Transthoracic echocardiography for diagnosis of traumatic aortic injury: an appraisal of the evidence
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CRD summary
The review assessed the diagnostic accuracy of transthoracic echocardiography (TEE) in patients suspected to have traumatic aortic injury (TAI). The authors concluded that TEE is a valuable tool for diagnosing TAI; however, given the lack of evidence from randomised controlled trials, no standard of care for its use as first-line evaluation can be drawn. The authors' conclusions are likely to be reliable.

Authors' objectives
To determine the diagnostic accuracy of transthoracic echocardiography (TEE) as first-line examination in patients suspected to have traumatic aortic injury (TAI).

Searching
MEDLINE was searched from January 1994 to December 2002 for articles published in English or French; the search terms were reported. Personal files and the bibliographies of retrieved articles were searched for additional references. Experts in the field were also contacted.

Study selection
Study designs of evaluations included in the review
Prospective clinical trials were eligible for inclusion.

Specific interventions included in the review
Studies evaluating TEE were eligible for inclusion. The specific TEE methods assessed included monoplane, biplane and multiplane probes.

Reference standard test against which the new test was compared
Studies presenting the results of patient surgery, necropsy or clinical follow-up to confirm diagnosis were eligible for inclusion. The included studies compared TEE with aortography, helical computed tomography scan or serum creatine-kinase monoclonal antibodies values. Aortography was described as the 'gold' standard.

Participants included in the review
Studies of adult patients with suspected TAI were eligible for inclusion.

Outcomes assessed in the review
Studies reporting the absolute number of true positives, false negatives, false positives and true negatives, or data allowing for the calculation of these outcomes, were eligible for inclusion.

How were decisions on the relevance of primary studies made?
Two reviewers independently assessed studies for selection purposes.

Assessment of study quality
The primary studies were assessed using a 32-item check list that evaluated criteria relating to (a) study design and conduct, (b) analysis, and (c) presentation. The maximum possible score was 100; the maximum for each subsection was 50, 30 and 20 points, respectively. Further details were not given. The authors did not state how many reviewers performed the validity assessment.
Data extraction

It appears that more than one reviewer extracted the data as the authors stated that disagreements were resolved by consensus. Data were extracted on overall TEE sensitivity and specificity, with their associated 95% confidence intervals, as well as data relating to TEE results versus other diagnostic techniques in subgroups. If a trial presented results based on more than one approach, accuracy data representing the whole sample were extracted.

Methods of synthesis

How were the studies combined?

Estimates of sensitivities and specificities were used to construct a summary receiver operating characteristic (ROC) curve. Separate ROC curves were constructed for all studies combined, those that compared TEE with aortography, and patients with TAI not requiring surgery.

How were differences between studies investigated?

Sensitivity analyses were performed to investigate the influence on the results of definition of TAI, publication date and type of probe used. The effect of sample size was used to investigate publication bias.

Results of the review

Seven clinical trials (n=812) were included in the review.

The methodological quality assessment scores ranged from 45 to 74; the medium score for each section was 31 (design and conduct), 10 (analyses) and 18 (presentation). All studies evaluated consecutive patients, and two performed a blinded evaluation.

The sensitivity of TEE ranged from 56 to 99% and the specificity from 89 to 99%; the area under the ROC curve for all studies was 0.95, indicating good diagnostic test accuracy. The maximum joint sensitivity and specificity for all studies was 97%.

The area under the ROC curve for the subset of individuals evaluated with TEE and aortography was 0.90 for TEE and 0.93 for aortography; the maximum joint sensitivity and specificity was 95% for TEE and 93% for aortography (based on 4 studies).

The area under the ROC curve for individuals with TAI not requiring surgery was 0.98 for TEE and 0.94 for aortography (P<0.05). The maximum joint sensitivity and specificity was 96% for TEE and 92% for aortography.

Subgroup analyses.

Studies with a sample size of greater than 70 showed a better performance than studies with less than 70 participants (area under the ROC curve 0.97 and 0.94, respectively; P<0.05). The maximum joint sensitivity and specificity was 98% for studies with a sample size greater than 70 and 88% for studies with less than 70 participants. Stringent definition of TAI versus less stringent definition of TAI, use of monoplane versus use of multiplane probes, and publication year were poor predictors of diagnostic test performance.

Authors' conclusions

TEE appears to be a valuable tool for diagnosing TAI, and its use as first-line evaluation is supported; however, no standard of care can be drawn from the current evidence because of the lack of randomised controlled trials.

CRD commentary

The authors addressed a clear question, supported by well-defined inclusion and exclusion criteria. Only one electronic database was searched, and the search strategy was restricted to studies published in either English or French; publication bias was investigated. Procedures implemented for the selection of primary studies and data extraction were likely to minimise reviewer error or bias; however, the methods used to assess methodological quality were not reported. The statistical analyses undertaken were appropriate, and the authors explored several differences in the
characteristics of the selected studies. The authors acknowledged a number of study limitations: the lack of randomised controlled trials, data on the level of experience of the operators, and information on the patients underlying condition. This enabled them to make some relevant recommendations for further research. The authors' conclusions are suitably cautious and appear consistent with the results obtained.

**Implications of the review for practice and research**

**Practice:** The authors stated that the data are inadequate to support standards of care for first-line evaluation in those with suspected TAI.

**Research:** The authors stated that large-scale, methodologically robust and randomised trials are needed to determine the use of TEE as standard care for first-line evaluation in adult patients with suspected TAI. It was suggested that future trials should also consider operator experience and the patients' underlying condition.

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