Accuracy of diagnostic ultrasound in patients with suspected subacromial disorders: a systematic review and meta-analysis

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CRD summary
This review found that ultrasound can be used to rule in or out full-thickness tears, rule in partial-thickness tears and to a lesser extent diagnose tendinopathy, subacromial bursitis and calcifying tendinitis in patients for whom conservative treatment failed. These conclusions should be interpreted with some caution due to the possibility of missing studies.

Authors’ objectives
To determine the accuracy of ultrasound for detecting subacromial disorders in patients presenting in primary and secondary care settings.

Searching
PubMed and EMBASE were searched from 2001 to June 2010. Search terms were reported and included a diagnostic filter. Studies included in a previous review on this topic were included. Reference lists of included studies were screened. The review was restricted to studies published in full in peer-reviewed journals in English, French, German or Dutch.

Study selection
Studies that assessed ultrasound imaging using linear array transducers (≥7.5MHz) (index test) against magnetic resonance imaging (MRI), surgery and/or radiography (reference standard) in adults with suspected subacromial disorders diagnosed with subacromial bursitis or the rotator cuff disorders tendinopathy, calcifying tendinitis and tears (partial- or full-thickness) were eligible for inclusion. The reference standard had to be described in detail or reference had to be made to standard techniques or procedures. Studies had to report sufficient data to construct a 2x2 table of test performance. Where insufficient data were available authors were contacted for further information.

Most of the included studies were conducted at orthopaedic and/or radiology departments; none of the studies were conducted in primary care. Mean age was 52 years. Most studies were adults with suspected rotator cuff disorders in whom conservative treatment had failed. Transducer frequency varied between studies with more recent studies including frequencies of at least 10MHz. Most studies used surgery as the reference standard; one study used MRI.

Two reviewers independently assessed studies for inclusion. Disagreements were resolved through consensus.

Assessment of study quality
Two reviewers independently assessed study quality using the 14-item QUADAS tool. Disagreements were resolved through consensus.

Data extraction
Two reviewers independently extracted data as 2x2 tables of test performance and were used to calculate sensitivity and specificity, together with 95% confidence intervals (CI). Disagreements were resolved through consensus.

Methods of synthesis
Summary estimates of sensitivity and specificity were calculated using the bivariate/HSROC model. Summary positive and negative likelihood ratios were estimated from the summary estimates of sensitivity and specificity. Summary receiver operating characteristic (SROC) curves were estimated using the HSROC model. Subgroup analyses were conducted based on the variables study design, transducer frequency, age, prevalence and key biases.

Results of the review
Twenty-three studies were included (n=2,045 participants). Nineteen studies included an appropriate patient spectrum and in four studies patient spectrum was unclear. There was a possibility of partial verification bias in 11 studies.
Uninterpretable results and withdrawals were poorly reported.

**Full thickness tear (22 studies, n=1,843):** Summary sensitivity was 95% (95% CI 90 to 97%). Summary specificity was 96% (95% CI 93 to 98%). Subgroup analyses showed similar results. None of the analyses showed substantial heterogeneity between studies.

**Partial thickness tear (15 studies, n=1,456):** Summary sensitivity was 72% (95% CI 58 to 83%). Summary specificity was 93% (95% CI 89 to 96%). Subgroup analyses showed similar results. None of the analyses showed substantial heterogeneity between studies.

**Subacromial bursitis (three studies, n=377):** Sensitivity ranged from 79% to 81%. Specificity ranged from 94% to 98%.

**Calcifying tendinitis (two studies, n=300):** Both studies reported sensitivity of 100%. Specificity estimates were 85% and 98%.

**Tendinopathy (two studies, n=97):** Sensitivity estimates were 67% and 93%. Specificity estimates were 88% and 100%.

**Authors' conclusions**
The authors strongly recommended ultrasound in patients for whom conservative treatment failed, to rule in or out full-thickness tears, to rule in partial-thickness tears and to a lesser extent to diagnose tendinopathy, subacromial bursitis and calcifying tendinitis.

**CRD commentary**
The review addressed a clear question. Inclusion criteria were defined. The literature search was adequate for published studies. The restriction to studies published in specified languages raised the possibility of language and publication biases. Appropriate steps were taken to minimise bias and errors at all stages of the review. Study quality was assessed using appropriate criteria and results were fully reported and considered in the analysis. The meta-analysis used statistically robust models and results were clearly presented. Heterogeneity was considered and investigated.

This was generally a well-conducted review and the authors conclusions were supported by the data. But the possibility of missing studies means the conclusions should be interpreted with some caution.

**Implications of the review for practice and research**

**Practice:** The authors stated that ultrasound should be used to rule in or out full-thickness tears, rule in partial-thickness tears and to a lesser extent diagnose tendinopathy, subacromial bursitis and calcifying tendinitis in patients for whom conservative treatment failed. These results can help physicians tailor treatment.

**Research:** The authors stated that future research should focus on diagnostic accuracy in settings with lower prevalences, follow-up studies of patients with shoulder complaints in primary and secondary care settings to evaluate the natural history and epidemiology, and studies on the cost-effectiveness of management that included diagnostic ultrasound in treatment decisions.

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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.