SRI DEVARAJ URS MEDICAL COLLEGE,
KOLAR ,KARNATAKA.

"ULTRASONOGRAPHIC AND MAGNETIC RESONANCE IMAGING OF ROTATOR CUFF OF SHOULDER TO DETECT AGE RELATED CHANGES AMONG ASYMPTOMATIC AGRICULTURISTS"

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ABBREVIATIONS

US	**-**	**Ultrasonography**
MRI	**-**	**Magnetic resonance imaging**
SST	**-**	**Supraspinatus**
IS	**-**	**Infraspinatus**
TR	**-**	**Repetition time**
TE	**-**	**Echo time**
TA	**-**	**Time for acquisition**
FOV	**-**	**Field of vision**
T1WI	**-**	**T1 weighted images**
T2WI	**-**	**T2 weighted images**

ABSTRACT

Background: Degenerative changes in the rotator cuff include full thickness and partial thickness tears, cystic changes and fatty atrophy of the muscles and fluid collection .These are considered to be part of the normal ageing process and are compatible with the normal painless function of the shoulder in some people, where as they are associated with pain in few people.

Objectives: To assess the age related changes in the rotator cuff of the shoulder in agriculturists who are asymptomatic.

Methods: This was a prospective study carried out in the hospital involving 90 patients between the ages of 40 – 70 years ,who were agriculturists by profession .Ultrasound and magnetic resonance imaging of the rotator cuff of the dominant shoulder was done in all the cases and were analyzed for degenerative changes including full/partial thickness tears and fluid collections. Statistical analysis was done using Med calc 9.0.1 and Systat 12 software .

Results: Partial thickness tears were seen in 11(12.2 %) of the 90 subjects. 1 (2.7%) subject in the age group between 40-50 years,5(16.6 %) subjects in the age group between 51-60 years and 5(22 %) subjects in the age group between 61-70 years. Supraspinatus was most commonly involved (11 subjects) .Three of the 11 subjects also had partial tears of the subscapularis .Full thickness tears were not seen in any of the subjects**.** Sub acromial sub deltoid fluid collection was seen in 36 (40%) of the 90 subjects. 9(24.3%) in the 40-50 years age group, 13(43.3%) in the 51-60 years age group and 14(61%) in the 61-70 years age group. All the 11 patients with partial thickness rotator cuff tears had sub acromial sub deltoid fluid collection. 6 (7%) of the 90 subjects had fatty degeneration of the muscle and 3 of the 6 subjects with fatty degeneration also had a rotator cuff tear.

Conclusion: The present study has shown increase in incidence of abnormalities with increasing age. The percentage of abnormalities is higher in each group , this is probably because other studies have taken subjects from urban population and our study group constituted entirely of agriculturists from a rural background .

This probably indicates that age related degenerative changes of the rotator cuff may be hastened by physical activity.

Keywords

Rotator cuff tears, MR Imaging of shoulder, US of rotator cuff.

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INTRODUCTION

INTRODUCTION

The rotator cuff is made up of tendons from the supraspinatus, infraspinatus, teres minor, and subscapularis. The tendon fibers of the supraspinatus, infraspinatus, and teres minor blend 1.5cms from their lateral margins before they insert onto the greater tuberosity, with the bulk of the supraspinatus fibers inserting onto the superior facet of the greater tuberosity, whereas the infraspinatus and teres minor tendon fibers insert along the posterior aspect. The subscapularis tendon inserts independently onto the lesser tuberosity.

The shoulder joint is the commonest joint examined sonographically, and is often the first joint on which most imagers are introduced to musculoskeletal ultrasound. The shoulder is superficial and readily accessible to ultrasound assessment and is excellent for assessing the normal anatomy and pathology of the shoulder joint; it has sensitivities and specificities in assessment of the rotator cuff that are comparable to magnetic resonance imaging .

Ultrasound offers excellent resolution, is multi planar, accessible, and cost effective. One of ultrasound's main strengths is its ability to image in real time the dynamic motion of joints and surrounding soft tissues.

MRI is used to assess impingement syndromes (coronal oblique views) and less often glenoid pathology (trans axial views); it accurately identifies full-thickness and partial rotator cuff tears, defects show up with high signal intensity traversing supraspinatus tendon on T2 images.

AIMS AND OBJECTIVES

AIMS AND OBJECTIVES

-To demonstrate age related degenerative changes of the rotator cuff among asymptomatic agriculturists.

-The changes that were looked for include full thickness and partial thickness tears of the rotator cuff , fatty infiltration of the muscles , sub acromial sub deltoid fluid collection .

-To establish the role of ageing and physical work in causing degenerative changes in the rotator cuff .

HISTORICAL BACKGROUND

HISTORICAL BACKGROUND

Ultrasonography was first introduced to medical world in 1950s.However, has its beginnings in the 1880s when Pierre Curie introduced simple echo sounding methods. This led to the discovery of SONAR -(Sound Navigating and Ranging).

SONAR, the technique of sending sound waves through the water and observing the returning echoes to characterize submerged objects inspired early ultrasound investigators. Shortly after World War II, researchers in Japan began to explore medical diagnostic capabilities of ultrasound. The US and Europe became aware of this new diagnostic technique in the 1950s when Japan presented their findings on the use of ultrasound to detect gallstones, breast masses, and tumors.US pioneers contributed many innovations and important discoveries to the field in the following decades.

First report of musculo skeletal system USG was in 1958 by KT Dussik. In 1972 Mc Donald and Leopold published the first B-mode scan of the human joint. Cooperberg PL et al first demonstrated synovitis in Rheumatoid arthritis in 1978.First reported USG guided joint aspiration was done in 1981 by Gompels and Darlington.

The principle of Nuclear Magnetic Resonance was first elucidated in the late 1940s by Professor Bloch at Stanford and Professor Purcell at Harvard. In 1952, they shared the Nobel Prize in physics for their work. The importance of this technique lies in the ability to define and study the molecular structure of the sample under investigation. In the 1970s, the principle of nuclear magnetic resonance was used to generate cross-sectional images similar in format to x-ray computed tomography (CT).

1977 – Mansfield: first image of human anatomy, first echo planar image (a fast imaging technique.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Noninvasive imaging techniques for the evaluation of rotator cuff pathologic conditions have substantially improved during the past decade. Diagnostic accuracy requires optimization of technique, a firm grasp of the anatomic characteristics, an awareness of imaging pitfalls, and an understanding of the pathologic process itself. Of the two modalities— magnetic resonance imaging and ultrasonography—the former currently is more limited by existing technologic constraints, the latter by operator proficiency[14].

Tears of the rotator cuff are a well-known cause of chronic pain and dysfunction in the shoulder, but it has been shown that some tears are, and possibly remain, asymptomatic. The true prevalence of rotator cuff disease is unclear because manifestation of the disease, such as cuff tears, can be asymptomatic[9]. A number of anatomical studies have been performed in an attempt to assess the prevalence of tears of the rotator cuff in the general population. These reports demonstrated a frequency of 5 to 39 per cent for full-thickness tears and of 13 to 37 per cent for partial-thickness tears [10]. The prevalence of tears is reported to be 30% in people older than 60 years, 50% in people at 70 years and more than 80% in people at 80 years[34].

Reported prevalence's vary from 6% to 34%, and increase with age. Why these tears are asymptomatic while others cause shoulder pain and dysfunction is not understood[16].

Previous reports, confirmed by arthroscopy or surgery, showed that US was highly accurate for detecting rotator cuff tears with diagnostic sensitivities and specificities above 90% [7] but the negative predictive value for ultrasonography was 95% [6].

Ultrasonography has proved to be less effective in detecting partial-thickness tears, with reported specificities and sensitivities ranging from 13 to 93% and from 20 to 94% respectively.

Lower sensitivity and specificity of ultrasonography for partial-thickness tears have been found in many studies[27,28,29,30,31]. With increasing experience ,the sensitivity of ultrasonography in the diagnosis of lesions of the rotator cuff is comparable with MR arthrography and MRI.

Zlatkin[18] and colleagues reported a sensitivity, specificity and accuracy of 91% , 88% and 89 % respectively for rotator cuff tears , partial and complete using conventional MRI.Tirman et al [6] reported 91% to 100% sensitivity and 81% to 95% specificity for MRI in diagnosing rotator cuff tears but described lower accuracy for partial tears. The sensitivity and specificity of magnetic resonance imaging in the differentiation of tendinitis from degeneration of the cuff were 82 and 85 per cent, and in the differentiation of a normal tendon from one affected by tendinitis with signs of impingement the sensitivity and specificity were 93 and 87 per cent[18].

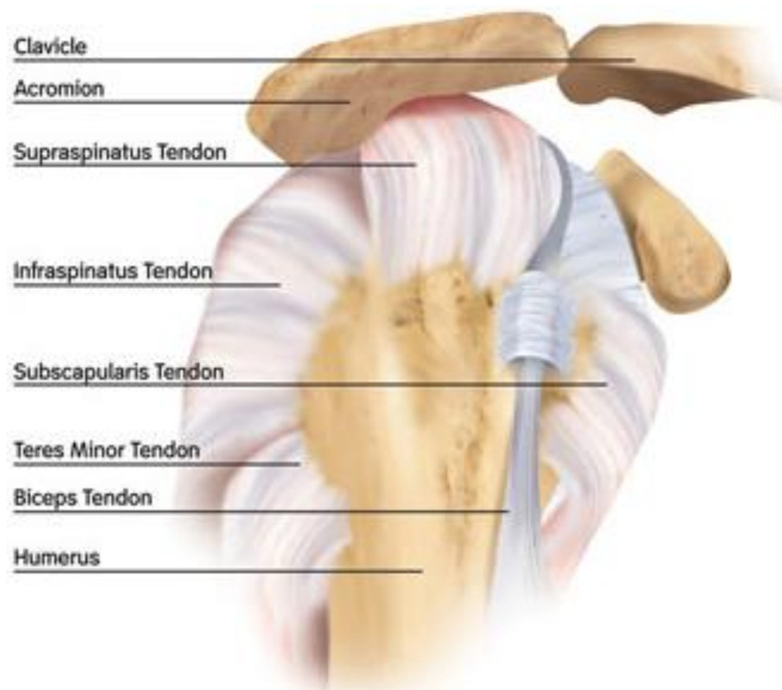
The use of secondary signs the presence of bursal fluid, has been shown to enhance the diagnostic performance of MR imaging . The presence of fluid in the subacromial—subdeltoid bursa have been shown to be sensitive indicators of rotator cuff pathology in some patient studies where as small amounts of fluid in the sub deltoid bursa have also been described as a normal finding in some studies[15].

Anatomy of the rotator cuff

The rotator cuff is made up of tendons of the supraspinatus, infraspinatus, teres minor and subscapularis and plays an important role in maintaining the stability of the glenohumeral joint. The glenohumeral joint is a ball and socket type of synovial joint. The large round humeral head articulates with the relatively shallow glenoid cavity of the scapula which is deepened slightly by the fibro cartilaginous glenoid labrum.The glenoid cavity accepts a little more than a third of the humeral head which is held in the cavity by the tonus of the rotator cuff muscles[1].

Glenohumeral joint stability is provided by a delicate balance between static stabilizers (eg, glenohumeral joint labro ligamentous complex, joint capsule, osseous structures) and dynamic stabilizers, including the rotator cuff muscles . The rotator cuff provides substantial dynamic stability to the glenohumeral joint in the end range as well as the midrange of motion. The infraspinatus, subscapularis, and latissimus dorsi muscles act as stabilizers during flexion, the subscapularis muscle acts as a stabilizer during external rotation, and the subscapularis and supraspinatus muscles work together as stabilizers during extension . The subscapularis, infraspinatus, and teres minor muscles act in unison to firmly center the humeral head within the glenoid fossa . The infraspinatus muscle also has a role as a humeral head depressor[3].

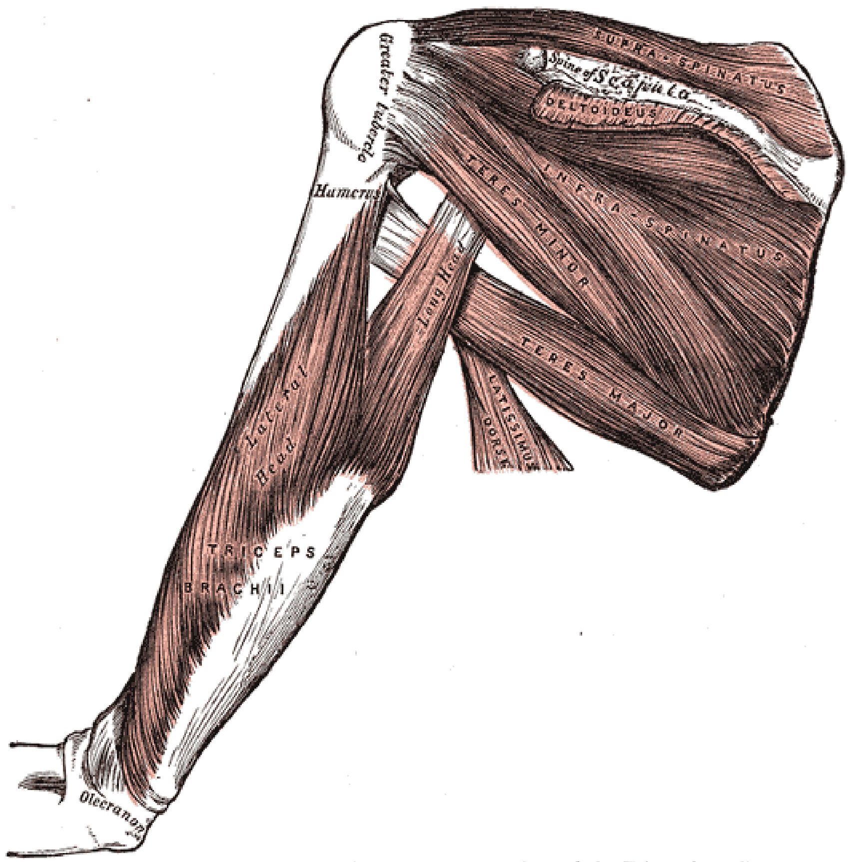
The rotator cuff is formed by the confluence of the tendons of the four muscles, the joint capsule, the coracohumeral and glenohumeral ligament complexes, which blend before inserting onto the humeral tuberosities.



The supraspinatus muscle originates from the supraspinous fossa on the scapula and inserts on to the anterior and middle facets of the greater tubercle of the humerus. Its principle function is to aid in the abduction of the arm along with the deltoid.

