MR Imaging findings of the shoulder in patients with shoulder pain

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Abstract

Background: Shoulder pain is the third commonest cause of pain of all musculoskeletal related complaints. The diagnosis of shoulder pathologies is based primarily upon the results of clinical tests and imaging findings. Of the imaging modalities Magnetic Resonance Imaging (MRI) is sensitive and accurate non-invasive tool in the investigation of shoulder pathology. Since the introduction of MR in this country, no data has been made available about the MR imaging findings of patients presenting with shoulder pain.

Objective: The aim of the present study is to determine the imaging pattern of various shoulder pathologies, as seen on MRI, in patients presenting with shoulder pain at St Paul's Hospital Millennium Medical College, which is one of the tertiary and teaching hospitals in Addis Ababa.

Method: This is an institutional based descriptive cross sectional study in which a total of 101 patients satisfying the inclusion criteria over a period of sixteen months were included. The MR images were read using structured reporting. Statistical analysis of the findings was then done using the software SPSS version 25.

Result: There were 54 (53.5%) male and 47 (46.6%) female patients. The age ranged from twenty to seventy years. The mean age was 43.81years.The most common indication to have an MRI was chronic pain accounting for 70 (69.2%) of the cases and the right shoulder was imaged more than the left with the ratio of 2.15:1. Rotator cuff disease is the most common pathology of glenohumeral joint, for which MRI was done. Involvement of supraspinatus tendon was 64.3% in all the pathologies. Of the 41 patients diagnosed with supraspinatus tear, partial tear was seen in 34 patients (82.9%) and complete tear was seen in 7 (17%) patients. Degenerative disease of the AC joint was the second most common pathology detected and it was associated with supraspinatus tendon pathology and sub acromial sub deltoid bursitis. 15.8% of the cases had a normal MR finding in this study.

Conclusion: Rotator cuff pathology and AC joint arthritis were the two commonest pathologies detected on MR, and supraspinatus tendon was the most common involved tendon with pathology. Though MRI is the preferred test for evaluating rotator cuff pathology and impingement syndrome, the cost and burden of ordering MR is significant. Proper indications and the relevance of the findings should be well evaluated and guide lines should be prepared for the imaging of patients with shoulder pain.

List of abbreviations and acronyms

MRI –Magnetic Resonance Imaging

TASH-Tikur Anbessa Specialized Hospital

SPHMMC-Saint Paul's Hospital millennium medical college

1. Introduction

1.1-Background

Shoulder pain is common in the population and can place a significant burden on individuals by limiting their activities and affecting their normal day to day life. Life-time prevalence of shoulder pain has been shown to range between 6.7% and 66.7% [1] .Shoulder pain is responsible for approximately 16 percent of all musculoskeletal complaints with a yearly incidence of 15 new episodes per 1,000 patients seen in the primary care setting [2,3] making it the third commonest complaint causing people to seek medical attention. In studies done in Ethiopia, Ararso et al reported a 45 % prevalence rate of self-reported cases of shoulder pain amongst sewing machine operators [4] and a study by Melaku et al on the prevalence of shoulder and neck pain among school teachers , self-reported case of shoulder and neck pain accounted for 57% [5].

The shoulder is a complex region with osseous, articular and soft tissue components. Shoulder pain can be caused by structures within the shoulder or can arise from problems external to the shoulder. Accurately localizing the source of pain presents a diagnostic challenge clinically due to overlap of the clinical signs. Imaging therefore plays a major role in the management of patients with shoulder pain by identifying the abnormalities and increasing the diagnostic confidence. Apart from acute traumatic lesions such as fractures, dislocations, contusions sprains and ruptured tendons, 85-90% of painful shoulders are due to adhesive capsulitis, acute or chronic calcific tendinits, bursitis and lesions at the musculotendinous cuff [6]. Thus disease of the rotator cuff is the most common cause of shoulder pain seen in clinical practice [6, 7]. Ostor *et al* in a study of patients with shoulder pain in primary care found rotator cuff tendinopathy in 85% and signs of impingement in 74% of the study population [8].

Although radiography is the initial imaging modality in the evaluation of patients with shoulder pain and is useful in trauma and assessment of bone lesions it has limited visualization of the soft tissues. In a study by Salek KM et al on comparison between ultrasound and x-ray in the evaluation of causes of shoulder pain, of the 32 patients with shoulder pain 100% had normal x- ray findings while on ultrasound the findings were otherwise [6].

Magnetic resonance imaging (MRI) has an extensive contrast resolution which allows for the detailed and non-invasive evaluation of the soft tissue. Hence it is a widely used diagnostic tool in the assessment of musculoskeletal abnormalities of the shoulder. Details of the rotator cuff pathology, including the size of the tear, extent of retraction, and amount of muscle atrophy are provided by the MRI and aid in surgical planning [9] .The other common indications for shoulder MRI include suspected shoulder instability, osteonecrosis, infection, and neoplasm . MRI with or without contrast was found to be the most accurate imaging modality for the evaluation of shoulder pathology allowing visualization of soft tissues that are often the source of pain[10].

Since the introduction of MRI in this country there has not been any study done on the prevalence of imaging pathologies of the shoulder. The aim of this study is thus to assess the pattern of pathologies that are diagnosed by MR imaging and to see the value of MRI in the evaluation of patients and in the prediction of prognostic outcome of patients with shoulder pain. Thus the information gained can be used as a baseline for further studies and will be an input for future studies.

1.2. Statement of the problem

Shoulder MRI is a valuable tool in the evaluation of patients with painful shoulder, as it accurately depicts rotator cuff tendon pathology and any associated muscle abnormalities as well as glenohumeral joint pathologies [7] .The present study is done to assess the MRI features of the most common glenohumeral joint pathologies and to study usefulness, advantages, and pitfalls of MRI in patients presenting with symptoms of glenohumeral joint pathologies.

Since the introduction of MRI in this country no study has been done so far to examine the epidemiology of the main shoulder complaints and their imaging finding. Knowledge of the present situation serves as a baseline for further studies that will be useful for stimulating public education policies, alerting doctors and primary care physicians about the problems and helps in preparing guidelines and imaging protocol for those patients presenting with shoulder pain, hence the importance of this study.

