Physical and Ultrasonic Examination for Evaluation of Shoulder Pain

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ABSTRACT:
BACKGROUND:
Shoulder pain is one of the most common complaints encountered in Rheumatological practice and often leads to considerable disability.
OBJECTIVE:
To assess the diagnostic value of six clinical tests for identifying pathologies in patients complaining of shoulder pain, and utilize ultrasound examination (US) as an imaging modality to confirm the clinical diagnosis.
PATIENTS AND METHODS:
This Cross-sectional study included 80 consecutive patients who presented with shoulder pain and at least one of the subsequent features: pain during daily activities, pain at night, neck pain, arm paresthesia or numbness. Six clinical tests that elicit tenderness in the shoulder were performed and then ultrasonography was performed to confirm the diagnosis.
RESULTS:
A total of 80 participants were enrolled in this study. Tenderness in various parts of the shoulder to deep palpation was the most accurate test for predicting the diagnosis with a sensitivity of 100% and specificity of 14.5%. There was significant difference between shoulder pain in dominant and non-dominant side (p value <0.001), and significant differences between the clinical examination results and US findings for 5 tests, except for drop-arm test which was insignificant (p = 1.000). There were no significant differences between diabetic and non-diabetic patients regarding all the shoulder ultrasound findings (p > 0.05).
CONCLUSION:
Although clinical tests are insufficient for diagnosis of the shoulder pathologies, the examination of the patient still plays an important role. However, Ultrasonography should be used for all patients suffering from painful shoulder in order to confirm the diagnosis.
KEYWORDS: Shoulder pain, diabetics, physical examination, US findings.

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INTRODUCTON:

Shoulder pain is the third most prevalent musculoskeletal complaint seeking evaluation in patient in general practice, adults commonly have shoulder pain, and it is prevalence increases with age, most shoulder problems fall into three major categories: soft tissue disorders, articular injury or instability, and arthritis [1]. To establish an accurate diagnosis and select the best course of treatment, a thorough physical examination and clinical history are essential[1]. The rotator cuff has been examined using a variety of clinical techniques so it is essential to provide a thorough description of clinical tests[1].

Every exam begins with a unique description and interpretation[1]. Yet, the details of numerous tests are similar and could be confused with one another[1]. Patients are often treated in the context that rheumatologist rely on both clinical symptoms, signs, and ultrasonographic findings as well as on the progression of the disease[2]. Frequently, there may be no connection between an ultrasound finding and a pain symptom, due to the potential

legal consequences, it is essential to make the accurate diagnosis in the workplace, the preferred method for evaluating a painful shoulder is an ultrasonography (US), it may identify rotator cuff disease, tendinitis, partial rupture and sub acromial impingement. In the past, a clinical symptom, physical examination, and medical history were typically used to make the diagnosis of shoulder pain, but misdiagnosis could happen[3]. The following physical examination techniques are done for patients with shoulder pain to detect certain shoulder pathologies are listed here:

1-Neer impingement:" Scapular rotation is prevented by one hand, as the other elevates the patient's arm midway between abduction and flexion. In a positive test, the patient experiences pain in the overhead position near the top of shoulder elevation, because the greater tuberosity impinges against the acromion" [4]. 2-Jobe maneuver:" Shoulder abducted 90°, flexed 30°, and internally rotated with the thumb pointing downward, patient attempts elevation against examiners resistance" [4]. 3-Gerber's lift off test:" Ask the patient to lift their arm away from the body against the examiner's resistance by placing their hand behind their back at waist level with their palms facing out" [4].

4-drop-arm test:" Ask the patient to progressively lower their arm to the side while you abduct their shoulder to 90 degrees , if their arm abruptly drops at 90 degrees, the test is positive" [4]. 5-Yergason's test:" Resisted forearm supination with the elbow flexed 90 degrees causes pain in the bicipital groove" [5]. 6-Cross-arm test:" with the patient seated, bring the arm across the chest as far as possible, if pain is provoked at the acromioclavicular joint, the test is positive" [6]. The above mentioned six tests show moderate sensitivity for the presence of some rotator cuff lesions and low specificity for the distinction of specific tendon lesion [1]. Additional imaging tests like Magnetic Resonance Imaging (MRI), X-rays, or musculoskeletal ultrasounds may be helpful in determining the cause of shoulder pain, although MRI does not use radiation, it does not provide real-time images and its costy[7]. Studies have revealed that the sensitivity and specificity of musculoskeletal ultrasound imaging for the diagnosis of shoulder disease are both excellent [8,9]. Diabetes mellitus (DM) is the most common endocrine pathology that causes skeletal system complications[10]. The most common complaints are shoulder pain and limitation of movement[11].