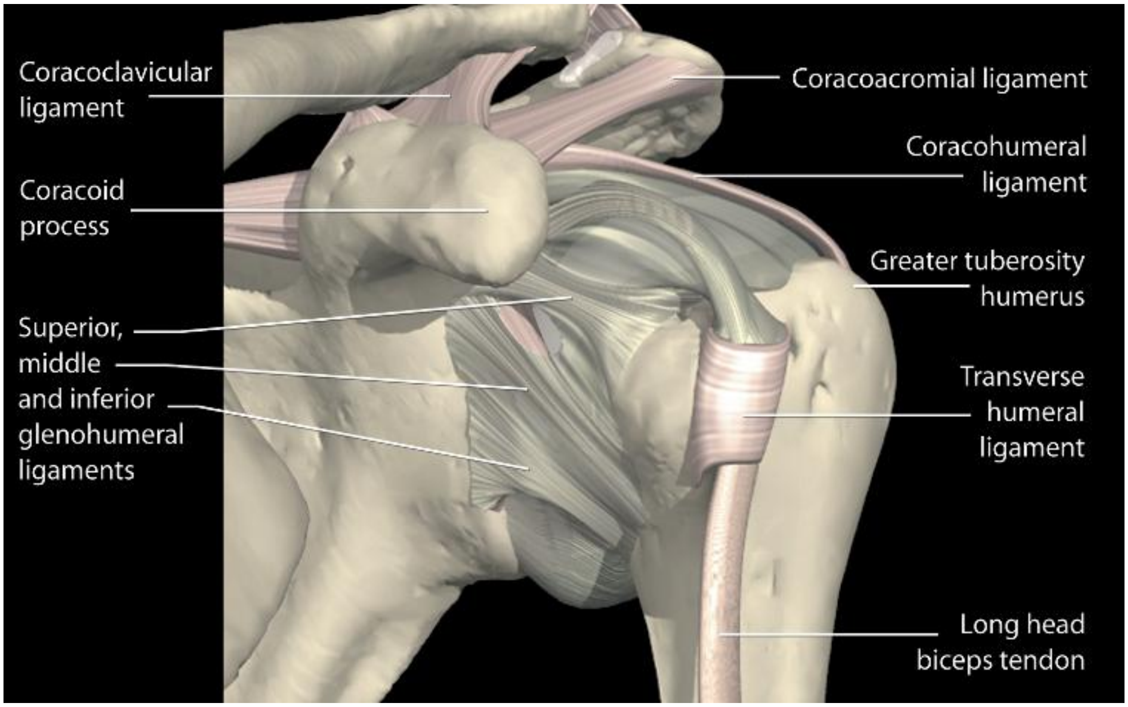
The infraspinatus originates from the infraspinous fossa of the scapula and inserts on to the middle facet of the greater tubercle ;the teres minor originates from the dorsal surface of the axillary border of the scapula and inserts on to the posterior facet of the greater tubercle and the adjacent humeral shaft. Their principle action is in the external rotation of the arm. The subscapularis originates from the sub scapular fossa of the scapula and attaches to the lesser tubercle of the humerus. Its main action is in the internal rotation of the arm.

The supra and infraspinatous tendons join approximately 15 mm proximal to their insertion on the humerus. At the distal aspect of the rotator cuff, the supraspinatus and infraspinatus tendons splay out and interdigitate, forming a common continuous insertion on the middle facet of the humeral greater tuberosity. To a lesser extent, the supraspinatus and subscapularis tendons demonstrate contiguity, with interwoven fibers from these two tendons enveloping the biceps tendon[3].

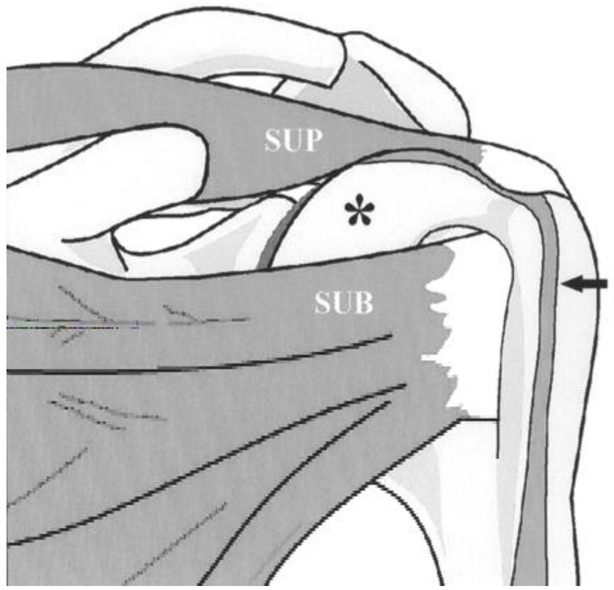


The non–rotator cuff structures include several tendons, ligaments, and bursae in the shoulder area. The 9–10-cm long tendon of the long head of the biceps muscle arises from the supraglenoid tubercle and the superior glenoid labrum, courses over the top of the humeral head intra articularly but extrasynovially, and goes down into the bicipital groove between the greater and lesser tuberosities. The glenohumeral joint capsule extends from the glenoid rim to the humeral neck. This capsule normally contains no US-detectable fluid. The fibro cartilaginous labrum surrounds the glenoid rim. Because of capsular laxity, certain synovial redundant spaces become prominent when the joint contains an effusion: the axillary pouch lying below the teres minor, the posterior recess lying deep to the infraspinatus tendon, the anterior recess lying next to the anterior labrum, and the superior subscapularis recess lying anterior to the superior surface of the subscapularis tendon. A large area below the deltoid muscle is covered by the subacromial-subdeltoid bursa. This bursa extends below the acromion from the coracoid process to the greater tuberosity. It communicates potentially with the subcoracoid bursa, which lies deep to the tendon of the short head of the biceps, next to the coracoid[4].

The acromioclavicular joint is made up of a fibrocartilaginous articular disk of highly variable size and with a weak capsule, thickened superiorly and inferiorly. Three ligaments are crucial to the stability of the acromioclavicular joint: the coracoacromial and coracoclavicular ligaments, the latter consisting of two components, conoid and trapezoid ligaments, which attach to the undersurface of the clavicle . The normal width of the joint space is 3. 5 mm ± 0. 9 [4].

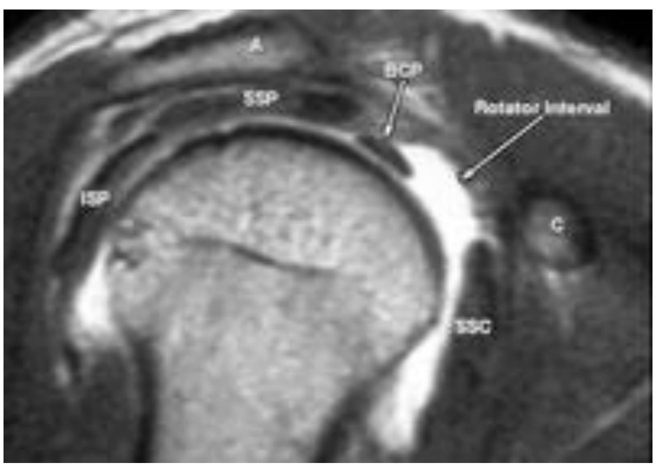


The rotator interval contains the long head of the biceps tendon, which descends from the glenohumeral joint through the interval into the bicipital groove. The rotator interval has a triangular shape, which is composed of the coracohumeral ligament and the superior glenohumeral ligament and envelops the anterior margin of the supraspinatus tendon and the superior margin of the subscapularis tendon . The rotator interval varies in size and may not be apparent in some individuals[2].



Rotator cuff interval (*asterisk*) lies between supraspinatus (SUP) muscle and subscapularis (SUB) muscle. Long head of biceps tendon (*arrow*) courses in bicipital groove

On a short-axis US scan of the supraspinatus tendon *(SSP)*, the rotator cuff interval *(RI)* anterior to this tendon can easily be mistaken for a rotator cuff tear. *BT* = biceps tendon (long head), *D* = deltoid muscle, *H* = humeral head.



Oblique sagittal T1-weighted magnetic resonance (MR) arthrogram shows the position of the long head of the biceps tendon *(BCP)* in the rotator cuff interval *A* _ acromion, *C* _ coracoid process, *ISP* _ infraspinatus tendon, *SSC* _ subscapular tendon, *SSP* _ supraspinatus tendon.

ULTRASONOGRAPHIC AND MAGNETIC RESONANCE IMAGING APPEARANCE OF SPECTRUM OF DEGENERATIVE CHANGES OF THE ROTATOR CUFF INCLUDING FULL AND PARTIAL THICKNESS TEARS

Most rotator cuff tears occur at the site of insertion of the supraspinatus tendon in the greater tubercle , but tendon fiber may deteriorate either locally (a partial tear becoming complete) or involve multiple shoulder tendons[4].

A partial-thickness supraspinatus tendon tear extends either to the articular or bursal surface of the tendon. A bursal-side partial-thickness tear produces flattening of the bursal surface, with loss of the superior convexity of the tendon. An articular-side partial-thickness tear appears as a distinct hypoechoic or mixed hyper-hypoechoic defect of the articular surface of the tendon[4] and the presence of sub acromial- sub deltoid effusions and flattening of the cuff tendon should raise the suspicion of rotator cuff pathology, and this is often a bursal sided partial tear [37].

A cortical bone irregularity of the greater tuberosity is a sensitive sign of an articular-side partial-thickness tear[4].

Calcific tendinitis is a common disorder caused by deposition of calcium hydroxyapatite crystals in various shoulder tendons. The cause is considered to be dystrophic, and all tendons can be affected, although the most common site is within the supraspinatus tendon near its insertion. It is believed that the calcifications become symptomatic when the calcium undergoes resorption. At US, calcium deposits may have a fluffy appearance, with echogenic foci without posterior shadowing, or may appear as typical discrete, well-circumscribed calcifications with posterior shadowing[4].

US findings for degenerative changes in the shoulder joint include the presence of intra articular loose bodies, buttressing osteophyte formation around the humeral head, subchondral bone cysts, joint effusion, and narrowing of the joint space[4].

MR imaging can provide information about rotator cuff tears such as tear dimensions, tear depth or thickness, tendon retraction, and tear shape that can influence treatment selection and help determine the prognosis. In addition, tear extension to adjacent structures, muscle atrophy, size of muscle cross-sectional area, and fatty degeneration have implications for the physiologic and mechanical status of the rotator cuff. Lastly, information about the coracoacromial arch and impingement as it relates to rotator cuff tears can be obtained with MR imaging[3].

The most common appearance of a full-thickness tear is high signal intensity on a T2-weighted image that extends from the articular surface of the rotator cuff to the subacromial-subdeltoid bursa and the most important MRI criterion of a partial-thickness tear is the presence of an increased signal that disrupts the normally low-signal surface of the rotator cuff.

The formation of spurs around the acromion and acromioclavicular joint correlated highly with increased age of the patient and with chronic disease of the rotator cuff. The sensitivity and specificity of magnetic resonance imaging in the diagnosis of labral tears associated with glenohumeral instability were 88 and 93 per cent. The study showed that high-resolution magnetic-resonance imaging is an excellent non-invasive tool in the diagnosis of lesions of the rotator cuff and glenohumeral instability [18].

There are different theories about whether rotator cuff tearing in individuals with no history of trauma , is caused by intrinsic degenerative changes as a process of aging related to vascular factors or whether rotator cuff tearing occurs from mechanical impingement [7].

A Type III acromion has been reported to show the highest correlation with rotator cuff pathology[11].Hypertrophic changes of the acromion cause impingement of the subacromial-subdeltoid bursa and the rotator cuff. Association between rotator cuff tears and osteophytes from the acromioclavicular joint lends additional support to the extrinsic impingement hypothesis [12].

According to the "intrinsic" (intratendinous) theory, the pathogenesis of rotator cuff tears is tendon degeneration. Degenerative partial-thickness tears of the rotator cuff tendons may allow superior migration of the humeral head. This migration will in turn cause abrasion of the rotator cuff tendons against the undersurface of the acromion, thereby leading to full-thickness tears[13].

The most common appearance of a full-thickness tear is high signal intensity on a T2-weighted image that extends from the articular surface of the rotator cuff to the subacromial-subdeltoid bursa and the most important MRI criterion of a partial-thickness tear is the presence of an increased signal that disrupts the normally low-signal of the rotator cuff .

Increased signal intensity in the supraspinatus tendon on proton density-weighted images without a corresponding increase on T2weighted images, the presence of small amounts of fluid in the subacromial space, and the lack of preservation of the subdeltoid fat plane are common findings in asymptomatic shoulders and by themselves are poor predictors of rotator cuff disease[20].

Full-thickness tears extend from the bursal surface to the articular surface and usually appear as hypoechoic or anechoic defects in which fluid has replaced the area of the torn tendon.

Partial-thickness tears occur within the tendon and do not communicate with the subacromial bursa or the glenohumeral joint. There are three subtypes: 1)a bursal-side tear (BT) which is confined to the bursal surface of the tendon; 2) an intratendinous tear (IT) which is found within the tendon; and 3) a joint-side tear (JT) which is present on the side of the tendon adjacent to the joint. A partial-thickness tear is considered to be a definite disruption of the fibers of the tendon and is not simply fraying, roughening or softening of the surface. The degree of tearing is described more by the depth involved in the thickness of the tendon than by the area of the tear[19]. Partial-thickness tears are focal defects in the tendon that involve only the bursal or articular surface and partial tears usually appear as focal areas of decreased or occasionally increased echogenicity within the tendon . The direct US sign for a partial-thickness tear is a focal tendon defect or focal tendon non visualization and indirect signs include sub deltoid bursal effusion, the double cortex sign, the sagging peribursal fat sign, compressibility, and muscle atrophy.

The correlation of presence and degree of MR-evident rotator cuff abnormalities with the presence and degree of associated MR-evident bone abnormalities, acromioclavicular joint osteoarthrosis, and subacromial spur formation revealed a high prevalence of MR-evident bone and peritendinous shoulder abnormalities among asymptomatic individuals. The prevalence of subacromial spurs and humeral head cysts correlated closely with the severity of MR-evident rotator cuff abnormalities, as did changes in the bursa and peribursal fat. Acromioclavicular joint osteoarthrosis is seen in many shoulders independently of rotator cuff disease[15].

It is well known that patients with diabetes are at increased risk for shoulder pathologies, such as frozen shoulder or rotator cuff tears. In addition, after a surgical repair, diabetics show a restricted range of motion of the shoulder and a higher incidence in re-tears. In asymptomatic subjects, age - related rotator cuff tendon changes are more common in diabetics. This is supported by the observation of a higher prevalence of tears and of degenerative phenomena in diabetics, as well as by the increased thickness of supraspinatus and biceps tendons, which is due to the abnormal storage of collagen layers in the tissue and, therefore, is itself an expression of degenerative changes[21].

Tobacco use reportedly occurs in association with musculoskeletal pain and dysfunction but has not been implicated specifically as a contributing factor to rotator cuff disease. The hypothesis that smoking increases a patient's risk for a rotator cuff tear is biologically plausible. Nicotine is a potent vasoconstrictor and decreases the delivery of oxygen to tissues. In addition, carbon monoxide decreases cellular oxygen tension levels necessary for cellular metabolism[22].

MR findings of abnormal signal in the glenoid labrum, and of abnormal signal and morphology of the rotator cuff tendons, supraspinatus depression, and acromioclavicular osteophytes have been reported as signs of instability, tendinitis, and impingement. Similar findings were seen in asymptomatic volunteers, indicating that these findings may not be a sign of clinically significant pathology[17].

PITFALLS IN ULTRASOUND AND MAGNETIC RESONANCE IMAGING

Owing to the complex shoulder anatomy and various pitfalls, US of the shoulder is susceptible to interobserver variability. Misinterpretation of rotator cuff tears could be technique-related, anatomy-related, disease-related, or patient-related factors.

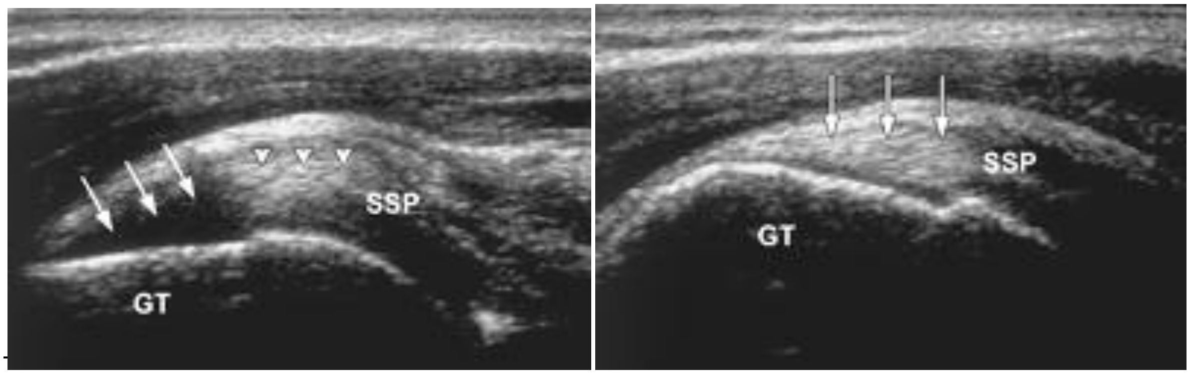
ANISOTROPY

A common technique related cause of false-positive diagnoses of rotator cuff tears is anisotropy or angle-dependent appearance of tissue structures .Anisotropy of fibers was first described by Dussik et al in 1958 [2].

