Systematic review of narrow-band imaging for the detection and differentiation of neoplastic and nonneoplastic lesions in the colon
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CRD summary
This review found that narrow band imaging had high sensitivity and specificity for the differentiation of neoplastic from non-neoplastic colon polyps when used by experienced endoscopists, and that its accuracy was comparable to chromoendoscopy. The review suffered from a number of limitations, which means that these findings should be interpreted with some caution.

Authors' objectives
To evaluate the accuracy of narrow-band imaging during colonoscopy for the detection of pre-malignant lesions and the differentiation between neoplastic and non-neoplastic lesions.

Searching
PubMed and EMBASE were searched to April 2008. Search terms were reported and did not include a diagnostic filter. Reference lists of included studies were screened to identify additional studies. The review was limited to studies published in English.

Study selection
Studies that assessed narrow-band imaging colonoscopy for the detection or the differentiation of lesions in the colon in patients undergoing colonoscopy, regardless of indication (screening, surveillance, symptoms), were eligible for inclusion. For the detection of neoplasia, studies had to compare narrow-band imaging colonoscopy with white-light endoscopy. For the differentiation between neoplastic and non-neoplastic lesions studies had to include histopathologic examination of biopsy or endoscopic resection specimens of the lesions of interest as the reference standard. Studies were required to report sufficient data to construct a 2x2 table of test performance. All classification systems for narrow-band imaging were eligible.

Studies on the detection of neoplasia included patients undergoing colorectal cancer screening, surveillance or evaluation of symptoms, patients with long-standing ulcerative colitis (pancolitis) and those with hereditary non-polyposis colorectal cancer. Mean age ranged from 46 to 62 years and the proportion of men ranged from 39 to 100%. The number of endoscopists performing the procedure ranged from 1-7, some were highly experienced, others had no previous experience with narrow-band imaging.

Studies on the differentiation of lesions assessed the following narrow-band imaging classification systems: fine capillary network, dark dots, light rounds, tubular or gyrus-like; Kudo classification; brownish vascular network for predicting neoplasia; brown blob or dense vascular network for predicting neoplasia; vessel thickness and vessel regularity; vascular pattern; honeycomb like capillary pattern. Final diagnosis included high-grade dysplasia, low-grade dysplasia, hyperplastic polyp, colorectal cancer, tubular adenoma, tubulovillous adenoma, villous adenoma, serrated adenoma and non-neoplastic. The mean age, where reported, ranged from 38 to 68 years and the proportion of men ranged from 43 to 100%. The number of endoscopists ranged from one to three and were either highly experienced or experience was unclear.

Two reviewers independently assessed studies for inclusion. Disagreements were resolved through discussion.

Assessment of study quality
Studies reporting on the detection of abnormalities were assessed for concealment of allocation, blinding of observers, patient selection, and comparability of groups. QUADAS (Quality Assessment of Diagnostic Accuracy Studies Assessment) was used to assess studies reporting on the differentiation of abnormalities. QUADAS items were scored as yes, no or unclear.
Two reviewers independently assessed study quality.

**Data extraction**
For studies on the detection of lesions, data were extracted on the numbers of detected neoplastic lesions or the numbers of patients with detected neoplasia. These data were used to calculate the odds ratio for the difference in the proportion of patients with detected neoplasia between narrow-band imaging and white-light endoscopy. The ratio of the mean number of detected neoplastic lesions by narrow-band imaging relative to the mean number detected by white-light endoscopy was also calculated. For studies on the differentiation of lesions, data were extracted as 2x2 tables of test performance. Estimates of sensitivity and specificity were calculated for each set of 2x2 data. All analyses were done on a per lesion basis. 95% confidence intervals were calculated for each outcome measure. Information on inter-observer and intra-observer agreement with respect to the classification by narrow-band imaging was extracted, where reported.

Data were extracted independently by two reviewers; disagreements were resolved through discussion.

