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SUDANESE UNIVERSITY OF SCIENCE AND TECHNOLOGY  
COLLEGE OF GRADUATE STUDIES



**STUDY OF SHOULDER JOINT PAIN USING MAGNATIC  
RESSONANCE IMAGING**

دراسة آلام الكتف باستخدام تقنية الرنين المغنطيسي

**THESIS REPORT SUBMITTED AS A PARTIAL FULFILLMENT OF  
THE REQUIREMENT OF MASTER DEGREE IN DIAGNOSTIC  
IMAGING TECHNOLOGY**

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## **DEDICATION**

THIS RESEARCH IS DEDICATED TO MY BELOVED FATHER (SOUL), TO MY MOTHER THE ORIGIN OF MY SUCCESS. I ALSO DEDICATE THIS WORK TO MY SISTERS & BROTHERS. LAST BUT NOT LEAST I AM DEDICATING THIS TO MY HUSBAND WHO INSPIRED ME ALL THE TIME AND TO MY BELOVED DAUGHTER. I ALSO DEDICATE THIS DISSERTATION TO MY FRIENDS WHO HAVE SUPPORTED ME THROUGHOUT THE PROCESS. I WILL ALWAYS APPRECIATE ALL WHAT THEY HAVE DONE FOR HELPING ME TO DEVELOP MY TECHNOLOGY SKILLS, THE MANY HOURS OF PROOFREADING, AND HELPING ME TO MASTER THE LEADER DOTS .THANK YOU. MY LOVE FOR YOU ALL CAN NEVER BE QUANTIFIED. ALLAH BLESSES YOU.

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*Firstly I thank Allah for his help to finish this work successfully. I would like to express my deepest thanks to my Supervisor **Dr. Mona Ahmed Mohamed** for her guidance. Also great thanks for all people who help me to finish this work*

## ABSTRACT

This was a descriptive and analytic study ,the main objective of this study was to study shoulder joint pain using magnetic resonance imaging.

The study was conduct at Alamal Daignostic center in Khartoum state which equipped by high quality machine Philips 1.5 tesla closed machine.

A total of 50 patients (29 male,21 female) aged from (20 years to 70 years) weight between (60 kg to 99 kg ), all those complaining of persistent shoulder pain most of them were under gone routine plain shoulder .

Study has come out with many result including that the shoulder joint pain is more in male (58% )than female(42%),52% of patients show evidence of rotator cuff tear ,the most effected age group above 50 (50-60),explaining that elder population are susceptible to rotator cuff tear ,and the shoulder joint pain also increase with weight (38%) 80-99kg.

As conclude to this study the magnatic resonance imaging is high quality diagnostic of soft tissue ,muscle,tendon and ligament of shoulder joint . And recommended the exam done by well trained technologist who is familiar with scan protocols to give full diagnosable image.

## مستخلص البحث

أجريت هذه الدراسة بمركز الامل التشخيصي بالخرطوم حيث يوجد به جهاز رنين مغناطيسي نو كفاءه عاليه 1.5 تسلا. تهدف هذه الدراسة لدراسة الام الكتف باستخدام تقنيه الرنين المغناطيسي. اجريت هذه الدراسة علي 50 مريض يعانون من الام الكتف وكانت اعمارهم ما بين 20-70 وأوزانهم بين 60-99 كجم واجريت لهم فحوصات اشعه روتينيه سابقه.كانت نتائج هذه الدراسة مطابقه للدراسات السابقه، حيث أوضحت هذه الدراسة أن الذكور أكثر عرضه من الإناث وأوضحت فحوصات الرنين المغناطيسي ان 52%(26)من الحالات يعانون من تمزق في اربطه عضلات الكتف التي لم تكن واضحه في الاشعه الروتينييه السابقه. كما أوضحت ان المرضي ذوي الاعمار الكبيره الذين كان عددهم 10(20%) . والمرضي الذين يعانون من الوزن الزائد (80-90)الذين عددهم 19 (38%) معرضون اكثر من غيرهم لالام الكتف المزمن. وتوصلت هذه الدراسة ان فحوصات الرنين المغناطيسي ذات دقه عاليه لتوضح التمزق في العضلات والاربطه والانسجه المحيطه بالكتف . ووصت بأن الفحوصات يجب أن تتم علي أيدي تقنيين مدربين وذو خبره ليعطوا صوره شامله تساعد علي التشخيص.

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## **LIST OF ABBREVIATIONS AND SYMBOLS USED**

### **Symbols**

<b>CT</b>	<b>Computed Tomography</b>
<b>C3</b>	<b>Third cervical nerve segment</b>
<b>C4</b>	<b>Fourth cervical nerve segment</b>
<b>C5</b>	<b>Fifth cervical nerve segment</b>
<b>C6</b>	<b>Sixth cervical nerve segment</b>
<b>FOV</b>	<b>Field of View</b>
<b>FSE</b>	<b>Fast Spin Echo</b>
<b>GT</b>	<b>Greater tuberosity</b>
<b>LHB</b>	<b>Long Head of Biceps</b>
<b>PD</b>	<b>Proton Density</b>
<b>GRE</b>	<b>Gradient Echo</b>
<b>MRI</b>	<b>Magnetic resonance imaging</b>
<b>STIR</b>	<b>Short Inversion Recovery</b>
<b>SE</b>	<b>Spin Echo</b>
<b>TI</b>	<b>Inversion time</b>

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# CHAPTER ONE

## INTRODUCTION

### **1.1 Introduction:**

The human shoulder is made up of three bones: the clavicle (collarbone), the scapula (shoulder blade), and the humerus (upper arm bone) as well as associated muscles, ligaments and tendons. The articulations between the bones of the shoulder make up the shoulder joints. The major joint of the shoulder is the glen humeral joint, which "shoulder joint" generally refers to. In human anatomy, the shoulder joint comprises the part of the body where the humerus attaches to the scapula, the head sitting in the glenoid fossa. The shoulder is the group of structures in the region of the joint. (Laughlin et al, 2009).