When the ultrasound beam insonates at 90° to the long axis of the tendon fibers the beam is reflected maximally which gives the rotator cuff its normal appearance namely,hyper echogenic to muscle. The more the angle deviates from this angle, the fewer reflected sound waves will be detected by the transducer. The tendon becomes isoechoic to muscle at angles of 2°–7° and hypoechoic at greater angles. Tendon insertions, where most rotator cuff tears occur, are most vulnerable to the anisotropic artifact due to their curved course .If unaware of this artifact, less experienced scanners could erroneously take this for tendinosis or a partial-thickness rotator cuff tear . Combination of tendinosis and anisotropy is the most common cause of a false-positive diagnosis of a partial-thickness rotator cuff tear [2]**.**

(a) **(b)**

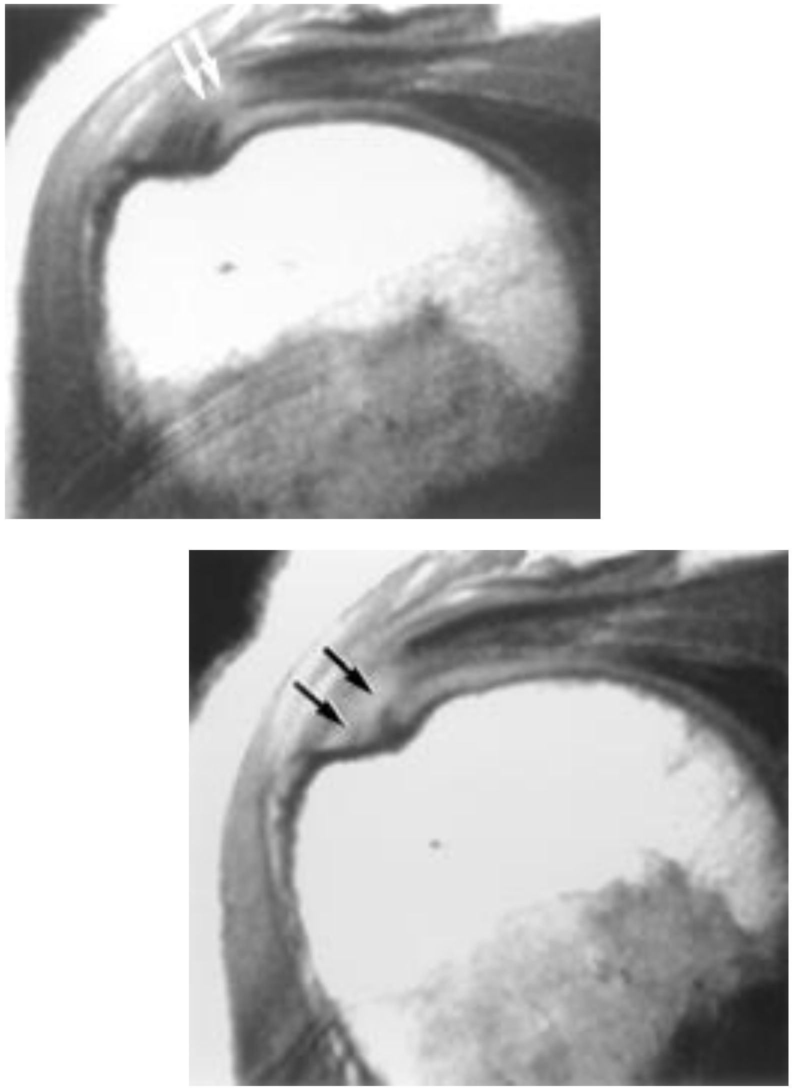
Anisotropy. **(a)** Tendon fibers have a parallel arrangement. Emitted sound waves are optimally reflected when they are perpendicular (at 90°) to the long axis of the fibers. **(b)** Deviation of the insonating beam from this angle causes a decrease in the echogenicity of the fibers because not all of the reflected sound waves will return to the transducer.



Anisotropy at the insertion of the supraspinatus tendon. *GT* = greater tuberosity. **(a)** Long-axis US scan of the supraspinatus tendon *(SSP)* shows that the fibers parallel to the transducer have a normal hyperechoic linear appearance (arrowheads). However, the fibers at the insertion (arrows) are poorly demonstrated due to anisotropy. **(b)** Corresponding image obtained with the transducer moved a bit laterally. The fibers at the supraspinatus tendon *(SSP)* insertion (arrows) are now parallel to the transducer and therefore have a normal hyperechoic appearance.

MAGIC ANGLE EFFECT IN MAGNETIC RESONANCE IMAGING

Tendons that course at or near the magic angle of 55° exhibit markedly augmented signal intensity that is most pronounced with short-echo-time sequences. The supraspinatus tendon is particularly vulnerable, since it curves along its course between the musculotendinous junction and its insertion on fibro cartilage. Furthermore, magic angle augmentation of signal intensity within the biceps tendon may be misinterpreted as focal cuff pathologic conditions near the rotator interval [14].



Magic angle effect. **(a)** Short-echo-time MR image obtained with the arm in neutral position shows a hyperintense focus approximately 1 cm proximal to the rotator cuff insertion (arrows). **(b)** On an MR image obtained with identical imaging parameters but with lateral flexion at the waist, the hyperintense region now extends to the insertion site (arrows). The change in position resulted in reorientation of the fibers in relation to the main magnetic field, causing a shift in the site of signal augmentation.

MATERIALS AND METHODS

MATERIALS AND METHODS

The study was conducted at Department of Radiodiagnosis , R.L.Jalappa Hospital and research center, attached to Sri Devaraj Urs Medical College, Tamaka ,Kolar, Karnataka, during the period from 2/5/2009 to 1/8/2011.Asymptomatic subjects aged between 41-70 years who were agriculturists by profession were evaluated on their dominant arm.

INCLUSION CRITERIA

1.Aged between 41-70 years

2.Agriculturist by profession

EXCLUSION CRITERIA

1.Subjects with shoulder pain

2.Subjects with past history of shoulder trauma

3.Subjects with past history of shoulder surgery

4.Subjects with past history of bone tumors in the shoulder region

USG AND MR IMAGING TECHNIQUE

ULTRASOUND IMAGING TECHNIQUE

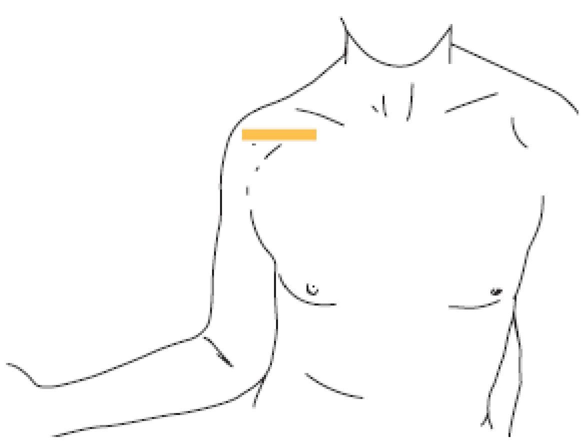
- Examination was done on a Siemens G-50 series ultrasound machine using a 5-10 Mhz linear transducer.
- The subject was made to sit comfortably on a revolving stool with the shoulder exposed; this allows for easy access to the anterior and posterior aspects of the shoulder and for the required positional changes.
- The US examination began with evaluation of the biceps tendon and subscapularis, then of the supraspinatus, and finally of the posterior structures, including the infraspinatus and teres minor muscle. The clavicle, acromioclavicular joint, and spine of the scapula are useful bone landmarks.

SUBSCAPULARIS

The subscapularis tendon is assessed with the arm both in neutral and in external rotation positions. Longitudinal assessment in the plane of the tendon demonstrates its subcoracoid position and attachment onto the lesser tuberosity . The transducer should be moved superiorly and inferiorly to encompass the full extent of the tendon. The axial scan best demonstrates its multipennate structure with the multiple proximal tendon slips seen as hyperechoic foci surrounded by the hypoechoic muscle.

Maintaining the elbow by the side and abducting and adducting the forearm allows for a dynamic assessment. This is an important component of the study that can help discriminate anisotropy, focal tendinosis, and partial tears. The transducer is medially repositioned so that it overlies the coracoid process and the dynamic study is repeated .

This may reveal subcoracoid impingement of the subscapularis tendon or the subcoracoid bursa. In addition, the subcoracoid bursa may lie medial to the coracoid process on a static study and extend to the lateral aspect of the coracoid only when assessed dynamically.



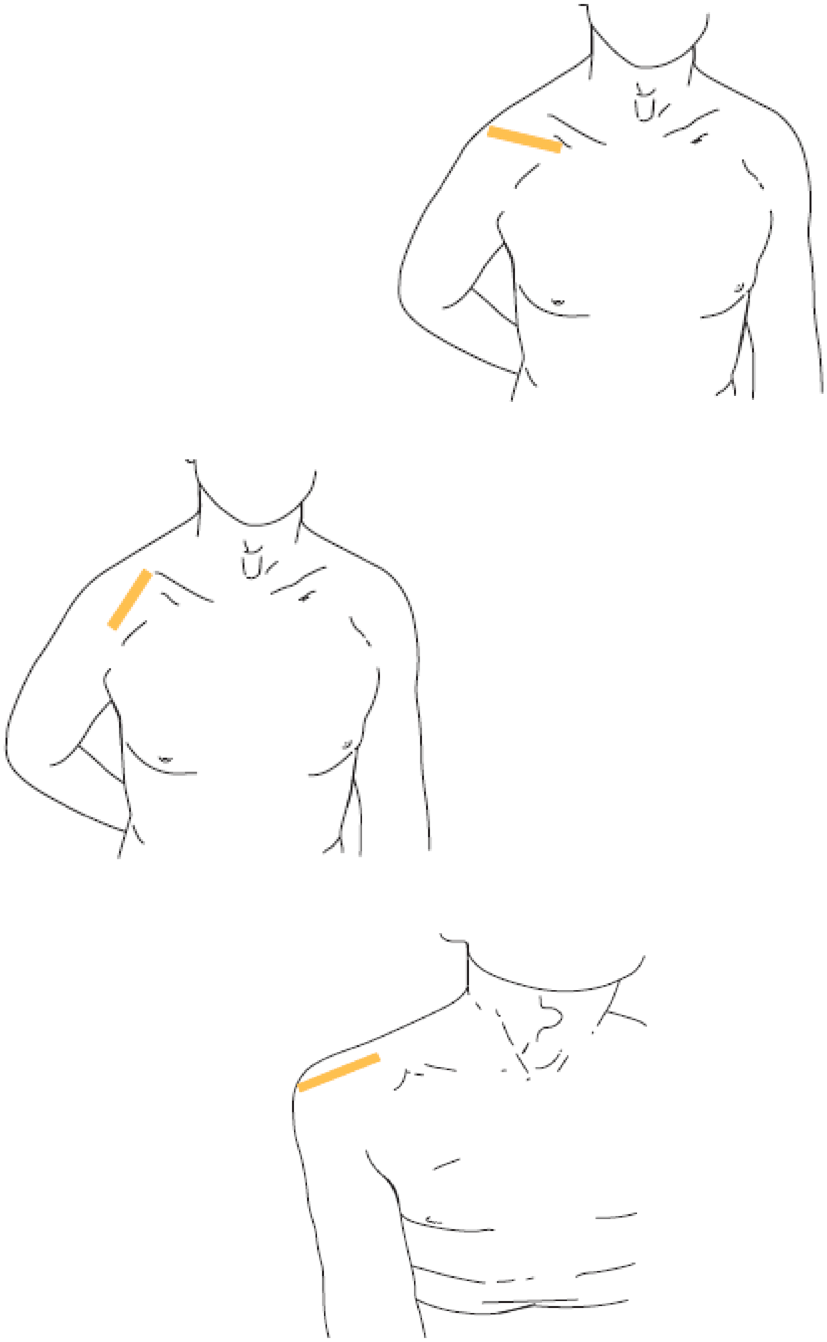
Transducer position for evaluation of the subscapularis tendon in transverse section

SUPRASPINATUS

The supraspinatus tendon is normally partially obscured by the overlying acromion process. To overcome this, the supraspinatus tendon should be viewed in full internal rotation and hyperextension with the forearm behind the back, palm facing posteriorly, overlapping the scapular tip while maintaining the elbow by the side, (The Crass position).This places the tendon under stress and hence accentuates tears.

Examination is repeated in the modified Crass/Middleton position with the upper arm extended and the shoulder in a neutral position, elbow flexed and pointing directly posteriorly,and the palm of the hand placed forward against the ipsilateral back pocket.

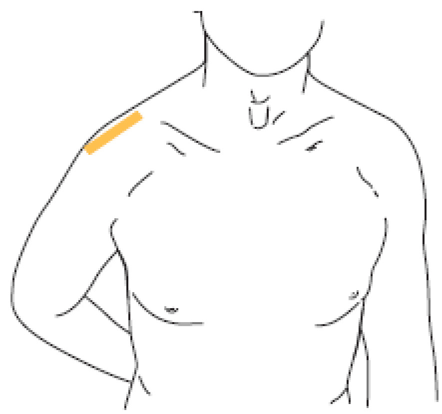
This position allows for visualization of the supraspinatus tendon immediately adjacent to the bicipital interval, an area often obscured by the acromion in the Crass position.



Transducer positions for the evaluation of the Supraspinatus tendon in transverse ,longitudinal sections and tendon in adduction position respectively.

INFRASPINATUS AND TERES MINOR

The infraspinatus and teres minor tendons are evaluated with the forearm placed across the chest and the palm of the hand placed against the contralateral shoulder . The infraspinatus is larger and lies superior to the teres minor . Differentiation is easily achieved at their site of insertion onto the greater tuberosity as the infraspinatus has a long tendon , whereas the teres minor has a short tendon, measuring only 1–2 cm.



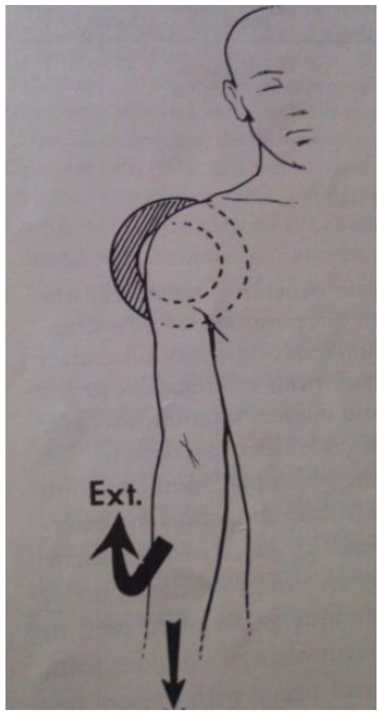
Transducer position for the evaluation of the infraspinatus and teres minor

SUB ACROMIAL SUB DELTOID BURSA

For evaluating the sub acromial sub deltoid bursal fluid, the shoulder is examined both with neutral positioning of the humerus and with the humerus in internal rotation and extension. The latter maneuver rotates the supraspinatus tendon out from under the acromion and, small amounts of fluid may be detected within the Sub acromial Sub deltoid bursa.

MAGNETIC RESONANCE IMAGING PROTOCOLS

The examinations were performed on a .35 T, Siemens Magnetom C! machine, using a 16 channel multipurpose coil. Patient was examined with the arm in a mildly externally rotated position.



