SYSTEMATIC REVIEW

Clinical tests accuracy in diagnosing subacromial impingement syndrome: A systematic review

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Abstract

Objective: To determine the sensitivity and specificity of the clinical diagnostic tests of subacromial impingement syndrome.

Method: The systematic review comprised search on PubMed, PEDro, Cochrane Library and Google Scholar databases. For prospective cohort studies published in peer-reviewed English-language journals without any time limit, at least fully describing one clinical test. Only studies with free full text available were included. Data extracted included sensitivity and specificity for each clinical test, and variations were sorted out by the 3 reviewers by discussion.

Results: Of the 4137 studies identified, 2951(71.3%) were on PubMed, 119(2.9%) PEDro, 5(0.1%) Cochrane Library and 1062(25.7%) Google Scholar. After screening out all the studies that did not match the detailed inclusion criterion, 3(0.07%) studies were selected for review; 1(33.3%) each done in Spain, Turkey and France. Overall, there were 181 aged 15-82 years; 85(47%) males and 96(53%) females. Supraspinatus palpation test had a sensitivity of 92%, while the modified Neer test had specificity of 95.56% in terms of ruling out subacromial impingement syndrome.

Conclusion: Supraspinatus palpation and modified Neer tests were found to be the most effective in the diagnosis of subacromial impingement syndrome.

Keywords: Clinical test, Diagnostic accuracy, Sensitivity, Specificity, Subacromial impingement syndrome.

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Introduction

Shoulder pain is one of the most common symptoms in patients presenting to the healthcare settings around the world with lifetime estimate of 67%.[1] Globally, musculoskeletal disorders, especially pain in joints and the back, represent the major impact on disability.[2] The most common cause of shoulder pain has been identified as subacromial impingement syndrome (SAIS).[3] Shoulder pain is second only to low back pain (LBP) among the costs associated with caring for musculoskeletal disorders and it is a common and important musculoskeletal problem.[4] The most frequent cause of shoulder pain associated with narrowing of the subacromial space is SAIS.[5] SAIS is a clinical syndrome in which supraspinatus muscle is entrapped in subacromial space due to different causes.[6] Charles Neer introduced the idea of SAIS in 1972.[7]

Patients will have pain localised at the anterolateral acromion, which radiates to the lateral mid humerus, and usually complain of discomfort at night when lying on the affected side or sleeping with overhead posture.[8] The medical diagnosis of conditions that causes shoulder pain is challenging and complex area of musculoskeletal practice.[9] The causes of SAIS are multifactorial which can be intrinsic and extrinsic. Intrinsic impingement is the partial or full thickness tear because of degenerative changes that occur with overuse tendon overload and trauma of the tendon.[10] External impingement is the painful condition of the shoulder that results from inflammation, irritation, and degradation of anatomical structures within SAIS.[11]

Multiple trials and reviews have been done to find the best diagnosis of the patients suffering from SAIS of the shoulder joint which has played a role in functional task and activities of daily life. Silva et al. in 2008 performed a prospective control trial comprising 14 males and 16 females, comparing the efficacy of different clinical tests with reference standard magnetic resonance imaging (MRI), and concluded that the Yocum test has high sensitivity and specificity.[12] Ioanna et al. in 2020 compared Hawkins Kennedy, Neer's test, painful arc of abduction, empty and full can tests and resisted isometric shoulder pronation, and reported that Hawkins Kennedy was the most accurate test to diagnose SAIS with sensitivity and specificity of 79% and 57% respectively.[13] Hegedus et al. in 2014 advanced previous research by doing a review on the diagnostic accuracy of individual physical examination tests, allowing the clinicians to find evidence regarding Neer and Hawkin Kennedy tests being valuable in

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diagnosing SAIS.[14]

Lorusso et al. in a systematic review concluded that all clinical tests showed reliability and were acceptable for clinical use. Studies used radiological findings, such as MRI, magnetic imaging arthrography (MRA) and ultrasound (US) as reference standards to evaluate sensitivity and specificity of clinical tests.[15]

Some studies favour Yocum test, while others Hawkin Kennedy test for accurate diagnosis of SAIS.[12,16] In physiotherapy clinics, Hawkins Kennedy test is mostly used.[17] Clinicians should utilise the most efficacious physical examination test for diagnosing patients which will increment treatment effect.[18]

Considering the increasing number patients with SAIS, conflict was found between clinicians and researchers in physical examination tests related to SAIS diagnosis.[12,16,19] Therefore, the current systematic review was planned to find diagnostic accuracy of clinical tests in diagnosing SAIS.

