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Effectiveness of artificial intelligence-assisted colonoscopy for colorectal lesion detection: A systematic review and meta-analysis of randomized controlled trials

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ADMINISTRATIVE INFORMATION

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Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 27 October 2025 and was last updated on 27 October 2025.

INTRODUCTION

Review question / Objective This systematic review and meta-analysis aims to evaluate the effectiveness of artificial intelligence (AI)-assisted colonoscopy compared with conventional colonoscopy in detecting colorectal lesions, by synthesizing evidence from randomized controlled trials (RCTs). The study seeks to determine whether AI assistance improves key quality indicators such as adenoma and polyp detection, thereby enhancing early colorectal cancer prevention.

Condition being studied Colorectal lesions, including adenomas, sessile serrated lesions (SSLs), and advanced adenomas — all recognized as precursors of colorectal cancer (CRC).

METHODS

Participant or population Adult patients (≥18 years) undergoing screening, surveillance, or diagnostic colonoscopy for colorectal lesions.

Intervention AI-assisted colonoscopy, also known as computer-aided detection (CADe), which utilizes deep learning algorithms to identify colorectal lesions in real time during colonoscopic procedures.

Comparator Conventional colonoscopy without AI assistance, performed under standard clinical conditions.

Study designs to be included Randomized controlled trials.

Eligibility criteria Inclusion criteria: (1) Randomized controlled trials (RCTs) comparing AI-assisted colonoscopy vs. conventional colonoscopy. (2) Participants aged 18 years or older undergoing colonoscopy. (3) Studies reporting at least one of the following outcomes: adenoma detection rate (ADR), polyp detection rate (PDR), sessile serrated lesion detection rate (SSL-DR), advanced adenoma detection rate (AADR), adenomas per colonoscopy (APC), or polyps per colonoscopy (PPC).
Exclusion criteria: (1) Non-RCTs, conference abstracts, reviews, or case reports. (2) Studies lacking essential outcome data or full text. (3) Trials not employing AI-assisted systems.

Information sources Databases searched included PubMed, Embase, Cochrane Library, Web of Science, ClinicalTrials.gov, CNKI, Wanfang, VIP, and CBM. The search covered all records up to October 18, 2025, using comprehensive combinations of MeSH and free-text terms related to AI, colonoscopy, and randomized trials.

Main outcome(s) Primary outcomes: Adenoma Detection Rate (ADR); Polyp Detection Rate (PDR)
Secondary outcomes: Sessile Serrated Lesion Detection Rate (SSL-DR); Advanced Adenoma Detection Rate (AADR) ; Adenomas per Colonoscopy (APC); Polyps per Colonoscopy (PPC).

Quality assessment / Risk of bias analysis Methodological quality was assessed using the Cochrane Risk of Bias Tool (RoB 1.0) across seven domains (randomization, allocation concealment, blinding, outcome completeness, selective reporting, etc.).
Discrepancies between reviewers were resolved by discussion or consultation with a third reviewer.

Strategy of data synthesis Meta-analyses were performed using RevMan 5.4 and Stata 14.0. Dichotomous data: expressed as risk ratios (RR) with 95% confidence intervals (CI). Continuous data: expressed as mean differences (MD) with 95% CI.
Heterogeneity assessed by Cochran's Q and I^2 statistics; random-effects models were used when $I^2 \geq 50\%$.
Evidence quality was graded using the GRADE system. Trial Sequential Analysis (TSA) was conducted to assess evidence sufficiency and robustness.

Subgroup analysis Subgroup analyses were conducted based on: AI system type (commercialized vs. non-commercialized), Study region (Asian vs. non-Asian), Sample size (≥500 vs. <500), Publication year (before vs. after 2021).

Sensitivity analysis Sensitivity analyses were performed using a leave-one-out approach, sequentially excluding individual studies to verify the stability of pooled estimates and to identify potential influential studies.

Country(ies) involved China.

Keywords Artificial intelligence; Colonoscopy; Computer-aided detection; Adenoma detection rate; Sessile serrated lesion; Systematic review; Meta-analysis.

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