IMAGING PROTOCOLS

Patient was subjected to spin echo MRI which was performed using the protocol including the following sequences in all the patients:

T1WI(T1)---TR=562ms, TE=22ms, section thickness=4mm, matrix=300x300, FOV= 220cms ,intersection thickness =2mm,TA=6:12min.

T2WI(T2)---TR=3030ms, TE=99ms, section thickness=4mm,intersection thickness=2mm, FOV=180 x200cms,TA=7:26min.

T2 FAT SUPRESSION---- TR=3540ms, TE=24 ms, slice thickness=4mm, intersection thickness=2mm,FOV=220cms,TA=7:20min.

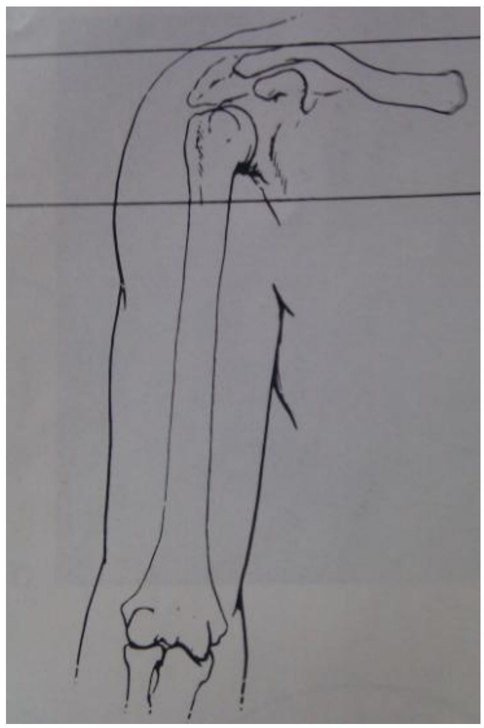
Proton Density (PD)---TR=937ms ,TE= 17 ms, slice thickness=4 mm, Intersection thickness=2mm,FOV=199x290 cms,TA-8.59 min.

TR=Repetition time, TE=Echo time ,TA=Time for acquisition

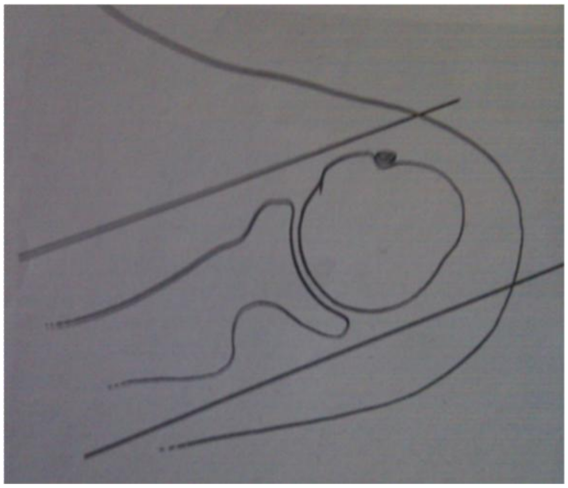
Images were acquired in the axial , oblique coronal and oblique sagittal planes for all the patients.

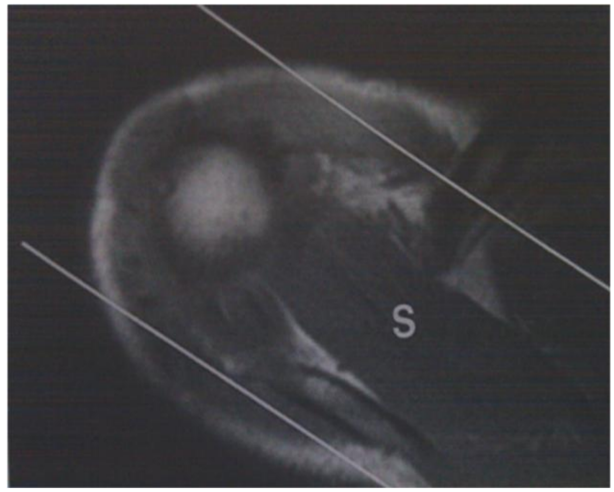
IMAGING PLANES

Axial images were obtained first from the level of superior aspect of the acromioclavicular joint till the inferior glenoid.

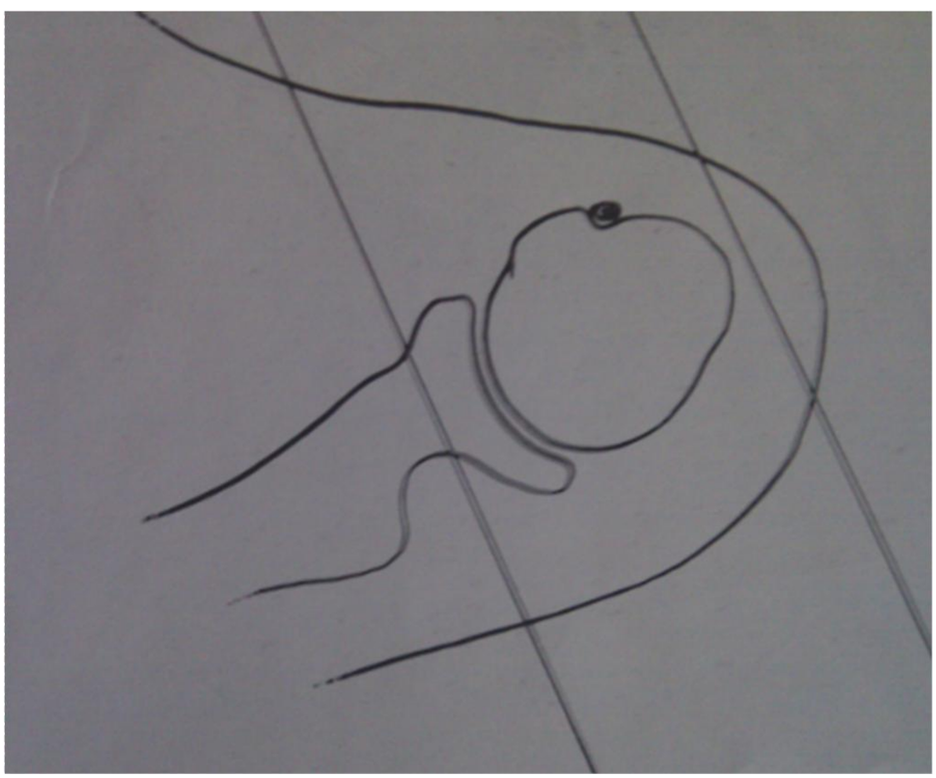


Axial images are used to select the coronal sections in the same plane as the scapula or infraspinatus and perpendicular to the gleno humeral articulation,





The sagittal images are taken parallel to the gleno humeral articulation and is particularly useful in assessing and further quantifying the size of rotator cuff tears.



OBSERVATIONS

AND

RESULTS

OBSERVATIONS AND RESULTS

Study design: A study with 90 asymptomatic agriculturists is undertaken in order to evaluate the Ultrasonographic and Magnetic Resonance Imaging findings of Rotator cuff of shoulder to detect the age related degenerative changes.

Table 1: Age distribution of patients studied

Age in years	Number of patients	%
40-50	37	41.1
51-60	30	33.3
61 & above	23	25.6
Total	90	100.0

Mean ± SD: 54.20±8.45

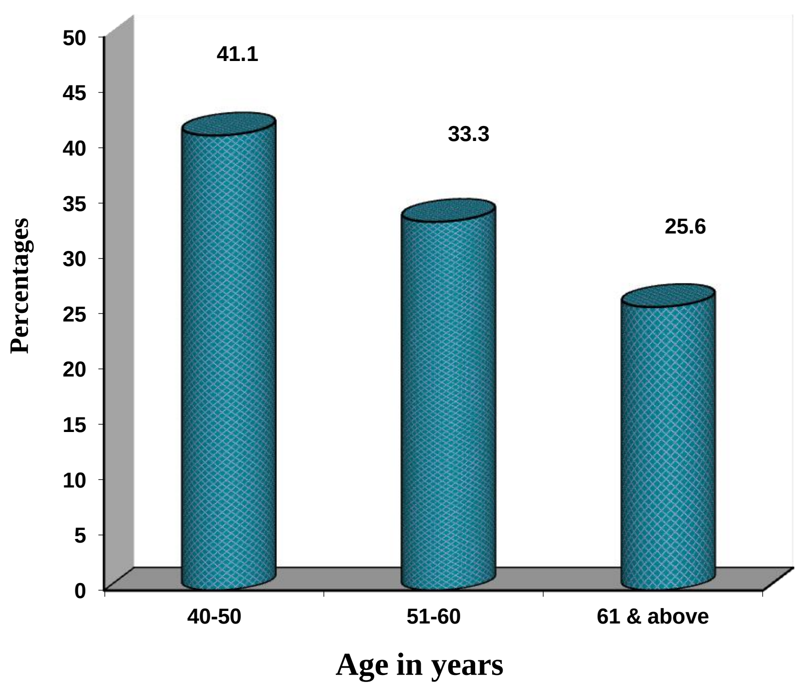


Table 2: Gender distribution of patients studied

Gender	**Number of patients**	**%**
Male	54	60.0
Female	36	40.0
Total	90	100.0

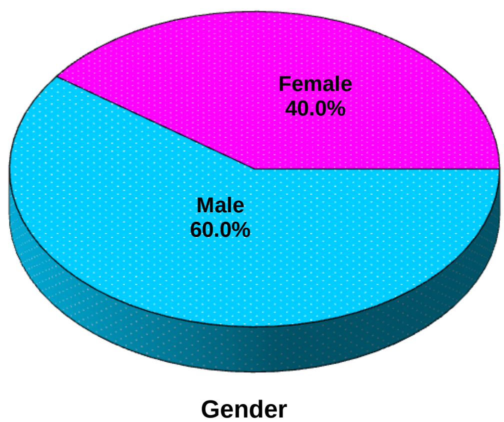


Table 3: Age and gender distribution of patients studied

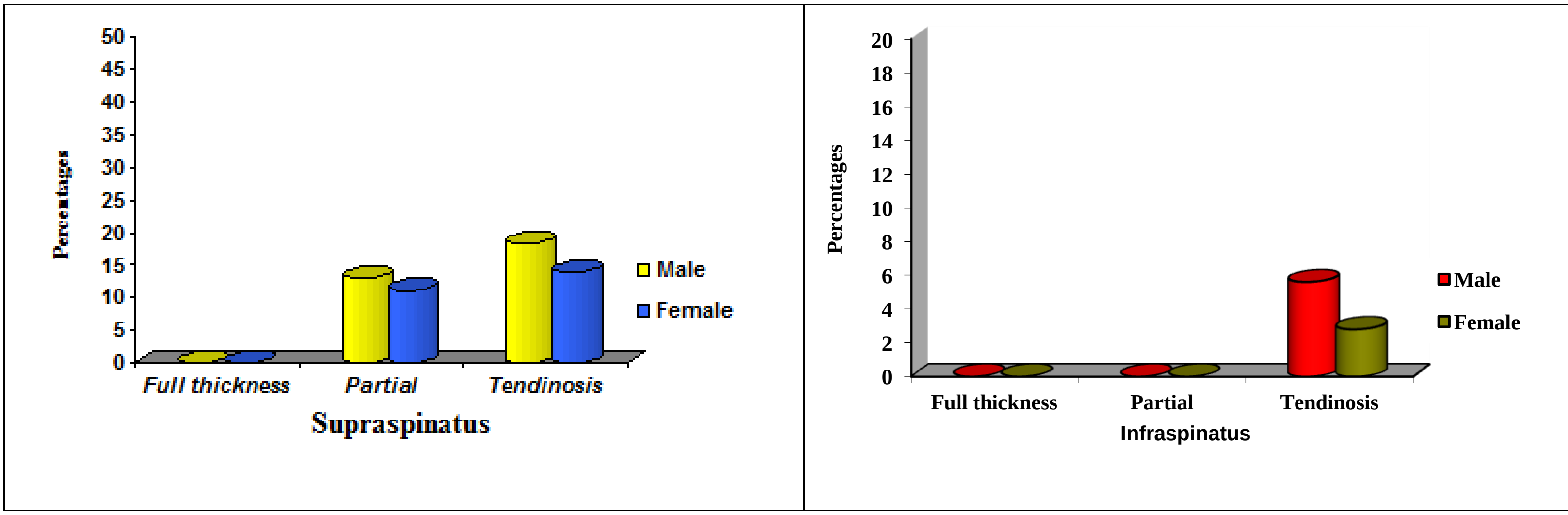
Age in years	Male		Female	
	No	%	No	%
40-50	26	48.1	11	30.6
51-60	16	29.6	14	38.9
61 -70	12	22.2	11	30.6
Total	54	100.0	36	100.0
Mean ± SD	53.20±8.35		55.69±8.52	

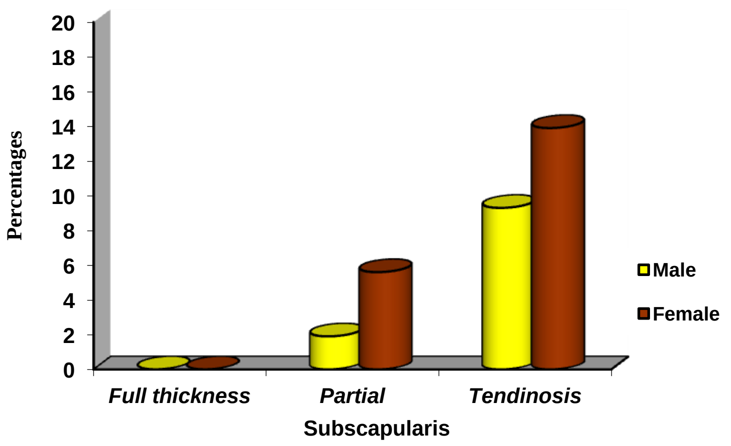
Table 4: MRI findings of patients studied

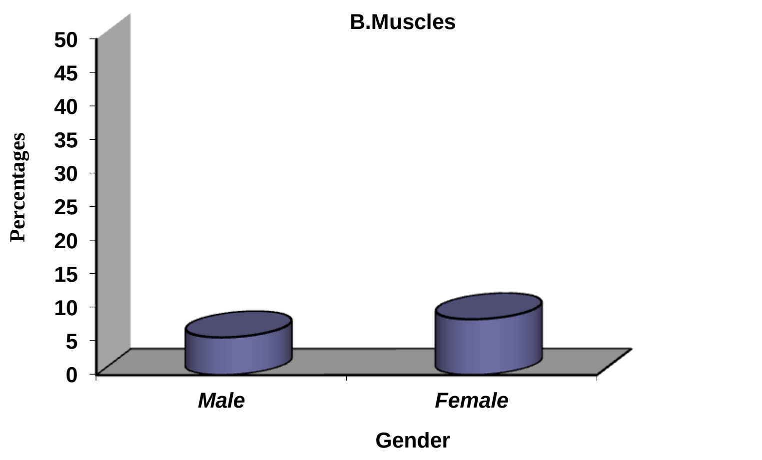
MRI findings	Total (n=90)	Male (n=54)	Female (n=36)	P value
Rotator cuff				
1.Supraspinatus				
• Full thickness tears	0	0	0	-
• Partial thickness tears	11(12.2%)	7(12.9%)	4(11.1%)	0.793
• Tendinosis	15(16.7%)	10(18.5%)	5(13.9%)	0.564
2.Infraspinatus				
• Full thickness tears	0	0	0	-
• Partial thickness tears	0	0	0	-
• Tendinosis	4(4.4%)	3(5.6%)	1(2.8%)	0.647
3.Subscapularis				
• Full thickness tears	0	0	0	-
• Partial thickness tears	3(3.3%)	1(1.9%)	2(5.6%)	0.561
• Tendinosis	10(11.1%)	5(9.3%)	5(13.9%)	0.513
4.Teres Minor				
• Full thickness tears	0	0	0	-
• Partial thickness tears	0	0	0	-
• Tendinosis	0	0	0	-
Muscles				
• Fatty degeneration	6(6.7%)	3(5.6%)	3(8.3%)	0.680

