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Role of ultrasound test in the diagnosis of clinically suspected Rotator cuff tear

ABSTRACT

Background The rotator cuff tendons are key to the healthy function of the shoulder. Rotator cuff tear is a painful injury involving the supraspinatus, Infraspinatus, teres minor, and subscapularis . Diagnosis is usually made through detailed history, physical examination, and often, imaging studies.

Patients and method From February 2006 to November 2007. Thirty two patients with shoulder pain were subjected to a prospective comparative study in Al-Yarmouk Teaching Hospital and of these 33 patients , 8 patients were found to have full thickness tear (FTT) and 25 patients were found to have partial thickness tear (PTT) clinically and these patients underwent ultrasonographic (U/S) examination.

Result The result of the clinical examination were compared to the result of ultrasonography (U/S) examination. The clinical examination shows that P.T.T. more common, and occurs in younger age groups than F.T.T. Also rotator cuff tears more common in the dominant side and more common in male than female. Sensitivity of U/S in detection of F.T.T. was {87.5%}. Sensitivity of U/S in detection of P.T.T. was {56%}

Conclusions F.T.T. is diagnosed mainly clinically and ultrasonography is useful in the diagnosis with sensitivity of {87.5%}. P.T.T. is diagnosed mainly clinically and ultrasonography is not so useful in the diagnosis with sensitivity of {56%}.

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Introduction

The rotator cuff (rotor cuff) is an anatomical term given to the group of muscles and their tendons that act to stabilize the shoulder. Along with the teres major and the deltoid the four muscles of the rotator cuff make up the six scapulohumeral(those that connect to the humerus and scapula)muscles of the human body(1).

The subacromial joint is formed by the acromio-clavicular joint and the coraco-acromial arch above, the tuberosities and head of humerus below, with the intervening subacromial bursa acting as a joint cavity(2).

The joint has two associated muscle sleeves, an outer sleeve composed of the deltoid and the teres major ,and an inner sleeve composed of the short rotator cuff muscles which includes the supraspinatus (S.S.) , infraspinatus (I.S.) , teres minor(T.M.) and subscapularis (S.Sc.).These two sleeves are separated by subacromial subdeltoid bursa(S.A.S.D.B.) which is firmly adherent in it's central part of it's base to the greater tuberosity and the related surface of the insertion of the rotator cuff[3].The upper aspect of the subacromial joint is composed of the acromio-clavicular arch is formed by the clavicle in front continued laterally by the acromio-clavicular

joint and backword by the acromion and scapular spine. The anterior defect is formed by the coraco-acromial ligament and below this, lays the subacromial subdeltoid bursa (S.A.S.D.B.). The inferior aspect of the joint is formed by the humeral tuberosities, the adjacent part of the anatomical neck and the combined musculo-tendinous cuff.The subacromial subdeltoid bursa never communicates with the glenohumeral joint unless there is complete rupture of musculo- tendinous cuff. [4]

The function of rotator cuff muscles is to hold the head of the humerus in the small and shallow glenoid fossa of the scapula. During elevation of the arm, the rotator cuff compresses the glenohumeral joint in order to allow the large deltoid muscle to further elevate the arm(limiting superior translation of the humeral head during abduction)(2)

Factors related to the development of rotator cuff tears are classified as intrinsic, extrinsic or traumatic.Intrinsic tendinopathy due to changes in vascularity of the cuff or other metabolic alterations associated with ageing may lead to degenerative tears.[5] Extrinsic subacromial impingement as a result of narrowing of the S.S. outlet by abnormalities of the coraco-acromial arch may cause tears by way of irritation of cuff.(6)

The cuff may become involved in systemic diseases such as rheumatoid arthritis and diabetes mellitus. Among all the tendons of rotator cuff the S.S. is involved in more than 90% of cases.(7)

The development of high resolution real time ultrasound instruments made its application in examination of more complex structures such as the shoulder, and most sonographers used a (10-12MHz) scanner to provide the best image. (8)

full-thickness rotator cuff tears usually appear as hypoechoic or anechoic defects in which fluid has replaced the area of the torn tendon [9].so Fluid in the region of the torn tendon can also allow increased through-transmission of the ultrasound beam, accentuating the appearance of the underlying cartilage. Thus, two hyperechoic lines representing the cartilage and the cortex are seen, producing the “double cortex” or “cartilage interface” (9)