Shoulder joint is a most movable joint in the body therefore being unstable because the humeral ball is larger than scapular socket that hold it, to remain in its stable position the shoulder must be anchored by muscle, tendons and ligament, because the shoulder can be unstable it is a common site of many problems, including strain, rotator cuff tear, dislocation tendonitis, frozen shoulder, degenerative disease. (Laughlin et al, 2009).

Magnetic resonance imaging (MRI), or nuclear magnetic resonance imaging (NMRI), is primarily a medical imaging technique most commonly used in radiology to visualize the internal structure and function of the body. (Brown, 1998).The best diagnostic method of shoulder pain is a magnetic resonance imaging. The most common indications for shoulder MRI are suspected rotator cuff tear, shoulder instability, osteonecrosis, neoplasm and infection.(Mark, 1998).

## **1.2 Problem Of The Study:**

Increasing of shoulder complains &the limitation of radiological finding of the causes of the pain which delayed the management of treatment.

## **1.3 Objectives:**

### **1.3.1 General Objective:**

- ❖ To study of shoulder joint pain using (MRI)

### **1.3.2 Specific Objective:**

- ❖ To assess the tendon- joint space.
- ❖ To detect common pathological condition of shoulder joint
- ❖ To detect the main underline causes of MRI finding.
- ❖ To correlate between shoulder pain, patient age, patient weight.

## **1.4 Significance of the Study:**

This study explain the role of the magnetic resonance imaging in shoulder joint pain and help in good diagnosis of any shoulder abnormalities.

## **1.5 Overview of the Study:**

This study consisted of five chapters, chapter one is introduction and problem of the study and objective and significance of the study and overview of the study. Chapter two includes literature review and previous studies. Chapter three includes material and methodology. Chapter four includes data collection, results and analysis Chapter five includes conclusion and recommendation.

## **CHAPTER TWO**

### **LITERATURE REVIEW AND THEORETICAL BACKGROUND**

#### **2.1 Theoretical background:**

##### **2.1.1 Anatomy of Shoulder:**

Shoulder girdle is composed of two main components on either side, the scapula posteriorly and the clavicle anteriorly, it is an incomplete ring, open in the back between the two scapulae and complete in the front as clavicles are connected to the sternum in the midline, the main purpose of this girdle is to maintain support to upper extremities, and provide attachment for muscles. (Snell, 1992).

##### **2.1.1.1 Bony structure of the shoulder:**

###### **2.1.1.1.1 Scapula:**

This bone has three prominent features, spine, acromion and coracoid processes. The spine is on the posterior aspect running obliquely across the scapula. The acromion process forms the tip of the shoulder, and articulates with the clavicle at the acromioclavicular joint, providing attachment for several muscles of the arm and chest. The coracoid process, which curves forward and downward below the clavicle, provides also attachment for arm and chest muscles. Between these two processes, the acromion and coracoid is a glenoid cavity, a hollow depression which articulates with the humeral head to form a ball and socket glenohumeral joint (Richard, 1992)

###### **2.1.1.1.2 Humerus:**

A longest bone of the upper limb having an expanded upper end, shaft and lower end, we shall describe the description of the upper end. This consists of the convex articular surface, the anatomical neck and two tubercles, greater and lesser tubercles. The head has an area 3 times more than

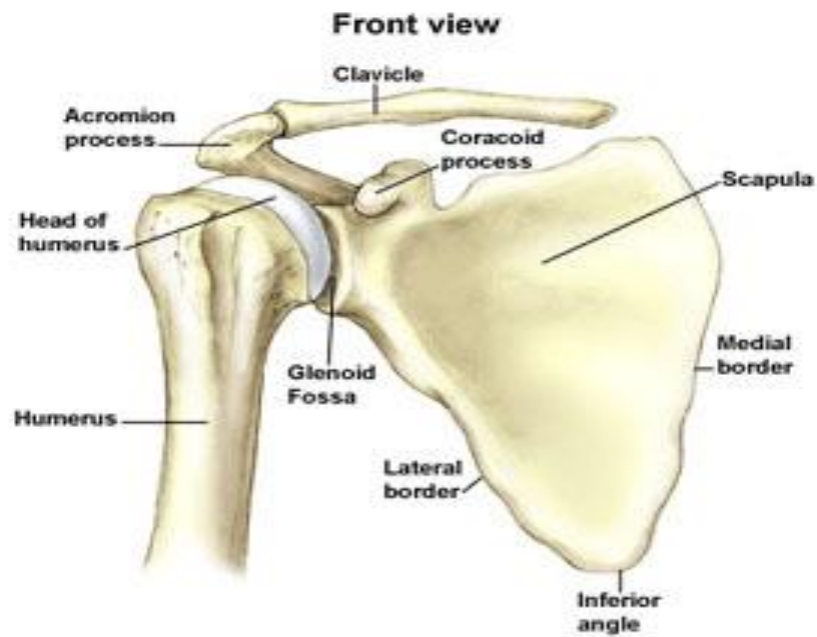


glenoid cavity, the tubercles are separated by biceptal groove, and this groove averages 4.3 mm in depth. Grooves which has less than 3mm depth are considerable shallow and has a high risk of long head of Biceps (LHB) dislocation or subluxation, the medial aspect of the groove which forms lesser tubercle is lower than lateral aspect of the groove resulting in higher incidence of medial subluxation of long head of Biceps (LHB) than lateral . (Snell, 1992).

