International Platform of Registered Systematic Review and Meta-analysis Protocols

INPLASY

Abdominal Binders Improve Colonoscopy Outcomes: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

INPLASY202550043
doi: 10.37766/inplasy2025.5.0043
Received: 15 May 2025
Published: 15 May 2025

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ADMINISTRATIVE INFORMATION

Support - N/A.

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

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202550043

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 15 May 2025 and was last updated on 15 May 2025.

INTRODUCTION

Review question / Objective To evaluate the effect of abdominal binder use on procedural efficiency and patient comfort during colonoscopy, and to determine whether body mass index (BMI) modifies this effect.

PICOS Framework:

Population (P): Adults undergoing elective diagnostic or screening colonoscopy

Intervention (I): Use of an abdominal binder, abdominal compression device, or support belt during colonoscopy

Comparison (C): No abdominal binder or standard care without compression

Outcomes (O):

Primary: Cecal intubation time (CIT), pain score during colonoscopy, frequency of manual pressure, and position changes

Secondary: Cecal intubation length (CIL)

Study Design (S): Randomized controlled trials (RCTs).

Rationale Loop formation during colonoscopy is a common technical challenge that can prolong cecal intubation time, increase patient discomfort, and necessitate additional maneuvers such as manual abdominal pressure and position changes. These interventions require extra staff effort and may not be consistently effective, especially in patients with high body mass index (BMI), where increased abdominal adiposity further complicates the procedure.

Abdominal binders have emerged as a potential standardized solution by applying consistent external compression to the abdomen, reducing

colonic loop formation and supporting bowel anatomy. This meta-analysis addresses modest improvements in procedural outcomes.

Condition being studied Colonoscopy is a widely used procedure for the diagnosis and screening of colorectal diseases, particularly colorectal cancer. However, procedural inefficiencies such as loop formation during scope insertion can lead to prolonged cecal intubation time, increased patient discomfort, and a higher need for ancillary maneuvers. These challenges are especially pronounced in patients with higher body mass index (BMI), where excessive abdominal adiposity may complicate scope advancement. This study investigates the role of abdominal binder use in improving procedural efficiency and patient comfort during colonoscopy.

METHODS

Participant or population This review focuses on adult patients (≥18 years old) undergoing elective diagnostic or screening colonoscopy. Included participants are from randomized controlled trials (RCTs) that evaluated the use of abdominal binders or abdominal compression devices during colonoscopy procedures. Studies involving both outpatient and inpatient settings were considered, provided that colonoscopy was performed for routine diagnostic or screening purposes. Trials exclusively involving pediatric populations, emergency procedures, or therapeutic colonoscopies (e.g., polypectomy, bleeding control) were excluded.

Intervention The intervention of interest is the application of an abdominal binder, abdominal compression device, or support belt during colonoscopy. These devices are used to apply consistent external pressure across the abdominal wall, with the aim of minimizing loop formation, facilitating colonoscope advancement, reducing the need for manual pressure or position changes, and improving patient comfort. The intervention may include a range of device types, from simple elastic abdominal bands to commercially available systems such as ColoWrap. All interventions must have been applied during the colonoscopy procedure and reported as a distinct study arm in randomized controlled trials.

Comparator The comparator group consists of patients undergoing colonoscopy without the use of an abdominal binder or compression device. These procedures may involve standard care practices, including manual abdominal pressure or patient position changes as needed, but without any form of mechanical or supportive compression applied to the abdomen. This allows assessment of the added value of abdominal binders compared to usual care during colonoscopy.

Study designs to be included Randomized controlled trials (RCTs).

Eligibility criteria Inclusion criteria included: (1) RCTs involving human participants, (2)Trials comparing using of abdominal binder, abdominal compression device, or similar mechanical support applied during colonoscopy., and (3) Studies providing data at least one of the following: CIT, pain score during or after colonoscopy manual pressure usage, position change frequency and CIL. Exclusion criteria were: (1) Non-RCT studies, (2) Studies lacking data on CIT, pain score during or after colonoscopy manual pressure usage, position change frequency and CIL, and (3) Studies with participant overlap from previously published trials.

Information sources We conducted a comprehensive search across multiple electronic databases to identify eligible randomized controlled trials. The following databases were searched from inception through April 30, 2025:

PubMed

Embase

Cochrane Central Register of Controlled Trials (CENTRAL)

ClinicalKey

ProQuest

ScienceDirect

Web of Science

To identify unpublished and gray literature, we also searched the ClinicalTrials.gov registry. Additionally, we manually screened the reference lists of relevant review articles and included trials to identify any studies not captured in the initial search.

