

Meta-Analysis

Incremental value of mucosal exposure device to computer-aided detection in colonoscopy: A meta-analysis and trial sequential analysis

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ABSTRACT

Background: It is unknown if mucosal exposure device improves the adenoma detection rate (ADR) of computer-aided detection (CAD)-assisted colonoscopy.

Aims: We performed a meta-analysis of randomized-controlled trials (RCTs) to compare the diagnostic outcomes of these two approaches.

Methods: We identified 4 RCTs (2968 patients). ADR was the primary outcome. Advanced ADR (aADR), sessile serrated ADR (SSDR) and adenoma per colonoscopy (APC) were also compared. The results were expressed in terms of mean difference (MD) or risk ratio (RR) and 95% confidence intervals (CIs), and we used trial sequential analysis (TSA) to assess if the required information size (RIS) was reached.

Results: There was no difference in terms of ADR both in the overall series (RR 1.05, 0.98–1.12; $p=0.16$) and in screening colonoscopy (RR 1.15, 0.72–1.82; $p=0.56$). Although the RIS (3829 participants) was not reached, the futility boundaries were crossed suggesting a high likelihood of futility in further comparison of ADR. No difference was observed in terms of aADR (RR 1.13, 0.90–1.44; $p=0.30$) and SSDR (RR 1.11, 0.92–1.35; $p=0.27$). APC was significantly higher in the combined group (MD 0.14, 0.05 to 0.22; $p=0.002$).

Conclusions: The addition of mucosal exposure devices does not increase ADR, aADR, and SSDR but increases APC.

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1. Introduction

The diagnostic yield of colonoscopy is dependent on accurate detection and complete removal of precancerous lesions and adenoma detection rate (ADR), defined as the percentage of colo-

scopies with at least 1 adenoma identified, has been recognized as a key performance measure for quality colonoscopy [1,2].

The implementation of computer-aided detection (CAD) of colorectal polyps based on the artificial intelligence (AI), deep learning, and machine learning methods has dramatically changed the scenario of digestive endoscopy. CAD-assisted colonoscopy already proved its efficacy in adenoma detection in several randomized-controlled trials (RCTs) and meta-analyses [3–5]. However, the real benefit of CAD-assisted colonoscopy particularly in the

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setting of the screening for colorectal cancer (CRC) is still uncertain, as pointed out by the discordant conclusions of recent guidelines [6,7], and several pitfalls of this approach still need to be improved, for example the detection of lesions out of the visual field.

Since failure to adequately expose the complete surface of the colorectal mucosa due to its folds and angulations may increase the rates of lesions missed during colonoscopy, several mucosal exposure devices have been tested in the clinical practice. These devices, including balloon, transparent cap, or cuff, have been found to increase ADR by flattening mucosal folds, straightening angulations, and facilitating inspection of areas behind folds [8]; particularly, the second generation of cuff (EndoCuff Vision®, Olympus, Tokyo, Japan) seems to consistently improve colon ADR, with a reduction in mean withdrawal time [9].

Therefore, increasing the mucosa exposure could represent a complementary strategy to CAD-assisted colonoscopy in order to further improve ADR.

This combined approach seemed to be effective in preliminary RCTs [10–12] but a recent study questioned its real benefit [13]. Given the discordant results in the literature, we decided to perform a systematic review and meta-analysis of available RCTs comparing combined CAD-assisted colonoscopy and mucosal exposure device versus CAD-assisted colonoscopy alone to improve ADR.

Furthermore, given the low number of RCTs comparing the two techniques, a trial sequential analysis (TSA) was performed to assess the credibility of our findings. Exactly like the calculation of the sample size in individual RCTs, TSA derives a power calculation for a meta-analysis. This methodology allows the application of monitoring (benefit, harm, and futility) and conventional boundaries and finally allows the calculation of the required number of participants based on the predefined intervention effect, adjusting it for the heterogeneity observed in the included studies [14].

We also used Grading of Recommendations Assessment, Development and Evaluation (GRADE) criteria [15] to appraise the quality of evidence.

2. Methods

This systematic review is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [16].

