Diagnostic performance of 18F-fluorodeoxyglucose positron emission tomography in giant cell arteritis: a systematic review and meta-analysis

Besson FL, Parienti JJ, Bienvenu B, Prior JO, Costo S, Bouvard G, Agostini D

CRD summary
This review concluded that 18F-fluorodeoxyglucose positron emission tomography had valuable diagnostic performance for giant cell arteritis (chronic vascular disease). The review had several methodological weaknesses and the conclusions were based on six small case-control studies (a study design which has been associated with bias in estimates of test performance), so these conclusions are unlikely to be reliable.

Authors’ objectives
To assess the performance of 18F-fluorodeoxyglucose positron emission tomography (FDG-PET) for diagnosing giant cell arteritis, with or without polymyalgia rheumatica.

Searching
MEDLINE, EMBASE and the Cochrane Library were searched for English language articles, up to November 2011. Search terms were reported. Bibliographies of included studies were searched for additional articles.

Study selection
Studies that assessed the performance of FDG-PET for the diagnosis of giant cell arteritis (with or without polymyalgia rheumatica) in at least eight participants were eligible for inclusion. Studies were required to use the American College of Rheumatology as the reference standard to confirm diagnosis of giant cell arteritis and the Healey criteria to confirm polymyalgia rheumatica. Only studies that used a control group were included in the meta-analysis.

Most included studies evaluated FDG-PET alone; two studies assessed FDG-PET and FDG-PET/CT, and one study assessed FDG-PET/CT. Most (10 of 14) included studies used qualitative FDG-PET diagnostic criteria. Of the six studies included in the meta-analysis, four assessed FDG-PET alone, one assessed FDG-PET and FDG-PET/CT, and one assessed FDG-PET/CT; all but one of these studies used qualitative diagnostic criteria. The mean age of patients in the vasculitis groups ranged from 62 to 71 years; the female to male ratio ranged from 1.5 to 5. The mean age of patients in the control groups ranged from 55 to 71 years; the female to male ratio ranged from 0.73 to 5.

The authors did not state how many reviewers selected studies for inclusion.

Assessment of study quality
The methodological quality of the six studies included in the meta-analysis was assessed using the 14-item QUADAS tool. Summary quality scores (maximum 14) were calculated.

Two reviewers independently assessed study quality; any disagreements were resolved by consensus.

Data extraction
For studies included in the meta-analysis, details of the imaging test and study participants and numbers of true positive, false negative, false positive, and true negative imaging results were extracted. For all other studies details of the imaging test and a qualitative description of study findings were extracted.

The authors did not state how many reviewers were involved in the data extraction process.

Methods of synthesis
Pooled estimates of sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), positive and negative likelihood ratio (LR) and diagnostic accuracy, with 95% confidence intervals (CIs) were calculated using a random effects model, weighted by the inverse of the sum of the within-study and between-study variance estimates.

Between study heterogeneity was assessed using the tau-squared test and I² statistic.
For studies not included in the meta-analysis, a narrative synthesis was provided.

Results of the review
Fourteen studies (total number of participants unclear) were included in the review; six studies (283 patients; 101 vasculitis patients and 182 control patients) were included in the meta-analysis. The summary quality scores for the six studies included in the meta-analysis ranged from 7 to 14; five of the six studies had scores of 12 or more.

The pooled estimate of $^{18}$F-fluorodeoxyglucose positron emission tomography (FDG-PET) sensitivity for diagnosing giant cell arteritis was 80% (95% CI 63 to 91); specificity was 89% (95% CI 78 to 94). The pooled estimate of positive predictive value was 85% (95% CI 62 to 95) and the negative predictive value was 88% (95% CI 72 to 95). The pooled estimate of positive likelihood ratio was 6.73 (95% CI 3.55 to 12.77) and negative likelihood ratio was 0.25 (95% CI 0.13 to 0.46). The pooled estimate of accuracy was 84% (95% CI 76 to 90%). The authors stated that there was statistically significant between study heterogeneity for sensitivity, positive predictive value and negative predictive value.

Qualitative analysis of the findings of all included studies indicated that smooth linear or long segmental pattern of $^{18}$F-fluorodeoxyglucose uptake in the aorta and its main branches appeared characteristic of giant cell arteritis, whilst vessel uptake that was superior to liver uptake was characteristic of vasculitis.

Authors' conclusions
FDG-PET had overall valuable diagnostic performance for giant cell arteritis compared with the reference standard.

CRD commentary
The review stated a clear objective and defined inclusion criteria for the index test, reference standard and study design. Searches were restricted to English language studies, which raised the possibility of language bias and the potential omission of relevant studies. The methodological quality of studies included in the meta-analysis was assessed and results were reported; the assessment was used to generate summary quality scores, which was an approach not recommended by the guidance for the use of the QUADAS tool. The quality assessment process included measures to minimise error and bias, but it was not clear whether these measures were applied throughout the review process.

Possible sources of heterogeneity were discussed, but were not formally investigated. Given the apparent between study heterogeneity, pooled estimates of test performance were of questionable validity. The analysis was based on a small number of small diagnostic case-control studies, a study design which has been associated with bias in estimates of test performance.

In light of these limitations, the authors' conclusions are not likely to be reliable.

Implications of the review for practice and research
Practice: The authors stated that FDG-PET to detect extracranial giant cell arteritis should be performed in patients with a negative temporal artery biopsy, isolated clinical polymyalgia rheumatica symptoms, or atypical cases that do not fulfil the reference criteria.

Research: The authors stated that there was a need for standardised FDG diagnostic criteria.

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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.