Computed tomography and ultrasonography in the diagnosis of equivocal acute appendicitis. 

a meta-analysis

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CRD summary
This review concluded that although CT scan was more sensitive than ultrasonography, either CT scan or ultrasonography could be used for the initial diagnosis of acute appendicitis in patients presenting with equivocal findings. The reliability of these conclusions may be limited by potential flaws in the review process.

Authors' objectives
To evaluate the diagnostic accuracy of computed tomography (CT) and ultrasonography for the early detection of acute appendicitis in patients presenting with equivocal findings.

Searching
MEDLINE was searched for English-language studies from 1966 to December 2005. Search terms were reported. Bibliographies of review articles and included studies were also searched for additional articles.

Study selection
Eligible studies investigated the diagnostic accuracy of CT scan, ultrasonography, or both, in prospective studies of at least 100 patients with suspected appendicitis. Studies in which pregnant patients were the major study group, or numbers used to calculate sensitivity and specificity were not reported, were excluded. The main outcome was diagnostic accuracy of either CT scan or ultrasonography.

The authors did not state how the studies were selected for the review, or how many reviewers were involved in the selection process.

Assessment of study quality
Studies were assessed for methodological quality based on the Users’ Guide to Evidence-based Medicine using the following criteria: use of an appropriate reference standard to establish diagnosis (surgical pathology or clinical follow-up): blinding of those conducting and interpreting the test; methods for performing the test were described in sufficient detail to allow replication; likelihood ratio for the test was presented, or data for calculation was included; and all patients were accounted for in the final analysis. Each study was awarded a score between 0 and a maximum of 6 points. 'Good quality' studies scored 5 to 6 points, 'fair quality' studies 3 to 4 points and 'poor quality' studies less than 3 points.

Two reviewers independently assessed study quality, with disagreements resolved by consensus or reference to a third reviewer.

Data extraction
Sensitivity and specificity with 95% confidence intervals (CI) were calculated for each study. Positive and negative likelihood ratios, and positive and negative predictive values were also calculated.

Two reviewers independently extracted the data, with disagreements resolved by consensus or reference to a third reviewer.

Methods of synthesis
Pooled sensitivity, specificity, positive likelihood ratios, negative likelihood ratios, positive predictive values and negative predictive values with 95% confidence intervals (CI) were calculated. Heterogeneity was assessed by comparing the confidence intervals of individual study findings with summary estimates.
Subgroup analyses were planned a priori for good quality studies and those that investigated the role of CT scan and ultrasonography on the same study population.

Results of the review
A total of 45 studies met the inclusion criteria. Twenty five studies evaluated ultrasonography (n=9,121 patients, range 100 to 1,285), of which 19 were 'good quality' and six were 'fair quality'. Twenty-five studies evaluated computed tomography (CT) scan (n=3,925, range 100 to 525) of which 19 were 'good quality' and six were 'fair quality'.

Ultrasonography: The overall pooled estimates for the diagnostic value of ultrasonography were: sensitivity 83.69% (95% CI 82.26 to 85.03); specificity 95.89% (95% CI 95.38 to 96.35); accuracy 92.23% (95% CI: 91.70, 92.80); positive predictive value 89.75% (95% CI 88.60 to 90.90); negative predictive value 93.20% (95% CI 92.20 to 94.20); positive likelihood ratio 20.38 (95% CI 18.08, 22.97); and negative likelihood ratio 0.17 (95% CI 0.16 to 0.19).

CT scan: The overall pooled estimates for the diagnostic value of CT scan were: sensitivity 93.44% (95% CI 92.11 to 94.56); specificity 93.33% (95% CI 92.25 to 94.27); accuracy 93.38% (95% CI 92.60 to 94.20); positive predictive value 90.33% (95% CI: 88.90, 91.80); negative predictive value 95.50% (95% CI 94.50 to 96.50); positive likelihood ratio 14.02 (95% CI 12.04 to 16.31); and negative likelihood ratio 0.07 (95% CI 0.06 to 0.09).

Sub-group analyses: For good quality studies (19 studies), CT scan (93.73%, 95% CI 92.30 to 94.91) was a more sensitive diagnostic tool than ultrasonography (86.94%, 95% CI 85.34 to 88.38), with less specificity (CT scan was 94.22%, 95% CI 92.90 to 95.32 versus ultrasonography at 95.82%, 95% CI 95.17 to 96.38). For good quality studies (five studies) comparing CT scan and ultrasonography diagnostic tools in the same population, CT scan (88.35%, 95% CI 84.67 to 91.23) was more sensitive than ultrasonography (75.97%, 95% CI 71.62 to 79.84), with greater specificity (CT scan was 90.35%, 95% CI 86.56 to 93.16 versus ultrasonography at 89.37%, 95% CI 86.22 to 91.87).

Authors' conclusions
Although CT scan was more sensitive than ultrasonography, either CT scan or ultrasonography could be used for the initial diagnosis of acute appendicitis in patients presenting with equivocal findings.

CRD commentary
The authors addressed a clear research question, supported by appropriate inclusion criteria. The literature search was limited to MEDLINE and only studies published in English were included. There was no specific search for unpublished data. This meant that relevant studies may have been missed and the review may be subject to language and publication bias. Data extraction was conducted in duplicate, but it was unclear whether similar methods to reduce error and bias were employed during study selection. Study quality was assessed using appropriate criteria and a grade given for each study; most of the studies were considered to be of good quality. Details of the studies and the results were summarised clearly in tables. Heterogeneity was not formally assessed and the methods employed for pooling the studies were not clearly reported, so it is uncertain whether more sophisticated methods of meta-analysis might have been suitable. These limitations, coupled with the likelihood that relevant studies may have been missed during the limited search, means the authors' conclusions should be interpreted with caution.

Implications of the review for practice and research
Practice: The authors stated that CT scan should be used in patients presenting with equivocal findings, unless there is contraindication to radiation or to contrast media if enhanced CT is used. Ultrasonography is recommended if CT scan is unavailable or contraindicated.

Research: The authors did not state implications for research.

Funding
Not stated.
Bibliographic details

PubMedID
17268692

Original Paper URL
http://www.smj.org.sa/PDFFiles/Feb07/01computed20060471.pdf

Indexing Status
Subject indexing assigned by NLM

MeSH
Abdomen, Acute /diagnosis /etiology; Acute Disease; Appendectomy; Appendicitis /radiography /surgery /ultrasonography; Confidence Intervals; Early Diagnosis; Female; Follow-Up Studies; Humans; Male; Predictive Value of Tests; Saudi Arabia; Sensitivity and Specificity; Severity of Illness Index; Tomography, X-Ray Computed /methods; Ultrasonography, Doppler /methods

AccessionNumber
12007006081

Date bibliographic record published
02/03/2009

Date abstract record published
20/01/2010

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.