2.1. Selection criteria

Studies included in this meta-analysis were RCTs published in English language meeting the following inclusion criteria: (a) Patients: adults (age >18 years) undergoing colonoscopy; (b) Intervention: combined CAD-assisted colonoscopy and mucosal exposure devices; (c) Comparator: CAD-assisted colonoscopy alone; and (d) Outcomes: ADR, advanced ADR (aADR), sessile serrated ADR (SSDR), number of adenomas per colonoscopy (APC), cecal intubation time. Non-comparative observational and retrospective studies, and RCTs comparing different AI methods or different mucosal exposure devices were excluded.

2.2. Search strategy

The search strategy was based on various databases with variant controlled vocabularies, expanded terminology, varying algorithms, and keyword capabilities, for RCTs published from inception through July 2025. Complementary manual search was performed on additional databases (Google Scholar, Cochrane library) to identify potential additional studies. The detailed literature search strategy is reported in the **Supplementary Table 1**.

Data were abstracted onto a standardized form by two authors independently (AF, MB). The risk of bias of individual studies was

assessed using the Cochrane Risk of Bias assessment tool 2.0 [17] by two authors (AF, MB). In the case of disagreements, the decision was based on a third author's (ADA) opinion.

2.3. Outcomes

Primary outcome was ADR, defined as the proportion of patients undergoing colonoscopies where at least one adenoma is detected. Secondary outcomes were aADR (proportion of patients where at least one advanced adenoma is detected), SSDR (proportion of patients where at least one sessile serrated adenoma is detected), APC (defined as mean number of adenomas per colonoscopy), and cecal intubation time.

2.4. Statistical analysis

Study outcomes were pooled and compared between the two groups through a random-effects model based on DerSimonian and Laird test [18], and results were expressed in terms of risk ratio (RR) or mean difference (MD) and 95 % confidence interval (CI), when appropriate.

Presence of heterogeneity was calculated through I^2 tests with $I^2 < 30\%$ interpreted as low-level heterogeneity and I^2 between 30 % and 60 % as moderate heterogeneity [19]. Any potential publication bias was verified through visual assessment of funnel plots.

Similar to RCTs, the TSA of the meta-analyses is based on an anticipated a priori intervention effect, on the basis of which the sample size is estimated to be subsequently detected with adequate power. This sample size in the TSA is the required information size (RIS), which is the number of events (or patients) from the included studies necessary to accept or reject the a priori statistical hypothesis, adjusted for the heterogeneity among the included RCTs [14,20].

When calculating the RIS, the Type I error was set at 5 % and the power at 80 % whereas the anticipated incidence rates were based on the cumulative meta-analysis of RCTs.

In TSA, the Z-value is updated with each additional published study added to the meta-analysis, providing the cumulative Z-curve. This Z-curve is then checked for crossover in 3 boundaries: the naïve (horizontal) boundaries, which correspond to a nominal $P = 0.05$ ($|Z| 1.96$); the monitoring boundaries, which are sequential monitoring boundaries calculated on the a priori intervention effect and are distinguished in benefit/harm boundaries; and the futility boundaries, which are the adjusted threshold for non-superiority and non-inferiority tests obtained by applying the α -spending function based on the O'Brien–Fleming method [14,20]. When the Z-curve crosses the naïve boundaries but does not cross the monitoring boundaries, there is a statistical difference in the conventional meta-analysis but not in TSA, thus not avoiding the risk of a false-positive result. If the Z-curve lies within futility boundaries and the appropriate RIS is reached, it can be easily concluded that the intervention does not have an effect. When the result of the meta-analysis is negative and the appropriate RIS is not reached, then there is lack of power. If the Z-curve crosses monitoring boundaries, it means that the treatment has evident benefit (or harm) in respect to the control group.

All statistical analyses were conducted using RevMan version 5 from the Cochrane collaboration; TSA was conducted with the Trial Sequential Analysis software provided by the Copenhagen Trial Unit. For all calculations a two-tailed p value of <0.05 was considered statistically significant.