Furthermore, compression over the focal hypoechoic defect will displace the fluid and produce loss of the normal convex contour of the peribursal fat. Loss of normal contour may be seen even without compression if there is no fluid present in the area of the torn and retracted tendon. In this situation, depression of the overlying

hyperechoic peribursal fat into the tendon gap occurs, creating the “sagging peribursal fat” (9)

Atrophy of the muscle, which manifests at U/S as increased echogenicity and decreased bulk of the muscle, has also been associated with tears of the tendon tears. Finally, in massive tears of the supraspinatus tendon, the tendon may be retracted under the acromioclavicular joint and not visualized at U/S. (9)

Thus, direct signs of tear include non-visualization of the supraspinatus tendon and hypoechoic discontinuity of the tendon, whereas indirect signs include the double cortex sign, the sagging peribursal fat sign, compressibility, and muscle atrophy(increased echogenicity of atrophied muscle. Cortical irregularity of the greater tuberosity and shoulder joint effusion, which manifests as anechoic fluid in the axillary pouch, posterior recess, and sheath of the long head of the biceps tendon, are also considered secondary signs of rotator cuff tear (FIG.10) (10)

Partial-thickness tears manifest as focal, well-defined hypoechoic or anechoic defects in the tendon but involve only the bursal or articular surface.

The extension of the hypoechoic defect to the bursal or articular surface should be visualized in two orthogonal imaging planes to

confirm the finding. Cortical pitting and irregularity can also be seen with partial-thickness tears[10]. Aim of the study: To evaluate patients with suspected rotator cuff tears clinically and to evaluate the results of ultrasonographic examination and its usefulness in the diagnosis of rotator cuff tears.

Patients and method

From February 2006 to September 2007. Thirty three patients with shoulder pain were subjected to a prospective comparative study in Al-Yarmouk Teaching Hospital and of these 33 patients(shoulders) , 8 patients were found to have full thickness tear(FTT)and 25 patients were found to have partial thickness tear(PTT)clinically and those patients underwent ultrasonographic (U/S) examination .

Clinical findings: History: including; name, age, sex, occupation, pain, site, duration , character, radiation, aggravation, relief, timing, limitation of movement, and history of relevant illness or trauma .

Physical examination

► Inspection: to detect any swelling, atrophy, asymmetry ,

or other findings .

► Palpation; to detect tenderness, coarse crepitation .

► ROM: Evaluate total active and passive ROM in all

Planes and scapulohumeral rhythm .

► Strength testing : Perform strength testing to isolate the relevant muscles individually .

► Special tests; the painful arc, drop-arm test, Hawkins-Kennedy impingement sign, impingement test, Job's test, shoulder shrug and abduction paradox .

Whenever we found a suggestive history in addition to the following criteria; atrophy , tenderness , coarse crepitation , painful arc we consider them suggestive of rotator cuff pathology. Whenever we found a suggestive history in addition to one or more of the following criteria (Shoulder shrug and abduction paradox, positive drop-arm test {Codman's test} and negative Impingement test. We consider the case as full thickness tear, according to the criteria of (Louis Solomon, David J. Warwick and Selvadurai Nayaga). [3], Whenever we found a suggestive history, absence of Shoulder shrug abduction paradox, and drop-arm test {Codman's test} with presence of one or more of the following criteria (positive Hawkins-Kennedy impingement test, positive Job's test, positive Neer's test, positive Impingement test). We consider the case as partial thickness tear

according to the suggestion of Louis *etal.*, (3)

Then each patient was sent for ultrasonographic (U/S) test .

Ultrasonography(U/S):All patients were examined with commercially available real time U/S equipment using a 7.5 MHz linear phased array transducer.

Transverse and longitudinal planes from the biceps tendon groove,

rotator cuff, and subacromial-subdeltoid bursa and transverse planes from the posterior glenohumeral recess and glenoid labrum were scanned. In all patients, comparable images of the opposite shoulder were obtained in order to compare U/S findings and to facilitate detection of subtle abnormalities.

Results

Types of tears:

The total number of patients included in our study was (33) patients {shoulders}, (8) of them (24.2%) were having F.T.T., and (25) of them (75.7%) were having P.T.T., clinically. {according to the criteria of Louis *etal.*, [3] .