PATIENTS AND METHODS:

This study is a cross-sectional study and was carried out at the Rheumatology Consultation Department at Rizgary Teaching Hospital in Erbil City during the period from 1st of November 2021 to 1st April 2022. A total of 80 consecutive patients aged between 18 to 59 years, of both genders with features of shoulder pain for ≥ 2 weeks with at least one of the subsequent features: pain during daily activities, pain at night, neck pain, associated arm paresthesia or numbness, presented to Rheumatology Consultancy Department of Rizgary Teaching Hospital were studied. Patients excluded from the study if they are younger than 18 years and older than 60 years, history of previous evident trauma, post shoulder or neck surgery, previous inflammatory or infective arthropathies and malignancy. Ethical approval for scientific assessment was obtained from the Ethics and Scientific Committees of Kurdistan Board for Medical Specialties. The patients had been assured that the information obtained from them will not be used outside the research purpose and the information will not be disclosed to others. A signed consent was taken from all patients studied.

Clinical examination:
The following 6 tests were performed for the painful shoulder in all studied patients.
Neer impingement, jobe maneuver, gerber's lift off test, drop-arm test, yergason's test, cross-arm test.

Ultrasound examination
After clinical examination, all patients were sent for ultrasonography of the affected shoulder, they were all performed by the same sonographer who was unaware about patient clinical findings, using a Samsung hs50 device with a multi-frequency probe (3_14 MHz). The biceps tendon was examined both longitudinally and transversely with the patient seated in front of the examiner and the shoulder in a neutral position[8]. The subscapular tendon is then inspected when the shoulder is fully externally rotated. The supraspinatus tendon is the next structure, and to position it anteriorly, the shoulder must be in hyperextension, adduction, and internal rotation. Finally, while the shoulder is in its neutral posture, the infraspinatus and glenoid labrum are examined.

Statistical analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 26). Chi square test of association was utilized to compare proportions. Fisher's exact test was used when the expected count of more than 20% of the cells of the table was less than 5. The McNemar test was employed to compare the outcomes of physical examination tests with the ultrasonographic results obtained from the same patients. The calculation of validity indicators for the physical examination tests is displayed in the table below:

		Ultrasonographic findings		
		Positive	Negative	
Physical examination tests	Positive	TP	FP	TP+FP
	Negative	FN	TN	FN+TN
Total		TP+FN	FP+TN	Grand total

TP, TN, FP, and FN stand for true positive, true negative, false positive, and false negative, respectively.
Sensitivity calculated by   TP / (TP+FN) *100;
Specificity calculated by   TN / (FP+TN) *100;
Positive predictive value (PV$^+$): TP / (TP+FP) * 100;
Negative predictive value (PV $^-$): TN / (FN+TN) * 100;
Total agreement = (TP + TN) / Grand total.
Statistical significance was determined by a P-value of ≤ 0.05

RESULTS:

Eighty patients presenting with shoulder pain were included in the study. The mean age of the participants was 47.3 years (SD 9.4), with a median of 50 years (range 20-59 years). The largest group of the participants (51.3%) were aged 50-59 years. Over half of the patients (60%) were females, with 61.3% were unemployed**.** Additionally, 60% of the patients were right-handed. 12.5% had hypertension, 23.8% had diabetes, and 18.8% had both conditions. Further basic characteristics are presented in Table 1.

Table 1: Basic characteristics of patients.

Categories	No.	(%)
Age (years)		
< 40	16	(20.0)
40-49	23	(28.7)
50-59	41	(51.3)
Gender		
Male	32	(40.0)
Female	48	(60.0)
Occupation		
Employee	31	(38.8)
Unemployed	49	(61.3)
Hand dominance		
Right	48	(60.0)
Left	32	(40.0)
Comorbidities		
Hypertension (HTN)	10	(12.5)
Diabetes (DM)	19	(23.8)
HTN&DM	15	(18.8)
None	36	(45.0)
Total	80	(100.0)

The pain was reported in the right shoulder in 53.8% of patients, and it was severe in 37.5% of patients.