2.5. Quality of evidence assessment

Quality of evidence was assessed through the GRADE criteria (**Supplementary Table 2**) [15]. Briefly, evidence from RCTs started

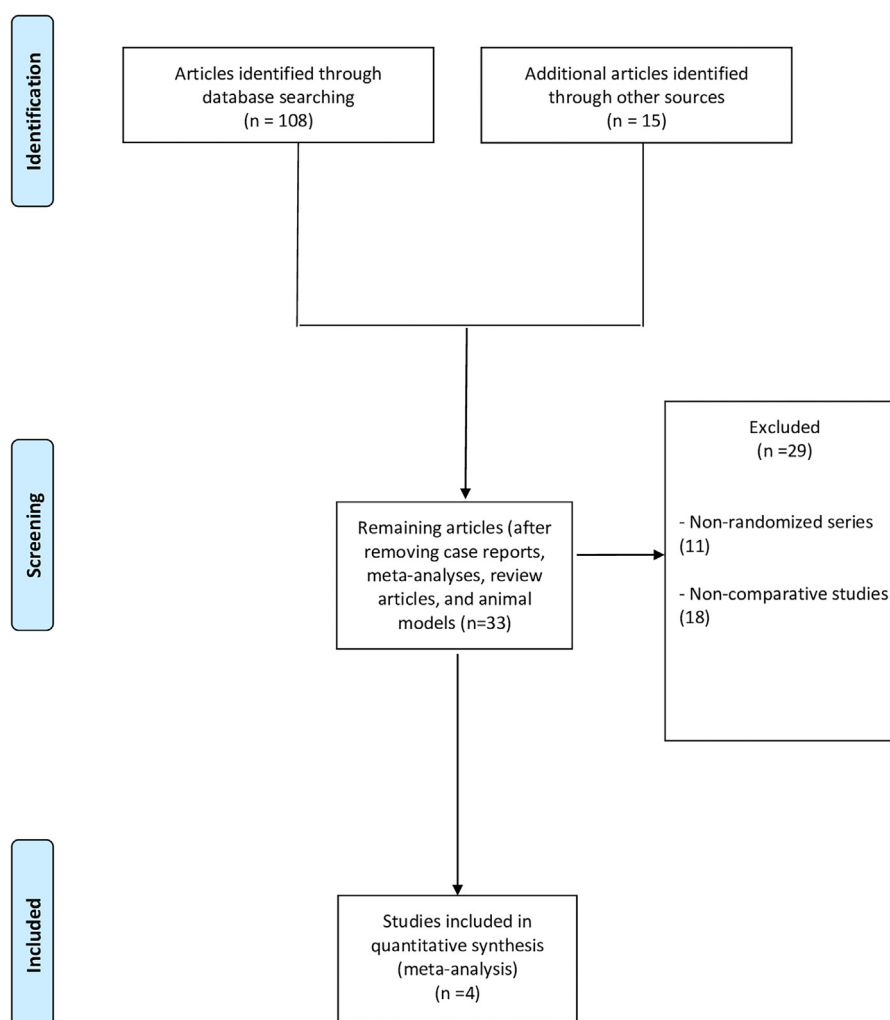


Fig. 1. Flow chart of the included trials.

at high quality, and was rated down for presence of any of the following factors – risk of bias in the literature, inconsistency, indirectness, imprecision and publication bias.

For imprecision, evidence was rated down even if the 95 % CI crossed unity or if the optimal information size (measure of fragility) was not reached [15].

3. Results

3.1. Characteristics of included studies

Out of 123 articles initially identified using the search strategy, we finally included 4 RCTs in the meta-analysis [10–13]. Fig. 1 details the study selection flowchart.

Table 1 summarizes the baseline characteristics of the RCTs included. Overall, the included 4 trials enrolled 2968 patients (1488 in the combined arm and 1480 in the CAD alone group).

Two RCTs [10,13], used the CAD EYE® AI system (Fujifilm, Tokyo, Japan), one RCT [11] used the OIP-1® (Olympus, Tokyo, Japan), and one RCT [12] used the GI-Genius® system (Medtronic, Dublin, Ireland). Among the mucosal exposure devices, 3 RCTs [10–12] used the EndoCuff Vision® and one RCT [13] used the G-EYE colonoscopy® (Fujifilm, Tokyo, Japan).