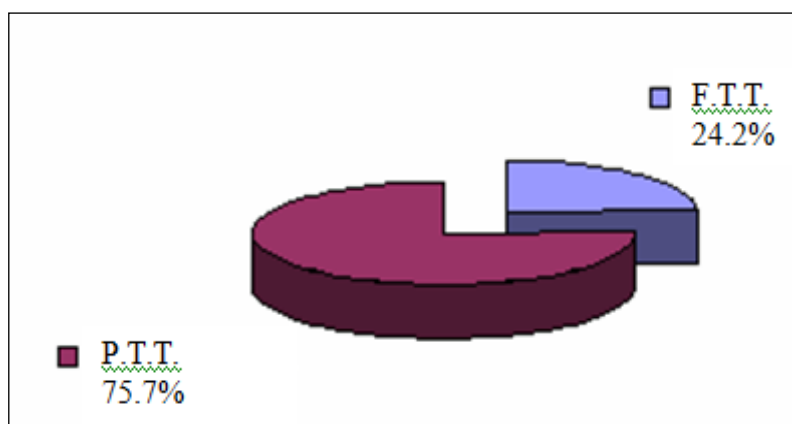


Figure (1) Percentages of patients with R.C.tear distributed according to the type.

Mean age of patients in general was (49.6) years ranging from (36 to 71) years, Mean age of patients with F.T.T. was (57.3) years ranging from (45 to 71) years. so Mean age of patients with P.T.T. was (47.2) years ranging from (36 to 62) years. Of the 33 patients included in our study there were 19 males (57.5%) and 14 females (42.4%); with rotator cuff tear. **Side:** Of the (33) patients (72.7%). The non dominant side was affected in (9) patients (27.2%). patients, the dominant side was affected in (24)

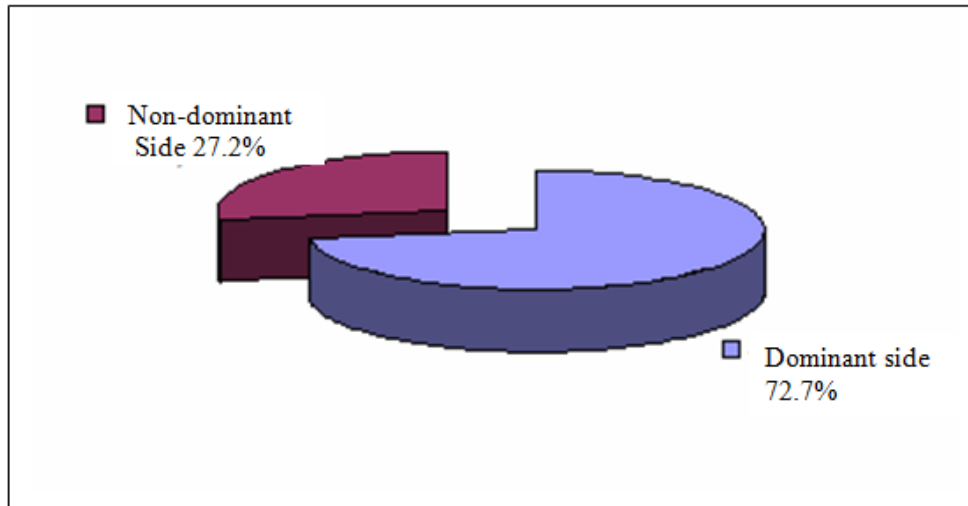
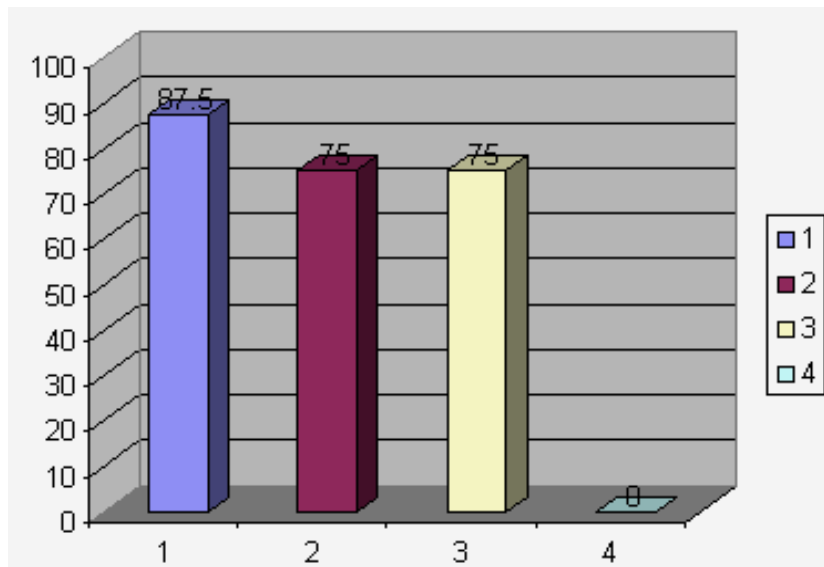


