Accuracy of computed tomographic colonography for the detection of polyps and colorectal tumors: a systematic review and meta-analysis

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CRD summary
The review assessed the diagnostic accuracy of computed tomography colonography (CTC) for detection of polyps and colorectal tumours and concluded that CTC was highly specific, but reported sensitivities varied greatly. Reporting of results focused upon sensitivity, but data presented do not appear to justify the authors' conclusions in respect of specificity.

Authors' objectives
To assess the accuracy of computed tomography colonography (CTC) for the detection of polyps and colorectal tumours.

Searching
MEDLINE and EMBASE were searched to January 2009. Search terms were reported.

Study selection
Prospective blinded (CTC interpreted independently of colonoscopy or surgical findings) studies of adult participants who underwent CTC after full bowel preparation followed by complete colonoscopy or surgery were eligible for inclusion. CTC was required to use at least a single detector scanner with colon insufflation by air or carbon dioxide. Studies that evaluated computer-aided detection systems were excluded. Most included studies were in high-risk patients. Most studies used polyethylene glycol (PEG) bowel preparation and multislice imaging. Most studies used colonoscopy as the reference standard. Use of contrast media and 2D or 3D imaging varied.

The authors did not state how many reviewers assessed studies for inclusion in the review.

Assessment of study quality
The methodological quality of included studies was assessed using the 14-item QUADAS tool.

The authors did not state how many reviewers performed the quality assessment.

Data extraction
Data were extracted for the numbers of true positive, false negative, false positive and true negative test results. Sensitivity and specificity values, with 95% confidence intervals (CIs), were calculated for each study per patient and per polyp. Positive and negative likelihood ratios were calculated.

Data were extracted using a predefined data extraction form. The authors did not state how many reviewers performed the data extraction.

Methods of synthesis
Pooled estimates of sensitivity, specificity and positive and negative likelihood ratios were calculated using a random-effects model (DerSimonian and Laird).

Threshold effect (variation of test performance with changing diagnostic threshold) was assessed using the Spearman test and examination of a plot of sensitivity and specificity values in receiver operating characteristic (ROC) space. Between-study heterogeneity was assessed by visual examination of forest plots and statistically using the $X^2$ and $I^2$ tests.

Subgroup analyses were conducted for polyp size (6mm to 9mm and >9mm), colonic preparation, use or not of faecal...
tagging, type of scanner (single or multi detector), imaging technique (2D or 3D), radiation dose and risk of colorectal cancer (CRC).

Results of the review
Forty seven studies, with a total of 10,546 participants (range 20 to 2,600), were included in the review. The results of QUADAS assessment were reported in full.

Sensitivity: The pooled estimate of the per polyp sensitivity of CTC was 66% (95% CI 64% to 68%), based on 37 studies, with significant between-study heterogeneity. The pooled estimate of the per patient sensitivity was 69% (95% CI 66% to 72%), based on 16 studies with significant between-study heterogeneity. Both per patient and per polyp sensitivity increased with polyp size. Subgroup analyses indicated that the per patient sensitivity of CTC was significantly higher where: sodium phosphate was for bowel preparation versus not used; faecal tagging was used versus not used; where 3D imaging was always used versus only used for confirmation; where higher radiation doses (>100mA) were used; and in average risk compared to high risk populations.

Specificity: The pooled estimate for CTC specificity was 83% (95% CI 81% to 84%), based on an un-reported number of studies with significant between-study heterogeneity. The specificity estimate increased with increasing polyp size. No other subgroup analyses were reported for specificity.

Likelihood ratios: Pooled positive and negative likelihood ratios were 2.9 (95% CI 1.8 to 4.0) and 0.38 (95% CI 0.27 to 0.53).

Authors' conclusions
The authors concluded that CTC was highly specific for detection of colorectal polyps and tumours and that some studies reported high sensitivities. They noted a high degree of between-study heterogeneity, which could only partially be explained by factors investigated.

CRD commentary
The review assessed diagnostic accuracy of computed tomography colonography (CTC) for detection of polyps and colorectal tumours. Appropriate inclusion criteria were defined and a limited search of the literature undertaken. The restriction of the literature search to two bibliographic databases may have resulted in omission of relevant data. No attempt to identify unpublished data was reported. Reporting of the review process was limited and it was unclear whether any measures were taken to avoid the introduction of error and/or bias during study selection and data extraction. The methodological quality of included studies was assessed using a validated tool and the results of this assessment were reported in full. An attempt to investigate sources of between-study heterogeneity was reported. Reporting pooled estimates for highly heterogeneous data was of limited value. The reporting of results was focused upon sensitivity estimates, with no corresponding forest plots or individual study estimates for specificity. Estimated specificities from the 2x2 contingency tables reported gave a wide range of values (62.2% to 94.1%) and the authors' conclusion that CTC is a highly specific test for polyps and colorectal cancers does not seem justified.

Implications of the review for practice and research
Practice: The authors stated that CTC was the method of choice for patients with incomplete colonoscopy and for those who cannot undergo colonoscopy. Use of CTC in routine screening should be subject to quality control, with prescribed examination standards.

Research: The authors stated that further research was needed to resolve the sources of between-study heterogeneity.

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