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To determine the efficacy of Neer's test in the diagnosis of subacromial impingement of the shoulder

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Abstract

Introduction: Subacromial impingement syndrome (SIS) is a clinical syndrome most often attributed to patients presenting with shoulder pain¹ and encompasses a spectrum of subacromial pathologies ranging from bursitis, rotator cuff tendinosis, and partial tears leading up to full-thickness tear of the rotator cuff. Several tests or maneuvers, like the Neer's test, are used in daily clinical practice to demonstrate the presence of SIS and to localize the periarticular lesions, but their accuracy is still questioned. Here we seek to determine the efficacy of Neer's test by comparing the clinical findings with that of MRI findings.

Materials and Methods: The study was performed on 100 shoulders over a period of 2 years at a tertiary care hospital. In patients who satisfied the inclusion criteria, a working diagnosis of Shoulder Impingement Syndrome was made by performing classical tests like Hawkin's and Neer's Sign which was followed by a Neer's test. MRI was then performed on each of the shoulders after 7 days to avoid fluid signals post injection and the findings were noted after the MRI was evaluated by a radiologist. Diagnostic efficacy of the Neer's test was then determined by 2x2 table for calculating the specificity, sensitivity, positive predictive value, negative predictive value and diagnostic accuracy using the "openepi" software with confidence interval being kept at 95%.

Results and Conclusion: Neer's test is a sensitive test for diagnosis of SIS, especially for diagnosis of partial rotator cuff tears and with a higher specificity for diagnosing rotator cuff pathology than bursitis. A negative test is especially useful in ruling out presence of partial or total rotator cuff tears with a positive test encouraging the examiner towards the diagnosis of SIS.

Keywords: Neers test, shoulder impingement, subacromial bursitis

List of abbreviations

SIS - Shoulder impingement syndrome
CAL- Coraco acromial ligament
Sen - Sensitivity
Sp - Specificity
PPV - Positive predictive value
NPV - Negative predictive value
AC - Acromioclavicular joint
SS - Supraspinatus

1. Introduction

Subacromial impingement syndrome (SIS) is a clinical syndrome most often attributed to patients presenting with shoulder pain^[1] and encompasses a spectrum of subacromial pathologies ranging from bursitis, rotator cuff tendinosis, and partial tears leading up to full-thickness tear of the rotator cuff.

Luime *et al.*, estimated the prevalence of shoulder complaints to be in the region of 7%–34% and about 14.7 new cases/1000 patients/year seen in clinics. Of these, SIS is the most common reported diagnosis accounting for up to two-thirds of all shoulder pain^[2]. Of this group, approximately 60% are women^[3,4].

The incidence in the age group older than 20 is greater for women than men. The incidence increases with age until the category of 50 -59 years and then gradually decreases^[5].

SIS is the compression of the suprahumeral structures against the anteroinferior aspect of the acromion and the coracoacromial ligament^[6].

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The structures most often irritated and inflamed with SIS are the rotator cuff muscles, the long head of the biceps and the subacromial bursa [7, 8].

The main features of SIS were first described by Neer in 1972 [7].

He has classified three stages of SIS. In stage 1: Oedema and haemorrhage; in stage 2: cuff fibrosis, thickening and partial cuff tearing; in stage 3: full thickness tendon tears, bony changes and tendon rupture are specific findings [7, 8, 9].

According to Neer, the syndrome results from mechanical impingement of the rotator cuff tendons beneath the anteroinferior portion of the acromion, especially when the shoulder is placed in the forward-flexed and internally rotated position [7, 10, 11].

The subacromial space is bordered inferiorly by the humeral head and superiorly by the coracoacromial ligament (CAL), coracoid process, and undersurface of the anterior third of the acromion [7].

These three structures form the coracoacromial arch. Radiologically, the average space between the acromion and the humeral head is between 10 and 15 mm [6].

Structures in this space include the subacromial bursa, rotator cuff tendons, long head of biceps, and the CAL. Any changes due to trauma or degeneration of these structures can lead to an impingement syndrome [12].