### **2.1.1.3 Clavicle:**

This bone courses almost horizontally across either chest sides, from the neck base to the shoulder, medially it articulates with sternum at the level of manubrium, and laterally it articulate with process of the scapula to form acromioclavicular joint, clavicle provide stability for scapula, and serves for attachment for several arm, chest and back muscle (Snell ,1992) .

Shoulder joint is protected superiorly by the two processes of the scapula, acromion and coracoids, and hold together by various muscles and tendon fibers. A loose capsule completely encircles the shoulder joint and attached around the circumference of glenoid cavity and anatomical neck of humerus this capsule is surrounded by several muscles and tendons which reinforce the joint and keep the humeral head and scapular in close proximity (Snell, 1992).



**Figure 2.1** Normal Bone Anatomy of Shoulder Joint(Lippert,2011)

### **2.1.1.2 Soft Tissue of Shoulder Joint:**

#### **2.1.1.2.1 The Deep Fascia:**

The deep fascia covers the deltoid and sends a numerous septa between fascicule. In front, it is continuous with pectorals fascia, behind, where it is thick and strong with fascia infraspinatus, above, it is attached to the clavicle, 6 the acromion, and the crest of the scapular spine, below with brachial fascia. (Standing, 2006).

#### **2.1.1.2.2 The Deltoid muscle:**

Is a thick triangular muscle which covers the shoulder joint, it arises from the anterior border and upper surface of lateral third of the clavicle, from the lateral margin and upper surface of acromion, and from the lower lip of scapular spine. The fibers converge towards their insertion, the middle fibers passing vertically, the anterior inclining backwards, and the posterior fibers forward, these thin groups of fibers unites in a thick tendon which inserted into the deltoid tuberosity on the lateral side

of the humeral shaft. This muscle is remarkably coarse in texture, the part arising from acromion consist of oblique fibers. (Standing, 2006).

The bulk of the muscle spread out over the projection formed by the greater tuberosity, accounts for the rounded contour of normal shoulder, and its limits can be determined accurately through the skin, if the arm is maintain in a true abduction against gravity. (Standing, 2006).

#### **2.1.1.2.3 SubscapularisMuscle:**

Is a large triangular muscle which fills the sub scapular fossa and arises from its medial two thirds, the fibers pass laterally and gradually converging, end in a tendon which inserts into the lesser tuberosity, some of these fibers continues crossing bicipital groove forming transverse ligament. anteriorly: posterior wall of the axilla, posterior, scapula and capsule of shoulder joint, lower border, teres major and latissimusdorsi.( Standing,2006).

#### **2.1.1.2.4: Supraspinatus muscle:**

The supraspinatus muscle occupies supraspinatus fossa arising from its medial two thirds and supraspinatus fascia the muscle fibers pass under the acromion and converge to a tendon which crosses the upper part of shoulder 7 joint and inserted into the highest of the three impressions of the greater tubercle G.T of humerus. (Standing, 2006)

#### **2.1.1.2.5InfraspinatusMuscle:**

It is a thick triangular muscle, which occupies the chief part of supraspinatus fossa. This muscle arises from the two medial third of infraspinatus fossa and deep fascia of infraspinatus. A bursa lies between the bare area of scapula and the muscle, sometimes it communicates to the shoulder joint, the tendons of this muscle insert into the smooth area on the central facet of greater tuberosity between supraspinatus above and teres minor below. (Standing, 2006)

#### **2.1.1.2.6 Teres Minor Muscle:**

Is a narrow elongated muscle, this muscle arises from the dorsal surface of auxiliary border of the scapula, passing upwards and laterally with lower border of infraspinatus and behind the long head of triceps, its tendons attached to the lowest facet on the greater tuberosity G.T. (Standing,2006).

#### **2.1.1.2.7 Teres Major:**

Is a thick, somewhat flattened muscle, arises from the dorsal surface of inferior angle of the scapula, and inserted into the medial lip of the intertubercular sulcus of the humerus. (Standing, 2006).

#### **2.1.1.2.8 Biceps Brachialis Muscle:**

Is a long, bursiform muscle placed on the front of the arm, it has two heads, the short head arises by a thick flattened tendon from the apex of the coracoid process with coracobrachialis, the long head takes origin within the fibrous capsule of shoulder joint at the apex of glenoid cavity and continues with glenoid labrum and unsheathed by a synovial membrane arches over the humeral head, passing behind transverse humeral ligament, descending in the intertubercular sulcus. (Standing 2006).

Relation: Overlapped by pectoralis major and deltoid muscles, but in the rest it is superficial, being covered only by fasciae, and skin, below it is on the brachial, and its medial border related to coracobrachialis, its lateral border is in relation with deltoid and brachioradialis. (Standing ,2006).