1.3 Significance of the study

No studies have been conducted on MR imaging features of common shoulder pathologies in this country so far. Thus this study tries to assess the pattern of shoulder pathologies as seen on MR images. The findings from this study will provide baseline information for further studies in this area and most of all it will help in the preparation of imaging guide lines. It may also serve as an input in raising the awareness of the primary care physicians, orthopedic surgeons and even radiologists as to when to use MRI in patients with shoulder pain.

2. Literature review

Shoulder pain is the third most common musculoskeletal condition. The reported annual incidence of shoulder pain in primary care is 14.7 per 1000 patients per year with a lifetime prevalence of up to 70% [1, 3]. In the community as many as 20% of the adult population experience shoulder symptoms at any one time and this seems to be increasing in incidence. Most common causes of shoulder pain in primary care are reported to be rotator cuff disorders, acromioclavicular joint (AC) disorder and glenohumeral joint (GH) disorders [7].

Plain radiology, ultrasound (US) and magnetic resonance imaging (MRI) have each been used diagnostically to assess the causes of shoulder pain. When assessed against the arthroscopy results, the MRI and US were comparable in terms of both identifying and measuring the size of rotator cuff (RC) tears with US identifying 45 of 46 full-thickness tears, and MRI identifying all 46[2].

In an Australian study on the comparison of structural abnormalities on MRI among symptomatic and asymptomatic patients, it was found out that tendinosis and tears of the rotator cuff were present in the majority of participants in each group. Labral abnormalities were rare among all [1].

In another study done in the United States on the appropriateness of MRI on the evaluation of shoulder pain, over the 12-month period, 734 new patients were identified, of which 547 had a chief complaint of shoulder pain and 491 of those had a common shoulder diagnosis and were further evaluated by the study, the common diagnoses were considered to be all types of rotator cuff tear, rotator cuff tendinitis, glenohumeral arthritis and adhesive capsulitis [14].

In a study done in India by Ram and Kumar [9] among 50 patients included in the study , the rotator cuff disease was found in 88% of cases, making it the most common pathology of glenohumeral joint, for which MRI was done. The least common group was infective (10%). Involvement of supraspinatus muscle or tendon was 74% in all the pathologies. Involvement of subscapularis and infraspinatus muscles was not as significant. Of the 42 patients diagnosed with supraspinatus tear, partial tear was seen in 34 patients (81%) and complete tear was seen in 8 (19%) patients. In supraspinatus tendon tear, traumatic (n = 21) and non-traumatic (n = 21) etiologies comprise the same number of patients. Partial supraspinatus tear was more commonly seen with traumatic injuries. In patients with single tendon involvement, supraspinatus tendon was the most common tendon involved. Osteoarthritis of acromioclavicular joint was a common occurrence in this study. Many of these patients (42%) had partial tear of supraspinatus tendon along with the AC osteoarthritis.

In another study done on the prevalence of shoulder disorders in Tertiary care center in India, of the 130 patients fulfilling the inclusion criteria, there was female predominance, with age range of 23-69.The commonest cause of shoulder pain were periarthritis shoulder (43.1%) followed by subacromial (SA) impingement (13.8%), acute rotator cuff injury (13.1%), GH arthritis (10.0%), AC Arthritis (8.5%) and miscellaneous group (myalgia, cases with unclear diagnosis etc.) (11.5%) [12].

In a study done in Kenya on the pattern of MRI findings of the shoulder at three imaging centers [15] there was a slight male predominance with prevalence of shoulder pathology being 54 and 45% for the male and female patients respectively. Tendinosis was the most common pathology in keeping with similar studies done in India , and supraspinatus was the commonest involved tendon accounting for (19%) of the total lesion. Rotator cuff tear was the third most common pathology with the right shoulder being involved more than the left.75% were partial tears whereas full thickness tears accounted for 25%.Tears involving the supraspinatus tendon were the commonest (85%) among these 70% were partial and 29.4% were complete. Only two cases of subscapularis tear were seen. As to the glenohumeral joint involvement Bankart lesions were seen in 3.3% of the cases whereas 5.8% cases of large Hill sachs lesions were seen. Thirteen out of 72 cases were degenerative changes of the glenohumeral joint and joint effusion was encountered in 7.5% of cases. In this study there was one case of normal MRI finding.

3. Objective

3.1. General objective

To determine the pattern of various shoulder pathologies as seen on MRI in patients with shoulder pain.

3.2. Specific objective

-Determine the different pathologies detected on MRI of the shoulder

-Determine the correlation between socio demographic patterns and different shoulder pathologies.

-Determine the most common indications for shoulder MRI

4. Methodology

4.1. Study area: The study was conducted at St Paul's Hospital Millennium Medical College.

St Paul's Millennium Medical College is a large teaching and referral Hospital located in Addis Ababa with a catchment population of more than 5million, in patient capacity of 700 and with an average of 1200 patients seen daily at the emergency and outpatient departments. The radiology department is one of the over thirteen departments in the college, which is fast growing and equipped with Philips Achieva 1.5T A series high field MRI scanner installed in 2015 G.C.

4.2. Study design: Institutional based retrospective cross sectional study.

4.3. Study population: All patients presenting with history of shoulder pain and for whom MRI was done during the study period.

4.4. Inclusion criteria: Adults between 18 and 70 years of age with history of shoulder pain were included in the study.

4.5. Exclusion criteria: Patients below 18 and above 70 years of age; patients with a known history of malignancy, patients with a previous operative history of the shoulder; and those who have contraindications for MRI such as pacemaker, metallic implants, and claustrophobia were excluded from the study.

4.6. Study duration: The study was conducted from August 2017 to January 2019 for a period of 16 months.

4.7. Sampling technique and sample size: In this study a non-random convenience sampling method was used. All those patients who presented with history of shoulder pain and for whom MRI was done during the study period and who fulfilled the inclusion criteria were 101 in number and were all included in the study.

4.8. Data collection and analysis: Data was collected by the principal investigator and checked for completeness. Clinical finding and socio demographic data of all patients, as registered in the PACS system, were filled on the questionnaire. The MR images were re-read by MSK fellow using a structured reporting system. The findings were then registered in the questionnaire.

The data was then analyzed using SPSS version 25. Frequencies of each of the features seen on MRI images were determined and presented as a pie chart, bar graphs and tables. For the correlation studies chi squared test and p values were used to test for association.