Two RCTs [12,13], were conducted in Italy and two RCTs [10,11], in Asia and the recruitment period ranged from 2020 to 2024.

Two RCTs [10,13], included only screening colonoscopy whereas the other two RCTs [11,12], included also diagnostic or surveillance procedures. Two RCTs [10,11], included also a third arm based on high-definition (HD) colonoscopy, with a reported ADR of 41.9 % [10] and 46.3 % [11], respectively.

The other baseline patient characteristics were homogeneously distributed between the two groups and across different trials (Table 1).

As described in the **Supplementary Table 3**, all studies were rated at low risk of bias.

3.2. ADR

As reported in Fig. 2, there was no difference in terms of ADR between the two groups (RR 1.05, 0.98–1.12; $p = 0.16$) with low evidence of heterogeneity ($I^2 = 22\%$). This finding was confirmed also in the sensitivity analysis restricted to screening colonoscopy (RR 1.15, 0.72–1.82; $p = 0.56$) (**Supplementary Figure 1**). Likewise, no difference was observed in the sensitivity analysis based on studies using the EndoCuff Vision device (RR 1.12, 0.78–1.76; $p = 0.34$, data not shown).

There was no evidence of publication bias based on visual inspection of the funnel plot (**Supplementary Figure 2**).

Table 1
Characteristics of included randomized controlled trials.

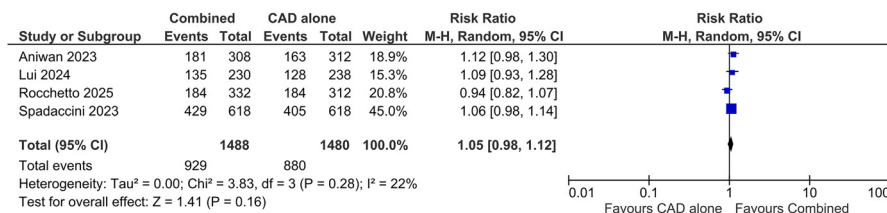
Author, year	Study period; Country	CAD/Device used	N patients	Age	Sex male	ADR HD colonoscopy	Indications to colonoscopy
Aniwan 2023 [10]	2020–2022; Thailand	CAD EYE/Endocuff Vision	308 Combined 312 CAD	61.7 ± 7 62.8 ± 6.82	132 (42.8 %) 133 (42.6 %)	41.9 %	Screening 100 %
Lui 2024 [11]	2022–2023; China	OIP-1/Endocuff Vision	230 Combined 238 CAD	64±10 66.3 ± 10.2	118 (51.3 %) 131 (55 %)	46.3 %	Screening 18 % Surveillance 29.6 % Diagnostic 52.6 %
Spadaccini 2023 [12]	2021–2022; Italy-Switzerland	GI Genius/Endocuff Vision	618 Combined 618 CAD	61.5 ± 9.9 61.3 ± 10.3	298 (48.2 %) 291 (47.1 %)	NA	Screening 43.8 % Surveillance 22.2 % Diagnostic 34 %
Rocchetto 2025 [13]	2023–2024; Italy	CAD EYE/G-EYE	332 Combined 312 CAD	62±12 63 ± 13	166 (50 %) 153 (49 %)	NA	Screening 100 %

Abbreviations: ADR, Adenoma Detection Rate; CAD, Computer Aided Detection; HD, High Definition.

Table 2
Meta-analysis of secondary outcomes.

Outcome	Number of studies	RR or MD (95 % CI)	I ²	P value
Overall aADR	4	1.13 (0.90–1.44)	35 %	0.30
Screening aADR	3	1.15 (0.72–1.82)	52 %	0.56
SSDR	4	1.11 (0.92–1.35)	3 %	0.27
Screening SSDR	3	1.13 (0.48–2.68)	60 %	0.77
APC	4	0.14 (0.05–0.22)	85 %	0.002
Cecal Intubation Time	4	−0.63 (−1.43 to 0.17)	86 %	0.12

Abbreviations: aADR, advanced adenoma detection rate; APC, adenoma per colonoscopy; CI, Confidence Interval; MD, Mean Difference; RR, Risk Ratio; SSDR, sessile serrated adenoma detection rate.