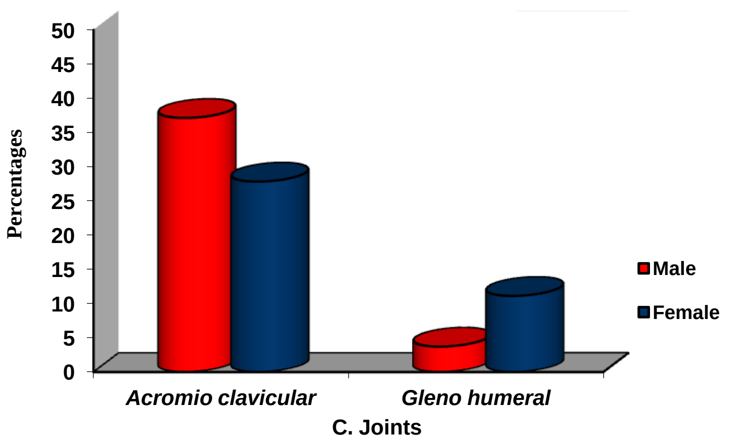
Osteoarthritic changes in the joints				
• Acromio clavicular	30(33.3%)	20(37.1%)	10(27.8%)	0.361
• Gleno humeral	6(6.7%)	2(3.7%)	4(11.1%)	0.213
Bursal fluid				
• Sub acromial sub deltoid	36(40.0%)	20(37.1%)	16(44.4%)	0.456
• Sub coracoid	0	0	0	-
Cysts				
• Insertional site	20(22.2%)	15(27.8%)	5(13.9%)	0.121
• Bony	1(1.1%)	1(1.9%)	0	0.400

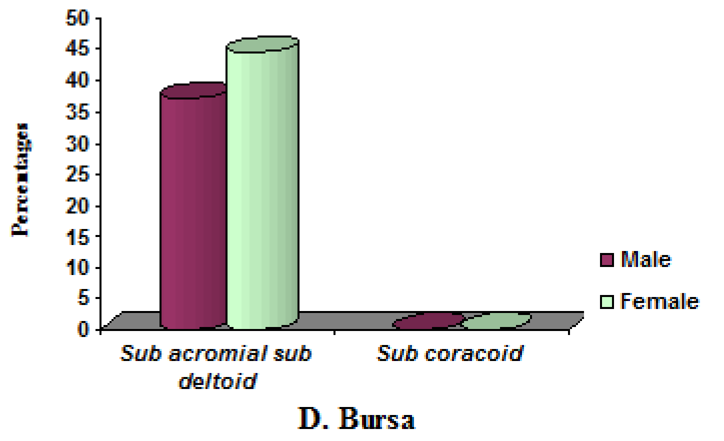
MRI FINDINGS




20
18
16
14
12
10
8
6
4
2
0
Percentages
Male
Female
Full thickness
Partial
Tendinosis
Subscapularis


B.Muscles
50
45
40
35
30
25
20
15
10
5
0
Percentages
Male
Female
Gender


50
45
40
35
30
25
20
15
10
5
0
Percentages
Male
Female
Acromio clavicular
Gleno humeral
C. Joints


50
45
40
35
30
25
20
15
10
5
0
Percentages
Male
Female
Sub acromial sub deltoid
Sub coracoid
D. Bursa

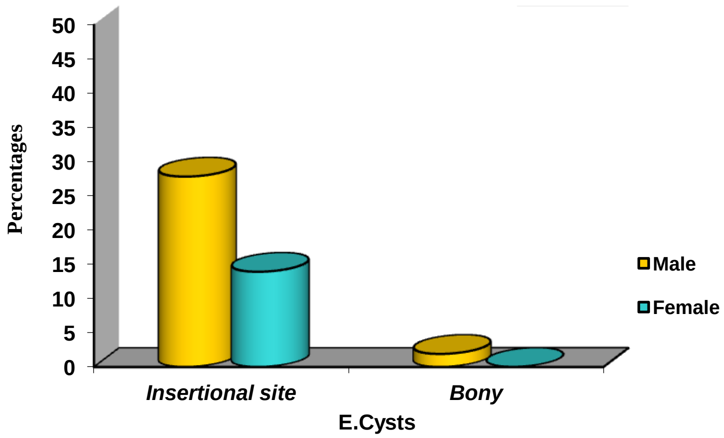
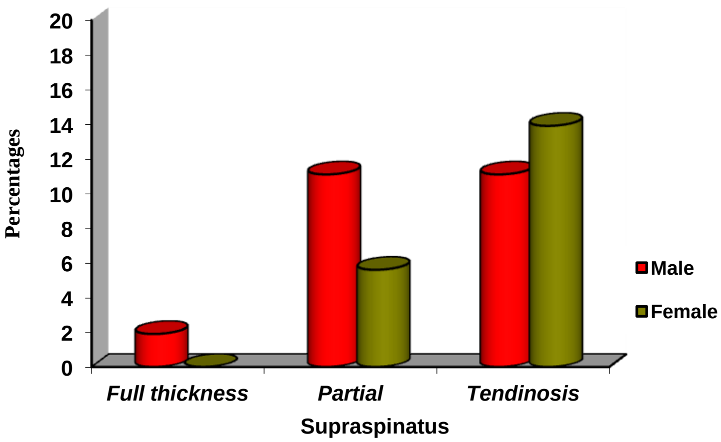

50
45
40
35
30
25
20
15
10
5
0
Percentages
Male
Female
Insertional site
Bony
E.Cysts

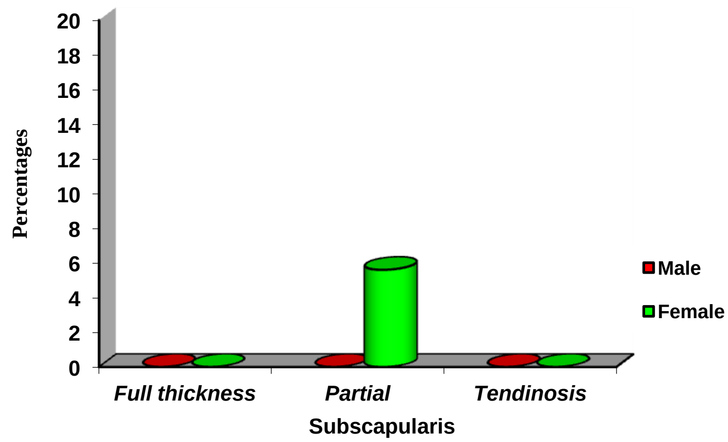
Table 5: USG findings of patients studied

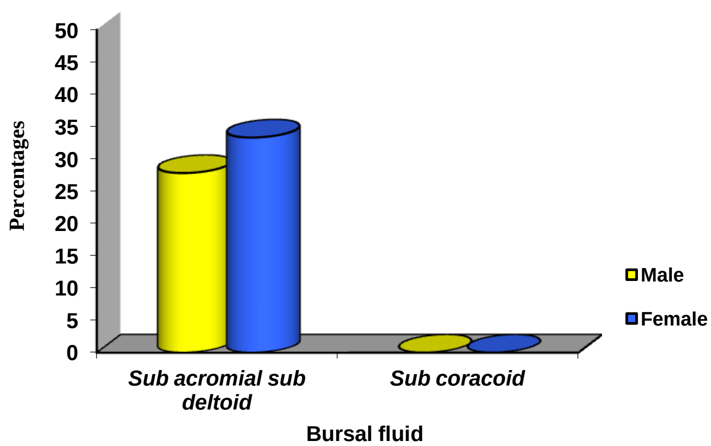
USG findings	Total (n=90)	Male (n=54)	Female (n=36)	P value
Rotator cuff				
1.Supraspinatus				
• Full thickness tears	0	0	0	-
• Partial thickness tears	8(8.9%)	6(11.1%)	2(5.6%)	0.468
• Tendinosis	11(12.2%)	6(11.1%)	5(13.9%)	0.749
2.Infraspinatus				
• Full thickness tears	0	0	0	-
• Partial thickness tears	0	0	0	-
• Tendinosis	0	0	0	-
3.Subscapularis				
• Full thickness tears	0	0	0	-
• Partial thickness tears	2(2.2%)	0	2(5.6%)	0.157
• Tendinosis	0	0	0	-
4.Teres Minor				
• Full thickness tears	0	0	0	-
• Partial thickness tears	0	0	0	-
• Tendinosis	0	0	0	-
Osteoarthritic changes in the Joints				
• Acromio clavicular	0	0	0	-
• Gleno humeral	0	0	0	-

Bursal fluid				
• Sub acromial sub deltoid	27(30.0%)	15(27.8%)	12(33.3%)	0.573
• Sub coracoid	0	0	0	-

USG FINDINGS







Statistical Methods: Descriptive statistical analysis [23,24,25,26] has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. The following assumptions on data is made, **Assumptions: 1.** Dependent variables should be normally distributed, 2.Samples drawn from the population should be random, Cases of the samples should be independent. One proportion Z test has been performed under the binomial assumption of 0.50 for frequency distribution of variables studied

Sample Size estimation

Mean Known Population size

Proportion Known populations

$n = [(z^2 * p * q) + ME^2] / [ME^2 + z^2 * p * q / N]$

Proportion Unknown population

$n = [(z^2 * p * q) + ME^2] / (ME^2)$

ME: is the margin of error, measure of precision and Z is 1.96 as critical value at 95%CI

Significant figures

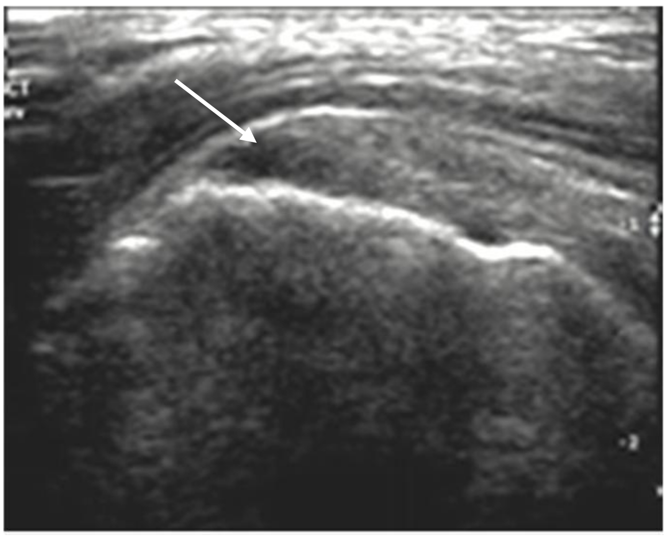
+ Suggestive significance (P value: $0.05 < P < 0.10$)

* Moderately significant (P value: $0.01 < P \leq 0.05$)

** Strongly significant (P value : $P \leq 0.01$)

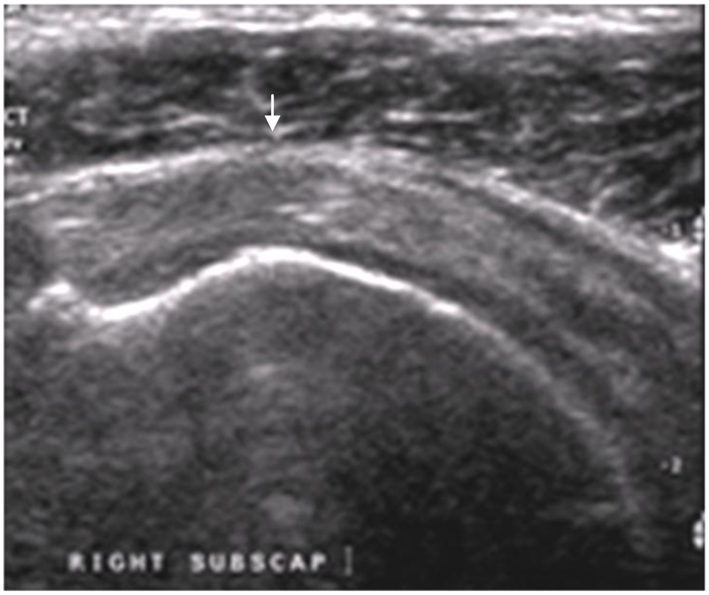
Statistical software: The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1 ,Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc**.**

NORMAL ULTRA SONOGRAPHIC APPEARANCE OF THE ROTATOR CUFF



transverse

The supraspinatus tendon seen as an echogenic band superior to the humeral head, with a convex upper surface; it tapers toward the greater tubercle(arrow).



(longitudinal view)

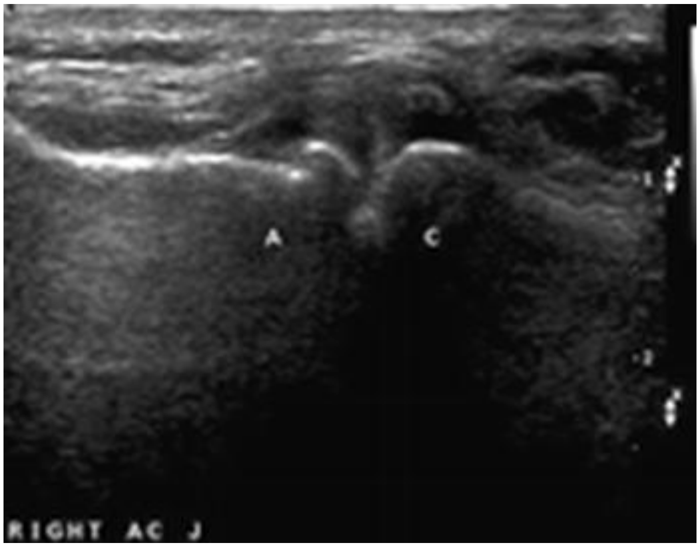
(longitudinal view)

The subscapularis tendon (arrow) demonstrates an internal fibrillar pattern and lies below the deltoid muscle. The coracoid process (*C*) lies anteriorly to the subscapularis tendon.

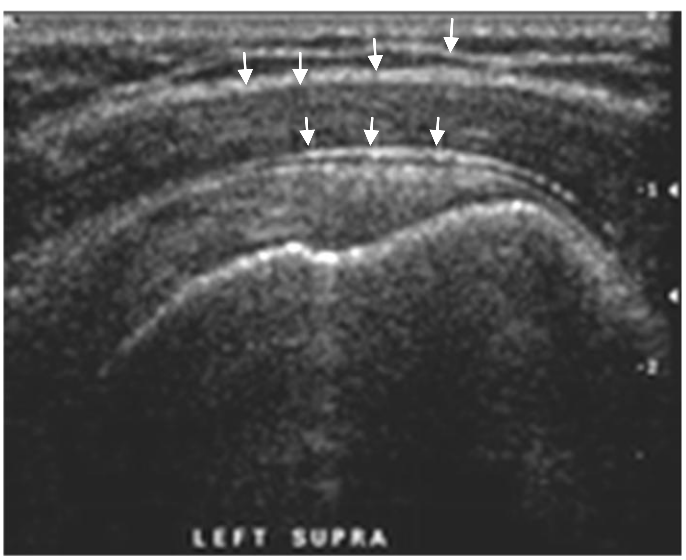
(longitudinal view)

The infraspinatus tendon (arrows) lies superior to the postero superior aspect of the humeral head. (arrows).

The supraspinatus and infraspinatus tendons are interwoven. On the transverse view the anterior 1.5 cm of the complex represents the supraspinatus tendon, while the posterior 1.5 cm represents the infraspinatus tendon.



Acromio-clavicular joint, longitudinal view. The acromio-clavicular joint is the area between the acromion (*A*) and clavicle (*C*). The superior aspect of the joint capsule is seen as a hypoechoic band above the joint.