Materials and Methods

The systematic review, done in line with the Preferred reporting items for systematic review and meta-analysis (PRISMA) guideline,[20] comprised search on PubMed, PEDro, Cochrane Library and Google Scholar databases. The search strategy included using a combination of relevant key words along with medical subject heading (MeSH): "clinical tests" AND "sensitivity" AND "specificity" AND "subacromial impingement syndrome" AND "special tests" AND "diagnostic accuracy" AND "supra humeral impingement" OR "external impingement" OR "anterior impingement".

Three reviewers independently assessed all titles and abstracts, and the nonrelevant articles were discarded. In the next stage, full-text articles were screened for eligibility. Disagreement related to reviewers' opinions were resolved with mutual discussion.

Inclusion criteria: Studies were included if they were prospective cohort studies published in peer-reviewed journals without any time limit, at least fully described one clinical test, a patient presenting with shoulder pain, sensitivity and specificity of the individual test reported, MRI, ultrasound, computed tomography (CT) scan used as a reference standard, and articles with free full text available in the English language.

Exclusion criteria: Studies were excluded if the study design was other than prospective cohort study, books/book chapters, workshop papers, grey literature, focusing on any other conditions that may lead to shoulder pain, like shoulder instability, fractures, dislocation and systemic diseases. Articles were also excluded if the clinical tests were performed under anaesthesia.

Information was extracted from the studies regarding authors, publication date, sample size, age of enrolled participants, and the country where the research was executed.

Data Extraction: Sensitivity and specificity for each clinical test were extracted from the included studies, and variations were sorted out by the reviewers with discussion.

Quality Assessment: Articles which totally met the eligibility criteria were assessed using the quality assessment of diagnostic accuracy studies (QUADAS), which consists of 14 points that are marked by 'yes', 'no', 'unclear' options.[21] The three independent reviewers assessed the quality of the studies and differences in scoring were resolved with consensus.

Results

Of the 4137 studies identified, 2951(71.3%) were on PubMed, 119(2.9%) PEDro, 5(0.1%) Cochrane Library and 1062(25.7%) Google Scholar. After screening out all the studies that did not match the detailed inclusion criterion, 3(0.07%) studies were selected for review (Figure 1); 1(33.3%) each done in Spain,[12] Turkey[22] and France.[23]

Overall, there were 181 subjects aged 15-82 years; 85(47%) males and 96(53%) females (Table).

The most frequently reported clinical test for determining SAIS was Neer test conducted in all the 3(100%) studies.

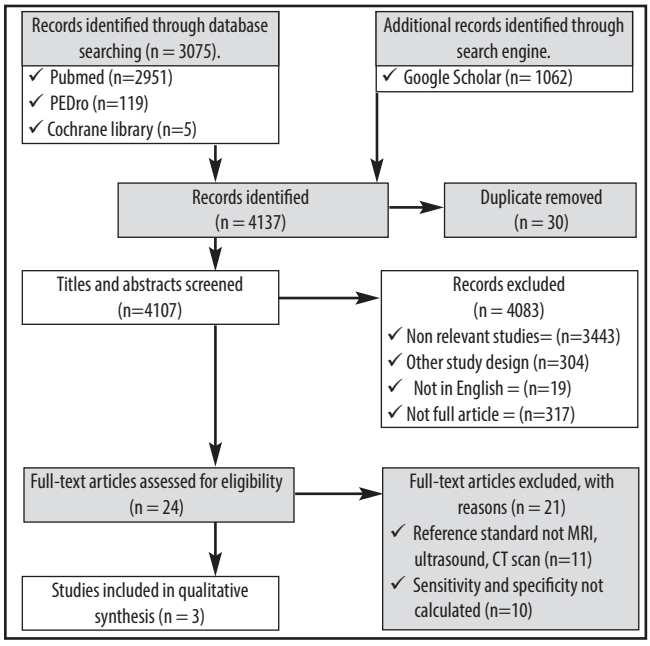

Figure-1: Preferred reporting items for systematic review and meta-analysis (PRISMA) flowchart.

Hawkin-Kennedy test was reported in 2(66.6%) studies. Yocum test, Jobe test, Patte test, Gerber test, passive abduction, resisted abduction, supraspinatus palpation test, infraspinatus palpation test, subscapularis palpation test, bicep palpation test, and Modified Neer test (MNT) were performed once in the 3(100%) studies. MRI as the reference standard was used in 2(66.6%) studies, while 1(33.3%) study used US.

Table-1: Summary of the studies reviewed.

