CRD summary
This review concluded that positive painful arc test and external rotation resistance test results were the most accurate findings for detecting rotator cuff disease and positive lag test result was most accurate for diagnosing full-thickness rotator cuff tears. Generalisability of the results to a primary care population was unknown. These conclusions appear appropriate but are based on limited evidence.

Authors' objectives
To identify the most accurate clinical examination findings for rotator cuff disease.

Searching
MEDLINE, EMBASE and CINAHL databases were searched to May 2013 for relevant studies published in Danish, Dutch, English, French, German, Norwegian, Spanish and Swedish. The search strategy was reported. References of eligible articles were examined.

Study selection
Studies were eligible for inclusion if they presented original data on history taking, physical examination or clinical tests concerning rotator cuff disease, reported sensitivity and specificity and used a reference standard with prespecified diagnostic criteria.

Included studies evaluated several different pain provocation tests, strength tests and composite tests for pain or weakness. Reference tests among included studies were ultrasound and/or MRI (magnetic resonance imaging). Mean age of patients ranged from 44 to 58 years. Rotator cuff disease prevalence ranged from 33% to 81%. Tests were carried on patients referred to specialist care.

Four reviewers independently selected studies for inclusion. Disagreements were resolved by a fifth reviewer.

Assessment of study quality
Two reviewers independently assessed the risk of study bias using the QUADAS tool. Studies were classified according to the Rational Clinical Examination Levels of Evidence criteria; better quality levels I and II described independent blind comparisons of index and reference tests among consecutive patients with shoulder discomfort.

Data extraction
Two reviewers independently extracted data to calculate sensitivity, specificity and positive and negative likelihood ratio (LR) values with 95% confidence intervals.

Methods of synthesis
Where three or more studies evaluated a test, diagnostic accuracy estimates were calculated using a univariate random-effects approach. Heterogeneity was quantified with the $I^2$ statistic. Tests results evaluated in only two studies were reported as a simple range. Results from single studies were shown as point estimates with their confidence intervals.

Emphasis was placed on level I and II studies; data from level IV studies were retained where they were the only evidence for certain tests but were not pooled or combined with data from higher-quality studies.

Results for rotator cuff disease and full-thickness tears were presented separately, where reported.

Results of the review
Twenty-eight studies were included in the review; all assessed the examination of patients referred by specialists.

Five studies (432 participants) were classed as being level I or II (these are results reported here). Accuracy of history
taking and physical examination were not reported in higher quality studies.

**Pain provocation tests:** A positive painful arc test result was the only finding with a positive likelihood ratio greater than 2.0 for rotator cuff disease (3.7, 95% CI 1.9 to 7.0; one study). A normal painful arc test result had the lowest negative likelihood ratio (0.36, 95% CI 0.23 to 0.54; one study).

**Strength tests:** External rotation lag test (positive LR 7.2, 95% CI 1.7 to 31; one study) and internal rotation lag tests (positive LR 5.6, 95% CI 2.6 to 12; one study) were the most accurate findings for detecting full-thickness tears. A positive drop arm test result increased the likelihood of any rotator cuff disease (positive LR 3.3, 95% CI 1.0 to 11; one study) but had low sensitivity. A normal internal rotation lag test result was most accurate for identifying patients without a full-thickness tear (negative LR 0.04, 95% CI 0.0 to 0.58; one study).

**Authors’ conclusions**
A positive painful arc test result and a positive external rotation resistance test result were the most accurate findings for detecting rotator cuff disease. Presence of a positive lag test result was most accurate for diagnosis of a full-thickness rotator cuff tear. Generalisability of results to a non-referred population was unknown.

**CRD commentary**
This review addressed a clearly defined question supported by appropriate inclusion criteria. Attempts were made to identify all the published evidence and minimise potential for errors and bias in the handling of this evidence. Data for most tests were derived from single studies and only a small amount of high quality evidence was available. The authors acknowledged by the authors that applicability of these data to primary care settings may be questionable.

The authors combined the available evidence using appropriate methods but the limited size and number of available studies mean that the conclusions of this review should not be seen as definitive.

**Implications of the review for practice and research**
**Practice:** The authors stated that for patients with shoulder pain, primary care physicians could perform a single pain provocation test (painful arc test), three strength tests (internal rotation lag test, external rotation lag test and drop arm test) and one composite test (external rotation resistance test). Patients with normal pain provocation and strength testing manoeuvres with persistent shoulder discomfort may need referral to orthopedists to establish the diagnosis.

**Research:** The authors stated that larger studies would be useful to increase the precision of estimates of accuracy.

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