**Fig. 2.** Forest plot for ADR.There was no difference in terms of adenoma detection rate (ADR) between the two groups (RR 1.05, 0.98–1.12; $p = 0.16$) with low evidence of heterogeneity ($I^2=22\%$).

3.3. Secondary outcomes

As reported in Table 2, no difference was observed in terms of aADR (RR 1.13, 0.90–1.44; $I^2=35\%$; **Supplementary Figure 3**). Similar results were observed in the subset of patients undergoing screening colonoscopy (RR 1.15, 0.72–1.82; $I^2=52\%$; Table 2).

SSDR was similar in the two groups both overall (RR 1.11, 0.92–1.35; $I^2=3\%$; **Supplementary Figure 4**) and in the screening sub-group (RR 1.13, 0.48–2.68; $I^2=60\%$; Table 2).

As depicted in Fig. 3, APC was significantly higher in the combined group (MD 0.14, 0.05 to 0.22; $p = 0.002$), with high evidence of heterogeneity ($I^2=85\%$; Fig. 3 and Table 2). Leave-one-out sensitivity analysis was not able to find a source of this high heterogeneity (Supplementary Figure 5).

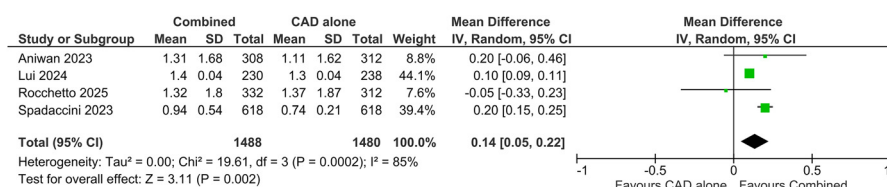
There was no difference in terms of cecal intubation time between the two groups (MD −0.63, −1.43 to 0.17; $p = 0.12$; Table 2 and **Supplementary Figure 6**).

The aforementioned analyses did not show any risk of publication bias (data not shown).

3.4. Trial sequential analysis

As depicted in Fig. 4, the RIS calculated by TSA for ADR was of 3829 participants, thus above the accrued information size of 2968 patients enrolled in the included RCTs. However, while the Z-curve did not cross the conventional test boundary remaining below the benefit monitoring boundary, it crossed the futility boundary. Therefore, although the RIS was not reached, it is unlikely that further data would change our findings and a Type II error (false negative) can be reasonably excluded.

TSA reported in **Supplementary Figure 7** showed that the RIS (25,125 patients) was not reached in the analysis of aADR (actual sample size 2968 patients). The cumulative Z-curve did not cross the futility boundaries nor the conventional test and the benefit

**Fig. 3.** Forest plots for APC.Mean number of adenomas per colonoscopy (APC) was significantly higher in the combined group (MD 0.14, 0.05 to 0.22; $p = 0.002$), with high evidence of heterogeneity

