INPLASY

Artificial intelligence in colonoscopy for reducing missed adenomas and polyps: a systematic review and meta-analysis of randomized clinical trials

INPLASY202390094

doi: 10.37766/inplasy2023.9.0094

Received: 27 September 2023

Published: 27 September 2023

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ADMINISTRATIVE INFORMATION

Support - Harbin Medical University Fund.

Review Stage at time of this submission - Data analysis.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202390094

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 27 September 2023 and was last updated on 27 September 2023.

INTRODUCTION

Review question / Objective Colorectal cancer(CRC) is the third most common cancer worldwide and its incidence is on the rise. It is also the major cause of cancer-related deaths. Colonoscopy is an indispensable test to confirm the diagnosis of colorectal cancer. However, about a quarter of colorectal tumors are missed on screening colonoscopy, which is the leading cause of interval colorectal cancer. Higher quality endoscopies tend to have higher ADR and lower AMR.The deep learning-based CADe system can reduce the AMR or PMR by alerting endoscopists with visual alerts of adenomas or polyps displayed in real time on endoscopic monitors.However, most Meta-analyses tend to ignore AMR and only use ADR as the primary outcome indicator.So the effectiveness of AI-assisted colonoscopy remains controversial. The purpose of this systematic evaluation is to accurately assess the role of AI-assisted enteroscopy in reducing the rate of missed adenoma or polyp detection.

Condition being studied Colorectal cancer(CRC) is the third most common cancer worldwide and its incidence is on the rise. It is also the major cause of cancer-related deaths. Colonoscopy is an indispensable test to confirm the diagnosis of colorectal cancer.Higher quality endoscopies tend to have higher ADR and lower AMR. Detection and excision of adenomatous polyps during colonoscopy is the most effective method of decreasing morbidity and mortality from colorectal cancer. But about 30% of adenomas or polyps may be missed during colonoscopy, either due to the fact that they appear on the screen but are not recognized by the endoscopist, or they may be located in places where the endoscope fails to see them.AI-assisted colonoscopy has gained attention in recent years. The deep learning-based CADe system can reduce the AMR or PMR by alerting endoscopists with visual alerts of adenomas or polyps displayed in real time on endoscopic monitors.However, AI-assisted colonoscopy is also controversial.However, most RCT studies did not include AMR or PMR as an observational metric.As a result, we evaluated the effectiveness of AI-assisted colonoscopy for AMR

by including as many randomized controlled trials as possible that used AMR as an outcome indicator. This meta-analysis was designed to improve statistical efficacy, reduce bias, and facilitate exploratory analyses to provide stronger evidence for the effectiveness of AI system-assisted colonoscopy.

METHODS

Search strategy Embase

1 exp endoscopy/ 776860
2 (colonoscop* or sigmoidoscop* or proctoscop* or endoscop*).mp. 604122
3 1 or 2 992176
4 exp large intestine tumor/ 472112
5 exp Polyps/ 89008
6 exp Adenoma/ 153260
7 ((colorect* or colon* or rect* or anal* or anus* or intestin* or bowel*) adj3 (carcinom* or neoplas* or adenocarcinom* or cancer* or tumor* or tumour* or sarcom* or polyp* or adenom*or lesion*)).mp. 725603
8 4 or 5 or 6 or 7 885125
9 exp algorithm/ 582985
10 exp computer aided design/ 52268
11 exp artificial intelligence/ 84566
12 exp machine learning/ 411119
13 (artificial adj1 intelligence).mp. 70489
14 ((deep or machine) adj2 learning).mp. 183516
15 ((deep or convolutional or neural) adj3 network*).mp. 145140
16 (computer* adj3 (assist* or aid* or heuristic*)).mp. 1068445
17 (AI or CAD*).mp. 468389
18 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 2330690
19 random:.tw. or placebo:.mp. or double-blind:.tw. 2243904
20 3 and 8 and 18 and 19 1198
Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations, Daily and Versions
1 exp endoscopy/ 407443
2 (colonoscop* or sigmoidoscop* or proctoscop* or endoscop*).mp. 327771
3 1 or 2 544970
4 exp Colorectal Neoplasms/ 238508
5 exp Polyps/ 35370
6 exp Adenoma/ 108393
7 ((colorect* or colon* or rect* or anal* or anus* or intestin* or bowel*) adj3 (carcinom* or neoplas* or adenocarcinom* or cancer* or tumor* or tumour* or sarcom* or adenom* or polyp*or lesion*)).mp. 448635
8 4 or 5 or 6 or 7 559796
9 exp Algorithms/ 437212
10 exp Computers/ 86652
11 exp Decision Making, Computer-Assisted/ 133564
12 (artificial adj1 intelligence).mp. 60787
13 ((deep or machine) adj2 learning).mp. 141872
14 ((deep or convolutional or neural) adj3 network*).mp. 115400
15 (computer* adj3 (assist* or aid* or heuristic*)).mp. 384496
16 (AI or CAD*).mp. 327057
17 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 1210698
18 randomized controlled trial.pt. or randomized.mp. or placebo.mp. 1101368
19 3 and 8 and 17 and 18 234
Cochrane
Search Name:
Date Run: 27/08/2023 22:05:13
Comment:
ID Search Hits
#1 MeSH descriptor: [Endoscopy] explode all trees 24742
#2 (colonoscop* or sigmoidoscop* or proctoscop* or endoscop*):ti,ab,kw 38652
#3 #1 or #2 53003
#4 MeSH descriptor: [Colorectal Neoplasms] explode all trees 11169
#5 MeSH descriptor: [Polyps] explode all trees 1496
#6 MeSH descriptor: [Adenoma] explode all trees 2133
#7 ((colorect* or colon* or rect* or anal* or anus* or intestin* or bowel*) NEAR/3 (carcinom* or neoplas* or adenocarcinom* or cancer* or tumor* or tumour* or sarcom* or adenom* or polyp*or lesion*)):ti,ab,kw 39355
#8 #4 or #5 or #6 or #7 41095
#9 MeSH descriptor: [Algorithms] explode all trees 7134
#10 MeSH descriptor: [Computers] explode all trees 2647
#11 MeSH descriptor: [Decision Making, Computer-Assisted] explode all trees 5068
#12 (artificial NEAR/1 intelligence):ti,ab,kw 1635
#13 ((deep or machine) NEAR/2 learning):ti,ab,kw 3295
#14 ((deep or convolutional or neural) NEAR/3 network*):ti,ab,kw 1916
#15 ((computer* NEAR/3 (assist* or aid* or heuristic*))):ti,ab,kw 21012
#16 (AI or CAD*):ti,ab,kw 21684
#17 #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 53260
#18 #3 and #8 and #17 533
#19 #3 and #8 and #17 in Trials 509.

