Clinical efficacy of SPECT bone imaging for low back pain

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Authors’ objectives
To evaluate the diagnostic accuracy, clinical usefulness (effect on patient management), and cost-effectiveness of single-photon enhanced computed tomography (SPECT) for lower back pain.

Searching
MEDLINE was searched from 1966 to September 1993. Biological Abstracts and Excerpta Medica were searched for selected non-Index Medicus journals. The search was restricted to English language publications. The search strategy was not given.

Study selection
Study designs of evaluations included in the review
The diagnostic accuracy studies were required to include a minimum of 10 patients. No inclusion criteria relating to the study design were specified for the cost-effectiveness or clinical effectiveness studies.

Specific interventions included in the review
Studies of bone SPECT were eligible for inclusion. No further details of the SPECT techniques included were reported.

Reference standard test against which the new test was compared
Only studies reporting an adequate reference standard (surgical results or long-term follow-up) were eligible for inclusion.

Participants included in the review
Only studies of lower back pain in humans were eligible for inclusion.

Outcomes assessed in the review
The included diagnostic accuracy studies were required to report the numbers of true-positive, false-positive, true-negative and false-negative test results. No inclusion criteria relating to the outcome measures were reported for other study types. The sensitivity, specificity, positive likelihood ratio, and positive and negative predictive values were calculated, where possible, for the primary studies and were reported in the review.

How were decisions on the relevance of primary studies made?
One investigator reviewed each report.

Assessment of study quality
The included articles were assessed for referral bias, generalisability, appropriateness of reference standard, and reviewer bias (blinding). The authors did not state how the papers were assessed for validity, or how many reviewers performed the validity assessment.

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

Methods of synthesis
How were the studies combined?
A narrative synthesis was presented. Details of the data obtained, whether complete or partial, were reported.
How were differences between studies investigated?
The authors did not combine individual estimates of the accuracy of SPECT because the reports studied such different patient populations. The issue of heterogeneity was discussed in detail and the authors acknowledged the problems associated with the quality of the research in this area.

Results of the review
Only 3 studies (104 patients in total) provided complete diagnostic accuracy data with a reference test. In addition, 7 full reports and 3 abstracts provided partial information.

Only 3 reports provided a ‘gold’ standard reference test and allowed the calculation of sensitivity and specificity.

1st report: 15 young patients with lower back pain of unknown source received SPECT to detect spondylolysis, spondylolithesis, lumbar Scheuerman disease and fractures. The reference test was by the review of medical records or telephone conversation at 7 months. The true -positive rate (TPR) was 0.917 and the false- positive rate (FPR) was 0.0. It was not possible to calculate the likelihood ratio.

2nd report: 74 patients known to have a primary malignancy with no known spinal metastases were investigated, using SPECT, in order to detect benign and malignant spinal lesions. The reference test was by some combination of biopsy, autopsy, CT, magnetic resonance imaging, follow-up planar bone scan, follow-up plain films and clinical follow-up at 6 months. The TPR was 0.966, the FPR was 0.956, and the likelihood ratio of a positive test was 1.01. The pattern of positive results indicated that SPECT might be useful in distinguishing between benign and malignant lesions.

3rd report: 15 patients who had received spinal fusion were examined, using SPECT, for pseudoarthrosis. The reference test was by repeat surgery or clinical follow-up (time unspecified). The TPR was 0.778, the FPR was 0.167, and the likelihood ratio was 4.7.

The reports were not combined because they studied such different patient populations. It was not possible to estimate the accuracy of SPECT in other important populations, such as adults with no known cancer or patients with suspected osteomyelitis. No reports were found on the clinical effect or cost-effectiveness of SPECT.

Authors' conclusions
There was weak evidence that SPECT is useful in: detecting pseudarthroses after failed spinal fusion; evaluating young patients with back pain; and distinguishing benign from malignant lesions in cancer patients. SPECT has not been studied sufficiently in any other setting. The decision to use SPECT in most patients with lower back pain cannot be supported by clinical trials, and its effect on clinical management and cost-effectiveness are unknown. The medical community should mount a large-scale, prospective evaluation of SPECT in lower back pain.

CRD commentary
The research question was presented clearly and the inclusion criteria were described in detail. The authors presented a structured narrative review and discussed, in detail, the problems associated with the quality of the available research and the characteristics of the individual primary studies. The search strategy was somewhat limited: there was no attempt to identify unpublished data and the included studies were restricted to English language publications. It is therefore possible that relevant studies may have been omitted from the review. The description of the review methodology was limited and single reviewers decided whether to include the primary studies, thus raising the possibility of bias in the review process. The authors planned a meta-analysis of diagnostic accuracy studies; their decision to employ a narrative synthesis was appropriate given the heterogeneity of the studies identified.

Implications of the review for practice and research
Practice: The authors stated that the decision to use SPECT in most patients with lower back pain could not now be supported by clinical trials.

Research: The authors stated that it is imperative that the medical community mounts a well-designed, prospective
evaluation of SPECT in lower back pain.

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