#### **2.1.1.2.9: The Pectoralis Major Muscles:**

Is a broad triangular muscle which covers the front of the upper part of the chest, it arises from the anterior surface of the sternum and from the costal cartilage of the 2nd to 6th ribs. It is inserted into the lateral lip of the intertubercular sulcus of the humerus. (Dean et al, 1987).

#### **2.1.1.2.10: The pectoralis minor muscles:**

Is a small muscle which lies deep to the pectoralis major. It arises from the 2nd, 3rd and 4th ribs and is inserted into the coracoid process of scapula. (Dean et al, 1987).

#### **2.1.2 Physiology:**

The ability of human to move is predicated on specific cells that have become highly differentiated, so that they function almost exclusively in contraction. There are three types of muscle, skeletal, smooth, and cardiac muscles. There are basic similarities among the three muscle types. They are all mesodermally derived and are elongated parallel to their axis of contraction, they possess numerous mitochondria to accommodate their high energy requirements, and all contain contractile elements known as myofibrils in form of actin and myosin, as well as additional contractile-associated proteins (Sukkar, 2000).

#### **2.1.2.1 Contraction of muscle:**

Contraction is defined as the active process of generating a mechanical force in muscle. The force exerted by contracting muscle on the object is known as muscle tension and the force exerted on muscle by a weight is known as load. To lift a load muscle tension must be greater than muscle load (William, 2003).

#### **2.1.2.2 Simple muscle twitch:**

The contraction to a single action potential is called simple muscle twitch. Following the stimulus, there is an interval of a few milliseconds, known as the latent period, before contraction begins. This is a time taken

for action potential to develop if muscle is stimulated through its nerve; the latent period is longer because of the time taken in transmission at neuromuscular junction (William, 2003).

### **2.1.2.3 Summation of contraction:**

A single twitch is of no mechanical value because its duration is very short. To produce sustained and coordinated muscle movements, single twitches' summate in two different ways. (Sukkar, 2000). Spatial summation: The muscle fibers, together with the motor neuron which innervate them, constitute a motor unit. In spatial summation, stimulation of numerous nerve fibers causes an increasing number of motor units to excite. The response of single motor units are therefore added together to produce a strong contraction by the muscle. (Sukkar, 2000).

Temporal summation: When frequency summation rises above 10/s the second stimulus contraction develops before the first one is over. As frequency increases, the degree of the summation becomes greater producing stronger contraction every time in stepwise fashion. When muscle is stimulated at a progressively greater rate, a frequency is reached at which contractions fuse together and cannot be distinguished. This is called tetanization and contraction is a tetanic contraction, which is smooth and maintained. Most contractions of muscles in everyday life are of this nature.

They allow useful work to be done (Sukkar, 2000).

### **2.1.2.4 The events in muscle contraction:**

Acetylcholine released by the motor nerve at the neuromuscular junction leads to formation of the EPP. In turn depolarizes the sarcolemma leading to formation of muscle action potential spreads to inside of the cell causing muscle contraction. Relaxation back into sacra

plasma reticulum, calcium is detached from troponin, troponin ceases pulling on tropomyosin resulting in muscle relaxation (William, 2003).

#### **2.1.2.5 The Deltoid muscle:**

Nerve supply: The deltoid muscle is supplied by axillary nerve C5 and C6. Actions: The muscle is capable of acting in parts or as a whole, the anterior fibers co-operates with pectoralis major in drawing the arm forward and medial rotation. The posterior fibers co-operates with latissimus dorsi and major in drawing the arm backwards and they act as lateral rotation for humerus, the middle part is stronger and most important part aided by supraspinatus, it raises the arm from the side (true abduction). (Standing, 2006).

#### **2.1.2.6 Subscapularis muscle:**

Nerve supply: supplied by upper and lower subscapular nerve arising from upper trunk of brachial plexus receiving fibers from C5 and C6 (Susan Standing, 2006).

#### **2.1.2.7 Supraspinatus muscle:**

Nerve supply: supraspinatus is supplied by suprascapular nerve which receives fibers from C4, 5 and 6 (Standing, 2006).

#### **2.1.2.8 Infraspinatus muscle:**

Action: bracing the head of the humerus to glenoid cavity, giving stability to the joint, the muscle has also a powerful lateral rotation of the humerus (standing, 2006).

#### **2.1.2.9 Teres minor muscle:**

Nerve supply: by a branch from posterior branch of the axillary nerve C5 and C6. Action: it acts as dynamic stabilizer for the shoulder joint, lateral rotation and weak adductor of the humerus. (Standing, 2006).

#### **2.1.2.10 Biceps Brachialis muscle:**

Nerve supply: The biceps is supplied by the musculocutaneous nerve from the lateral cord of brachial plexus receiving fibers from C.5 and C.6. Action: Is a powerful supinator of the forearm, flexes the elbow joint, and to slight extent the shoulder joint. The long head exercises downward pressure on the upper end of the humerus, and so help to prevent the head of the bone from gliding upward under the influence of the deltoid. (Standing, 2006).