4.9. Ethical clearance

Data collection was done after getting permission from the ethical committee of the department of Radiology, St Paul's Hospital Millennium College. The advantage and purpose of the study was explained to the staff members and the committee. Written consent pertaining to the confidentiality of the retrieved information was given to the department of radiology at SPHMMC.

4.10. Dissemination plan

The result of the study will be presented to the department of radiology at TASH.

4.10 Operational definitions

Acute pain: pain of less than 6 months

Chronic pain: pain of more than or equal to 6months

ACJ arthritis: ACJ arthritis severity was determined according to the degree of osteophytes, joint effusion, synovial thickening, bone edema and articular cartilage thinning.

Sub acromial bursitis: mild bursitis had a sliver of fluid present or a small increase in T2 signal; moderate bursitis, clear fluid or thickening present; and severe bursitis, marked fluid distension and synovial thickening and/or the presence of rice bodies;

Tendon damage: based on standard radiological terms: ***tendinosis***; was present if the proton density fat-saturated sequence signal was increased but the T2 signal was less than that obtained if fluid was present; ***a partial tear*** – T2 signal of defect was a fluid signal; ***full-thickness tear,*** there was a tear evident from one side to other side of the tendon but not necessarily whole tendon; ***complete tear*** all the fibers of the tendon were torn.

GHJ cartilage damage: classified as ***mild*** if there were small areas of cartilage thinning (<50 mm thickness), ***moderate*** if areas of cartilage thinning were >50 mm or more extensive involvement of the <50 mm areas of thinning and ***severe*** if there were larger areas of full cartilage loss.

Gleno humeral arthritis: Classification of arthrosis according to Samilson Preto

Mild: Osteophytes of less than 3mm on the humeral head; ***Moderate***: osteophytes of 3-7mm on the humeral head or glenoid labrum; ***Severe***: osteophytes of more than 7mm with or without joint incongruity

Glenoid labrum tears; were deemed to be ***small*** if they were less than full thickness of the labrum and not displaced; ***large*** tears were full thickness

Capsulitis: Thickening and contraction of the shoulder joint capsule and surrounding synovium

Age groups: 20-30**(0),** 31-40**(1**), 41-50**(2),** 51-60**(3),** 61-70**(4)**

All the MRI studies were done using the 1.5T Phillips Achieva machine and the following sequences were used T1W, TSE: Axial, Coronal; PDW-SPIR: axial, coronal, and sagittal and T2W –coronal. Shoulder coil was used in all of the images.

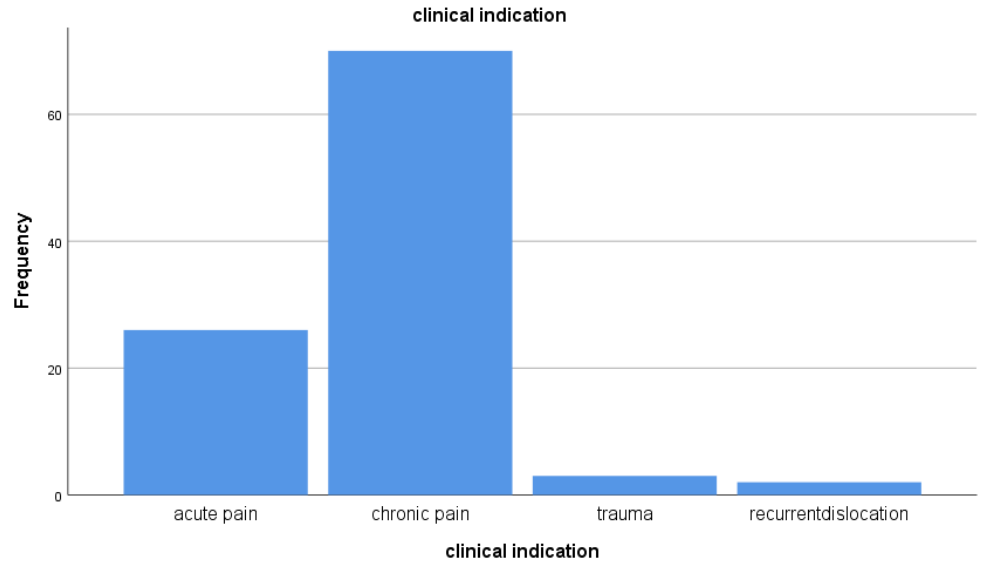
5. Result and Analysis

Overall a total of 101 patients were evaluated in this study. Of these 54 were male accounting for 53.5% and 47 were female accounting to 46.5% with male to female ratio of 1.15:1 .The mean age was 43.81 years with standard deviation of 12.45 and age range of 20-70 years. As to the clinical indication, the majority of the patients had chronic pain as a cause, accounting for 70 (69.2%) of all the indications and trauma and recurrent dislocations accounted for 3(3%) and 2(2%) each. MRI of the right shoulder was ordered in 68.2% of the patients while 32% was of the left.

Table1 :Sex distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	54	53.5	53.5	53.5
	female	47	46.5	46.5	100.0
	Total	101	100.0	100.0	

Figure 1: Clinical indication



5.1. Type of lesions seen on MRI

Among 101 patients included in the study, the various pathologies detected on MRI are tabulated in Table 2.

Table 2: Frequency of shoulder pathologies

Pathologies of shoulder joint	Number of patients (%)
Rotator cuff pathology	68 (67.3%)
Degenerative osteoarthritis	45 (44.6)
Labral pathology	30(29.7%)
Glenohumeral joint abnormalities	7 (6.9%)
Trauma	5(4.9%)
Infection	2(1.9%)