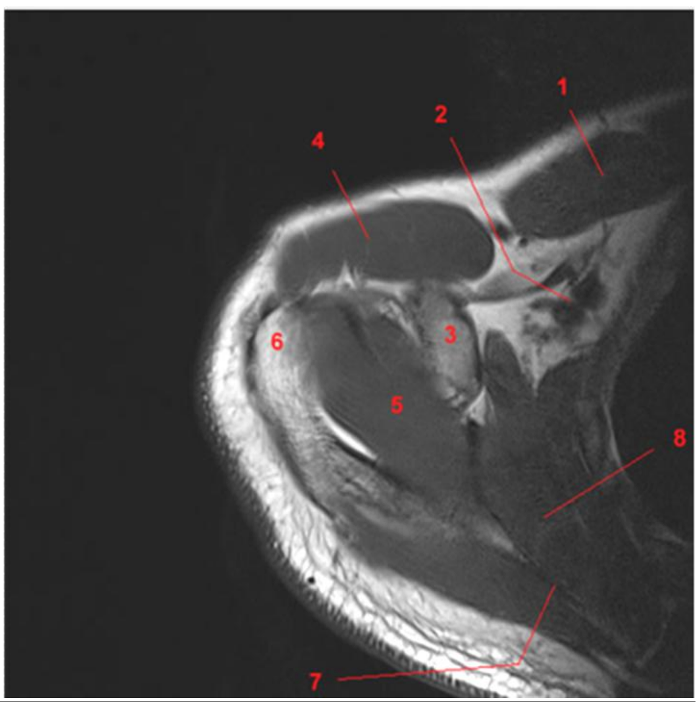


Sub acromial-sub deltoid bursa, longitudinal view. The sub deltoid bursa (arrows) is seen as a thin hypoechoic line superior to the supraspinatus tendon. The echogenic line superior to the bursa represents sub deltoid fat.

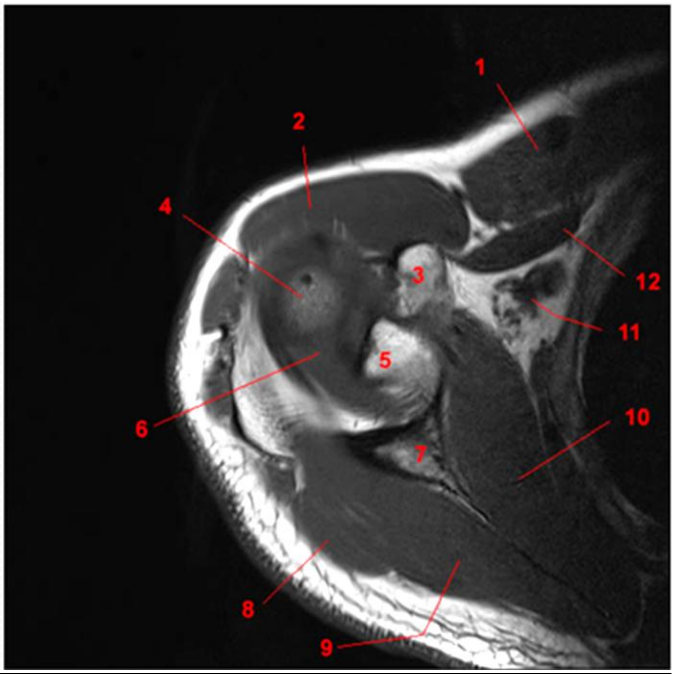
NORMAL MAGNETIC RESONANCE IMAGING APPEARANCE OF ROTATOR CUFF

In recent years magnetic resonance imaging has replaced techniques such as arthrography, computed tomography or arthrotomography for screening of the shoulder because it is non invasive and the information obtained is significantly greater. An additional benefit of magnetic resonance imaging is the ability to image the shoulder in any orthogonal or off-axis oblique plane[6].

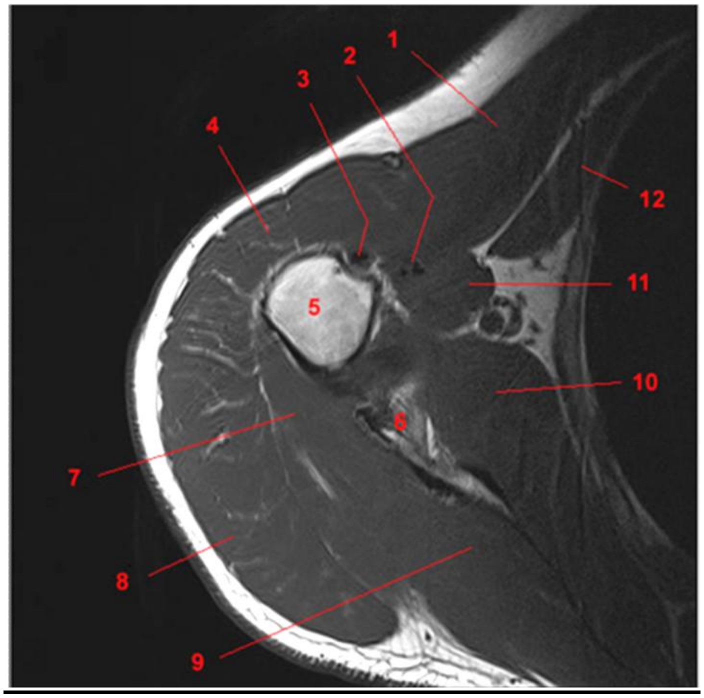
T1 WEIGHTED AXIAL IMAGES



1.Pectoralis major muscle.2.Axillary vein and artery. 3. Coracoid process. 4. Deltoid muscle 5.Supraspinatus muscle .6. Acromion .7 .Scapula .8.Subscapularis muscle .



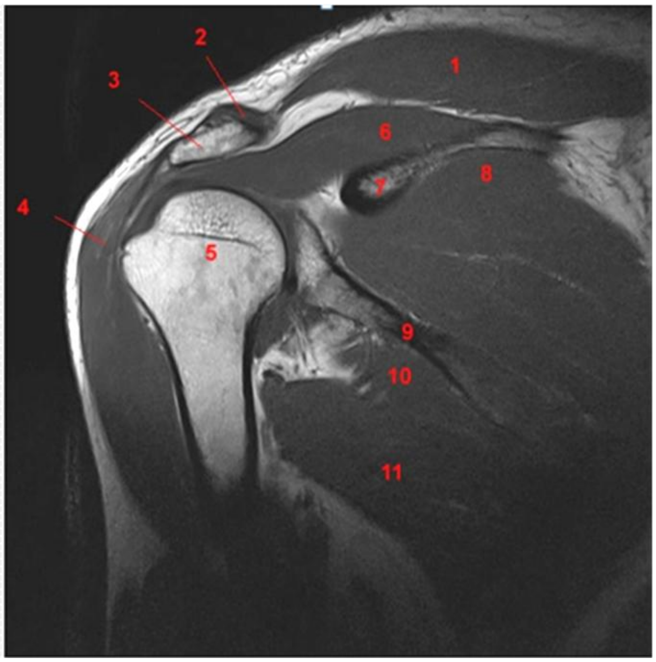
1.Pectoralis major muscle 2. Deltoid muscle.3. Coracoid process. 4. Humeral head .5. Glenoid.6.Supraspinatus muscle.7.Scapula.8.Deltoid muscle Infraspinatus muscle .10. Subscapularis muscle. 11. Axillary vein and artery.12. Pectoralis minor muscle.



1.Pectoralis major muscle.2. Biceps tendon (short head).3, Biceps tendon (long head) .4 Deltoid muscle.5.Humeral head.6.Glenoid.7.Teres minor muscle.8.Deltoid muscle.9.Infraspinatus muscle.10.Subscapularis muscle.11.Coracobachialis muscle.12. Pectoralis minor muscle.

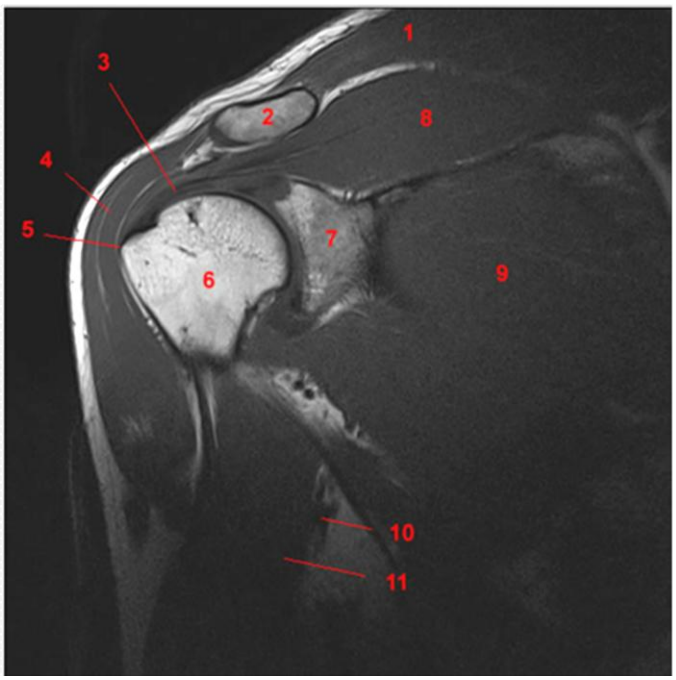
T1 WEIGHTED CORONAL IMAGES

1.Trapezius.2. Acromion. 3. Infraspinatus tendon. 4. Deltoid muscle.5.Humeral head .6. Infraspinatus muscle. 7. Teres minor muscle. 8. Teres major muscle.9. Tricipital muscle .



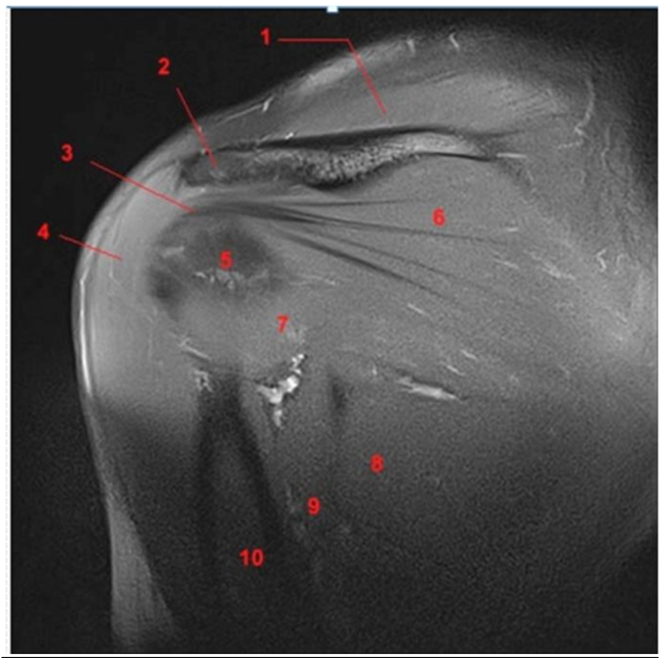
1, Trapezius. 2.Acromioclavicular joint 3 Acromion 4. Deltoid . 5. Humeral head 6 Supraspinatus muscle 7.Scapular Spine .8.Infraspinatus muscle. 9.Scapula.10. Subscapularis muscle.11. Teres major muscle .

1.Trapezius .2. Clavicle. 3. Acromioclavicular joint. 4.Acromion.5.Supraspinatus tendon. 6, Greater tuberosity. 7. Humeral head. 8.Supraspinatus muscle. 9, Glenoid. 10.Spine of the scapula.11.Infraspinatus muscle. 12. Scapula.13.Subscapularis muscle.14.Teres major muscle.



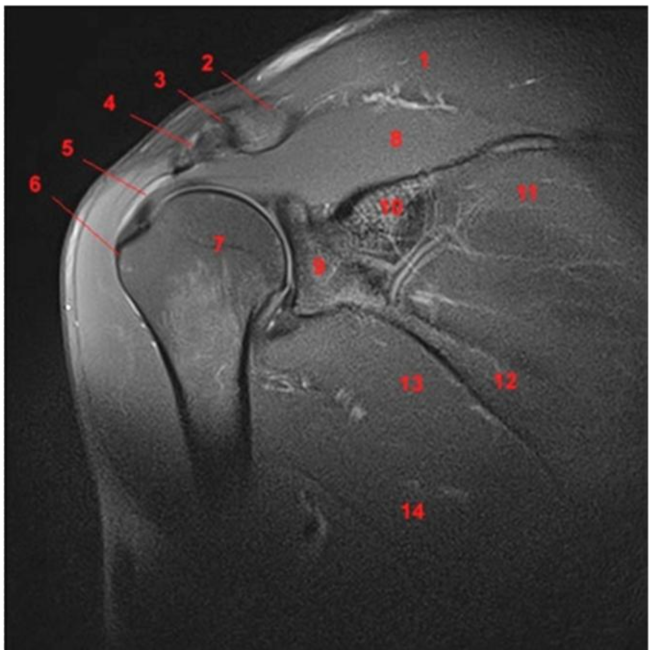
1 .Trapezius muscle. 2. Clavicle. 3, Supraspinatus tendon. 4. Deltoid muscle. 5, Greater tuberosity. 6. Humeral head 7, Glenoid 8. Supraspinatus muscle. 9, Subscapularis muscle. 10. Axillary vein and artery. 11. Biceps and coracobrachialis muscle.

FAT SATURATED T2 WEIGHTED CORONAL IMAGES

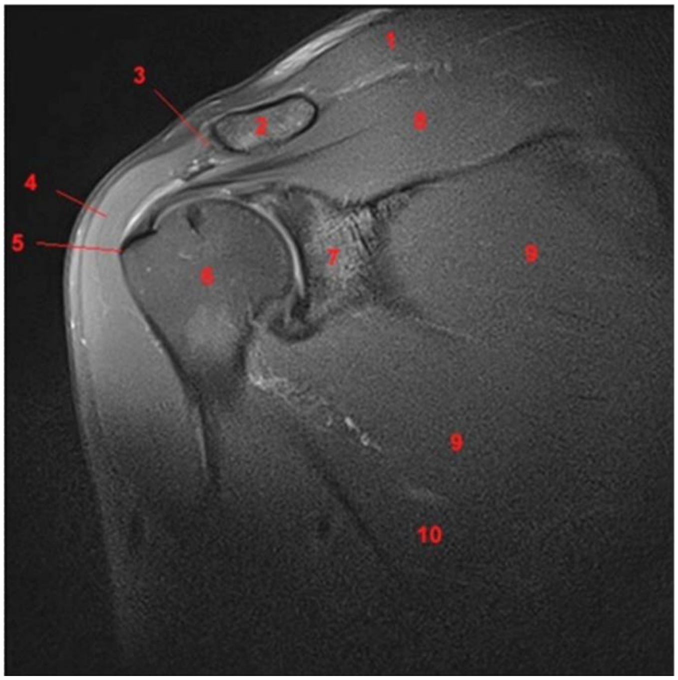


1.Trapezius 2. Acromion .3.Infraspinatus tendon. 4 Deltoid muscle.5.Humeral head. 6, Infraspinatus muscle.7.Teres minor muscle 8, Teres major muscle.9. Triceps muscle 10.Humerus

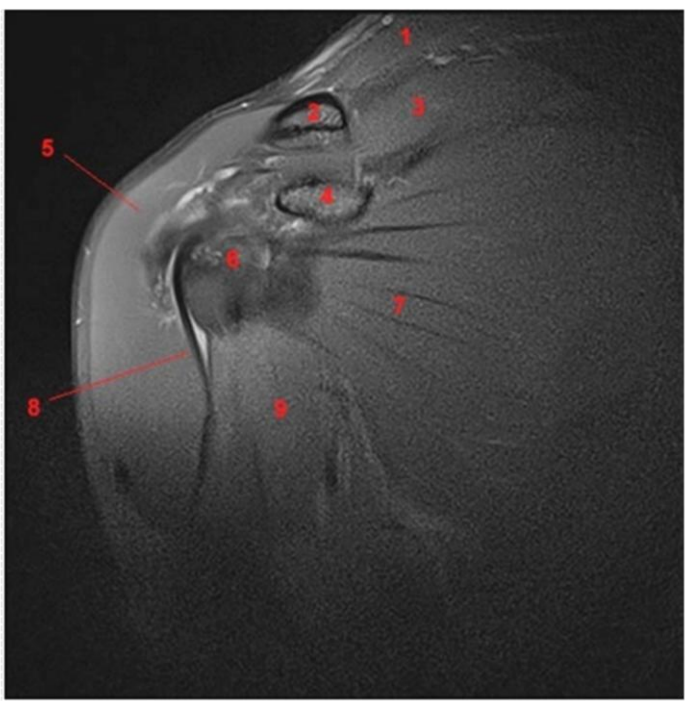
.



