Fine-needle aspiration biopsy versus core-needle biopsy in diagnosing lung cancer: a systematic review

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CRD summary
This review concluded that available evidence was insufficient to support a difference between fine-needle aspiration biopsy and core-needle biopsy in identifying lung cancers in patients with lesions. Given the limitations of the review and the available evidence, the authors' conclusions seem suitably cautious. The recommendation for further research is appropriate.

Authors' objectives
To compare fine-needle aspiration biopsy (FNAB) with core-needle biopsy (CNB) for diagnostic characteristics and yields for diagnosing lung cancer in patients with lung lesions.

Searching
MEDLINE and EMBASE were searched from 1990 September 2009 for articles and reports in English that had been published in full; search terms were reported. The Cochrane Library and the websites of a range of organisations that produced guidelines in USA, UK, Australia, New Zealand and Canada were searched to identify existing systematic reviews and practice guidelines. Bibliographies of included studies were screened.

Study selection
Systematic reviews, meta-analyses, clinical practice guidelines, randomised trials, and comparative cohort studies that compared the diagnostic characteristics and yields of fine-needle and core-needle biopsy were eligible for inclusion. Articles had to: include patients with an undiagnosed lung nodule or mass on imaging; use histologic confirmation, surgical resection, metastases, autopsy or clinical follow-up as the reference standard; and provide sufficient data to calculate at least one estimate of diagnostic accuracy or complication rates for both fine-needle and core-needle biopsy. Studies that recruited patients with a previous or current diagnosis of lung cancer, studies that suffered from incorporation bias and studies that used fine-needle and core-needle biopsy in different patient populations were excluded from the review.

Less than half of the included studies conducted fine-needle and core-needle biopsy in the same patients. Most of the included participants were adults; age ranged from 10 to 92 years. Where reported, lesion diameters ranged from 3mm to 150mm. Lesions were most commonly located in the lung; some studies included lesions in the mediastinum, pleura and/or chest wall. The prevalence of malignant lesions was 67.3% to 85.7%.

One author screened titles and abstracts to identify potentially relevant studies. Full paper screening was conducted by three independent reviewers; differences were resolved by discussion.

Assessment of study quality
Study quality was assessed using the 11-point checklist from Cochrane Handbook for Systematic Reviews of Diagnostic Test Accuracy. This tool assesses spectrum, progression, verification, clinical review and incorporation biases, the acceptability of the reference standard, blinding and the reporting of uninterpretable results and withdrawals. Direction of data collection was added to the list of criteria.

The authors did not state how many reviewers performed the quality assessment.

Data extraction
Data were extracted to construct 2x2 tables of test performance, from which sensitivity, specificity, positive and negative likelihood ratios (LR-/+) and overall accuracy were calculated along with 95% confidence intervals (CI).

The authors did not state how many reviewers performed the data extraction.
Methods of synthesis
A narrative synthesis was presented and the ranges of diagnostic accuracy estimates and complication rates across studies were provided. Differences between studies were discussed in the text. Study details were provided in tables.

Results of the review
Eleven studies met the inclusion criteria: four studies were prospective, four retrospective and the direction of data collection was not reported in the other three. Ten of the 11 studies had an acceptable reference standard, avoided partial verification, incorporation and clinical review biases and reported uninterpretable results; six recruited exclusively patients with lung lesions; five, in which it was considered applicable, avoided progression bias; none avoided differential verification bias; four reported blinding investigators for the index test; and eight explained withdrawals. Overall, the quality of the eligible studies was considered to be poor.

When distinguishing between benign and malignant lesions (based on three out of five studies, 792 participants) sensitivity of fine-needle aspiration biopsy ranged from 81.3% to 90.8%, specificity from 75.4% to 100%, LR+ from 3.67 to 45.46, LR- from 0.10 to 0.18, and overall accuracy from 79.7% to 91.8%. Sensitivity of core-needle biopsy ranged from 85.7 to 97.4%, specificity from 88.6% to 100%, LR+ from 7.79 to 75.94, LR- from 0.03 to 0.12, and overall accuracy from 89.0% to 96.9%.

For identifying the histologic subtype of malignancies or the specific benign diagnoses (seven studies, 834 participants) sensitivity of fine-needle aspiration biopsy ranged from 56.3% to 86.5%, specificity from 6.7% to 57.1%, LR+ from 0.60–1.93, LR- from 0.30–6.56, and overall accuracy from 40.4% to 81.2%. Sensitivity of core-needle biopsy ranged from 56.5 to 88.7%, specificity from 52.4% to 100%, LR+ from 1.55 to 15.07, LR- from 0.12 to 0.50 and overall accuracy from 66.7% to 93.2%.

For direct comparisons of fine-needle and core-needle biopsy (five studies, 545 participants) accuracy ranged from 58.7% to 81.2% for fine-needle aspiration biopsy and 66.7% to 89.5% for core-needle biopsy; accuracy was significantly higher for fine-needle than for core-needle biopsy in two studies.

Overall there was no significant difference in the rate of pneumothorax or haemoptysis between fine-needle and core-needle biopsy (11 studies). Additional results were provided for studies that used CT (computed tomography) imaging (five studies), recruited only patients with lung lesions (four studies) or used an on-site cytopathologist (four studies).

Authors’ conclusions
The evidence was insufficient to support a difference between fine-needle aspiration biopsy and core-needle biopsy in identifying lung malignancies in patients with lung lesions. Compared with fine-needle aspiration biopsy, core-needle biopsy might have a higher specificity to diagnose specific benign lesions.

CRD commentary
The review addressed a clear review question supported by appropriate inclusion criteria. Several relevant sources were searched. The search was restricted to articles published in English, so bias may have been present. Some parts of the review process were conducted in duplicate, but this was not the case for the entire process so error and bias may have been introduced. Study quality was assessed using appropriate criteria and the results were published in full. Although the studies were heterogeneous and a narrative synthesis may have been appropriate, there are robust models for producing summary receiver operating characteristic curves where heterogeneity is present. The application of one of these models would have produced summary estimates of sensitivity and specificity and given an indication of the uncertainty around these estimates.

Given the limitations of the review and the available evidence, the authors conclusions seem suitably cautious. The recommendation for further research is appropriate.

Implications of the review for practice and research
Practice: The authors stated that the best technique in a given diagnostic centre may in part be determined by the local availability of resources and expertise in biopsy technique and sample interpretation.

Research: The authors stated that well-designed good-quality studies to compare fine-needle aspiration biopsy and core-needle biopsy with core-needle biopsy are needed.
needle biopsy for diagnostic characteristics and yields in diagnosing lung cancer should be encouraged.

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