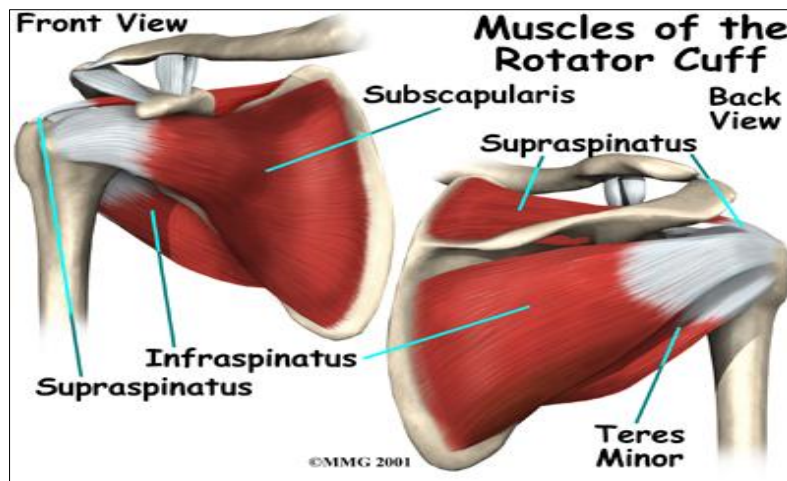
#### **2.1.2.11. Blood Supply:**

The subclavian artery arises from the brachiocephalic trunk on the right and directly from the aorta from the left. This becomes the axillary artery as it passes beyond the first rib. The axillary artery also supplies blood to the arm, and is one of the major sources of blood to the shoulder region. The other major sources are the transverse cervical artery and the suprascapular artery, both branches of the thyrocervical trunk which itself is a branch of the subclavian artery. (Bogart, Bruce (2007).

#### **2.1.2.12 Rotator Cuff:**

The supraspinatus, infraspinatus, teres minor, and subscapularis, the muscles and tendons of the rotator cuff form a sleeve around the anterior, superior, and posterior humeral head and glenoid cavity of the shoulder by compressing the glenohumeral joint. In addition to stabilization, the rotator cuff provides the shoulder with tremendous mobility. (Favard et al, 2007)





**Figure 2.2** The Rotator Cuff (Favard et al,2007)

## **2.1. PATHOLOGY:**

### **2.1.3.1 Shoulder Pain:**

The skin over shoulder and halfway down the lateral surface of the deltoid muscle is supplied by the supra scapular nerves (C3,C4) pain may be referred to the region as a result of inflammatory lesion involving the diaphragmatic pleura or peritoneum. The afferent stimuli reach the spinal cord via phrenic nerves (C3,C4) and C5 pleurisy, peritonitis. Sub-phrenic abscess or gallbladder disease may therefore be responsible for shoulder pain. ([www.physioroom.com/injuries/shoulder](http://www.physioroom.com/injuries/shoulder)).

### **2.1.3.2 Frozen Shoulder:**

Inflammation develops in the shoulder that causes movement in the pain and stiffness. As a frozen shoulder progresses shoulder can be severely limited. ([www.physioroom.com/injuries/shoulder](http://www.physioroom.com/injuries/shoulder)).

### **2.1.3.3 Osteoarthritis:**

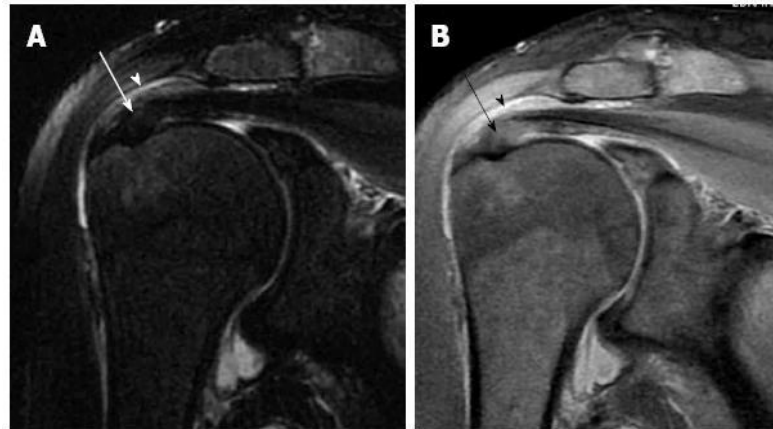
The common “wear and Tear” arthritis that occur with aging

### **2.1.3.4 Rotator cuff tears:**

Rotator cuff tear occurs in advanced cases of cuff tendinitis; the necrotic supraspinatus tendon can become calcified or ruptured. Rupture of tendon can seriously interfere with the normal abduction movement of shoulder joint. It will be remembered that the main function of the supraspinatus muscle is to hold the head of humerus in glenoid fossa a commencement of abduction. The patient with ruptured supraspinatus tendon is unable to initiate abduction of the arm. However if the arm is passively assisted for the first 15 of abduction, the deltoid can then take over and complete the movement to the right angle. (www.physioroom.com/injuries/shoulder).

