Variable stiffness colonoscope versus regular adult colonoscope: meta-analysis of randomized controlled trials

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CRD summary
This review found that variable stiffness colonoscope was associated with a higher cecal intubation rate, less abdominal pain and decreased need for sedation compared with the standard adult colonoscopy. Cecal intubation times were similar. This was a well-conducted review and the conclusions are likely to be reliable.

Authors' objectives
To compare the effectiveness of variable stiffness colonoscope with standard adult colonoscope.

Searching
MEDLINE and Cochrane Central Register of Controlled Trials (CENTRAL) were searched from inception to 2008; search terms were reported. Abstracts of major gastroenterology scientific meetings for the previous five years and bibliographies of selected articles were screened. No language restrictions were applied.

Study selection
Randomised controlled trials (RCTs) that compared the paediatric or adult variable stiffness colonoscope with standard adult colonoscope in adults were eligible for inclusion. Primary outcomes were cecal intubation rate, cecal intubation time and abdominal pain score. Other outcomes assessed were sedation used, use of ancillary manoeuvres during the procedure and procedure-related complications.

Indications for the procedure were screening colonoscopy or polyp surveillance and change in bowel habits, where reported. Mean age ranged from 52 to 63 years. Four trials compared adult variable stiffness colonoscope with standard adult colonoscope. Three trials compared paediatric variable stiffness colonoscope with standard adult colonoscope. All studies were done in outpatient settings in teaching institutions. In six studies procedures were carried out by experienced gastroenterologists and in two studies they were inexperienced; one study included both experienced and inexperienced examiners.

Two reviewers independently screened studies for inclusion.

Assessment of study quality
Two reviewers independently assessed study quality using the Delphi list of nine items related to treatment allocation, blinding, data presentation and analysis, eligibility of study population and prognostic comparability of the study groups. Studies were assigned a quality score based on the number of items fulfilled (maximum 9).

Data extraction
Two reviewers independently extracted data using a standardised form; disagreements were resolved through referral to a third reviewer. Dichotomous data were summarised as odds ratios (OR) and risk differences (RD). Continuous data were summarised as weighted mean differences (WMD) or standardised mean differences (SMD).

Methods of synthesis
Summary odds ratios, risk differences, weighted mean differences and standardised mean differences, together with 95% confidence intervals (CIs), were estimated using the Mantel-Haenszel fixed-effect model. Heterogeneity was assessed using the I² statistic. Sensitivity analyses was carried out by exclusion of trials with small numbers of patients or those performed by inexperienced providers. Subgroup analysis was carried out by stratified results according to type of variable stiffness colonoscope (adult versus paediatric) and experience of colonoscopist. Publication bias was assessed with a funnel plot.

Results of the review
Seven RCTs were included (n=1,923). All studies scored 6 or 7 out of 9 on the quality assessment. It was not possible to blind outcome assessors or colonoscopists due to the nature of the intervention; allocation concealment was not stated clearly in three RCTs.

Variable stiffness colonoscope was found to be superior to standard adult colonoscope in terms of higher cecal intubation rate (OR 2.08, 95% CI 1.29 to 3.36; eight RCTs), lower abdominal pain scores during the procedure (SMD -0.33, 95% CI -0.45, 0.20; four RCTs) and lower use of sedation (dose of meperidine WMD -3.76, 95% CI -6.91, -0.60; three RCTs and dose of midazolam WMD -0.20mg, 95% CI -0.35, -0.04; three RCTs). There was no significant difference between procedures in cecal intubation time (six RCTs), use of abdominal pressure (five RCTs) and odds of changing patient position during the procedure (four RCTs). One study reported one incidence of rectal perforation in a patient assessed with a paediatric variable stiffness colonoscope; there were no other major complications. Most meta-analyses showed no evidence of heterogeneity with the exception of the studies of abdominal pressure ($I^2=66\%$, $p=0.01$).

Subgroup and sensitivity analysis showed little influence on the results.

There was no evidence of publication bias.

**Authors' conclusions**
Variable stiffness colonoscope use was associated with a higher cecal intubation rate, less abdominal pain and decreased need for sedation compared with standard adult colonoscope. Cecal intubation times were similar.

**CRD commentary**
The review addressed a focused question supported by clearly defined inclusion criteria. The literature search was adequate for published studies, but no specific attempts were made to locate unpublished studies. However, publication bias was assessed in the review and no evidence of it was found. Appropriate steps were taken to minimise bias and errors at all stages of the review process. Study quality was assessed against appropriate criteria. The meta-analysis was appropriate and results were presented clearly. This was a well-conducted review and the conclusions are likely to be reliable.

**Implications of the review for practice and research**
**Practice:** The authors stated that the variable stiffness colonoscope could be useful for un-sedated colonoscopy in clinical practice.

**Research:** The authors stated that further studies were needed to address the role of the variable stiffness colonoscope among inexperienced colonoscopists and in patient populations where colonoscopy was technically difficult.

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