Participant or population The study population included male and female patients at average risk

for CRC undergoing screeningor surveillance colonoscopy for CRC.

Intervention AI-assisted colonoscopy.

Comparator Conventional colonoscopy.

Study designs to be included RCT.

Eligibility criteria Our search strategy was restricted to include only RCT. The inclusion criteria for these studies were as follows: (1) The intervention group had an AI system-assisted colonoscopy followed by conventional colonoscopy (2) The control group was examined with conventional colonoscopy followed by AI system-assisted colonoscopy; (3) Patients who underwent colonoscopy based on average risk screening or symptoms; and (4) Outcome metrics were reported for AMR and PMR.The following studies were excluded: (1) Studies without primary data. (2) Studies for which the full text is not available. (3) Studies conducted in patients with inflammatory bowel disease or hereditary polyposis syndromes. (4) Letters to the editor, case reports, retrospective studies, review articles and editorials, and duplicate studies.

Information sources We conducted a comprehensive electronic literature search in the Ovid-MEDLINE, Ovid-EMBASE, and Cochrane Central databases to identify eligible articles published from the time of inception through August 2023. We also searched for relevant randomized controlled trials from the reference lists of all identified studies, guidelines, and reviews.

Main outcome(s) The primary outcome was AMR, which was defined as the number of adenomas detected in the second-pass colonoscopy divided by the total number of adenomas detected in both passes. PMR is also the primary outcome, which was defined as the number of polyps detected in the second-pass colonoscopy divided by the total number of polyps detected in both passes, in which the hyperplastic polyps in the rectum that had not undergone biopsy were included. The miss rate of advanced adenomas and sessile serrated lesion (SSL) was calculated with the same definitions as AMR and PMR.

Additional outcome(s) Secondary outcomes assessed were ADR, and polyp detection colonoscopy (PDR).

Data management For dichotomous outcomes, we estimated risk ratios (RRs), and for continuous ones, we calculated mean differences (MDs), together with their 95% confidence intervals (CIs). As we anticipated considerable between-study heterogeneity, sensitivity studies were conducted. And we used prediction intervals to quantify between-study heterogeneity. We assessed heterogeneity of intervention effects among primary studies using the Cochran's Q test and I2 statistic. Meta-regression and subgroup analyses were conducted to investigate potential sources of heterogeneity. All analyses were performed using Stata (version 17) and Review Manager 5.3. A two-tailed p-value of 0.05 was used as the threshold for statistical significance.

Quality assessment / Risk of bias analysis The Cochrane tool was used to assess the risk of bias, while publication bias was evaluated using Begg's rank correlation and Egger's weighted regression tests.

Strategy of data synthesis Data were obtained by direct extraction or indirect calculation. Graphically reported data were extracted using GetData Graph Digitizer software (Version 2.26). Corresponding authors were contacted via e-mail for missing data when necessary. We quantified indicator heterogeneity through prediction intervals and performed sensitivity analyses. The Cochrane tool was used to assess the risk of bias, while publication bias was evaluated using Begg's rank correlation and Egger's weighted regression tests.

Subgroup analysis Subgroup analysis based on year of publication.

Sensitivity analysis After deleting any of them, the combined results of the rest of the literature were not significantly different from what they would have been without deletion, which means that the sensitivity analysis was passed.

Country(ies) involved China.

Keywords Artificial intelligence Colonoscopy.

Contributions of each author

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