No restrictions were placed on publication language. When necessary, non-English articles were translated for eligibility screening and data extraction.

Main outcome(s) The primary outcomes of this meta-analysis focus on the efficacy and comfort of

colonoscopy procedures when using an abdominal binder. These include:

Cecal Intubation Time (CIT):
Time required to reach the cecum during colonoscopy, measured in minutes. This reflects procedural efficiency.

Pain Score During Colonoscopy:
Patient-reported pain levels during the procedure, typically assessed using visual analog scales (VAS) or numerical rating scales.

Frequency of Manual Abdominal Pressure:
Proportion of cases in which additional manual pressure was required by assisting personnel to facilitate scope advancement.

Frequency of Position Changes:
Proportion of procedures in which the patient required repositioning (e.g., left lateral to supine) to overcome looping or technical difficulty.

These outcomes were quantitatively synthesized using Hedges' g for continuous variables (e.g., CIT, pain) and odds ratios (ORs) for dichotomous outcomes (e.g., manual pressure, position change), with 95% confidence intervals.

Quality assessment / Risk of bias analysis The methodological quality of all included randomized controlled trials was independently assessed by two reviewers (P.-F.H. and Y.-K.K.) using the Cochrane Risk of Bias 2 (RoB 2) tool. This tool evaluates bias across five domains:

Randomization process

Deviations from intended interventions (adherence and protocol compliance)

Missing outcome data

Measurement of the outcome

Selection of the reported result

Each study was judged as having low risk of bias, some concerns, or high risk of bias in each domain, followed by an overall judgment.

For this review, the per-protocol approach was used under the domain of deviations from intended interventions, as the effectiveness of the abdominal binder depends on actual device application and adherence.

Strategy of data synthesis Data synthesis was conducted using a random-effects model to account for expected clinical and methodological heterogeneity across studies. The following effect size measures were used:

Hedges' g for continuous outcomes (e.g., cecal intubation time, pain scores, cecal intubation length)

Odds ratios (ORs) for dichotomous outcomes (e.g., frequency of manual pressure, position changes)

All effect sizes were reported with 95% confidence intervals (CIs).

Meta-analyses were performed using Comprehensive Meta-Analysis (CMA) software, version 4.0 (Biostat, Englewood, NJ, USA). For studies with missing or zero event data, a continuity correction of 0.5 was applied.

Heterogeneity among studies was assessed using the Cochran's Q test and I^2 statistic, with thresholds of 25%, 50%, and 75% indicating low, moderate, and high heterogeneity, respectively.

To test the robustness of findings, sensitivity analyses were performed by sequentially removing each study (leave-one-out method). Additionally, meta-regression analyses were conducted to explore the potential effect-modifying role of body mass index (BMI) on primary outcomes.

Publication bias was examined using funnel plot asymmetry and Egger's regression test. A p-value < 0.05 in Egger's test was considered indicative of potential publication bias.

Subgroup analysis To explore potential sources of heterogeneity and identify patient populations that may benefit most from abdominal binder use during colonoscopy, the following a priori subgroup analyses were planned:

Body Mass Index (BMI) Subgroups:

Normal weight (BMI < 25 kg/m^2)

Overweight (BMI 25–29.9 kg/m^2)

Obese (BMI ≥ 30 kg/m^2)
This stratification was used to assess whether the efficacy of abdominal binders differs by body habitus.

Sensitivity analysis To evaluate the robustness and stability of the pooled estimates, sensitivity

analyses were conducted using the leave-one-out method, in which each study was sequentially removed from the meta-analysis to assess its influence on the overall effect size and heterogeneity.

These analyses were applied to all primary outcomes, including:

Cecal intubation time (CIT)

Pain scores during colonoscopy

Frequency of manual pressure

Frequency of position changes

If removal of any single study substantially altered the magnitude or statistical significance of the pooled effect, the result was considered potentially sensitive to that study. In such cases, possible reasons (e.g., outlier effect size, high risk of bias, unique population characteristics) were further explored.

This approach ensured that the findings were not disproportionately driven by any individual study and supported the overall validity of the conclusions.

Country(ies) involved Taiwan.

Keywords Abdominal binder; Colonoscopy; Cecal intubation time; Body mass index; Obesity; Meta-analysis; Procedural efficiency; Patient comfort.

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