#### **2.1.3.5 Shoulder Impingement:**

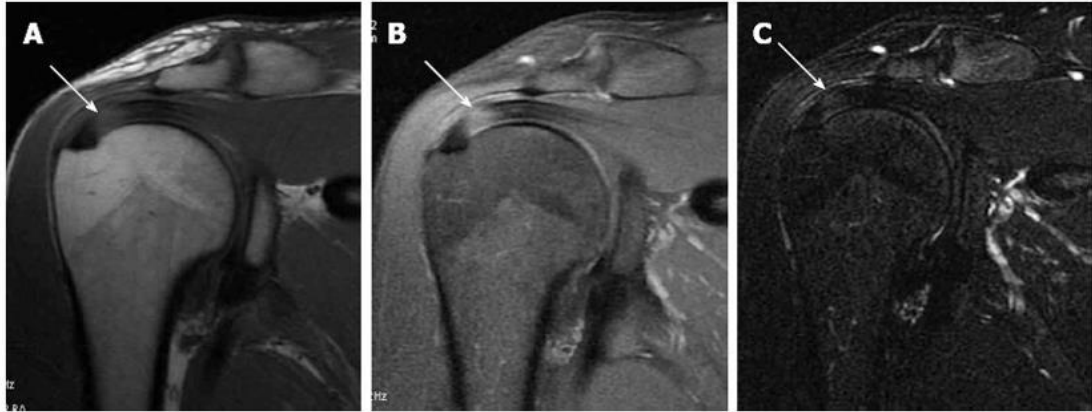
The acromion (edge of the scapula) presses on the rotator cuff as the arm is lifted. If inflammation or an injury in the rotator cuff is present, this impingement causes pain. (Giaroli et al, 2006)



**Figure 2.3** Sub-acromial impingement2. (Giaroli et al, 2006)

#### **2.1.3.6 Shoulders Tendinitis:**

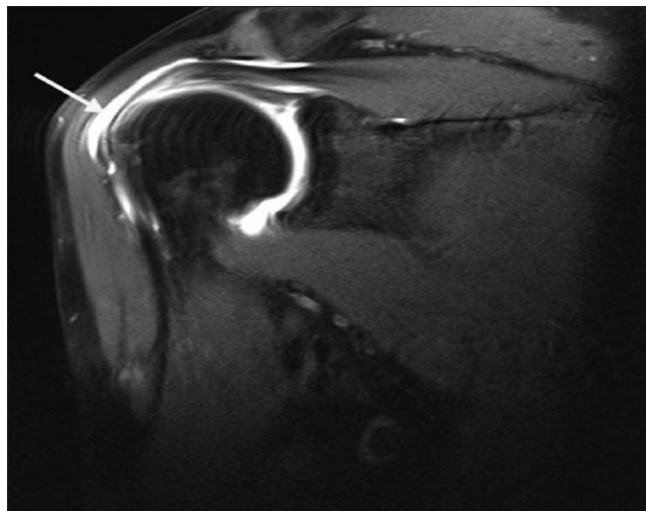
Inflammation of one of the tendons in the shoulders rotator cuff .(tawfik et al 2004)



**Figure 2.4**Shoulders Tendonitis(tawfik et al 2004)

#### **2.1.3.7 Shoulders Bursitis:**

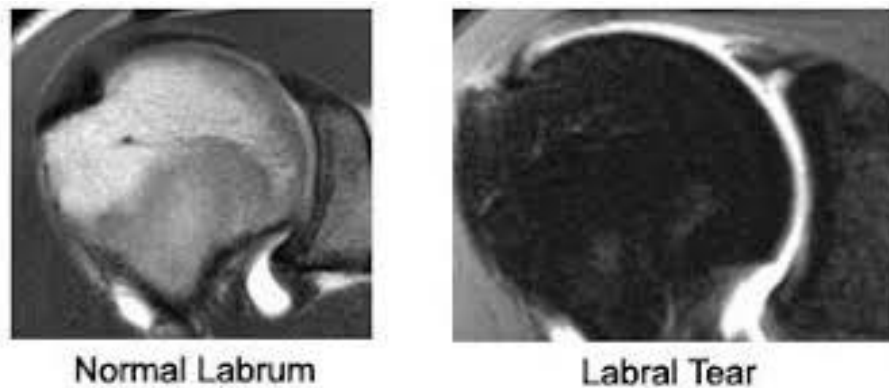
Inflammation of the bursa, the small sac of fluid that rests over the rotator cuff tendons, Pain with overhead activities or pressure on the upper, outer arm are symptoms. (Bureau et al.1996)



**Figure 2.5**Shoulders Bursitis(Bureau et al.1996)

#### **2.1.3.8 Labral Tear:**

An accident or overuse can cause a tear in the labrum, the cuff of cartilage that overlies the head of the humerus. Most labral tears heal without requiring surgery. (Dodson, 2009).



**Figure 2.6:** Normal Labrum and Labral Tear (Dodson, 2009)

#### **2.1.4 DIAGNOSTIC IMAGING MODALITIES:**

##### **2.1.4.1 Magnetic Resonance Imaging**

One of the advantages of MRI compared with other imaging modalities is the excellent soft tissue discrimination of the image (Catherine Westbrook, 2008).

##### **2.1.4.2 MRI Component:**

###### **2.1.4.2 .1 An MRI Scanner consists of:**

Large powerful magnet in which the patient lays a radio wave antenna is used to send signals to the body and receive signals back, computer to converted signals to images. (Catherine Westbrook, 2008).

##### **2.1.4.3 Parameters of Image Quality:-**

Contrast to noise ratio (CNR) , Spatial Resolution , Signal to noise ratio (SNR) ,Scan time (Catherine Westbrook,2008).

##### **2.1.4.4 Indication of MRI Shoulder:**

Evaluation of Shoulder pain ,Diagnose of impingement syndrome , Suspected rotator tear , Evaluation of recurrent dislocation (instability) ,Frozen shoulder syndrome. (Catherine Westbrook, 2008).

#### **2.1.4.5 MRI Equipment:**

Immobilization pads and straps , Ear plugs ,Shoulder array/ small surface coil pair or array/ small flexible coil. (Catherine Westbrook, 2008).

