A meta-analysis of the diagnostic accuracy of esophageal capsule endoscopy for Barrett's esophagus in patients with gastroesophageal reflux disease

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CRD summary
This review concluded that capsule endoscopy of the oesophagus had moderate sensitivity and specificity for the diagnosis of Barrett's oesophagus in patients with gastro-oesophageal reflux disease. The conclusions were a reasonable interpretation of the data, but should be viewed with caution given the unknown quality of the included studies, the small sample sizes and the limited applicability of the findings.

Authors' objectives
To evaluate the diagnostic accuracy of oesophageal capsule endoscopy for Barrett's oesophagus in patients with gastro-oesophageal reflux disease.

Searching
MEDLINE, EMBASE and Cochrane Central Register of Controlled Trials (CENTRAL) were searched for articles published between August 2003 and July 2008 in any language. Search terms were reported. In addition, Google Scholar was searched, as were abstracts from Digestive Disease Week, World Congress of Gastroenterology and American Society of Clinical Oncology. Reference lists of included studies were searched manually.

Study selection
Prospective or retrospective blinded studies that evaluated the diagnostic accuracy of oesophageal capsule endoscopy for Barrett's oesophagus in adult patients were eligible for inclusion. To be eligible, patients had to undergo oesophagogastroduodenoscopy, with or without oesophageal biopsy, and oesophageal capsule endoscopy during the study. Studies that used oesophagogastroduodenoscopy or histologically confirmed intestinal metaplasia as the reference standard were eligible for inclusion. Within these studies, the primary outcomes of sensitivity and specificity of oesophageal capsule endoscopy for the diagnosis of Barrett's oesophagus had to be calculable.

Included studies used PillCam oesophageal capsules that captured between four and 15 images per second; most captured 14 images per second (where reported). Studies were not excluded based on the type of capsule or images captured per second. One study involved a string capsule. Where reported, the mean age of the participants in the included studies ranged from 51 to 59 years; the proportion of males ranged from 45 to 91%. Over half of the studies used oesophagogastroduodenoscopy as the reference standard; a small number used histologically confirmed intestinal metaplasia. The majority of studies were undertaken in the USA, Israel and France.

Two reviewers independently screened publications for inclusion and disagreements were resolved by a third reviewer.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
Three reviewers independently extracted data using a standardised form. Sensitivity and specificity were extracted or calculated; positive and negative predictive values were not extracted. Study authors were contacted for missing data.

Methods of synthesis
Pooled sensitivity and specificity were calculated, with 95% confidence intervals (CIs), using random-effects models where statistical heterogeneity was present; fixed-effects models were used when heterogeneity was absent. Heterogeneity was assessed using the p-value and \( I^2 \) statistic. Where studies reported sensitivity and specificity using oesophagogastroduodenoscopy and histologically confirmed intestinal metaplasia as reference standards, oesophagogastroduodenoscopy data were used in the meta-analysis.

Subgroup analysis was undertaken by separating studies into those that: reported data using...
oesophagogastroduodenoscopy as the reference standard; and those using histologically confirmed intestinal metaplasia as the reference standard.

Funnel plots and fail-safe N were calculated to assess publication bias.

Results of the review
Nine studies were included in the review (n=618 patients, range 20 to 106); eight studies were prospectively blinded and one was retrospectively blinded. There was no evidence of publication bias (fail-safe N was 102 for sensitivity and 221 for specificity).

Diagnostic sensitivity: The pooled sensitivity of oesophageal capsule endoscopy for the diagnosis of Barrett’s oesophagus was 77% for all studies (nine studies), 78% for the studies using oesophagogastroduodenoscopy as the reference standard (seven studies), and 78% for studies using histologically confirmed intestinal metaplasia as the reference standard (four studies). There was no evidence of statistical heterogeneity for these results.

Diagnostic specificity: The pooled specificity of oesophageal capsule endoscopy for the diagnosis of Barrett’s oesophagus was 86% for all studies (nine studies), 90% for the studies using oesophagogastroduodenoscopy as the reference standard (seven studies), and 73% for studies using histologically confirmed intestinal metaplasia as the reference standard (four studies). There was evidence of significant statistical heterogeneity for these results (P<0.001, I²=74%).

Oesophageal capsule endoscopy was found to be safe and had a high rate of patient preference.

Authors’ conclusions
Capsule endoscopy of the oesophagus had a moderate sensitivity and specificity for the diagnosis of Barrett’s oesophagus in patients with gastro-oesophageal reflux disease.

CRD commentary
The authors addressed a clear review question that was supported by appropriate inclusion criteria. Several relevant sources were searched with no language restrictions or diagnostic filters. No apparent attempt was made to identify unpublished studies; although the funnel plot did not indicate the presence of publication bias, it may still have been possible as the small number of studies may have masked its detection. Study selection and data extraction were conducted in duplicate, reducing the risk of error and bias.

No assessment of the methodological quality of included studies was undertaken. The majority of studies comprised small numbers of patients, a potential limitation acknowledged by the authors. Details of participant characteristics and diagnostic methods were provided for the included studies. The methods used to generate pooled estimates of diagnostic performance measures were reasonable for the data sets reported, although (as acknowledged by the authors) the included studies used two different reference standards.

The conclusions were a reasonable interpretation of the data, but should be viewed with caution given the unknown quality of the included studies, the small sample sizes and the limited generalisability of the findings.

Implications of the review for practice and research
Practice: The authors stated that when evaluating suspected Barrett's oesophagus the modality of choice is oesophagogastroduodenoscopy.

Research: The authors stated that well designed, large, multi-centre trials are required to assess the role of capsule endoscopy for the evaluation of Barrett's oesophagus. They also recommended that future studies should address the limitations of oesophageal capsule endoscopy and evaluate modifications of the ingestion protocol to improve visualisation of oesophageal pathology.

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