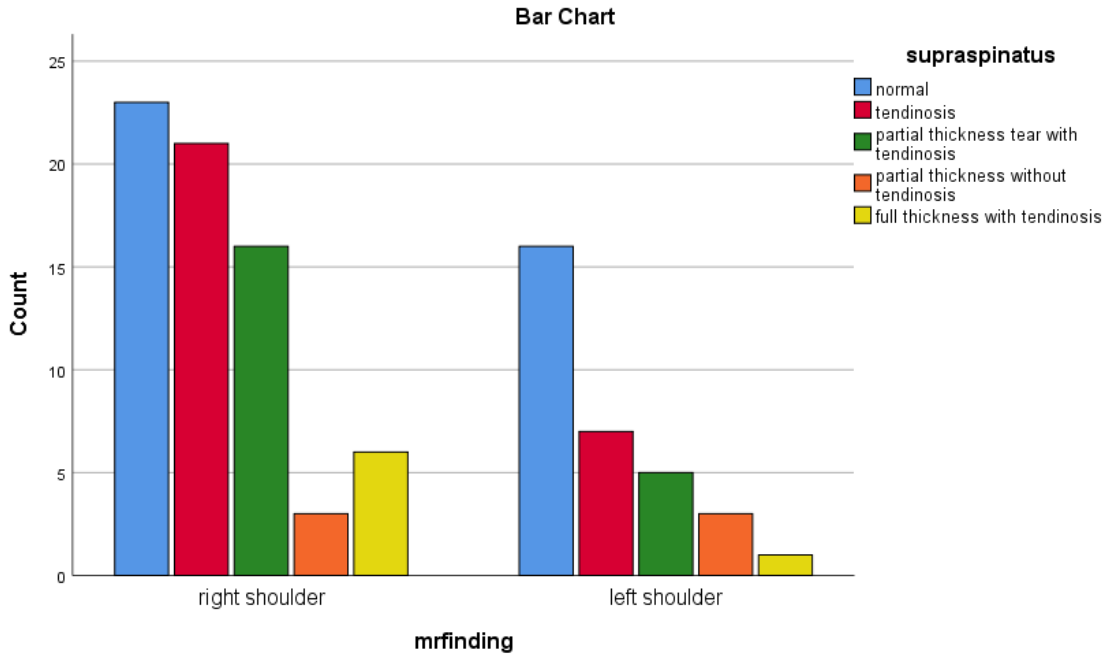
Rotator cuff disease was found to be the most common glenohumeral joint pathology for which MR was done and infection was the least. There was involvement of multiple tendons in case of rotator cuff pathology [Table 3]. In patients with single tendon involvement; supraspinatus tendon was the most common tendon involved. Involvement of other tendons along with supraspinatus tendon varies but doesn't show significant difference. Involvement of all three rotator cuff tendons including the long head of the biceps were seen in 19(18.8%) of the cases.

Table 3: Involvement of multiple tendons

Tendon involved	Number of patients (%)
Supraspinatus	29
Supraspinatus, subscapularis and biceps (long head)	15
Supraspinatus and infraspinatus	14
Supraspinatus ,Infraspinatus ,subscapularis	4
Subscapularis and biceps	2

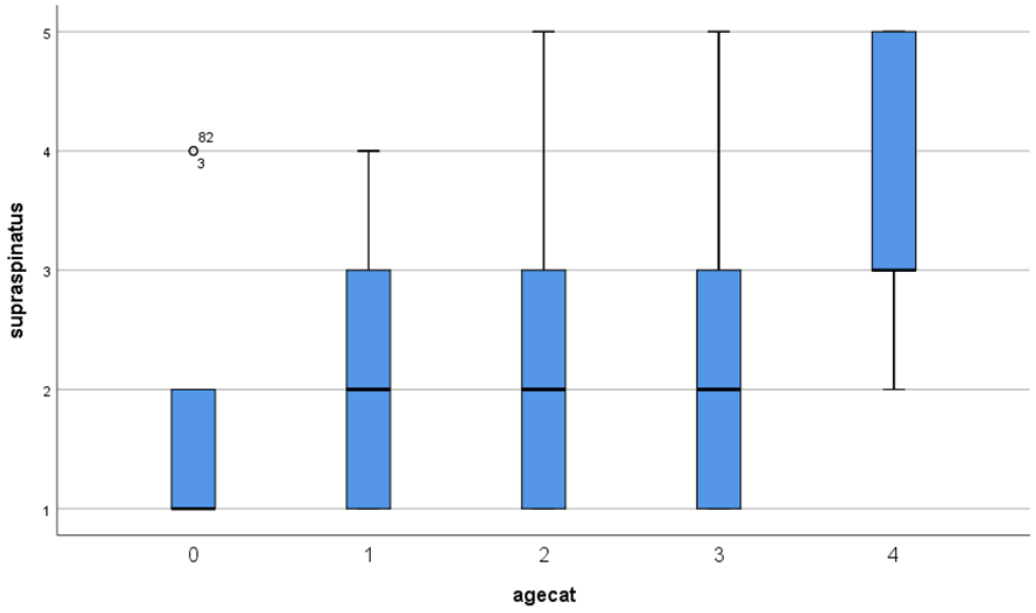
In this study, involvement of supraspinatus tendon was 64.3% in all the pathologies. Of the 101 patients diagnosed with supraspinatus pathology tendinosis 28 (27.7%) and partial tear with tendinosis accounted for 21(20.8%) of the cases. Full thickness tear was seen in 7(6.9%) of the cases. The distribution among the right and left shoulder along with the frequency of the pathology is seen in figure 2.

Figure 2: Supraspinatus tendon pathology distribution.



And when it comes to the age distribution of the different pathologies of the supraspinatus, the mean age at which most of the rotator cuff pathologies were seen were in the age group 61-70 and in the age group of 20-30 no rotator cuff abnormality was detected. [Figure 3]

Figure 3: Distribution of supraspinatus pathology with age.

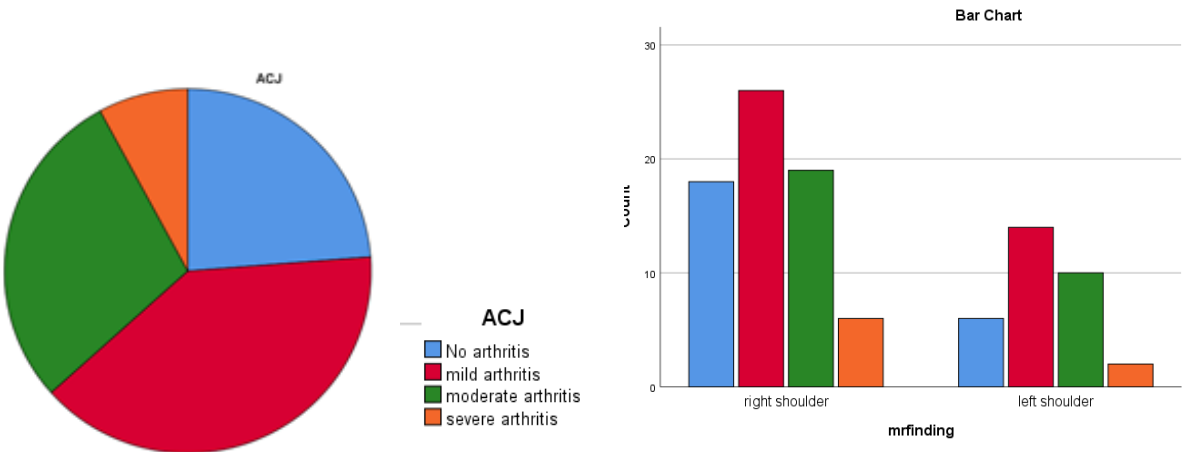


ACJ (acromioclavicular joint)