Figure (2) Percentages of patients with R.C.tear distributed according to the side.

Physical signs:

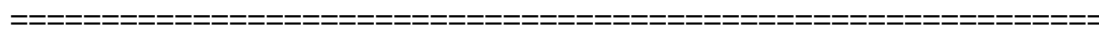
Among those patients who had F.T.T. clinically there were 7 patients (87.5%) had positive shoulder shrug and abduction paradox, 6 patients (75%) had positive drop arm sign {Codman’s test} ,6 patients (75%) had positive painful arc, but all patients were having **negative** impingement test { Neer’s injection test}.

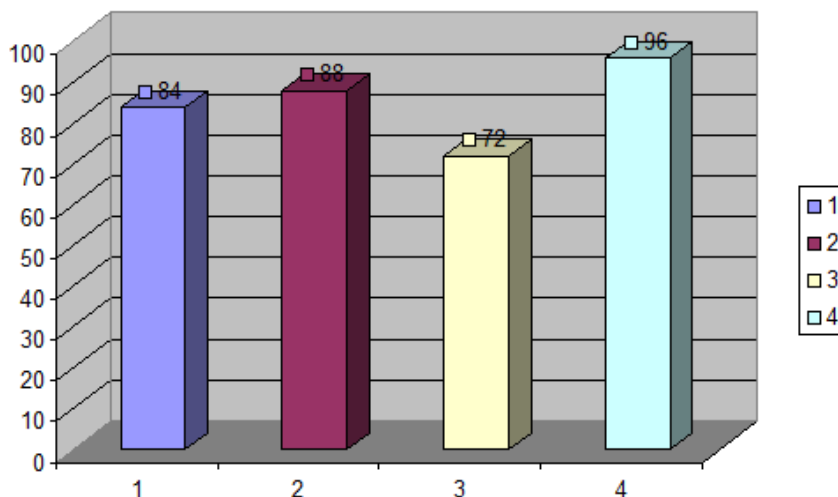
Among those patients who had P.T.T. clinically there were 21 patients (84%) had positive Hawkins-Kennedy impingement test,22 patients (88%) had positive Neer’s test,18 patients (72%) had positive Job's test, all but one patient (96%) were having **positive** impingement test { Neer’s injection test}.



1= shoulder shrug and abduction paradox. 2= drop arm sign {Codman’s test}.
 3= painful arc. 4= impingement test { Neer’s injection test}.

Figure (3) Percentages of patients with F.T.T. distributed according to physical signs.





1= Hawkins-Kennedy impingement test. 2= Neer's test.
 3= Job's test. 4= impingement test { Neer's injection test}.

Figure (4) Percentages of patients with P.T.T. distributed according to physical signs.

Ultrasonography:

Among the (33) patients and according to the criteria mentioned above, (8) patients (24.2%) were having F.T.T., (15) patients (45.4%) were having P.T.T., and (10) patients (30.3%) were having intact tendon.

Among the (8) patients that were having F.T.T. clinically (7) of them (87.5%) were having F.T.T. by ultrasonography, (1) of them (12.5%) were having P.T.T.

- Sensitivity of U/S in detection of F.T.T. was {87.5%}.

Among the (25) patients that were having P.T.T. clinically (14) of them (56%) were having P.T.T. by ultrasonography, (10) of them (40%) were having intact tendon, (1) of them (4%) were having F.T.T.

- Sensitivity of U/S in detection of P.T.T. was {56%}.

Table (1) comparison of clinical and ultrasonographic diagnosis of rotator cuff tears.