#### **2.1.4.6 Patient Positioning:**

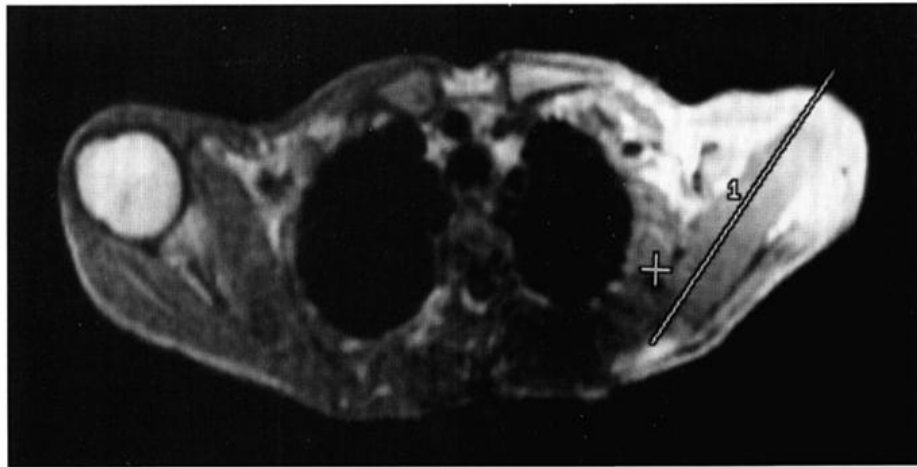
The patient lies supine with the arms resting comfortably by the side slide the patient across the table to bring the shoulder under examination as close as possible to the center of the bore, relax the shoulder to remove any upward "hunching". The arm to be examined is strapped to the patient with the thumb up (natural position) and padded so that the humerus is horizontal.

Place the coil to cover the humeral head and the anatomy superior and medial to it. If a surface or flexible coil is used, care must be taken to ensure that the flat surface of the coil is parallel to the Z axis when it is placed over the humeral head. Center the FOV on the middle of the glenohumeral joint. Patient and coil immobilization is essential for a good result instruct the patient not to move the hand during sequences. The patient is positioned so that the longitudinal alignment light and the horizontal alignment light pass through the shoulder joint. (Catherine Westbrook, 2008).

#### **2.1.4.7 Suggested Protocol:**

**Axial/coronal incoherent (spoiled) GRE/FSE/SE T1** act as a localizer if three-plane localization is unavailable and ensures that there is adequate signal return from the whole joint. Medium slice/gap is prescribed relative to the horizontal alignment light so that the

supraspinatus muscle is including in the image. (Catherine Westbrook, 2008)



**Figure 2.7** Axial SE T1 Weighted Localizer of the Shoulder

**Axial SE/FSE T2 or coherent GRE T2 thin slices/gap** are prescribed from the top of acromio-clavicular joint to below the inferior edge of the glenoid. The bicipital groove on the lateral aspect of the humerus to the distal supraspinatus muscle are included in the image, the axial projection displays joint cartilage glenoid labrum, and the condition of muscle and tendons of the rotator cuff. (Catherine Westbrook, 2008).

**Coronal/ oblique SE/FSE T1 thin slice/ gape** are prescribed from the infraspinatus posteriorly to the supraspinatus anteriorly and the angle parallel to the supraspinatus muscle. This is best to seen on superior axial view(Catherine Westbrook, 2008).



**Figure 2.8** Coronal/ oblique T1 Weighted Image

**Coronal/oblique SE/FSET2+Chemical/spectral pre saturation** slice prescription as for coronal/oblique T1. Fat suppressed T2W image clearly display muscle tears, trabecular injury, joint fluid and tendon tears. If SE is used chemical/spectral pre-saturation may not be necessary. (Catherine Westbrook, 2008).

#### **2.1.4.8 Image Optimization:**

The SNR of shoulder is largely depends on the quality and type of coil used. Dedicated shoulder coils return a much higher and more uniform signal than a surface coil. If using dedicated coil, thinner slices and finer matrices can be used to achieve the necessary spatial resolution without lengthening the scan time.

Spatial resolution the key to accuracy in shoulder imaging and the resolution must not drop below .SE and FSE are usually the sequences of choice but coherent GRE and STAIR are useful to visualize joint fluid. STAIR may provide better result than fat suppressed FSE if magnet shimming is suboptimal. (Catherine Westbrook, 2008).

#### **2.2 PREVIOUS STUDY:**

-Hema and sangeeta in December 2012. MRI Evaluation of Shoulder Joint, Made their in 81 patients (average age 42.3 years) and they found that the rotor cuff tendinopathy account in supraspinatus maximum in 55 patient (67.6%), 2 patient infrapinatus 2%, hill sachs lesion in 8 patient (11%) ACJ capsulitis in 17 patiet (Hema et al , 2012)

-Yamaguchi et al, from Missouri, United States, evaluated 588 patients with unilateral (U/L) shoulder complaints. Their analysis revealed 199 (33.8%) U/L and 177 (30.1%) bilateral (B/L) RC tears with average ages of 58.7 and 67.8 years respectively, the authors found high correlation between advancing age and RC tears. (Yamaguchi et al, 2006).