Osteoarthritis of the acromioclavicular joint is a common occurrence in this study accounting for 77 (76.2%) of the cases. [Table 4]

Table 4: ACJ pathology distribution

	Frequency	Percent	Valid Percent	Cumulative Percent
No arthritis	24	23.8	23.8	23.8
mild arthritis	40	39.6	39.6	63.4
moderate arthritis	29	28.7	28.7	92.1
severe arthritis	8	7.9	7.9	100.0
Total	101	100.0	100.0	



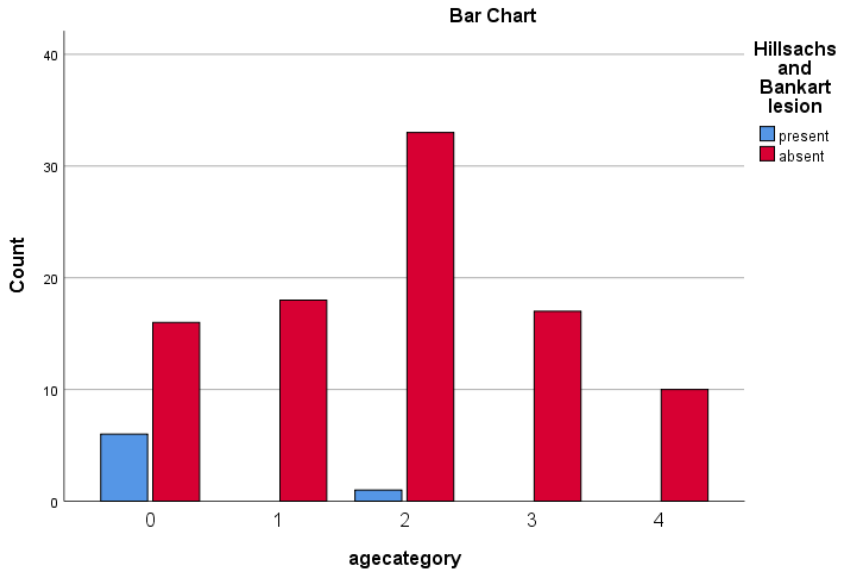
Most of the patients with ACJ arthritis had supraspinatus pathology. The patients having moderate ACJ arthritis show a higher rate of partial thickness tear with tendinosis of supraspinatus tendon as compared to those who had mild or no ACJ arthritis (P <0.001). They were also associated with a higher frequency of mild to moderate sub acromial bursitis. Other bone pathologies that are seen include; fractures, osteoarthritis of the glenohumeral joint, defects in the posterolateral humeral head (Hill-sachs defect) and infections [Table 5].

Table 5: Bony changes

Bony change	Number of patients in %
Osteoarthritis of acromioclavicular joint	76.2
Osteoarthritis of glenohumeral joint	44.5
Defect on posterolateral aspect of Humerus –Hillsachs	6.9
Fracture	4.9
Osteomyelitis	1.2

The Hill-sachs and Bankart lesions each accounting for 6.9%, were associated with trauma and were more common in the younger age group of less than 45.

Figure 5: Hill-sachs and Bankart lesion distribution with age.



Joint effusion and sub acromial sub deltoid bursitis were seen in 15 (14.9%) and 34(33.6%) respectively.

In this study labral pathologies were seen in 29.7% of the cases and adhesive capsulitis was seen in 10.8% of the cases.

Figure 6: Supraspinatus tendinosis

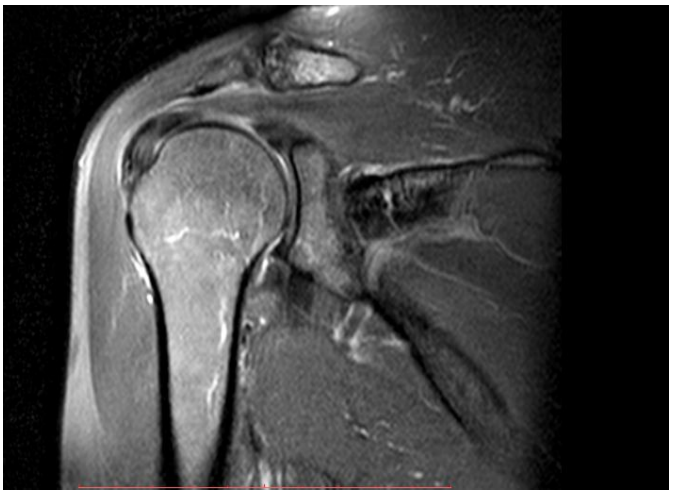


Figure 7: Calcific tendinitis of the infraspinatus with tendinosis of the supraspinatus and ACJ arthritis