Neer has proposed that 95% of rotator cuff tears occur as a consequence of SIS [7, 8, 9, 13].

Several tests or maneuvers, like the Neer's test, are used in daily clinical practice to demonstrate the presence of SIS and to localize the periarticular lesions, but their accuracy is still questioned [10, 11, 12, 14, 15].

The Neer sign constitutes the first part of the Neer injection impingement test where one hand stabilises the patient's scapula while the other hand raises the arm into full flexion (Neer 1983) [7, 8, 13]. This was thought to cause the greater tuberosity to impinge against the anterior acromion, damaging the rotator cuff tendons, long head of biceps, and the subacromial bursa, with a positive test indicated by pain (Neer 1983) [7, 8, 13]. The second part of the test involves a subsequent xylocaine injection to reduce the pain and thereby differentiate impingement lesions from other causes of shoulder pain (Neer 1983) [7, 8, 13].

Ultrasonography and magnetic resonance imaging (MRI) are both widely used investigations for SIS. Ultrasonography has several advantages over MRI scans as they tend to be more accessible, cheaper, and provide a dynamic assessment of the shoulder, but is highly operator dependent.

MRI has of some time now been the noninvasive investigation of choice for patients with suspected SIS. It allows excellent static visualization of structures in the subacromial space.

Even though the clinical tests are used, not much data is available, on their diagnostic value.

Here we seek to determine the efficacy of Neer's test by comparing the clinical findings with that of MRI findings.

2. Material and Methods

The study was performed on a 100 shoulders over a period of 2 years at a tertiary care hospital.

Routine history and general and relevant Orthopaedic examination was performed on adult patients coming to the Orthopedic outpatient department with complaints of unilateral or bilateral shoulder pain for 3 weeks or more.

Non consenting patients or patients with an acute traumatic history, pre-existing inflammatory or systemic condition, with a history of undergoing surgery in the shoulder region, neck or elbow disorder, with no external/internal rotation, flexion or abduction at the shoulder or with any neurological deficits were excluded from the study.

In patients who satisfied the above criteria, a working diagnosis of Shoulder Impingement Syndrome was made by performing classical tests like Hawkin's and Neer's Sign.

Neer's Sign: All suspected cases of SIS were seated and with the examiner standing behind, the patient's affected extremity was forward flexed passively by the examiner with slight abduction and while stabilizing the ipsilateral scapula at the same time. If this maneuver elicited pain, the sign was considered positive, the patient was asked to record the pain intensity on a numerical VAS scale (0 to 10) and the patient was included in the study and selected to undergo Neer's test.

2.1 Neer's Test: Patients with a positive Neer's sign were included. Lignocaine sensitivity testing was done with 2% lignocaine and in patients with no sensitivity, 10ml of 2% was injected in the subacromial space after taking the necessary informed consent and all aseptic precautions^{16, 17}. The Neer's maneuver was repeated again and the patients were first orally asked if they experienced a significant reduction in pain as compared to the pre injection passive movement and were asked to record their pain intensity on a numerical VAS scale (0 to 10).

Complaint of pain or catch sensation on arm abduction or flexion with replication of pain on Neer's sign were taken to make a clinical diagnosis of SIS.

MRI was then performed on each of the shoulders after 7 days to avoid fluid signals post injection and the findings were noted after the MRI was evaluated by a radiologist.

If there were finding consistent with Shoulder Impingement Syndrome, the case was labelled as "Diseased", while shoulders with normal MRI results or with anatomical findings not consistent with SIS, like Hill Sach's lesion, Bankart's lesion, etc were labelled as "Not diseased".

Diagnostic efficacy of the Neer's test was then determined by 2x2 table for calculating the specificity, sensitivity, positive predictive value, negative predictive value and diagnostic accuracy using the "openepi" software with confidence interval being kept at 95%.

3. Results

100 shoulders were included in the study after eliciting the basic clinical findings and with positive Neer's sign.

The age distribution was from 20 to 80 years.

The mean age of the participating patients was – 47.1 years and median age was 47.5 years

Our study included 67 males and 33 female with male to female sex ratio of 2:1.