**Methods of synthesis**
For the detection of lesions, odds ratios and ratios were pooled using DerSimonian and Laird random-effects models. Forest plots were used to summarise results. For studies on the differentiation of lesions, sensitivity and specificity were pooled using the bivariate random effects model. If multiple classification systems were used within one study, the mean number of true-positive and true-negative numbers was used for the meta-analysis. Forest plots of paired sensitivity and specificity were used to visualise the data.

**Results of the review**
Six studies (n=1,222 patients) assessed the detection of neoplasia including four randomised controlled trials (RCTs) and two tandem design studies (that compared the two techniques back to back). One randomised study was not included in the meta-analysis. Eleven studies (n=866 patients) on the differentiation of lesions were included in the table but only 9 (n=770) were included in the analysis and quality assessment table. One study assessed both and so contributed data to each analysis. Results of the quality assessment for the detection studies were not reported. Studies on the differentiation of lesions all fulfilled items on use of an appropriate reference standard and avoidance of disease progression, partial verification, differential verification and incorporation bias. Items relating to test details, reference standard details, test bias and review bias were poorly reported. Only four studies included an appropriate patient spectrum and only three reported sufficient details of selection criteria.

Detection of neoplasia: The proportion of patients with at least one adenoma detected by narrow-band imaging was similar to the proportion detected by white-light endoscopy (pooled odds ratio 1.19, 95% confidence interval (CI): 0.86 to 1.64; three RCTs) as was the mean number of adenomas detected (relative ratio of means 1.23, 95% CI: 0.93 to 1.61; three RCTs). In the two observational studies, the adenoma miss rates of white-light endoscopy were 40% (29/72) and 46% (21/46) for each study.

Differentiation of lesions: Three studies on the differentiation of lesions were excluded from the meta-analysis as they included highly selected patient groups and were therefore thought to be biased. Based on the remaining six studies, the pooled sensitivity of narrow-band imaging for the differentiation of neoplastic compared to non-neoplastic colon polyps was 92% (95% CI: 89 to 94) and pooled specificity was 86% (95% CI: 80 to 91). Five studies also reported on the accuracy of chromoendoscopy. Pooled sensitivity was reported to be 91% (955 CI: 83 to 96) and pooled specificity was 89% (95% CI: 83 to 93). Four studies provided data on inter-observer agreement. Kappa values ranged from 0.48 to 1.0, suggesting moderate to excellent agreement.

**Authors' conclusions**
Narrow-band imaging showed high sensitivity and specificity for the differentiation of neoplastic from non-neoplastic colon polyps when used by experienced endoscopists. Its accuracy was comparable to that of chromoendoscopy.

**CRD commentary**
The review addressed a clearly defined question. Inclusion criteria were reported but would have been clearer had they been stratified by whether the aim was detection or differentiation of polyps. The literature search was adequate for published literature but restriction of the review to published English language studies means that the review may be subject to language and publication bias. Appropriate steps were taken to minimise bias and errors at all stages of the review process. Study quality was assessed using appropriate criteria. The results of this were clearly reported in a table for studies on the differentiation of polyps but were less clear for studies on the detection of polyps. Limited study details were reported in a table. Further details, especially in relation to the patients included in the studies, would have helped to assess the generalisability of findings.

The meta-analysis used appropriate methods and results were clearly reported. For the differentiation of polyps, data on the accuracy of a second technique (chromoendoscopy) was also pooled, but this technique had not previously been mentioned in the review methods (inclusion criteria, data extraction or analysis). Reasons for this were unclear. For both sets of analysis, not all studies reported to have fulfilled inclusion criteria and summarised in the table contributed to the analysis. Reasons for this are unclear. Heterogeneity was not formally assessed or investigated.

The authors' conclusions are supported by the data presented but should be interpreted with some caution, due to the possibility of language and publication bias, unclear generalisability of findings and the fact that some studies were excluded from the analysis without justification.

Implications of the review for practice and research
Practise: The authors did not state any implications for practice.

Research: The authors stated that future research should focus on defining learning curves, inter-observer variation and validation in general practice.

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