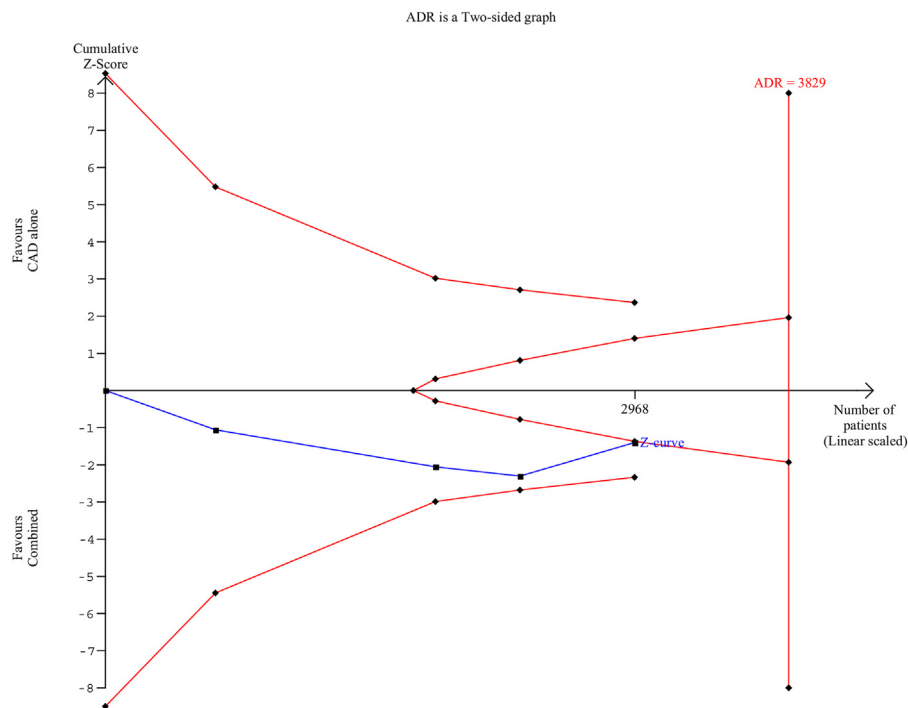


Fig. 4. Trial sequential analysis concerning ADR.

The required information size (RIS) calculated by trial sequential analysis (TSA) for ADR was of 3829 participants, thus above the accrued information size of 2968 patients. However, while the Z-curve did not cross the conventional test boundary remaining below the benefit monitoring boundary, it crossed the futility boundary. Therefore, although the RIS was not reached, it is unlikely that further data would change our findings and a type II error (false negative) can be reasonably excluded.

monitoring boundaries, thus not supporting the superiority of the intervention over the comparator, with a clear evidence of lack of power.

TSA reported in **Supplementary Figure 8** showed that the RIS (4798 patients) was not reached in the analysis of APC. The cumulative Z-curve crossed both the conventional test and the benefit monitoring boundaries whereas it did not cross the futility boundaries. Therefore, while the current results suggest the superiority of the combined approach in detecting more polyps per colonoscopy, we cannot exclude this finding could be biased by the lack of power and more data are needed to draw definitive conclusions on this aspect.

3.5. Quality of evidence

The quality of evidence was mainly judged as moderate due to the imprecision (broad 95 % CIs crossing the unity and low number of events not reaching the RIS).

4. Discussion

Distal attachment devices, which improve mucosal exposure and help the visualization of polyps hidden behind haustral and CAD systems have been both shown to improve the ADR [3,4,8]. Recent evidence suggests that the combination of these technologies may have a synergistic effect [10–12], although these findings were recently questioned in an Italian RCT conducted in a fecal immunochemical test (FIT)-based screening program [13].

Through a meta-analysis of 4 RCTs, the first ever published in the field, and using GRADE criteria to appraise the quality of evidence, we made several key observations. First, there was no difference in terms of ADR between the two groups (RR 1.05, 0.98–1.12), a finding confirmed also in the sensitivity analysis restricted

to screening colonoscopy (RR 1.15, 0.72–1.82; $p = 0.56$). The above reported RR of 1.05 suggests a very marginal effect of the combination of the two approaches, given the 5 % increment of ADR and a “number needed to scope” of 33 colonoscopies needed to increase the ADR of 1 point. On the other hand, the mean APC was significantly higher in the combined group thus suggesting that there is a synergistic effect of CAD+mucosal exposure devices in detecting more adenomas, particularly small adenomas, but without increasing consistently the ADR. These findings support the evidence of a potential ceiling effect when the ADR in the control group is very high, as in the aforementioned Italian series [13], in which adenoma detection might be already be maximized by CAD alone. Moreover, while ADR represents a quality index whose inverse correlation with interval CRC rates is well described, less evidence is available with APC, which in turn could be also correlated with the detection and removal of irrelevant lesions. Although the two quality indexes are commonly correlated, a study evaluating 80,915 screening colonoscopies showed that almost 48 % of endoscopists with the lowest APC had higher ADR, whereas, no endoscopist with high APC had a lower ADR [21]. Therefore, the apparently discordant findings in our study are not surprising. Of note, there was high heterogeneity concerning the analysis of APC. However, this high heterogeneity, not explained by the leave-one-out sensitivity analysis, should be interpreted with caution as it is well-known that I^2 % statistics is higher when considering continuous variables as compared to categorical outcomes due to the intrinsic broad numeric nature of these variables [22].