Other clinical characteristics details are shown in Table 2.

Table 2:Clinical characteristics of 80 studied patients.

	No.	(%)
Side of pain		
Right	43	(53.8)
Left	37	(46.3)
Severity of pain		
Mild	2	(2.5)
Moderate	48	(60.0)
Severe	30	(37.5)
Presence of associated symptoms	21	(26.3)
Pain affecting daily activities	69	(86.3)
Limitation of movement	56	(70.0)
History of previous attacks of shoulder pain	35	(43.8)
Presence of neck pain	35	(43.8)
History of taking analgesic/NSAIDs	60	(75.0)

More than half (53.8%) of the patients of the whole sample had right shoulder pain, but it is evident in the table (3) that 81.3% of those with a dominant right hand, had right shoulder pain compared with 12.5% of patients with a dominant left hand. On the other hand, 18.8% of the right-handed people had left shoulder pain, compared with 87.5% of the left-handed people ($p < 0.001$).

Table 3: Shoulder pain side by hand dominance.

	Hand dominance			
	Right	Left	Total	
Shoulder pain side	No. (%)	No. (%)	No. (%)	P*
Right	39 (81.3)	4 (12.5)	43 (53.8)	
Left	9 (18.8)	28 (87.5)	37 (46.3)	< 0.001
Total	48 (100.0)	32 (100.0)	80 (100.0)	

*By Chi square test.

The results of clinical examinations are shown in table 4.

Table 4: Results of clinical examination of 80 studied patients.

Test	Number examined	No.& (%) positive	
Tenderness to palpation	79	68	(85.0 %)
Neer impingement sign	74	30	(37.5 %)
Jobe test	74	53	(66.3 %)
Lift-off test	74	16	(20.0 %)
Yergasons test	75	32	(40.0 %)
Cross-arm test	74	41	(51.3 %)
Drop-arm test	74	2	(2.5 %)

On US examination 47.5% of the patients were diagnosed as supraspinatus tendinitis, 28.8% had acromioclavicular arthritis, and 25% had biceps tendinitis. While other tendinopathies are shown in table 5.

Table 5: Ultrasound findings of 80 studied diabetic and nondiabetic patients.

	Diabetic patients (N = 34)	Non diabetics (N = 46)	Total (N = 80)	
Positive ultrasound findings	No. (%)	No. (%)	No. (%)	P
Acromioclavicular arthritis(AC)	8 (23.5)	15 (32.6)	23 (28.8)	0.375†
Supraspinatus tendonitis (SST)	17 (50.0)	21 (45.7)	38 (47.5)	0.700†
Biceps tendonitis	10 (29.4)	10 (21.7)	20 (25.0)	0.433†
Sub acromion bursitis	0 (0.0)	4 (8.7)	4 (5.0)	0.133*
Adhesive capsulitis	4 (11.8)	5 (10.9)	9 (11.3)	1.000*
Tendon tear	1 (2.9)	1 (2.2)	2 (2.5)	1.000*

*By Fisher's exact test. †By Chi square test.

There were no significant differences between the diabetic and non-diabetic patients regarding all the ultrasound findings (p > 0.05) (Table 5). There were significant differences between

The clinical examination results and the ultrasonographic findings in 5 tests, except for drop-arm test which was insignificant as shown in table (6a).

Table 6a:Physical examination tests versus ultra-sonographic findings.

Tests	Acromioclavicular arthritis			
Cross-arm test	Positive	Negative	Total	P*
Positive	15	26	41	
Negative	8	25	33	0.003
Total	23	51	74	
	Supraspinatus tendonitis			
Jobe test	Positive	Negative	Total	P*
Positive	37	16	53	
Negative	1	20	21	< 0.001
Total	38	36	74	
	Biceps tendinitis			
Yergasons test	Positive	Negative	Total	P*
Positive	20	12	32	
Negative	0	43	43	< 0.001
Total	20	55	75	
	Tendon tear			
Drop-arm test	Positive	Negative	Total	P*
Positive	2	0	2	
Negative	0	72	72	1.000
Total	2	72	74	
	Adhesive capsulitis			
Limitation of movement	Positive	Negative	Total	P*
Positive	9	47	56	
Negative	0	24	24	< 0.001
Total	9	71	80	
	Sub acromion bursitis			
Tenderness to palpation	Positive	Negative	Total	P*
Positive	4	65	69	
Negative	0	11	11	< 0.001
Total	4	76	80	

By McNemar test.