1.Trapezius. 2. Clavicle .3. Acromioclavicular joint. 4 Acromion. 5.Supaspinatus tendon 6. Greater tuberosity.7. Humeral head 8, Supraspinatus 9, Glenoid 10 Spine of scapula 11.Infraspinatus muscle.12.Scapula.13.Subscapularis muscle ,14. Teres major muscle .

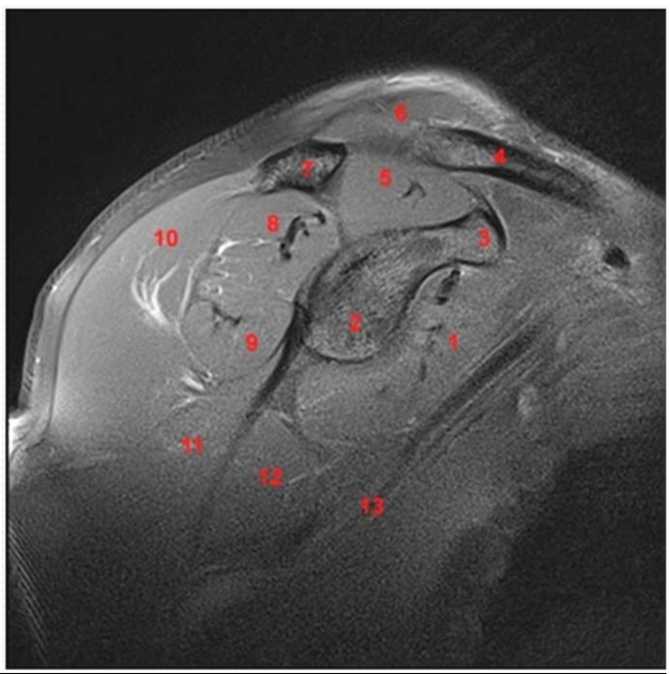


1.Trapezius. 2, Clavicle. 3, Acromioclavicular joint. 4 Deltoid. 5, Greater tuberosity. 6, Humeral head. 7. Glenoid. 8.Supraspinatus muscle. 9. Subscapularis muscle. 10.Teres major muscle.

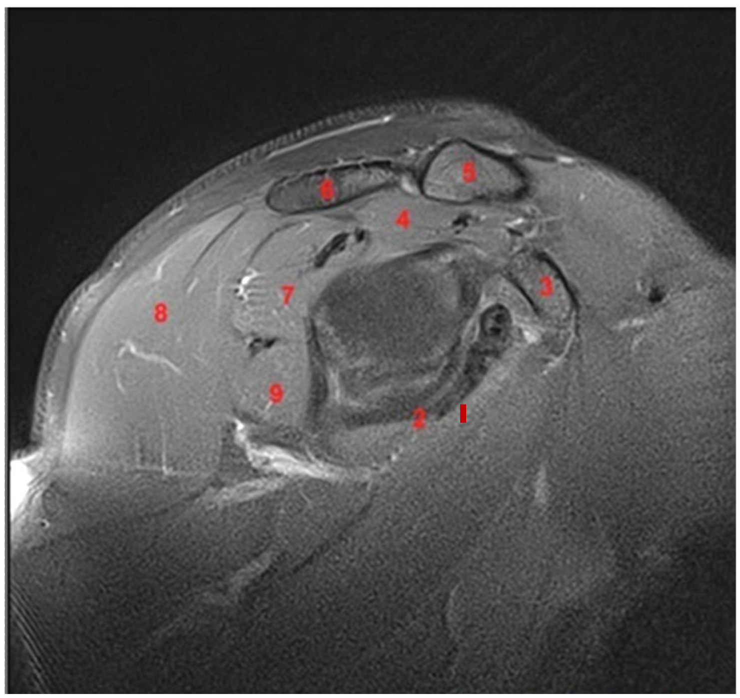


1 Trapezius muscle. 2, Clavicle 3 Supraspinatus muscle. 4 Glenoid S Deltoid muscle. 6. Humeral head. 7, Subscapulans muscle. 8 Biceps tendon (long head). 9.Biceps and coracobrachialis.

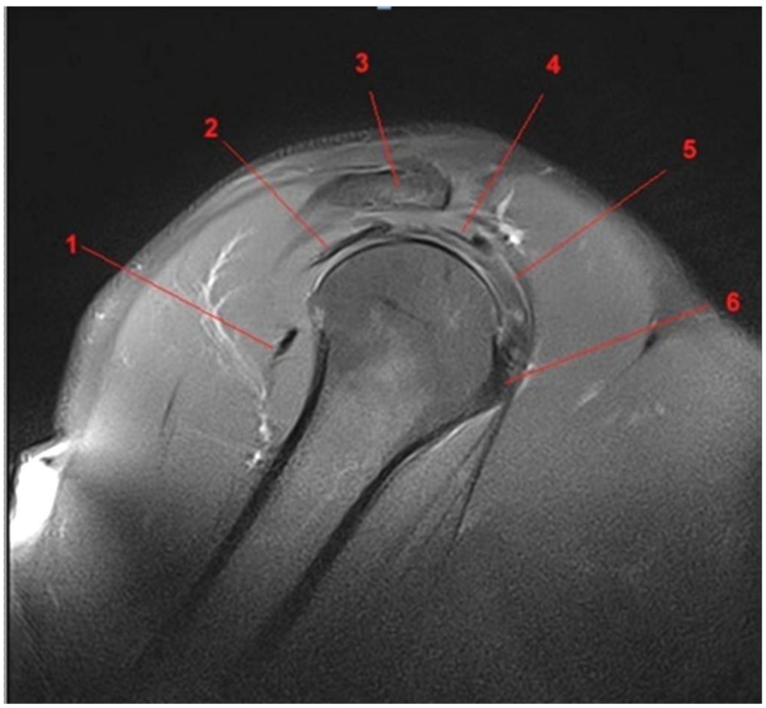
FAT SATURATED T2 WEIGHTED SAGITTAL IMAGES



1.Subscapularis muscle. 2. Glenoid. 3.Coracoid process. 4.Clavicle. 5. Supraspinatus .6.Trapezius muscle.7.Acromion.8.lnfraspinatus muscle 9. Teres minor muscle. 10.Deltoid muscle. 11.Triceps muscle. 12.Teres major muscle.13. Biceps muscle.

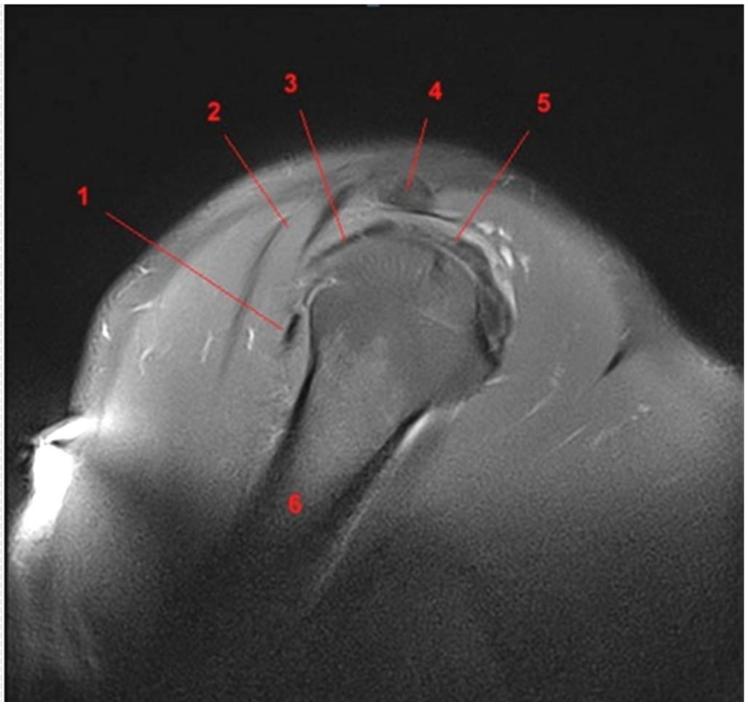


1&2.Subscapularis muscle. 3. Coracoid process .4. Supraspinatus muscle. 5. Clavicle.6. Acromion.7. Infraspinatus muscle. 8.Deltoid muscle. 9. Teres minor muscle.



1, Teres minor muscle and tendon 2. Infraspinatus tendon 3. Acromion.4.Supaspinatus tendon.

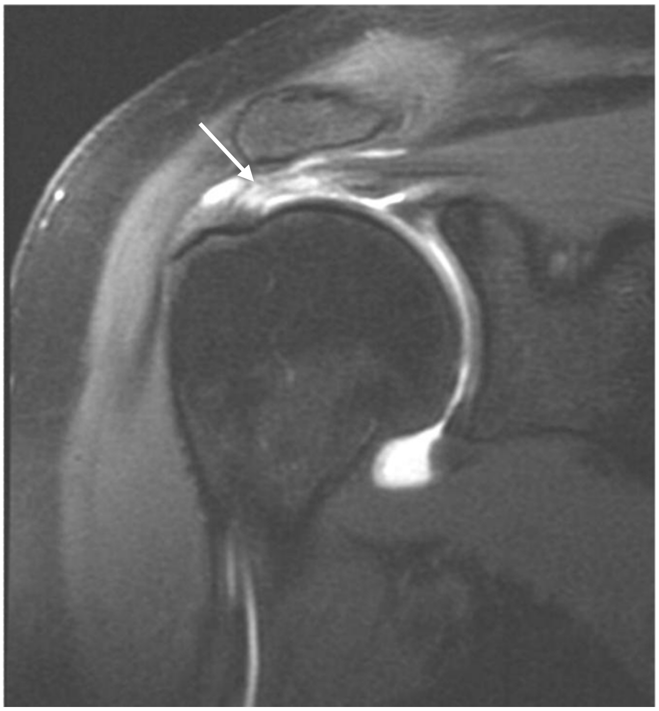
5. Biceps tendon (long head). 6.Subscapularis tendon .



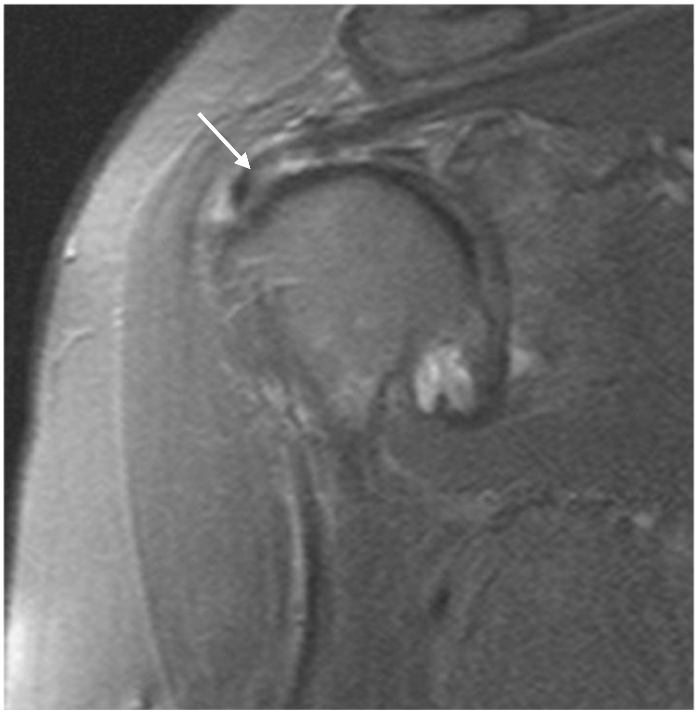
1.Teres minor muscle and tendon.2. Deltoid muscle.3. Infraspinatus tendon.4. Acromion

5.Supraspinatus tendon. 6. Humerus.

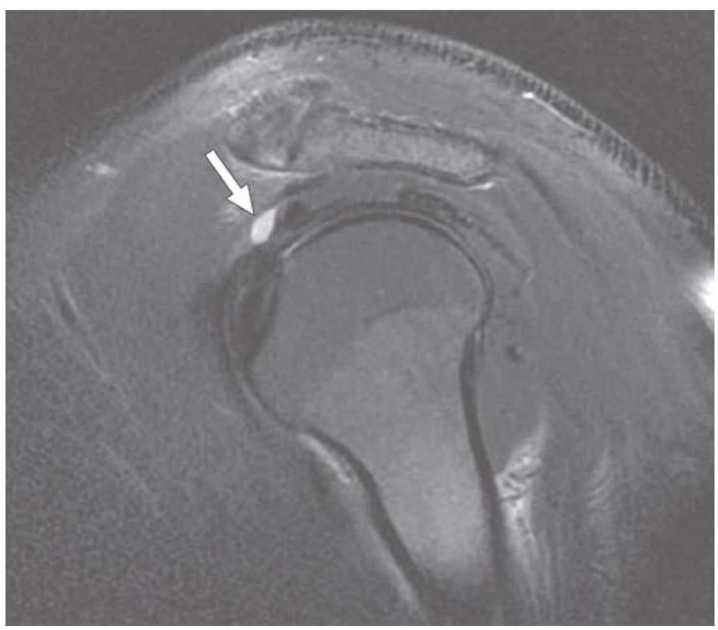
ULTRASONOGRAPHIC AND MAGNETIC RESONANCE IMAGING APPEARANCE OF SPECTRUM OF DEGENERATIVE CHANGES OF THE ROTATOR CUFF



Fat supressed oblique coronal image showing increased signal itensities in the substance of the supra spinatus tendon consistent with a partial thickness tear (arrow).

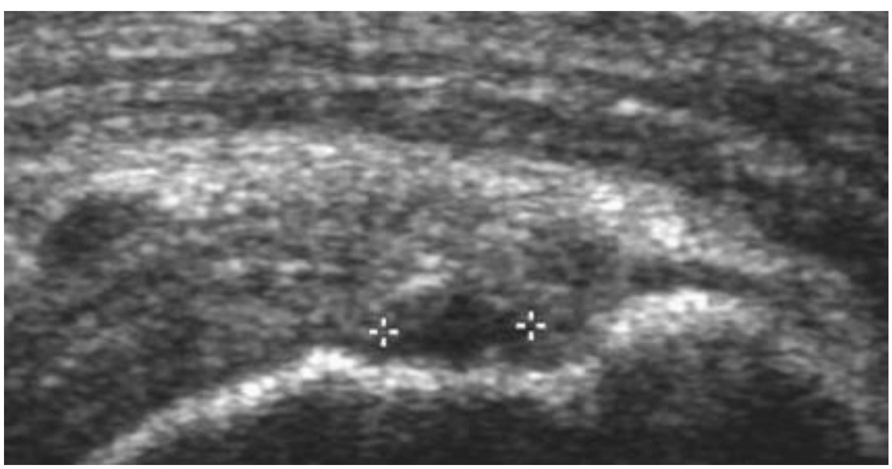


Proton density oblique coronal image showing a partial thickness supraspinatus tear (arrow).