Second, as mentioned above, no difference was observed in terms of aADR and SDDR both overall and in the screening setting. This result is not unexpected as the included studies already observed that the main reason for the higher detection rate of polyps in the combined intervention arm was the gradient in diminutive and proximal lesions, and no difference was found for larger or

more advanced lesions [12]. It is well known that both mucosal exposure devices and CAD are more effective in the detection of smaller lesions whereas they do not show any additional benefit for larger or advanced adenomas [23,24]. Third, there was no difference in terms of cecal intubation time between the two groups ($p = 0.12$), suggesting a neutral effect of the use of these distal attachment devices on the prolongation of the examination, at least as compared to CAD-assisted colonoscopies. Finally, although the TSA showed that <80 % of the RIS was actually accrued in the RCTs conducted so far, the Z-curve crossed the futility boundary. Therefore, while the RIS was not reached, our results suggest a high likelihood of futility in the comparison for the primary outcome since it is unlikely that further data would change our findings and a type II error (false negative) can be reasonably excluded. On the other hand, we cannot draw definitive assumptions on the comparison between the two approaches in terms of aADR and APC as further RCTs are still needed and the current findings could be due to a type II error (false negative) because of the lack of power in the meta-analysis.

As a consequence, only a moderate quality of evidence is currently available due to the imprecision of the estimates.

There are certain limitations to our study which merit further discussion. First, the number of included studies and recruited patients was low and as aforementioned the RIS was not reached. Second, the included RCTs were unblinded, hence prone to performance bias. However, no deviations from the intended protocol were observed, hence the RCTs were considered to be at low risk of bias. Third, not all the available distal attachment devices nor all the CAD systems were tested in the included RCTs, although the current evidence does not suggest a significant difference among the different devices or AI tools [6,8]. A sensitivity analysis based on specific distal attachment devices or CAD systems could not be performed due to the limited number of studies. Therefore, further RCTs are needed to compare these aspects.

In conclusion, the addition of mucosal exposure devices to CAD-assisted colonoscopy does not significantly improve the performance measures, excepted for a higher APC which does not lead to increased rates of adenoma detection. Further RCTs are warranted in order to inform the comparison between these two approaches in terms of aADR and APC.

Disclosures

None.

Author contributions

- Study concept and design: AF, AA, GDA
- Acquisition of data: AF, AA, EG, GDA, MM, ES, MB
- Analysis and interpretation of data: AF, MM, ADA, MS
- Drafting of the manuscript: AF, SFC, GDA, GD, GA
- Revision of the manuscript for important intellectual content: GD, YM, ES, ADA
- Approval of the final manuscript: all the authors
- Guarantor of the article: AF

Declaration of competing interest

The authors have no conflicts of interest to declare.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.dld.2025.12.010.