Of the 100 Shoulders included in the study, 51% were right and 49% were left.

81% of the patients included (i.e. with Neer's sign positive) had the disease and 71% showed a positive Neer's Test.

74% of the males included in the study had the disease but only 55% tested positive on Neer's test. Of the 17 (26%) males who were without the disease, 7 (41%) also tested positive on Neer's test. 93% of the females included had the disease and 87% showed a positive Neer's test. Rest of the female (7%) who were without the disease also tested negative on Neer's test. Sensitivity, Specificity and confidence intervals for Neer's Test in Shoulder Impingement Syndrome has been shown in table 1.

Table 1: Sensitivity, specificity, positive predictive value, negative predictive value of Neer's test for diagnosing shoulder impingement

Parameter	Point estimate (%)	95% confidence limit
Sensitivity	79.0	68.9-86.5
Specificity	63.2	41.0-80.9
Positive predictive value	90.1	81.0-95.1
Negative predictive value	41.4	25.5-59.3
Diagnostic accuracy	76.0	66.8-83.3

Sensitivity, Specificity and confidence intervals for Neer’s Test in Shoulder Impingement Syndrome with/ due to Subacromial Bursitis has been shown in table 2.

Table 2: Sensitivity and specificity along with PPV and NPV of Neer’s test for diagnosing shoulder impingement with Subacromial bursitis

Parameter	Point estimate	95% confidence limit
Sensitivity	75	59.8-85.8
Specificity	57.1	32.6-78.6
Positive predictive value	83.3	68.1-92.1
Negative predictive value	44.4	24.6-66.3
Diagnostic accuracy	70.4	57.2-80.9

Sensitivity, Specificity and confidence intervals for Neer’s Test in Shoulder Impingement Syndrome with Rotator Cuff Pathology like Partial or Complete Supraspinatus Tear has

Table 4: Sensitivity and specificity along with PPV and NPV of Neer’s test for diagnosing shoulder impingement with rotator cuff pathology like partial and complete supraspinatus tear

	Sensitivity (95% confidence limit)	Specificity (95% confidence limit)	P Positive predictive value (95% confidence limit)	Negative predictive value (95% confidence limit)	Diagnostic accuracy (95% confidence limit)
P Partial Supraspinatus Tear	90.0 (69.9-97.2)	32.5 (23.2-43.4)	25.0 (16.4-36.1)	92.9 (77.4- 98.0)	44.0 (34.7-53.8)
C Complete Supraspinatus Tear	66.7 (41.7-84.8)	30.6 (21.8-41.1)	14.5 (8.1-24.7)	83.9 (67.4-92.9)	36 (27.3-45.8)

Sensitivity of Neer’s test for SIS was 79% with Specificity being 63.2% and the Diagnostic Accuracy being 76%. Of the two major pathologies associated with SIS, i.e. Subacromial Bursitis and Rotator Cuff Pathologies, the Neer’s test is more sensitive (84.7) and more specific for Rotator Cuff abnormalities with the diagnostic accuracy of 81.6%. Amongst the RC abnormalities, the Neer’s Test is more sensitive and specific for Partial Rotator Cuff tears. False positive Neer’s test was seen in 7 shoulders, of which 2 were normal, 2 had adhesive capsulitis, 1 had Antero-superior labrum tear and the rest 2 had Hill Sach’s lesion with Bony Bankart’s lesion. False Negative Neer’s test was recorded in 17 shoulders- of which 8 cases had Subacromial Bursitis, 6 had Partial Supraspinatus tear and 3 were diagnosed with full thickness tear of the supraspinatus. The correlation between the post-test Neer’s test and VAS score was done and found significant. (Table 5)

Table 5: Correlation between Neer’s test and VAS scores (Post)

Neer’s test	VAS score (Post)		P value
	Mean	SD	
Negative	7.3	0.9	<0.001*
Positive	2.9	0.7	
Total	4.1	2.2	

Independent t-test (p value-significant)

4. Discussion

Various studies have been conducted in the past comparing the efficacy of different tests of impingement, like Neer’s sign, Hawkins’s test, Neer’s test, Jobe’s test, Yocum’s test etc in the diagnosis of SIS. Our study worked towards finding out the diagnostic efficiency and accuracy of Neer’s test in diagnosis various types of SIS like Subacromial Bursitis, Supraspinatus tendinosis, in shoulders with a positive Neer’s sign. The mean age in our study was 47.1 years and the median age was 47.5 years, this was similar to the findings of Çalis *et al.*, [18] and of Nanda *et al.*, [19] who reported mean age of 50

been shown in table 3.