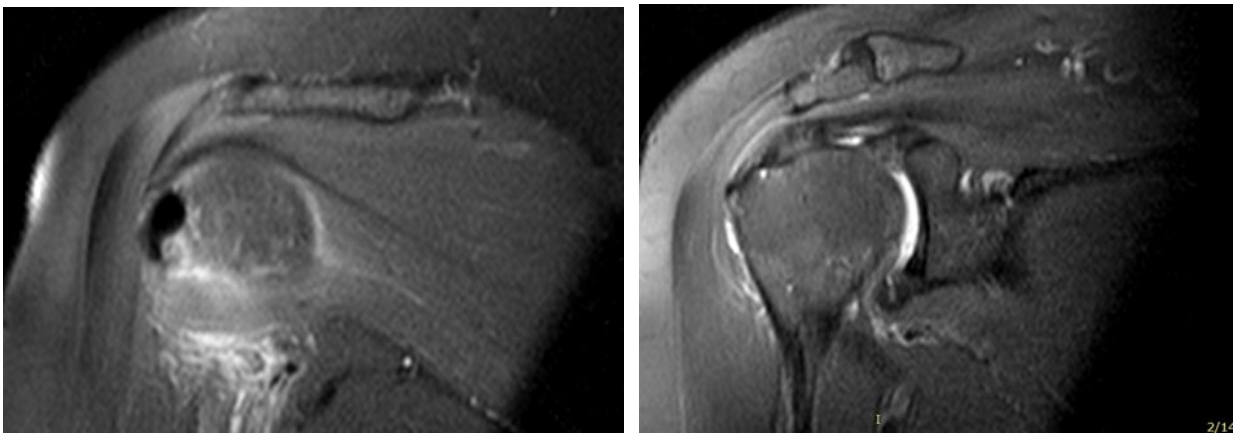


Figure 8: Hill –Sachs lesion with bone edema

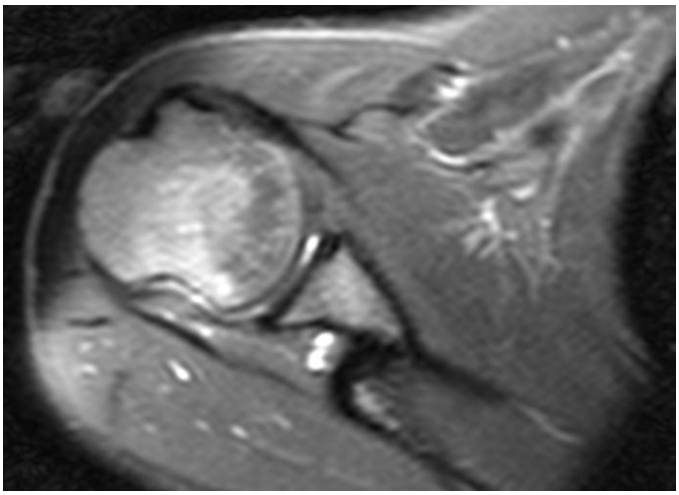


Figure 9: Bankart lesion

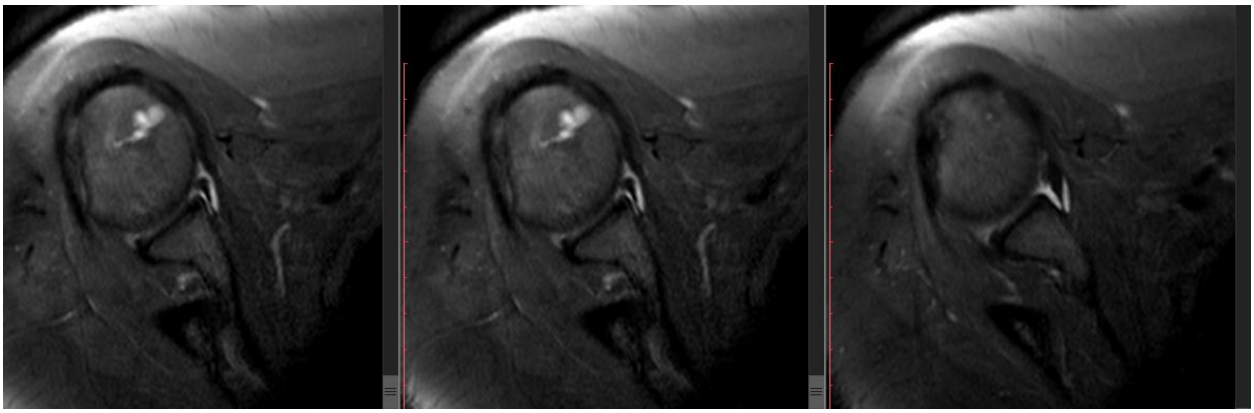


Figure 10: Biceps dislocation with tear and subscapular tendinosis

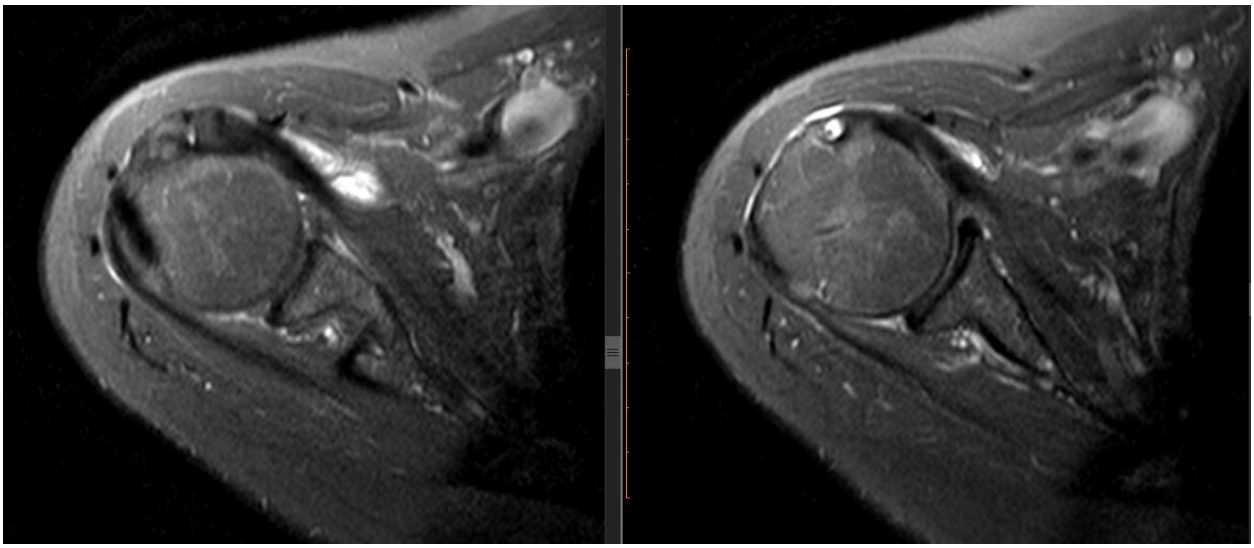


Figure 11: Adhesive capsulitis

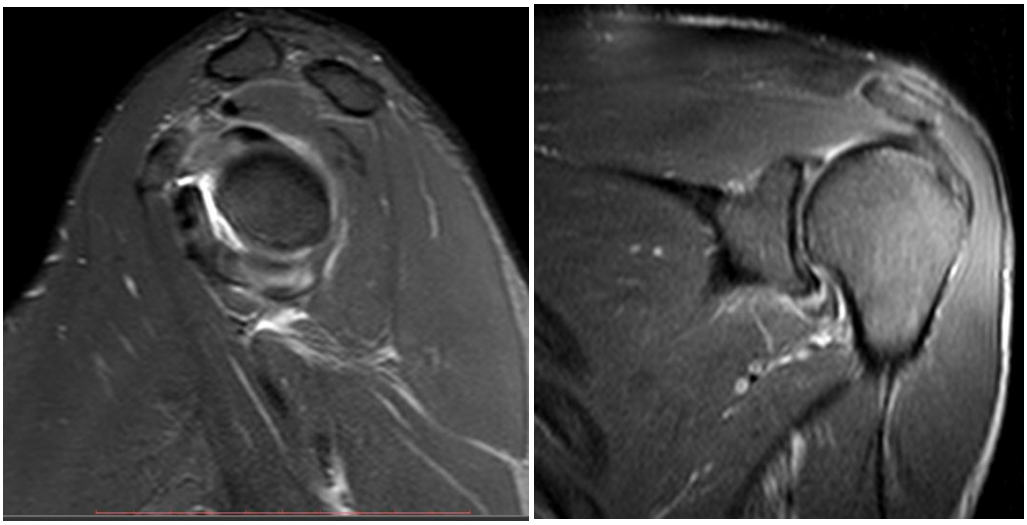
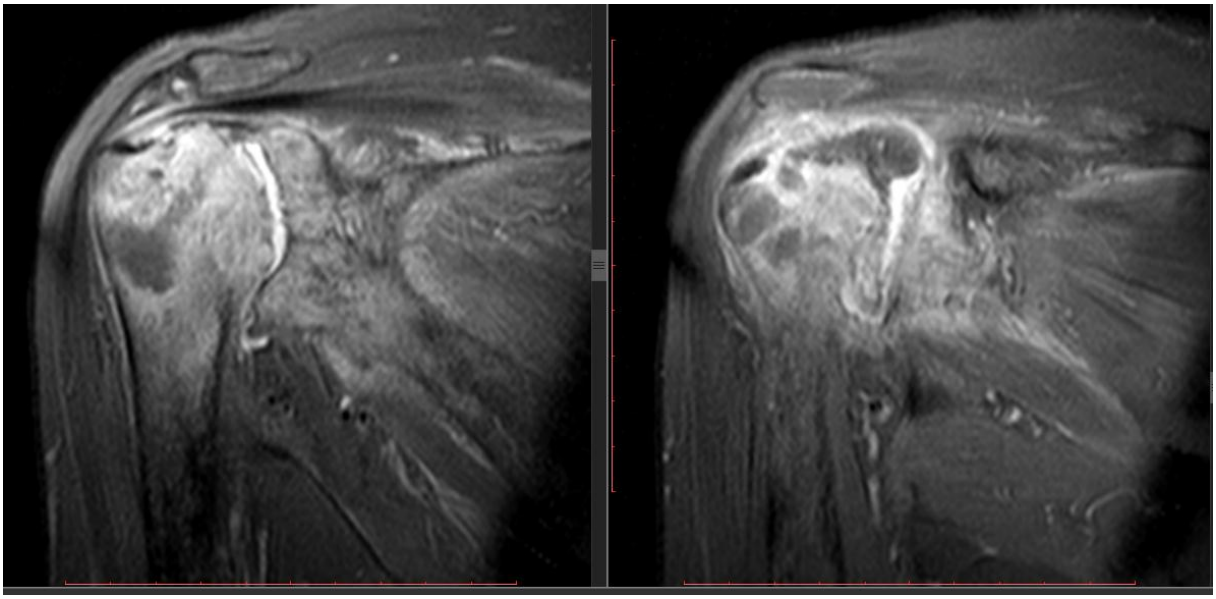


Figure 12: TB arthritis of the glenohumeral joint



6. Discussion

Shoulder pain is a common cause of musculoskeletal pain[1].Though general population based studies are lacking in Ethiopia ,in studies done on particular groups including teachers and sewing machine workers the prevalence of self-reported shoulder pain goes up to as high as 45 to 57% [2,3]. Currently MRI is the main imaging modality used in the evaluation of soft tissues of the shoulder [13]. This study was undertaken to study the common shoulder disorders in patients reporting to St Paul's Hospital Millennium Medical College radiology department for imaging.

In this study the commonest indication for MRI was chronic shoulder pain (69.2%). The mean age was 43.81 years, and of the total of 101 patients seen 54 were male accounting for 53.5% and 47 were female accounting to 46.5% with male to female ratio of 1.15:1.Most of the patient in the age group of 20 to 30 presented with acute pain while those greater than 40 years of age presented with chronic pain ($P<0.001$). In a similar study done in India [9] the mean age for shoulder pathologies was found to be 46.6 and male to female ratio 1.27:1.A mean age of 48years with a male to female ratio of 1.18:1 was reported in a study done in Kenya [15].Though these results are similar pertaining to age as well as gender, the gender distributions are contrary to what have been reported so far. In general there has been a higher prevalence of shoulder pain among females [22].The cause of this discrepancy needs further study and in addition correlation studies of shoulder pain with occupation are recommended so as to address this issue.

The commonest pathology was tendinosis (67.3%), which is documented in other studies as well, followed by degenerative changes of the acromioclavicular joint (44.3%).Tendinosis accounted for 27.7% of all the supraspinatus pathology. The supraspinatus tendon accounted for 67% of all the pathologies documented in the rotator cuff making it the most common single tendon involved in rotator cuff pathology. These results are similar to those done in India [9] in which the supraspinatus accounted for 74% of all pathologies. Of the 41 patients diagnosed with supraspinatus tear, partial tear was seen in 34 (82.9%) and complete tear was seen in 7 (17%), thus partial supraspinatus tear is more common than complete tear. These findings are similar with those studies done in Kenya in which it was reported that, of the tears involving the supraspinatus 70 % of them were partial and 29.4%were complete.

