Colorectal cancer: CT colonography and colonoscopy for detection — systematic review and meta-analysis

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CRD summary
This review concluded that computed tomography colonography was highly sensitive for colorectal cancer, especially when both cathartic and tagging agents were combined in the bowel preparation, and may be a more suitable initial test than optical colonoscopy. These conclusions reflect the data presented, but comparative estimates of sensitivity should be interpreted cautiously due to some limitations in the analysis.

Authors' objectives
To assess the sensitivity of computed tomography (CT) colonography and optical colonoscopy for detection of colorectal cancer.

Searching
PubMed was searched from January 1994 (first report of CT colonography) to December 2009. Search terms were reported. Bibliographies of retrieved articles were screened for additional studies.

Study selection
Original studies of 30 or more patients who underwent CT colonography for the diagnosis of colorectal polyps and cancer were eligible for inclusion if histology following optical colonoscopy was used as the reference standard to determine diagnosis. Studies that failed to report sufficient details of lesion detection, studies with high cancer prevalence due to patient selection or with samples artificially enriched with positive cases and studies in which no malignancies were found were excluded. The primary outcomes were per patient sensitivity of CT colonography and optical colonoscopy. Secondary outcomes were the characteristics of cancers missed at CT and associated clinical or technical features.

Most of the included studies were conducted in Europe or USA. Most assessed symptomatic rather than screening populations. Most of the included studies used multidetector CT with 2-D imaging in both prone and supine positions and employed a cathartic bowel preparation. Most studies did not use faecal tagging. Around half of the studies used radiation at more than 100 milliampere seconds.

Studies were assessed for inclusion by two reviewers.

Assessment of study quality
The methodological quality of included studies was assessed using items from the QUADAS tool that were considered relevant to the review: whether asymptomatic adults or patients at higher risk of colorectal cancer were included; time interval between index test and reference standard; whether the reference standard was modified according to the CT colonography result; whether sufficient details of the CT colonography and optical colonoscopy methods were reported to allow replication of the study; whether data on CT colonography failures or incomplete optical colonoscopy examinations were provided; whether CT colonography lesions were matched at optical colonoscopy on the basis of size and/or segment location; and how lesions were measured at optical colonoscopy.

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

Data extraction
Data were extracted on numbers of true positive and false negative test results for optical colonoscopy and/or CT colonography in each study. Sensitivity estimates and their 95% confidence intervals (CIs) were calculated. Details of cancers missed at CT were extracted.

Data extraction was performed independently by two reviewers who used predefined forms. Any disagreements were resolved by a third reviewer.
Methods of synthesis
Pooled per patient estimates of the sensitivity of CT colonography and optical colonoscopy for detection of colorectal cancer, with 95% CIs, were calculated using a random-effects model.

Between-study heterogeneity was assessed using the $I^2$ statistic. Where present, possible sources of heterogeneity were investigated using meta-regression analyses and Galbraith plots.

Results of the review
Forty-nine studies (11,551 participants, range 32 to 2,531) were included in the review. All studies assessed CT colonography and 25 studies (9,223 participants) assessed optical colonoscopy. The main methodological issues identified in the included studies were the awareness of radiologists, in most cases, of the clinical indication for CT colonography (knowledge that patients were symptomatic may have resulted in the expectation of a higher prevalence of disease) and variation in the potential for CT results to influence the reference standard.

Sensitivity of CT colonography for colorectal cancer was 96.1% (95% CI 93.8% to 97.7%; 49 studies). There was no evidence of heterogeneity ($I^2=0\%$).

Sensitivity of optical colonoscopy for colorectal cancer was 94.7% (95% CI 90.4% to 97.2%; 25 studies). There was moderate heterogeneity ($I^2=50\%$). No variable included in the meta-regression analysis (variables not specified) could account for the observed heterogeneity.

Sixteen of 414 colorectal cancers were missed at CT colonography. Ten of these were located in the rectosigmoid colon, including six in the rectum, and six were located proximal to the splenic flexure. No cancers were missed by CT colonography when both cathartic and tagging agents were used in the bowel preparation.

Authors’ conclusions
CT colonography was highly sensitive for colorectal cancer, especially when both cathartic and tagging agents were combined in the bowel preparation.

CRD commentary
The review addressed a clearly stated objective and defined appropriate inclusion criteria. It was not clear whether language and publication status restrictions were applied during the search for relevant studies. Measures were taken to minimise error and/or bias during study selection and data extraction; whether or not similar methods were applied during quality assessment was unclear. Methodological quality of the included studies was assessed using a review-specific checklist and the results were reported online in full.

Use of a random-effects model was appropriate for generating pooled estimates of sensitivity alone. Comparisons were made between optical colonoscopy and CT colonoscopy; a separate analysis that included only those studies that reported data for both tests would have been helpful.

The authors’ conclusions reflect the data presented, but comparative estimates of sensitivity should be interpreted cautiously due to some limitations in the analysis.

Implications of the review for practice and research
Practice: The authors stated that given the relatively low prevalence of colorectal cancer, CT colonography may be more suitable for initial investigation than optical colonoscopy (assuming that specificity was reasonable).

Research: The authors did not specify any recommendations for future research.

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Bibliographic details
Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.