Author		n	Mean Age (Range)	Clinical Test	Sensitivity (%)	Specificity(%)	Reference Standard	Country
Silva 2008[12]		30	54.87±13.8 years	Neer	68.4	30.0	MRI	Spain
	Males	14	(24-82)	Hawkin-	73.7	40.0		
	Females	16		Kennedy	79.0	40.0		
				Yocum	73.7	30.0		
				Jobe	57.9	60.0		
				Patte	68.4	50.0		
				Gerber	73.7	10.0		
				Passive ABD	57.9	20		
				Resisted ABD				
Toprak 2012[22]		69	48±8.7 years	Neer	80	52	US	Turkey
	Males	21	(30-65)	Hawkin-	67	47		
	Females	48		Kennedy	92	41		
				Supraspinatus				
				palpation test	33	66		
				Infraspinatus	60	0		
				palpation test				
				Subscapularis	85	48		
				palpation test Bicep				
				palpation test				
Guosheng 2017[23]		82	(15-65)	Neer test	90.24	50.00	MRI	France
	Males	50		Modified	85.00	95.56		
	Females	32		Neer test				

MRI: Magnetic resonance imaging, US: Ultrasound.

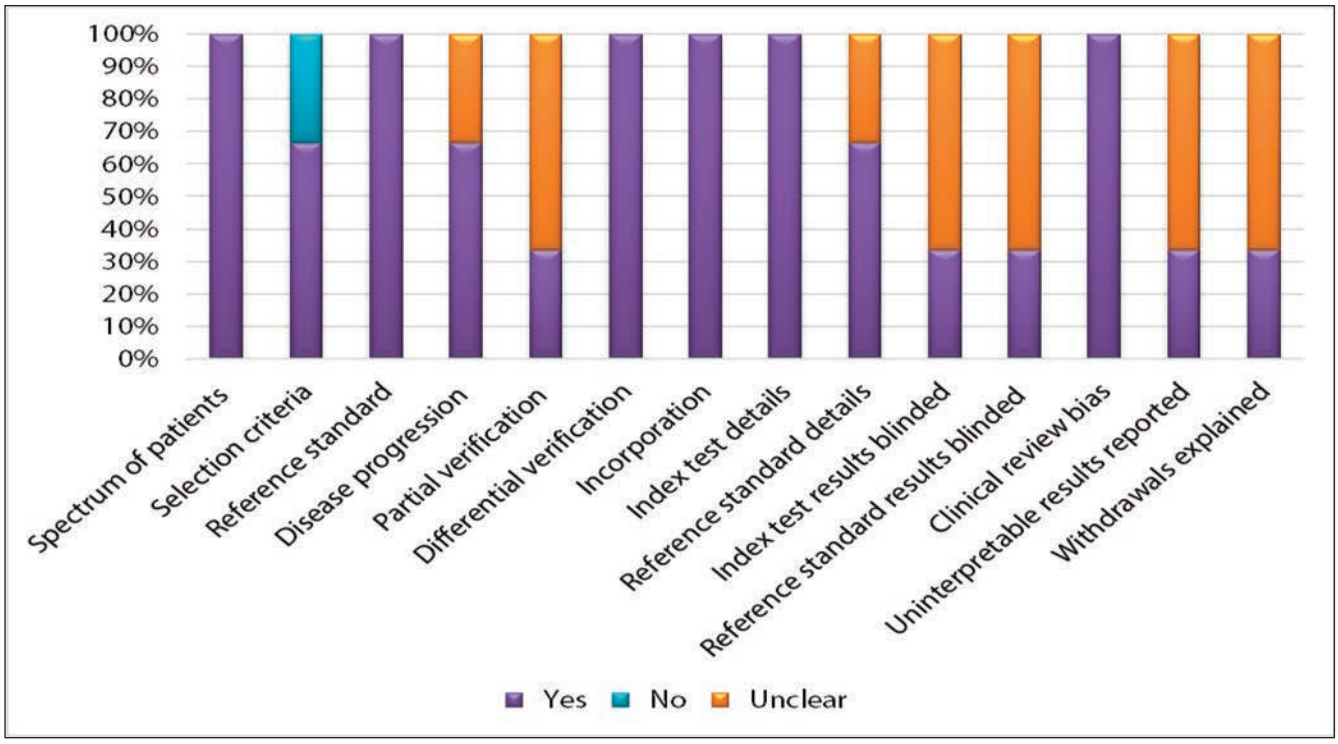

Figure-2: : Quality assessment of diagnostic accuracy studies (QUADAS) flowchart.

Supraspinatus palpation test had sensitivity 92%, whereas MNT was the most specific 95.56%.

Quality assessment findings were based on the QUADAS tool (Figure 2).

