Positron emission testing for six cancers (brain, cervical, small cell lung, ovarian, pancreatic and testicular): brain cancer

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CRD summary

This review investigated the performance of fluorodeoxyglucose positron emission tomography (FDG-PET) for the diagnosis of brain tumours. The authors concluded that FDG-PET may be valuable for distinguishing tumour from radiation necrosis, but this is tempered by results showing it was similar to single-photon emission tomography. The authors' conclusion is appropriately cautious given the limitations of the data available.

Authors' objectives

To investigate the diagnostic accuracy of fluorodeoxyglucose positron emission tomography (FDG-PET) as an adjunct to conventional imaging compared with conventional imaging alone for guiding lesion biopsy of recurrent low-grade tumours in patients with indeterminate magnetic resonance imaging (MRI), and in distinguishing high- from low-grade tumours and distinguishing tumour from radiation necrosis in recurrent brain lesions. A further objective was to investigate the diagnostic accuracy of FDG-PET as an adjunct to biopsy compared with biopsy alone for the diagnosis of primary brain tumours.

Searching

MEDLINE was searched up to April 2003 for studies published in the English language; the search terms were reported. The bibliographies of review articles were screened and some experts were contacted (information obtained from communication with the authors).

Study selection

Study designs of evaluations included in the review

Studies of at least 12 participants were eligible for inclusion.

Specific interventions included in the review

Studies comparing FDG-PET as an adjunct to conventional imaging with imaging alone in guiding lesion biopsy of recurrent low-grade brain tumours in patients with an indeterminate MRI scan, or in distinguishing high- from low-grade tumours and tumours from necrosis in recurrent brain lesions, were eligible for inclusion. Also eligible for inclusion were studies comparing FDG-PET as an adjunct to biopsy with biopsy alone in the initial grading of malignancy with primary tumours when the initial biopsy result was indeterminate grade II/III glioma. The included studies used MRI and single-photon emission tomography (SPECT) as the conventional imaging comparator. Some studies did not appear to have a comparator.

Reference standard test against which the new test was compared

Studies were required to use a reference standard for the detection of malignancy to be included in the review, though the standard itself was not specified. The included studies used histology or clinical follow-up of patients as the reference standard.

Participants included in the review

Studies of patient groups that addressed the research questions were eligible for inclusion. The included studies were of patients with recurrent brain lesions or patients with primary brain tumours.

Outcomes assessed in the review

Inclusion criteria for the outcomes were not specified. The outcome measures used in the review were sensitivity and specificity and impact on therapeutic choice.

How were decisions on the relevance of primary studies made?

The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality

The following criteria were assessed: whether the sample was representative; clear description of the setting and patient selection; minimisation of differences between patients who received the tests; description of the scanner model; use of clearly defined criteria for test interpretation; use of histopathological or clinical criteria for the confirmation of disease, and blinding of the test reader and person interpreting the reference standard. One point was given for the presence of each criterion and these were summed to give a total quality score.

At least two reviewers assessed the quality of each study and any discrepancies were resolved by consensus.

Data extraction

The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction.

The sensitivity, specificity and associated 95% confidence intervals were calculated where possible.

Methods of synthesis

How were the studies combined?

The studies were described individually and a summary provided.

How were differences between studies investigated?

The studies were grouped based on the review sub-question addressed, and then by quality score.

Results of the review

Thirteen studies were included (n more than 490; one study reported the number of tumours only, n=59). Four studies were retrospective in design; it was unclear for the rest.

Seven studies investigated the performance of FDG-PET in distinguishing tumour from radiation necrosis in recurrent brain lesions. In two studies assessing the impact on therapeutic choice, FDG-PET did not appear to have a benefit over MRI. There were five diagnostic accuracy studies addressing this question. With the exception of one study with only one patient without recurrence, the sensitivity of FDG-PET ranged from 67 to 83% and the specificity from 50 to 62%. FDG-PET was compared with SPECT/SPET in three of these studies:

in one study, FDG-PET sensitivity and specificity were 50% and 80%, respectively, for the diagnosis of radiation necrosis and recurrence, while SPECT sensitivity and specificity were 50% and 75% for radiation necrosis and 75% and 50% for recurrence;

in the second study, FDG-PET had 67% sensitivity and 100% specificity while both sensitivity and specificity were 100% for SPET;

in the third study, sensitivity and specificity for recurrence were 76% and 100% (based on one patient), respectively, for FDG-PET and 70% and 100% (based on one patient) for SPET.

No studies addressing the performance of FDG-PET guided lesion biopsy compared with conventional imaging in patients with recurrent brain tumour were identified; nor were there any studies addressing the performance of FDG-PET in distinguishing between tumour grades compared with biopsy when a new brain tumour is deemed indeterminate by biopsy. Four studies of patients with a definite biopsy grade were reported, though these did not meet the inclusion criteria for the review.

Authors' conclusions

FDG-PET may be a valuable method for distinguishing tumour from radiation necrosis in recurrent brain lesions, but this conclusion is tempered by the results of three studies in which FDG-PET had similar operating characteristics to the more accessible SPECT.

CRD commentary

The review addressed a clearly stated research question, though the inclusion criteria were very broad. The limited searches, combined with the restriction to English language publications, might have resulted in the loss of relevant data. The review methodology was poorly described and, apart from an assessment of study quality, it was unclear whether appropriate measures were taken to reduce error and bias. The methodological quality of the studies was assessed and reported. The studies were summarised, rather than synthesised, making it difficult to get a clear overview of the findings. The authors' conclusion is appropriately cautious given the limitations of the data available.

Implications of the review for practice and research

The authors did not state any implications for practice or further research.

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