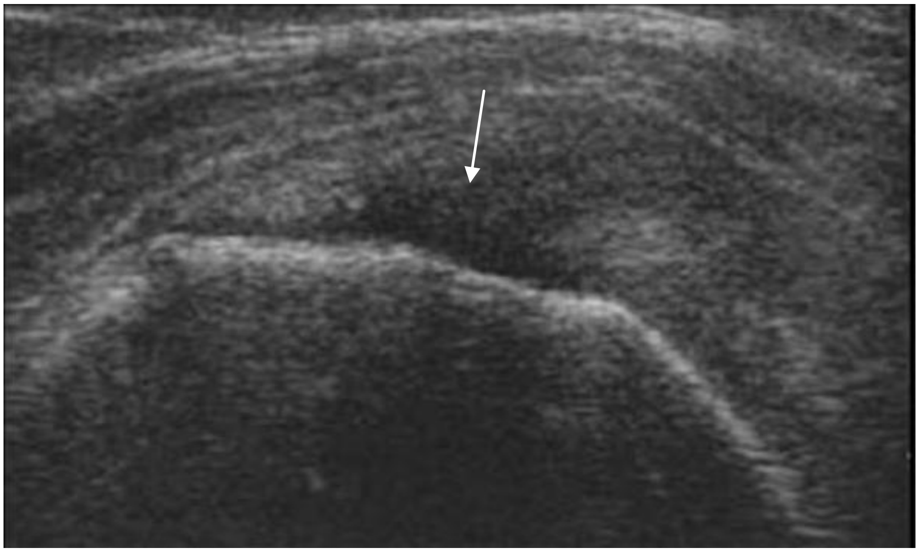


Fat saturated Oblique Sagittal image showing a cyst near the supraspinatus insertional site.

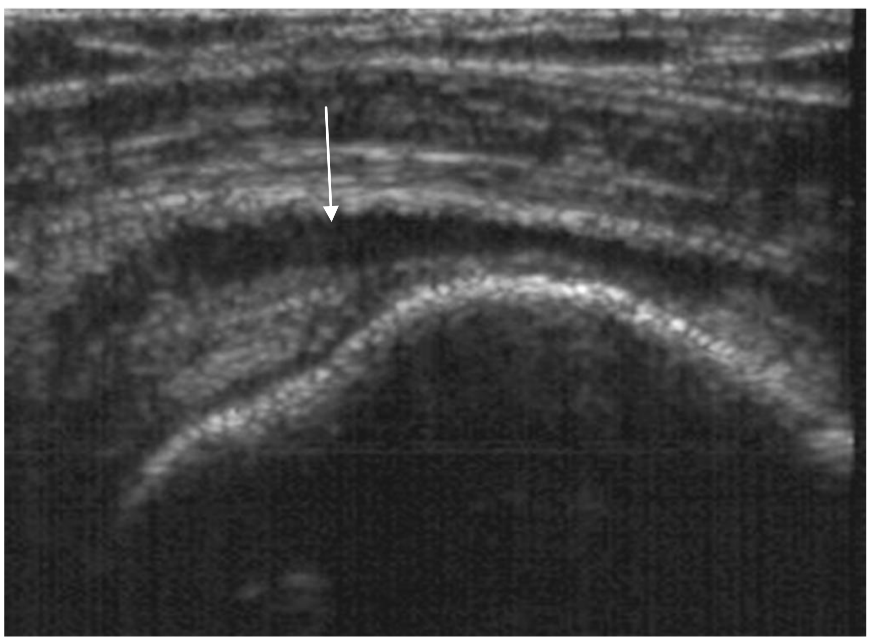
Fat saturated oblique coronal image showing a cyst in the humeral head



Long axis ultrasound image of the supraspinatus tendon shows a hypoechoic defect within the tendon ,which is consistent with a partial thickness tear.



Long axis ultrasound image of the supraspinatus tendon shows tendinosis



Longitudinal USG showing hypoechoic sub acromial sub deltoid fluid collection

DISCUSSION

DISCUSSION

The purpose of the present study was to compare the imaging characteristics and prevalence of asymptomatic rotator cuff disease in patients between the ages of 40 and 70 years who were agriculturists by profession.

Our study did not reveal any full thickness tears on both ultrasound and magnetic resonance imaging. Various authors [5,7,35,36,38] have demonstrated a frequency of 5 to 39 per cent for full-thickness tears. Moosemayer et al [35] showed a prevalence of full thickness tears increasing with age, as follows: 2.1% in subjects aged 50 to 59 years, 5.7% in subjects aged 60 to 69 years, and 15% in subjects aged 70 to 79 years .

Present study showed partial thickness tears in 11(12.2 %) of the 90 subjects. 1 (2.7%) subject in the age group between 40-50 years,5(16.6 %) subjects in the age group between 51-60 years and 5(22 %) subjects in the age group between 61-70 years. Supraspinatus was most commonly involved (11 subjects). Three of the 11 subjects also had partial tear of subscapularis tendon. Infraspinatus and Teres minor were not involved in any subject. Of the 11 subjects with partial tears of the rotator cuff , 8 were detectable by both USG and MRI and 3 were detected only by MRI. Values obtained by our study were higher than that of a study conducted by N.Schibany et al [7] in a group of 212 asymptomatic patients between the ages of 18-85 years where 6% of them had rotator cuff tears. In their study none of the patients below the age of 50 years had a rotator cuff tear, 2 % in the age group of 50- 60 years had a tear and 14 % in the age group of 60 – 70 years had tears.

Of the 79 subjects without rotator cuff tears, 29 (36.7%) had evidence suggestive of tendinosis - 15 (19%) in the supraspinatus tendon, 4(5%) in the infraspinatus tendon and 10(12.6%) in the subscapularis tendon.

In our study sub acromial sub deltoid fluid effusion was seen in 36 (40%) of the 90 subjects. 9(24.3%) in the 40-50 years age group, 13(43.3%) in the 51-60 years age group and 14(61%) in the 61-70 years age group. All the 11 patients with partial thickness rotator cuff tears had sub acromial sub deltoid fluid collection .Farin et al[33] found sonographic abnormalities (bursal fluid or thickening) of the Sub acromial sub deltoid bursa in 68 patients, 38 (56%) of whom had rotator cuff tears. van Holsbeeck et al [39] incidentally observed that 90% of the patients with sub acromial sub deltoid bursal effusion had associated rotator cuff tear .

30 (33%) of our subjects had osteoarthritic changes in the acromio-clavicular joint and 6(7%) of the subjects had gleno humeral joint osteoarthritic changes.

Fatty degeneration of the supraspinatus muscle was observed in 6(7%) of the subjects and 3 of them had an associated rotator cuff tear also.

.

Author	Present study	Girish et al	Schibany et al	Sher et al
Year	2011	2011	2004	1995
Number of patients	90	51	212	96
Full thickness tears	----	5%	6%	15%
Partial thickness tears	12.3%	11%		20%
Bursal fluid	40%	40%	----	----
Fatty atrophy of muscles	6.6%	-----	-----	----

Author	Present			Schibany et al		
Year	2011			2004		
Total number of patients	90			212		
Age groups(yrs)	41-50	51-60	61-70	< 50	50-59	60-69
Patients in each age group	37	30	23	49	51	58
Rotator cuff tears	2.7%	16.6%	21.8%	0	2%	14 %

The incidence of degenerative changes increases with age as shown by Moosemayer et al[35]. The present study has also shown increase in incidence of abnormalities with increasing age. The percentage of abnormalities in each group is higher than the study conducted by Schibany et al [7] and this is probably because their study has taken subjects from urban population and our study group constituted entirely of agriculturists from a rural background . This probably indicates that age related degenerative changes of the rotator cuff may be hastened by physical activity.

CONCLUSION

CONCLUSION

There are different theories about whether rotator cuff tearing in individuals with no history of trauma is caused by intrinsic degenerative changes as a process of aging related to vascular factors or whether rotator cuff tearing occurs from mechanical impingement.

The present study has shown increase in incidence of abnormalities with increasing age. The percentage of abnormalities in each group is higher, probably because other studies have taken subjects from urban population and our study group constituted entirely of agriculturists from a rural background This probably indicates that age related degenerative changes of the rotator cuff may be hastened by physical activity.

Even though higher prevalences are found in our study , there is less statistical significance due to the small sample size. Future studies with similar but larger groups ,as well as study of the non dominant arm are necessary to confirm this association between advancing age, physical exertion and occurrence of asymptomatic rotator cuff tears .

SUMMARY

SUMMARY

- This study was conducted from May 2009 till August 2011 with a total number of 90 asymptomatic subjects between the ages of 41-70 years who were agriculturists.
- None of the subjects had history of shoulder pain or dysfunction.
- For all the subjects ,the study was conducted on their dominant arm
- No full thickness tears of the rotator cuff were detected in any of the age groups.
- Partial thickness tears were seen in 11(12.2 %) of the 90 subjects. 1 (2.7%) subject in the age group between 40-50 years,5(16.6 %) subjects in the age group between 51-60 years and 5(22 %) subjects in the age group between 61-70 years. Supraspinatus was most commonly involved (11 subjects) .Three of the 11 subjects also had a partial tear of the subscapularis tendon. Infraspinatus and Teres minor were not involved in any subject. .
- Sub acromial sub deltoid fluid collection was seen in 36 (40%) of the 90 subjects. 9(24.3%) in the 40-50 years age group, 13(43.3%) in the 51-60 years age group and 14(61%) in the 61-70 years age group.. All the 11 patients with partial thickness rotator cuff tears had sub acromial sub deltoid fluid collection .None of the subjects had collection in the sub coracoid bursa.
- The present study has shown increase in incidence of abnormalities with increasing age. The percentage of abnormalities in each group is higher, probably because other studies have taken subjects from urban population and our study group constituted entirely of agriculturists from a rural background . This probably indicates that age related degenerative changes of the rotator cuff may be hastened by physical activity.

Even though higher prevalences are found in our study, there is less statistical significance due to the small sample size. Future studies with similar but larger groups ,as well as study of the non dominant arm are necessary to confirm this association between advancing age, physical exertion and occurrence of asymptomatic rotator cuff tears .

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PROFORMA

PROFORMA

Name:

Age & sex:

Address:

Occupation:

History of shoulder pain/shoulder trauma/Injury /shoulder surgery/tumors in the shoulder region:

Supraspinatus --Full thickness /partial thickness tear/Tendinosis on MRI :

Supraspinatus --Full thickness /partial thickness tear/Tendinosis on USG :

Infraspinatus --Full thickness /partial thickness tear/Tendinosis on MRI :

Infraspinatus--Full thickness /partial thickness tear/Tendinosis on USG:

Subscapularis-- Full thickness /partial thickness tear/Tendinosis on MRI :

Subscapularis --Full thickness /partial thickness tear/Tendinosis on USG :

Teres minor--Full thickness /partial thickness tear/Tendinosis on MRI:

Teres minor--Full thickness /partial thickness tear/Tendinosis on USG:

Sub acromial sub deltoid fluid collection on MRI :

Sub acromial sub deltoid fluid collection on USG:

Sub coracoid collection on MRI:

Sub coracoid collection on USG:

Fatty degeneration of the muscles on MRI:

Acromio-clavicular and Gleno humeral osteoarthritic changes on MRI:

Bony and insertional site cysts on MRI:

MASTER CHART

			MRI																		
			Rotator cuff												Muscles	Joints		Bursa		Cysts	
S.No	AGE(yrs)	Sex	Supraspinatus			Infraspinatus			Subscapularis			Teres Minor									
			Full thickness tears	Partial thickness tears	Tendinosis	Full thickness tears	Partial thickness tears	Tendinosis	Full thickness tears	Partial thickness tears	Tendinosis	Full thickness tears	Partial thickness tears	Tendinosis	Fatty degeneration	Acromio clavicular	Gleno humeral	Sub acromial sub deltoid	Sub coracoid	Insertional site	Bony
1	42	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	44	M	-	-	+	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-
3	43	F	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-
4	56	F	-	+	-	-	-	-	-	+	-	-	-	-	-	+	-	+	-	-	-
5	54	M	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
6	44	M	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-
7	45	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	56	F	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+
9	65	F	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
10	66	F	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	+	-	-	-
11	47	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	56	M	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
13	64	M	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	+	-
14	40	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
15	42	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
16	44	M	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-
17	46	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
18	56	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	65	F	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	70	M	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
21	66	F	-	-	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-
22	62	M	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	64	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	71	F	-	+	-	-	-	-	-	+	-	-	-	-	+	-	-	+	-	+	-
25	54	M	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-

26	55	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	49	M	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	47	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
29	48	M	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-
30	65	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	47	M	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
32	57	M	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-
33	58	F	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-
34	56	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	54	M	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
36	59	F	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-
37	62	M	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-
38	54	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
39	47	M	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
40	56	M	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	+	-
41	44	M	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
42	47	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	58	M	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	+	-
44	59	M	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
45	68	M	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	+	-
46	54	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
47	44	M	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	+	-	+	-
48	43	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
49	46	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	47	F	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-
51	48	F	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-
52	46	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
53	45	M	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-
54	47	F	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
55	55	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
56	53	F	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-
57	57	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
58	59	F	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
59	61	F	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	+	-	-	-
60	62	F	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	+	-
61	55	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
62	47	F	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-
63	44	F	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
64	65	M	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-
65	55	F	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-
66	68	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-

67	58	F	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-
68	70	F	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-
69	64	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
70	55	M	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	+	-
71	46	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
72	45	M	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
73	46	M	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-
74	45	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
75	47	M	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-
76	43	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
77	55	M	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-
78	68	M	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-
79	64	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
80	66	M	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-
81	69	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
82	50	M	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-
83	56	M	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-
84	44	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
85	67	M	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
86	60	M	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-
87	53	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
88	48	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
89	57	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
90	49	M	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-

			USG															
			Rotator cuff												Joints		Bursa	
S.No	AGE(yrs)	Sex	Supraspinatus			Infraspinatus			Subscapularis			Teres Minor						
			Full thickness tears	Partial thickness tears	Tendinosis	Full thickness tears	Partial thickness tears	Tendinosis	Full thickness tears	Partial thickness tears	Tendinosis	Full thickness tears	Partial thickness tears	Tendinosis	Acromio clavicular	Gleno humeral	Sub acromial sub deltoid	Sub coracoid
1	42	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	43	F	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-
4	56	F	-	+	-	-	-	-	-	+	-	-	-	-	-	-	+	-
5	54	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
6	44	M	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
7	45	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	56	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
9	65	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	66	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
11	47	M	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
12	56	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	64	M	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-
14	40	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	42	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	44	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	46	F	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-
18	56	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	65	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	70	M	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
21	66	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	62	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
23	64	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	71	F	-	+	-	-	-	-	-	+	-	-	-	-	-	-	+	-
25	54	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
26	55	F	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
27	49	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

28	47	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	48	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
30	65	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	47	M	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-
32	57	M	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	58	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
34	56	M	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	54	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36	59	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
37	62	M	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
38	54	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
39	47	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	56	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
41	44	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
42	47	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	58	M	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
44	59	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45	68	M	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-
46	54	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
47	44	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
48	43	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
49	46	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	47	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51	48	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
52	46	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
53	45	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
54	47	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
55	55	F	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
56	53	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
57	57	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
58	59	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
59	61	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	62	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
61	55	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
62	47	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
63	44	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
64	65	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
65	55	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
66	68	F	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
67	58	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	70	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-

69	64	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	55	M	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
71	46	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
72	45	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
73	46	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
74	45	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
75	47	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
76	43	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
77	55	M	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
78	68	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
79	64	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80	66	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
81	69	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
82	50	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
83	56	M	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-
84	44	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
85	67	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
86	60	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
87	53	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
88	48	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
89	57	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90	49	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-