Discussion

SAIS is an external impingement syndrome in which tendon of supraspinatus muscle are entrapped in subacromial space due to any physical outgrowth or any other pathology. Clinical tests have fundamental importance for establishing a diagnosis whether a patient have a particular condition or not. The benefit of making a proper diagnosis is that it guides the treatment plan. This review has highlighted the most sensitive and specific test for diagnosing SAIS with reference standard of MRI, US and CT scan.

Different clinical tests were used for diagnosing SAIS, and sensitivities of the clinical tests were higher than specificities. Silva et al, proposed Yocum test as the most sensitive for SAIS diagnosis, but Hawkins Kennedy test, Jobe test and passive abduction test also are good diagnostic tools.[12] Hegedus et al. proposed that Hawkins Kennedy test was the most sensitive test to rule in SAIS.[14] In a cohort study on 50 patients and 50 controls, sensitivity, specificity, positive and negative predictive values, and likelihood ratios of five physical examination tests were calculated using a 2 * 2 table. The study concluded that all the physical examination tests exhibited clinical useful positive likelihood ratio (LR) >2. Yocum, Jobe, and Hawkins-Kennedy tests exhibited clinically useful negative LR <0.5.[24]

Toprak et al. reported the sensitivity of supraspinatus palpation test higher than that of impingement test but the ability of this test to rule out the condition was quite low. The comparison of Neer, and Hawkins Kennedy tests with the reference standard of sonographic finding revealed Neer test to be a highly sensitive test for SAIS. The authors reported a positive correlation between Neer test and supraspinatus tendinosis, while Hawkins Kennedy had a positive correlation with tear of the supraspinatus muscle. The occurrence of subacromial subdeltoid bursitis (SASDB) was higher with supraspinatus tendinosis compared to partial supraspinatus tendon tear, whereas tendinosis was most frequently found with partial supraspinatus tendon tear. The results of tendon palpation test with sonographic finding revealed that chances of supraspinatus tendinosis increase with supraspinatus palpation. The specificity of supraspinatus palpation test decreased for SAIS due to its correlation with SASBD, whereas no association was identified between tenderness of palpation test and US findings.[22] A prospective cohort study with 125 painful shoulders used conventional radiograph with MRI as the reference standard for clinically evaluating the diagnostic accuracy of physical examination tests. The most sensitive tests were Hawkins Kennedy, Neer and horizontal adduction tests, while the most specific test was the drop-arm test.[25]

Alqunaee et al. conducted a first systematic review and provided evidence that Neer's sign, empty can test, and Hawkins-Kennedy had higher sensitivities for SAIS, whereas the drop-arm test and lift-off test were more specific.[26]

A prospective a blinded cohort study found painful arc, external rotation resistance and empty can test to be useful in confirming SAIS diagnosis. However, the Neer test had the lowest level of reliability.[15] Caliş et al, reported sensitivity of 88.7% for the Neer test.[25] Prior evidence indicated higher reliability of Neer sign, Hawkins-Kennedy, Patte manoeuvre and Jobe supraspinatus test.[27]

Guosheng et al. reported MNT as the best diagnostic tool for SAIS.[24] Another study found that MNT had diagnostic accuracy of almost 90.56% and specificity 95.56%.[26]

Frozen shoulder was found to have same symptoms as third-stage SAIS. To differentiate between the two conditions, MNT was found to have significant advantage.[26]

Silva et al. found that the combination of different clinical test results decreased in sensitivity, showing that combination of tests minimises the ability to rule in a condition, but increases positive predictive value (PPV).[12] Clinical tests are accurate in diagnosing SAIS, but using MRI as the reference standard increases diagnostic accuracy. The diagnosis of the impingement syndrome is challenging as other conditions may be present at the time of examination.[10]

The current review has its limitations. The inclusion criteria were only limited to sensitivity and specificity of the clinical diagnostic tests. Meta-analysis was not carried out for the calculation of the diagnostic accuracy of clinical tests. More studies should be carried out with reference standard CT scan and with greater number of participants. Further research on this topic can be carried out by including likelihood ratio. However, more studies are required for measuring sensitivity and specificity of a clinical test with reference standard MRI, US and CT scan.

Conclusion

SAIS diagnosis is a difficult task for clinicians without examining through reference standard MRI, US because of the existence of secondary conditions. Supraspinatus palpation test was found to be most sensitive test for determining Neer stage I and II of SAIS. Neer test was also found to be valuable in ruling in SAIS. MNT was reported

to be highly specific for SAIS having a discriminative power to distinguish between SAIS and frozen shoulder.

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