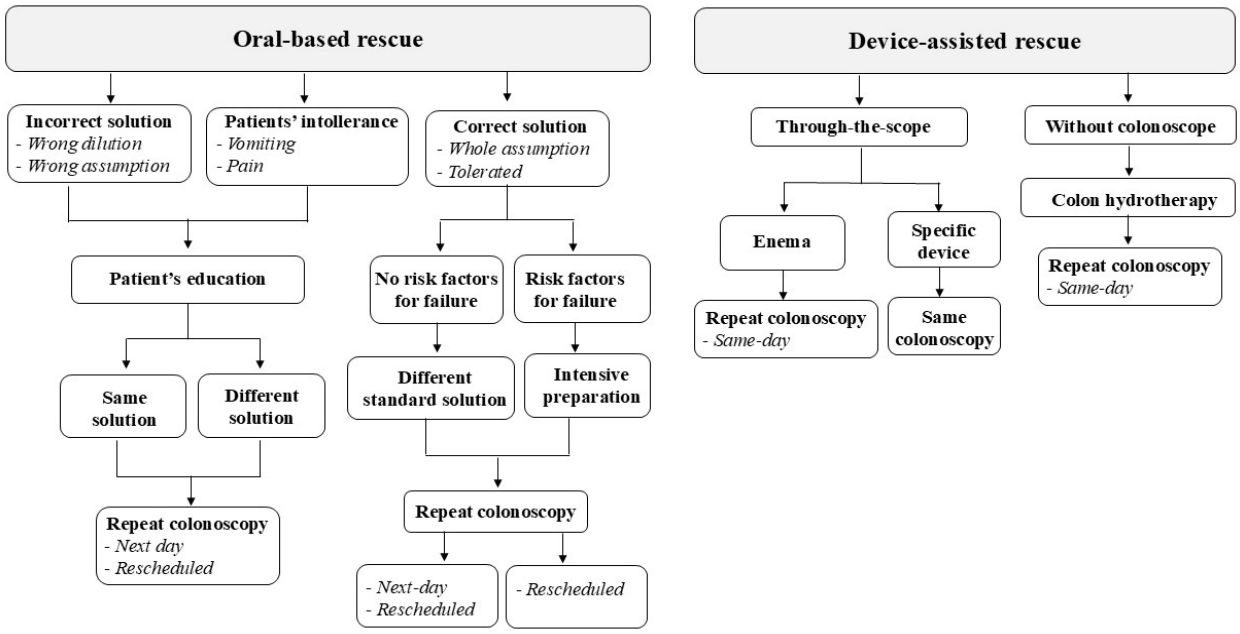

Fig. 2. Proposal for salvage bowel preparation.

The findings suggest a high degree of equivalence among the subgroups with respect to success rates, with no approach demonstrating clear superiority. Indeed, our data found that achieving an adequate bowel cleaning still failed in more than 20% of cases, irrespective of the salvage preparation used.

Data showed that the most used approach was a high-volume PEG solution with a rescheduled examination, followed by a low-volume PEG administered in the same or next day. Rescheduling the colonoscopy later is advantageous for the Endoscopic Unit, as it does not affect the pre-planned slots in the endoscopy session. However, it represents a significant inconvenience for the patient and a waste of resources. Furthermore, it has been found that when the colonoscopy was scheduled on the next day, from 8% until to as many as 80% of patients failed to repeat the colonoscopy, resulting in relevant diagnoses being overlooked in a substantial proportion of cases[8, 24]. On the other hand, performing an additional low-volume preparation and postponing the colonoscopy in the same- or next-day may be more beneficial for the patient with a 4-fold increased adhesion as compared to the rescheduled approach [24]. However, such a procedure is not always feasible due to logistical constraints, such as insufficient availability of dedicated watery room, and unavailable endoscopy slots. When the same-day salvage preparation is chosen, no differences emerged when the additional preparation was given orally or through-the-scope. Finally, we identified data of less than 150 patients in whom salvage bowel preparation was performed by using a colonoscope-assisted washing with a specific device. Further studies are required, including those on cost-effective analysis, before the potential implementation in clinical practice.

Our study has some strengths and limitations. The heterogeneity among different approaches in term of type and dose of colon preparations used prevented a reliable meta-analysis from being conducted. We estimated the range of success achieved by similar approaches, rather than pooling data of different rescue attempts, so that a head-to-head comparison among subgroups was impossible. However, we aggregated data in manner as homogeneous as possible.

CONCLUSIONS

The available data on salvage approach for inadequate bowel preparation are scanty and heterogeneous.Each approach entails its own set of advantages and drawbacks, and none consistently achieved a successful preparation in all patients. Therefore, salvage bowel preparation should be chosen based on the best facilities in each center.

Conflict of interests: None to declare.

Authors' contributions: A.Z. and R.M. conceived the study. A.Z. V.D.F., G.C. and L.G. collected the data. A.Z. drafted the manuscript. L.G. provided constructive criticisms. All the authors read and approved the final version of the manuscript.