In this study infraspinatus tear was seen in 5.9% and subscapularis tear was seen in 1.9% and biceps partial thickness and full thickness tears were seen in 4.9% of cases in total. These findings correlate well with other studies but as to correlation with trauma as cause of complete tears and concerning the specificity and sensitivity of MR in picking up both partial thickness and full thickness tears further studies are very much recommended.

Osteoarthritis was a common finding in this study making it the second most common pathology detected in the glenohumeral joint. Many of the patients with ACJ arthritis had associated supraspinatus pathology and sub acromial bursitis. These findings are concordant with other studies indicating it as one of the causes of rotator cuff injury [9, 23].These findings correlate well with other studies.

As to Bankart and Hill-sachs lesion, a total of 6.9% of cases were seen and most of them were found in young patients of less than 40 years of age and in one of the patients it was associated with recurrent dislocation. In the Kenyan study all the different variants of Bankart lesions accounted for 9.2%. Labral tears accounted for 29.7% of the cases with SLAP tears accounting for 13.9% .Adhesive capsulitis was found in 10 patients accounting for 10.9% of all cases. This finding when compared to similar studies done in India on prevalence of shoulder pathologies in tertiary hospital settings showed a significant discrepancy. In that study adhesive capsulitis accounted for 43.1% of the cases [12]. There were also limitations and discrepancy in the diagnosis of labral tears. This may be attributed to the fact that none of the images were post contrast arthrography studies. Lack of experience in MSK imaging evaluation may also have contributed to these differences. Therefore training as well as additional correlation study with surgery and arthroscopic findings is recommended for the proper diagnosis of such shoulder and labral pathologies.

Finally of the 101 cases 16 (15.8%) were reported normal. When compared to the Kenyan study in which there was only one normal study accounting for (1.3%) this finding is significant. Though MR demonstrates a high validity in the diagnosis of shoulder rotator cuff pathologies its accessibility is limited by cost and availability. In resource limited areas such as ours, proper usage is highly recommended. Thus reduction of unnecessary MR imaging by having an imaging protocol guideline for patients presenting with shoulder pain is highly recommended.

7. Conclusion: This is the first report on the MR imaging pattern of shoulder pain disorders reporting to a tertiary care center.

- As seen in this study since rotator cuff pathologies are the commonest findings with those patients presenting with shoulder pain, it makes MRI the imaging modality of choice in the assessment of such patients.
- Tendinosis was the common finding and supraspinatus was the commonest tendon where pathologies were found. The commonest age group where supraspinatus tear was most frequent was in the age group between ages 60 to 70 years. Partial thickness tears were more common than complete tears of the supraspinatus tendon. Degenerative AC joint arthritis was also a common finding. Moderate to severe arthritis of the ACJ was strongly associated with supraspinatus tendon pathology.
- There were only two cases of infection in this study making infection the least common diagnosis in patients coming for MR evaluation of the shoulder.
- Hill-sachs and Bankart lesions were common in the young (<45years of age) and associated with trauma and recurrent dislocations.
- In 15.9% of cases the MR was normal.

8. Recommendations:

- Further prevalence and correlation studies especially correlations with surgical and arthroscopic findings of some of the mentioned shoulder pathologies are recommended.
- In addition detailed analysis of each pathology and looking for possible cause as well as searching for the demographic pattern of each disease is highly recommended.
- Comparative studies with other imaging modalities including ultrasound and x-ray findings are recommended.
- Further trainings, updates and seminars on the evaluation of shoulder pathologies especially pertaining to labral pathologies are highly recommended.
- Clear shoulder MR imaging protocols including arthrography studies for patients presenting with shoulder pain is highly recommended to ensure the important role MR plays in the diagnostic and therapeutic management of patients with shoulder disease.

9. Limitations of the study

- Many of the major constraints were concerns of time, lack of availability of data especially of x-rays or ultrasound studies.
- Since the study design is a retrospective cross sectional descriptive study it does not show causal relationship.
- Scope wise, the study was limited to only one hospital due to the lack of availability of MRI in TASH and other teaching hospitals, which may have affected the representativeness of the sampling.
- The limited experience in the field of MSK radiology may have affected the interpretation of some of the images and thus the results.
- The other limitation lies in the fact that the research topic encompasses and tries to address lots of issues all at the same time. This limits the studies' specificity in addressing one particular issue meticulously, thus may decrease its reproducibility.

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.

MR sequence, coil (mention if only different coil is used)

X-ray /Ultrasound done: finding

Annex; 1

Questionnaire

1. Age 2.Sex

3. Shoulder x –ray study done a. yes b. No

4. If the answer for 2 is yes what is the finding a. Normal b. abnormal c. any specific finding please state.

5. Reason for doing MRI /clinical indication a. Acute pain b. chronic pain c. trauma d. recurrent dislocation e. others

6. MRI finding a. right shoulder b. left shoulder

6.1**. ACJ** a. No arthritis b. Mild arthritis c. Moderate arthritis d. severe arthritis.

e. Os acromiale.

6.2**. Subacromial bursitis**

a. None b. Mild c. Moderate

6.3**. Supraspinatus**

a. Normal/Equivocal b. Tendinosis c. Partial thickness tears with tendinosis d.partial thickness tears without tendinosis d. Full thickness tear e. calcific tendinosis

6.4. **Infraspinatus**

a. Normal/Equivocal b. Tendinosis c. Partial thickness tear tendinosis d. partial thickness tears without tendinosis d. calcific tendinosis

6.5**. Subscapularis**

a. Normal/equivocal b. Tendinosis c. Partial thickness tears with tendinosis d. Partial thickness tears without tendinosis.

6.6**. Teres minor**

a. Normal/equivocal b. change in signal intensity (denervation)

6.7**. Long head of biceps**

a. Normal/equivocal b. Tendinosis c. Partial thickness tear with tendinosis d. partial thickness tear without tendinosis e. Full thickness tear f: Tenosynovitis.

6.8. **GHJ cartilage/arthritis**

a. Normal/equivocal b. Mild c .Moderate d. GHJ subchondral bone cyst

6.9**. Glenoid labrum**

a. Normal/equivocal b. Small tear c. Large tears

6.10**. Capsulitis** a. present b. absent

6.11**. Hill-sachs** a. present b .absent

6.12**. Bankart lesion** a. present b. absent

6.14**. Septic arthritis or any other infection**

7**. Fractures** a. yes b. no

8. If the answer to question number 8 is yes please specify