References

- [1] Kaminski MF, Regula J, Kraszewska E, et al. Quality indicators for colonoscopy and the risk of interval cancer. *N Engl J Med* 2010;362(19):1795–803.
- [2] Corley DA, Jensen CD, Marks AR, et al. Adenoma detection rate and risk of colorectal cancer and death. *N Engl J Med* 2014;370(14):1298–306.
- [3] Repici A, Badalamenti M, Maselli R, et al. Efficacy of real-time computer-aided detection of colorectal neoplasia in a randomized trial. *Gastroenterology* 2020;159(2):512–20.
- [4] Hassan C, Spadaccini M, Mori Y, et al. Real-time computer-aided detection of colorectal neoplasia during colonoscopy : a systematic review and meta-analysis. *Ann Intern Med* 2023;176(9):1209–20.
- [5] Mohan BP, Facciorusso A, Khan SR, et al. Real-time computer aided colonoscopy versus standard colonoscopy for improving adenoma detection rate: a meta-analysis of randomized-controlled trials. *EClinicalMedicine* 2020 Nov 21;100622 29–30.
- [6] Foroutan F, Vandvik PO, Helsing LM, et al. Computer aided detection and diagnosis of polyps in adult patients undergoing colonoscopy: a living clinical practice guideline. *BMJ* 2025 Mar 27;388:e082656.
- [7] Brethauer M, Ahmed J, Antonelli G, et al. Use of computer-assisted detection (CADE) colonoscopy in colorectal cancer screening and surveillance. *Eur Soc Gastrointest Endosc (ESGE) Position Statement Endosc* Jun 2025;57(6):667–73.
- [8] Facciorusso A, Del Prete V, Buccino RV, et al. Comparative efficacy of colonoscopy distal attachment devices in increasing rates of adenoma detection: a network meta-analysis. *Clin Gastroenterol Hepatol* 2018;16(8):1209–19.
- [9] Patel HK, Chandrasekar VT, Srinivasan S, et al. Second-generation distal attachment cuff improves adenoma detection rate: meta-analysis of randomized controlled trials. *Gastrointest Endosc* 2021;93(3):544–53.
- [10] Aniwani S, Mekritthikrai K, Kerr SJ, et al. Computer-aided detection, mucosal exposure device, their combination, and standard colonoscopy for adenoma detection: a randomized controlled trial. *Gastrointest Endosc* 2023;97(3):507–16.
- [11] Lui TK, Lam CP, To EW, et al. Endocuff with or without artificial intelligence-assisted colonoscopy in detection of colorectal adenoma: a randomized colonoscopy trial. *Am J Gastroenterol* 2024;119(7):1318–25.
- [12] Spadaccini M, Hassan C, Rondonotti E, et al. Combination of Mucosa-exposure device and computer-aided detection for adenoma detection during colonoscopy: a randomized trial. *Gastroenterology* 2023;165(1):244–51.
- [13] Rocchetto S, Rondonotti E, Alicante S, et al. Added value of a balloon-based mucosal exposure device in computer-aided detection-assisted colonoscopy: a randomized controlled trial (COMBAT study). *Endoscopy* 2025 in press.
- [14] Wetterslev J, Jakobsen JC, Gluud C. Trial sequential analysis in systematic reviews with meta-analysis. *BMC Med Res Methodol* 2017;17:39.
- [15] Guyatt GH, Oxman AD, Vist GE, et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ* 2008 Apr 26;336(7650) 924–6.
- [16] Moher D, Liberati A, Tetzlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Ann Intern Med* 2009;151 264–W64.
- [17] Sterne JAC, Savović J, Page MJ, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. *BMJ* 2019;366:l4898.
- [18] DerSimonian R, Laird N. Meta-analysis in clinical trials. *Control Clin Trials* Sep 1986;7(3):177–88.
- [19] Higgins JP, Thompson SG, Deeks JJ, et al. Measuring inconsistency in meta-analyses. *BMJ* 2003;327:557–60.
- [20] Claire R, Gluud C, Berlin I, et al. Using trial sequential analysis for estimating the sample sizes of further trials: example using smoking cessation intervention. *BMC Med Res Methodol* 2020;20:284.
- [21] Wang S, Kim AS, Church TR, Perdue DG, Shaikat A. Adenomas per colonoscopy and adenoma per positive participant as quality indicators for screening colonoscopy. *Endosc Int Open* Nov 2020;8(11):E1560–5.
- [22] Alba AC, Alexander PE, Chang J, et al. High statistical heterogeneity is more frequent in meta-analysis of continuous than binary outcomes. *J Clin Epidemiol* 2016;70:129–35.
- [23] Facciorusso A, Triantafyllou K, Murad MH, et al. Compared abilities of endoscopic techniques to increase colon adenoma detection rates: a network meta-analysis. *Clin Gastroenterol Hepatol* Nov 2019;17(12):2439–54.
- [24] Spadaccini M, Iannone A, Maselli R, et al. Computer-aided detection versus advanced imaging for detection of colorectal neoplasia: a systematic review and network meta-analysis. *Lancet Gastroenterol Hepatol* 2021;6(10):793–802.