Diagnostic accuracy of multislice CT angiography in peripheral arterial disease

Sun Z

CRD summary
Individual included studies broadly support the conclusion that multislice computed tomographic angiography is useful for the assessment of peripheral arterial disease. Limitations in the methodology and reporting of this review make the pooled estimates of diagnostic performance questionable. The author's secondary conclusion, that performance is significantly increased by the use 16-slice scanners (compared with 4-slice scanners), is not supported by the data presented.

Authors' objectives
To determine the accuracy of multislice computed tomographic angiography (MSCT) for the diagnostic assessment of peripheral arterial disease (PAD).

Searching
MEDLINE was searched from 1998 (the date at which MSCT was first introduced into clinical practice) to August 2006; the search terms were reported. The bibliographies of identified articles were checked for additional studies. Conference abstracts were excluded.

Study selection
Study designs of evaluations included in the review
Prospective and retrospective diagnostic accuracy studies with at least 10 participants were included; no further details of the study designs were reported.

Specific interventions included in the review
Studies using MSCT to evaluate calcification of the arterial wall or 50% stenosis or occlusion of the aortoiliac and arteries of the lower extremities were eligible for inclusion. The majority of included studies used 4-slice CT; two used 16-slice CT. Details of the scan parameters and contrast agent doses were reported. Studies investigating the use of stent-grafts were excluded.

Reference standard test against which the new test was compared
Studies that used conventional digital subtraction angiography (DSA) as the reference standard were eligible for inclusion.

Participants included in the review
Studies of patients being investigated for stenoses or occlusions of the aortoiliac and arteries of the lower extremities were included in the review. The mean age of the participants in the included studies ranged from 64 to 69 years, where reported.

Outcomes assessed in the review
Studies that reported data on sensitivity and specificity were eligible for inclusion.

How were decisions on the relevance of primary studies made?
The author did not state how the papers were selected for the review, or how many reviewers performed the selection.

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

Data extraction
One reviewer, unblinded, extracted the data. Data were extracted on the overall sensitivity, specificity and accuracy, or were stratified by anatomic region. Where data were reported for multiple observers, only data for the observer with the highest reported accuracy were used in the analyses.
Methods of synthesis
How were the studies combined?
Sensitivity, specificity and accuracy estimates were combined across studies.

How were differences between studies investigated?
The chi-squared test was used to test for significant (p<0.05) differences in diagnostic performance between 4- and 16-slice CT and between different anatomic regions.

Results of the review
Ten studies were included. The number of patients in the included studies ranged from 17 to 75 (total number unclear) and the number of arterial segments examined ranged from 163 to 3,402. Eight studies assessed accuracy for the diagnosis of stenosis and/or occlusion, and two dealt with arterial calcification.

Diagnosis of stenoocclusive PAD (>50% stenosis or occlusion).
For all anatomic regions combined (10 studies, 16 comparisons), the pooled estimates for sensitivity and specificity were 92% (95% confidence interval, CI: 90, 95) and 91% (95% CI: 87, 95), respectively. The results were similar when analysed separately for the aortoiliac, femoropopliteal and infrapopliteal regions.

Diagnosis of occlusive PAD.
For all anatomic regions combined (3 studies, 3 comparisons), the pooled estimates for sensitivity and specificity were 87% (95% CI: 75, 99) and 93% (95% CI: 82, 99), respectively.

The pooled sensitivity of MSCT in the femoropopliteal region was found to be significantly higher than in other anatomic regions or all regions combined. Sixteen-slice CT was found to be significantly more sensitive than 4-slice CT, but this difference disappeared when 16-slice CT was compared with 4-slice CT using thin sections (<3 mm).

Authors’ conclusions
MSCT angiography has high diagnostic performance for the assessment of PAD. The diagnostic performance of MSCT angiography has been significantly increased with the introduction of 16-slice scanners (compared with 4-slice scanners).

CRD commentary
The research question was clearly stated and appropriate inclusion criteria were defined. The search strategy was limited to a single bibliographic database, conference abstracts were excluded, and no attempt to identify unpublished studies was described; the omission of relevant data (both published and unpublished) cannot be ruled out. Since no assessment of the methodological quality of the included studies was reported, the potential impact of sources of error and bias in the primary studies upon the findings of the review cannot, therefore, be assessed. The review process was conducted by a single researcher, thereby increasing the potential for error and bias (as the author acknowledged).

Although the results of individual included studies were reported, there was only limited reporting of other relevant data (e.g. numbers of patients and arterial segments used to derive each data set, relevant co-morbidities of patients) and it is also unclear whether data from the same patients were included in some analyses more than once; these factors make interpretation of the results presented difficult. The description of the methods used to generate pooled estimates of diagnostic performance was very limited. The 'one-sample test' reported is a method generally used to compare a calculated mean with a hypothesised value; it is unclear how this relates to the generation of pooled estimates. The author acknowledged the presence of between-study heterogeneity in the text and it is therefore unlikely that any method of generating pooled estimates based upon a simple mean would be reliable; the generation of summary receiver operating characteristic curves might have been more informative and could have been used to make a visual comparison of the variation in test performance with, for example, anatomic region. The data set described would not, however, be adequate to support exploration of potential sources of heterogeneity.

Despite the limitations outlined, the results of the individual studies presented broadly support the author’s conclusion.
that MSCT angiography could provide a reliable alternative to DSA in the diagnosis of PAD. The author's assertion that diagnostic performance has been significantly increased by 16-slice scanners is not, however, supported by the data presented.

Implications of the review for practice and research
Practice: The author stated that MSCT angiography is a reliable technique that can be recommended as an alternative to DSA in the diagnostic assessment of PAD.

Research: The author stated that, since DSA is an imperfect reference standard, the true diagnostic performance of MSCT angiography should be calculated by comparison with multiple techniques such as magnetic resonance angiography, intra-operative angiography and surgical findings. The reasons for variation in performance with anatomical region, as well as the impact of the presence of calcification, also require further exploration. Studies are also needed to assess the reduction in radiation dose associated with 16-slice or 64-slice CT.

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