Table 3: Sensitivity and specificity along with PPV and NPV of Neer’s test for diagnosing shoulder impingement with rotator cuff pathology like partial or complete supraspinatus tear

Parameter	Point estimate	95% confidence limit
Sensitivity	84.7	74.7-91.3
Specificity	66.7	41.7-84.8
Positive predictive value	92.4	83.5-96.7
Negative predictive value	47.6	28.3-67.6
Diagnostic accuracy	81.6	72.2-88.4

Sensitivity, Specificity and confidence intervals for Neer’s Test in Shoulder Impingement Syndrome with Rotator Cuff Pathology like Partial and Complete Supraspinatus Tear has been shown in table 4

years. Our mean age was higher than that reported by MacDonald *et al.*, [20] who reported the mean age of 40 years. We reported the male to female sex ratio of 2:1 which is comparable to 2.7:1 ratio as reported by Macdonald *et al.*, [20] and 1.4:1 as reported by Nanda *et al.*, [19]. It was dissimilar to the ratio reported by Çalis *et al.*, [18] and Luime *et al.*, [2] was 0.6:1. Park *et al.*, [21] reported Specificity of 65.7%, Sensitivity of 68%, PPV of 80.4% and NPV of 53.2% for Neer’s Test in diagnosing of SIS in general. Mustafa Çalis *et al.*, [18] reported specificity of 30.5%, Sensitivity of 88.7%, NPV of 52.3% and PPV of 75.9% for Neer’s Test in diagnosing of SIS in general. While, Nanda *et al.*, [19] reported 84% sensitivity, 50% specificity, PPV of 90%. Our findings were found compatible with those of the past studies with sensitivity of 79%, Specificity of 63.2%, PPV of 90.1% and NPV of 41.4% and the diagnostic accuracy of 76%, which is similar to as reported by M. Çalis *et al.*, [18] as 72%. MacDonald *et al.*, [20] and Tennent *et al.*, [16] presented sensitivity of Neer’s test at 75% and specificity at 48% for subacromial bursitis. Park *et al.*, [21] presented sensitivity at 85.7% and specificity at 49.2% for diagnosis of subacromial bursitis. Our study also presents similar findings with sensitivity at 75% and specificity at 57%. MacDonald *et al.*, [20] and Tennent *et al.*, [16] presented sensitivity of Neer’s test at 86% and specificity at 42.6% for Rotator Cuff Pathology. Our study also presents similar findings with sensitivity at 84.5% and specificity at 66.7%. Park *et al.*, [21] reported 75% sensitivity, Specificity of 48%, PPV of 18.1% and NPV of 93% for Neer’s Test in diagnosing partial rotator cuff tears and reported sensitivity of 59%, Specificity of 47.2%, Positive predictive value (PPV) of 41.3% and Negative Predictive Value (NPV) of 65% for Neer’s Test in diagnosing total rotator cuff tears. Our study presents similar findings with exception of a larger sensitivity (90%) for partial rotator cuff pathology.

5. Conclusion

Neer's test is a sensitive test for diagnosis of SIS, especially for diagnosis of partial rotator cuff tears and with a higher specificity for diagnosing rotator cuff pathology than bursitis. A negative test is especially useful in ruling out presence of partial or total rotator cuff tears with a positive test encouraging the examiner towards the diagnosis of SIS. Neer's test thus continues to form an important part of an Orthopaedician's armamentarium in clinical diagnosis of SIS and warrants further research in the future.

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