Diagnostic accuracy of EUS for vascular invasion in pancreatic and periampullary cancers: a meta-analysis and systematic review
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CRD summary
This review concluded that endoscopic ultrasound was the best non-invasive test to diagnose vascular invasion in pancreatic and periampullary cancers; specificity was high, but sensitivity not as high as suggested. The review did not assess other non-invasive methods, was based on small studies of unknown quality, and had several limitations; the pooled results and conclusions should be treated with caution.

Authors' objectives
To evaluate the accuracy of endoscopic ultrasound in diagnosing vascular invasion in patients with pancreatic and periampullary cancers.

Searching
MEDLINE, EMBASE, CINAHL, Cochrane Central Register of Controlled Trials (CENTRAL) and International Pharmaceutical Abstracts were searched; search terms were reported, but not search dates.

Study selection
Studies evaluating the accuracy of endoscopic ultrasound in the diagnosis of vascular invasion in patients with pancreatic and periampullary cancers, that used surgery or angiography as the reference standard, were eligible for inclusion. Endoscopic ultrasound criteria for vascular invasion were: tumour in the lumen; abnormal vessel contour; presence of collateral vessels in absence of main vascular structure; and loss of hyperechoic interface between the tumour and vessel. Studies had to provide sufficient data to produce a 2x2 table of test performance.

The most commonly used endoscopic ultrasound was the Olympus GF-UM20. Most included studies used surgery as the reference standard, with some using surgery and angiography. No further study or participant details were provided.

The authors did not state how many reviewers selected the studies.

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

Data extraction
Two authors independently extracted data to produce 2x2 tables of test performance, from which sensitivity, specificity, positive and negative likelihood ratios, and the diagnostic odds ratio (DOR) were calculated. Confidence intervals were calculated using the F distribution method. For cells containing zero, 0.5 was added. Differences were resolved by consensus.

Methods of synthesis
Pooled estimates of sensitivity, specificity, positive likelihood, negative likelihood, diagnostic odds ratio were calculated using both fixed-effect and random-effects models. Heterogeneity was assessed using the likelihood ratio test for sensitivity and specificity, and the X^2 test for positive likelihood, negative likelihood, diagnostic odds ratios (p<0.05 considered statistically significant). Estimates of sensitivity and specificity were plotted in receiver operating characteristic space, summary receiver operating characteristic curves estimated, and the area under the curve calculated.

Subgroup analyses were conducted to investigate the impact of technological advancements on sensitivity and specificity by analysing studies grouped by date of publication.
Results of the review
Twenty nine studies met the inclusion criteria (n=1,308 patients; range 17 to 92).

The pooled estimates for endoscopic ultrasound in diagnosing vascular invasion were: sensitivity 73.0% (95% CI 68.8 to 76.9), specificity 90.2% (95% CI 87.9 to 92.2), positive likelihood ratio 9.1 (95% CI 4.6 to 17.9), negative likelihood ratio 0.3 (95% CI 0.2 to 0.5), diagnostic odds ratio 40.1 (95% CI 16.1 to 99.9). No statistically significant heterogeneity was observed. The area under the curve was 0.929 (standard error 0.023).

Both sensitivity and specificity were reduced in studies published more recently (2000 to 2005).

Authors’ conclusions
Although endoscopic ultrasound was the best non-invasive test to diagnose vascular invasion in pancreatic and periampullary cancers, specificity was high (90%) but sensitivity was not as high as suggested (73%).

CRD commentary
The authors searched a range of relevant databases. There was no indication whether language restrictions were applied during the search, and there was no specific search for unpublished studies. Diagnostic search terms were used during the searches, which meant that some studies may have been missed. Two authors extracted data, but it was unclear whether similar methods were used to reduce error and bias during study selection.

Study quality was not assessed and there were insufficient study details provided to make a judgement, so the reliability of the results of the included studies is uncertain. The p-value to denote statistically significant heterogeneity was <0.05, rather than <0.1. Given the variability between studies when displayed on the forest plots, the use of this level of significance may have underestimated the presence of heterogeneity across studies. Most of the studies were small; none had over 90 patients. There appeared to be evidence of a threshold effect; the methods used to pool studies did not take into consideration this potential threshold effect across studies. This, along with the potential heterogeneity across studies, means that the reliability of the pooled results was uncertain. The review did not assess other non-invasive methods of assessing vascular invasion, therefore the conclusion that endoscopic ultrasound was the best method was not based on the results of the review.

Given the limitations outlined regarding the review and included studies, the pooled results and conclusions should be treated with caution.

Implications of the review for practice and research
Practice: The authors stated that endoscopic ultrasound has a role in identifying small neoplasms not seen by other diagnostic modalities and allows fine needle aspiration for cytological examination. They also stated that additional refinements in endoscopic ultrasound technology may be required to improve sensitivity.

Research: The authors stated that the sensitivity of endoscopic ultrasound compared with new generation computed tomography or magnetic resonance imaging/angiography needs to be evaluated.

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