Clinical diagnosis	Number of patients	Ultrasonographic diagnosis		
		F.T.T.	P.T.T.	Intact tendon
F.T.T.	8	7 87.5%	1 12.5%	----
P.T.T.	25	1 4%	14 56%	10 40%
Total numbers	33	8	15	10

Discussion

Rotator cuff tears represent a significant cause of shoulder pain and dysfunction.

In 1960's only plain films were available for the evaluation of painful shoulder. Later on many diagnostic tools have been developed to assess the diagnosis of shoulder problems specially the rotator cuff, like arthrography, sonography, arthroscopy, and MRI.

In our study we tried to evaluate patients with suspected rotator cuff tears clinically and to evaluate the results of ultrasonographic examination that assists in the diagnosis of rotator cuff tears.

The total number in our study was 33 patients, (24.2%) of them were having F.T.T. and this complies with Leman et al., [11] And (75.7%) were having P.T.T. and this complies with the finding of K. Yamanaka and H. Fukuda [12] by that the P.T.T. is being the most common tears of the rotator cuff tear.

Age: mean age of the patients was 49.6 yrs and this complies with what L. U. Bigliani [13; 14] and this confirms that the degenerative process of the rotator cuff is an important factor in rotator cuff pathology.

Mean age of patients with F.T.T. was 57.3 yrs and this complies with the findings of Gartsman, Khan, and Hammer man [15] and Norwood,

Barack, and Jacobson [16]. And this is because that the degenerative process is increase with age and healing will be slower.

Mean age of patients with P.T.T. was 47.2 yrs and this complies with findings of Fukuda et al., [17] and this inform as P.T.T. of rotator cuff usually occur in younger age group than F.T.T. And this is because that the healing is relatively rapid than in older age group.

Sex: Of the 33 patients included in our study there were 19 males (57.5%) and 14 females (42.4%); with rotator cuff tear, and this complies with the findings of Codman [18]. And that also complies with the findings of Gartsman, Khan and Hummerman [19]. And this is probably because males involved in more strenuous ,active movements and jobs.

Side: the dominant side was affected in (72.7%) of the patients, the non dominant side was affected in (27.2%) and this complies with findings of Rockwood, et, al [20]. and this obviously due to the overuse of the dominant side in activities that may predispose to rotator cuff pathology and at the same time is more susceptible to trauma.

Physical signs: shoulder shrug and abduction paradox was present in (87.5%) of patients suspected to had F.T.T., drop arm sign {Codman's test} was present in (75%) of patients,

painful arc was present in (75%) of patients, all patients were having negative impingement test { Neer's injection test }.

Hawkins-Kennedy impingement was present in (84%) of patients suspected to had P.T.T., Neer's test was present in (88%) of patients, Job's test was present in (72%) of patients, impingement test {Neer's injection test} was present in (96%) of patients. and this shows that the main cause of weak movement was the pain due to the subacromial lesion, while in F.T.T. no one showed positive { Neer's injection test} and this declared that the main cause of weak movement is the discontinuity of rotator cuff tendon and not due to pain, and this complies with what Neer described [21].

Ultrasonography:

Among the 8 patients that having F.T.T. clinically. 7 patients (87.5%) were having F.T.T. by ultrasonography and (12.5%) of them were having P.T.T. and this complies with the findings of Crage S. Robart [22] Brenneck and Morgan [23].

Among the 25 patients that having P.T.T. clinically, (4%) were having F.T.T. by ultrasonography, (56%) were having P.T.T. and (40%) were having intact rotator cuff by ultrasonography.

• Sensitivity of U/S in detection of F.T.T. was {87.5%}. And

{56%} for P.T.T. and this complies with the findings of K. Takais and Koubunn Makino [24]. And this means that U/S is a useful test in diagnosis and early detection of F.T.T. and this will help in the management which is mainly operative especially in active, young patient by determining the size, location, and some time the causes. But U/S is not so useful in the diagnosis of P.T.T. and this is need for more tests to be evaluated, mainly the MRI.

Conclusions

Rotator cuff tears affect the dominant side in different age group mainly above the age of fourteen. and more common in male.

F.T.T. is diagnosed mainly clinically and ultrasonography is useful in the diagnosis with sensitivity of {87.5%}.

P.T.T. is diagnosed mainly clinically and ultrasonography is not so useful in the diagnosis with sensitivity of {56%}. And thus those patients need for further evaluation with other test like MRI.

U/S is non-invasive, safe with no known risk like radiation, and quick.

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