There was complete agreement between drop arm test on clinical and US examination as presented in Table 6b, its sensitivity, specificity, predictive values positive and negative, were 100%.

The other 5 tests that had relatively high agreement rates were the jobe test (77% agreement rate) and the Yergasons test (78% agreement rate). Other details are presented in Table 6b.

Table 6b: Validity of clinical examination versus US findings.

Tests*	Sensitivity	Specificity	PV+	PV-	Agreement
Cross-arm test	65.2%	49.0%	36.6%	75.8%	54.0%
Jobe test	97.4%	55.6%	69.8%	95.2%	77.0%
Yergasons test	100.0%	78.2%	62.5%	100.0%	78.8%
Drop-arm test	100.0%	100.0%	100.0%	100.0%	100.0%
limitation of movement	100.0%	33.8%	16.1%	100.0%	41.3%
Tenderness to palpation	100.0%	14.5%	5.8%	100.0%	18.8%

Refer to table 5 to see the ultra-sonographic finding.

DISCUSSION:

The rotator cuff lesions are frequent cause of shoulder pain and disability [12]. There were several international studies investigated a wide range of periarticular shoulder diseases and compared clinical examination results with those obtained from ultrasonography.

In our study 67 (83.75%) of the 80 studied patients had shoulder pain in the dominant side, while 13 (16.25%) had shoulder pain in the non-dominant side, there was significant difference between shoulder pain in dominant and non-dominant side (p value <0.001). This was in agreement with a study done by Keener et al[13], whom they investigated 250 patients (196 in study group and 54 in control group), 62% of the study group (78.4%) having shoulder pain in the dominant hand, while (16.4%) had pain in non-dominant side.

Our results showed that the clinical diagnoses of periarticular conditions in the painful shoulder is not consistent with US diagnoses, which was in contrast with a study done by Khan et al[14], which covered 30 individuals with shoulder pain who were assessed clinically and sonographically, their findings were different from ours. This study showed that the clinical testing for the supraspinatus tendon (Neer's, Hawkin's, and Jobe's) and infraspinatus had statistically significant difference (p<0.05) when compared with ultrasonography and there was no statistically significant difference between semiological and ultrasound tests for subscapular and the long head of the biceps tendon. This difference may be attributed to the small number of the patients and the use of 3 maneuvers for testing supraspinatus tendon when compared with US, while we used only 2 clinical tests.

Our results revealed that the most commonly US finding was supraspinatus tendonitis, followed by acromioclavicular arthritis and biceps tendinitis. This agreed with the findings of a study by Patidar et al[16], who evaluated 425 patients with a mean age of 57.9 years. On ultrasonography, most common pathology detected in painful shoulders was supraspinatus tendinitis followed by biceps tendinitis and biceps tendon sheath effusion.

On the other hand, our study was in contrast with an US study done by Reddy et al [16], whom they examined 52 patients (mean age 41-50), followed by (21-30) yrs with shoulder pain.

The most frequent finding was Supraspinatus muscle partial thickness tear which was seen in 44.2% On USG, while in our study supraspinatus full thickness tear presented in only 2 patients (2.5%). The high prevalence of tendon tear among their patients might be attributed to the history of trauma which was the commonest risk factor for shoulder pain. Among our 80 studied patients, 34 (42.6%) were diabetics.

In this study comparing diabetic and nondiabetic's ultrasound findings, we reported no significant differences between both groups in terms of the presence of AC arthritis, SST, supraspinatus tear, adhesive capsulitis, sub acromial bursitis (p>0.05), this was similar to a study done by Kang et al[17]. they investigated 419 patients (80 diabetics, 339 nondiabetics) complaining of shoulder pain by ultrasound, they found no significant differences in the ratio of rotator cuff tear and calcific tendinitis as depicted by ultrasonography examinations between diabetic and nondiabetic patients with chronic shoulder pain, after adjusting for age in their studied patients.

CONCLUSION:

Although there were significant differences between clinical tests and US among studied patients, clinical examination of the patient still plays an important role in diagnosis of shoulder disorders, but US should be utilized for all patients suffering from painful shoulder to improve the level of diagnosis. In comparison between diabetic and nondiabetic patients with shoulder pain, no significant differences among ultrasonographic findings were reported.

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