REFERENCES

1. Hassan C, East J, Radaelli F, et al. Bowel preparation for colonoscopy: European Society of Gastrointestinal Endoscopy (ESGE) guideline-update 2019. Endoscopy. 2019;51:775–794. doi:10.1055/a-0959-0505
2. Jacobson BC, Anderson JC, Burke CA, et al. Optimizing bowel preparation quality for colonoscopy: consensus recommendations by the US Multi-Society Task Force on colorectal cancer. Am J Gastroenterol. 2025;120:738–764. doi:10.14309/ajg.0000000000003287
3. Maida M, Marasco G, Fuccio L, et al. Comparative efficacy of different bowel preparations for colonoscopy: a network meta-analysis. Dig Liver Dis. 2025;57:688–696. doi:10.1016/j.dld.2024.11.019
4. Mahadev S, Green PH, Lebwohl B. Rates of suboptimal preparation for colonoscopy differ markedly between providers: impact on adenoma

detection rates. J Clin Gastroenterol. 2015;49:746–750. doi:10.1097/MCG.0000000000000210
5. MacPhail ME, Hardacker KA, Tiwari A, Vemulapalli KC, Rex DK. Intraprocedural cleansing work during colonoscopy and achievable rates of adequate preparation in an open-access endoscopy unit. Gastrointest Endosc. 2015;81:525–530. doi:10.1016/j.gie.2014.05.002
6. Cho JH, Goo EJ, Kim KO, Lee SH, Jang BI, Kim TN. Efficacy of 0.5-L vs 1-L polyethylene glycol containing ascorbic acid as additional colon cleansing methods for inadequate bowel preparation. World J Clin Cases. 2019;7:39–48. doi:10.12998/wjcc.v7.i1.39
7. Gimeno-García AZ, Hernandez G, Aldea A, et al. Comparison of two intensive bowel cleansing regimens in patients with previous poor bowel preparation: a randomized controlled study. Am J Gastroenterol. 2017;112:951–958. doi:10.1038/ajg.2017.5
8. Özsoy U, Yıldırım M, Daldal E, et al. The results of same-day and appointment colonoscopy in inadequate bowel cleansing: a randomized controlled trial. Turk J Surg. 2025;41:61–68. doi:10.47717/turkjsurg.2025.6541
9. Yang HJ, Park DI, Park SK, et al. A randomized controlled trial comparing colonoscopic enema with additional oral preparation as salvage for inadequate bowel cleansing before colonoscopy. J Clin Gastroenterol. 2019;53:e308–e315. doi:10.1097/MCG.0000000000001087
10. Alvarez-Gonzalez MA, Pantaleón Sánchez MA, Cabredo BB, et al. Educational nurse-led telephone intervention shortly before colonoscopy as a salvage strategy after previous bowel preparation failure: a multicenter randomized trial. Endoscopy. 2020;52:1026–1035. doi:10.1055/a-1178-9844
11. Kim JW, Han JH, Boo SJ, et al. Rescue bowel preparation: same-day 2 L polyethylene glycol addition not superior to bisacodyl addition 7 days later. Dig Dis Sci. 2014;59:2215–2221. doi:10.1007/s10620-014-3125-3
12. Murphy CJ, Samadder NJ, Cox K, et al. Outcomes of next-day versus non-next-day colonoscopy after an initial inadequate bowel preparation. Dig Dis Sci. 2016;61:46–52. doi:10.1007/s10620-015-3833-3
13. Gerard DP, Gerard SF, Raiser MW. High-dose polyethylene glycol-3350 and Gatorade solutions for patients with previous inadequate bowel preparations are safe and effective. BMC Gastroenterol. 2023;23:146. doi:10.1186/s12876-023-02663-0
14. Panigrahi MK, Gupta S, Rath MM, et al. Same-day yoga-based Laghu Shankhaprakshalana versus standard polyethylene glycol for rescue colonoscopy. Indian J Gastroenterol. 2024;43:1059–1061. doi:10.1007/s12664-024-01638-7
15. Ibáñez M, Parra-Blanco A, Zaballa P, et al. Usefulness of an intensive bowel cleansing strategy for repeat colonoscopy after preparation failure. Dis Colon Rectum. 2011;54:1578–1584. doi:10.1097/DCR.0b013e31823434c8
16. Akgul G, Ozgur Yeniova A, Ozsoy Z, et al. Effect and tolerability of same-day repeat colonoscopy. J Invest Surg. 2020;33:459–465. doi:10.1080/08941939.2018.1513611
17. Zhang D, Zhao C, Tao Y, et al. Remedial colon hydrotherapy device enema as a salvage strategy for inadequate bowel preparation: a retrospective cohort study. PLoS One. 2025;20:e0319493. doi:10.1371/journal.pone.0319493
18. Sohn N, Weinstein MA. Management of the poorly prepared colonoscopy patient: colonoscopic colon enemas as preparation. Dis Colon Rectum. 2008;51:462–466. doi:10.1007/s10350-007-9127-x
19. İbiş M, Önal İK, Arhan M, et al. Efficacy of through-the-scope sodium phosphate solution with same-day completion colonoscopy as a salvage option. Turk J Med Sci. 2016;46:1089–1093. doi:10.3906/sag-1506-116
20. Horiuchi A, Nakayama Y, Kajiyama M, et al. Colonoscopic enema as rescue for inadequate bowel preparation: a prospective study. Colorectal Dis. 2012;14:e735–e739. doi:10.1111/j.1463-1318.2012.03107.x
21. Pérez Jiménez J, Diego Bermúdez L, Gralnek IM, et al. Intraprocedural endoscopic cleansing device for poorly prepped patients. J Clin Gastroenterol. 2019;53:530–534. doi:10.1097/MCG.0000000000001114
22. van Riswijk MLM, van Keulen KE, Neumann H, Siersema PD. Intraprocedural bowel cleansing system for difficult-to-prepare patients: a multicenter feasibility study. United European Gastroenterol J. 2024;12:56–65. doi:10.1002/ueg2.12501
23. Beran A, Abourshed T, Ali AH, et al. Risk factors for inadequate bowel preparation: systematic review and meta-analysis. Am J Gastroenterol. 2024;119:2389–2397. doi:10.14309/ajg.0000000000003073
24. Chokshi RV, Hovis CE, Colditz GA, Early DS, Wang JS. Physician recommendations and patient adherence after inadequate bowel preparation. Dig Dis Sci. 2013;58:2151–2155. doi:10.1007/s10620-013-2642-9