-A German prospective study on 411 asymptomatic shoulders by Tempelhof et al revealed 23% overall prevalence of RC tears with high occurrence in patients over the age 70 and 80 years of 31% and 51% respectively.( Tempelhof et al,1999)

- In a larger cohort of 683 Japanese villagers with a mean age of 57.9 years, Yamamoto et al observed RC tears in 36% symptomatic against 16.9% in asymptomatic subjects with an overall prevalence of 20.7%. (Yamamoto et al,2010)

-A recent systematic review of 30 studies, Teunis et al analysed 6112 shoulders with 1452 cuff abnormalities. Overall prevalence of RC abnormalities ranged from 9.7% in patients younger than or 20 years and increased to 62% in patients aged 80 years and older ( $P < 0.001$ ) regardless of symptoms, among the general population and in patients with a dislocated shoulder. (Teunis et al ,1999)

-Study of 50 patients for this study(28 male 22 female,) aged from (16 years to 76 years), weight between( <60 Kg to >99 Kg)), almost all those complaining of persistent shoulder pain, most of them were under gone routine plain shoulder radiographs. More than 70%(35) of patient showed evidences of rotator cuff tear of different grades the most common muscle effected was supraspinatus (64%)32 of cases, that would not be seen in radiography, most of them were elder patient(28%)14 of sample were above 50 (55-64), explaining that elder population are susceptible to cuff tears, and at high risk and occurrence of the shoulder pain increase with weight(62%)80-99 kg .(Nada ,2016)



## CHAPTER THREE

### MATERIAL & METHODS

#### 3.1 Materials:

##### 3.1.1. Patients:

In these study 50 patients (male 29 and female 21) with ages range between(20 -70 years) complaining of shoulder joint painthey came to MRI department for chech up. All patients underwent magnetic resonance imaging. Study patient with shoulder pains both genders and all ages were included, and patient was undergoes to MRI scan

##### 3.1.2. MRI Machine:

The MRI for study shoulder joint was taken by one MRI unit, Alamal daignostic center, closed magnet, with field of (1.5 Tesla).



**Figure 3.1** Philips MRI machine was used in the study  
(AlamalDiagnostic Center)

### **3.1.3 Shoulder Coil:**

Shoulder array/small surface coil pair or array/small flexible coil, immobilization pads and straps and ear plugs.



**Figure 3.2** MRI coil was used in the study (AlamalDiagnostic Center)

## **3.2 Methods:**

### **3.2.1 Technique:**

Patient was positioned on the MRI examination table lied supine with the arm resting comfortably by the side. The patient was slide across the table to bring the shoulder under examination as close as possible to the center of the bore. The shoulder was relaxed to remove any upward. The arm was examined is strapped to the patient, with the thumb up (neutral position) and padded so that the humerus was horizontal. The coil was placed to cover the humeral head and the anatomy superior and Z axis when it is placed over the humeral head. The FOV was centered on the middle of the glenohumeral head joint.

Patient and coil immobilization is essential for a good result. the patient was instructed not move the hand during sequences. The patient was positioned so that the longitudinal alignment light and the horizontal alignment light pass through the shoulder joint.

### **3.2.2: Protocol Used**

Axial T1-T2, Sagittal T2, Coronal T1 –T2+STIR, and an Axial T2\*GRE, Axial T1 SE, Coronal T1FSE, Coronal PD and Sagittal T2 FSE

### **3.2.3: interpretation:**

The image radiography diagnosed by qualified radiologist. The data were analyzed by using simple statistical graphs, mean, frequency, percentage

### **3.2.4 Data analysis:**

The data was analyzed by Excel software using various statistics and all this information were analyzed and presented in tables and figures.

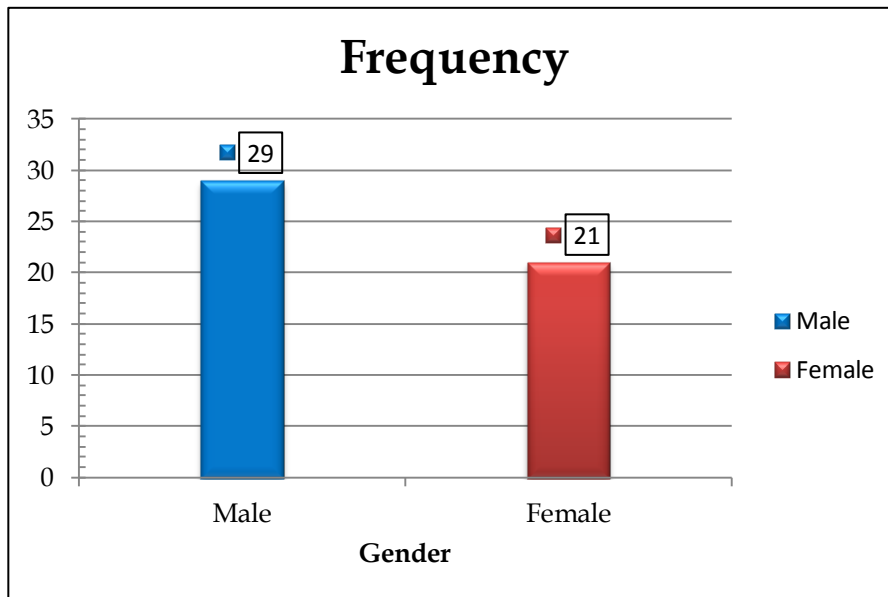
## CHAPTER FOUR

### RESULTAND ANALYSIS

#### 4.1 RESULTS AND ANALYSIS

**Table 4.1:** The Distribution of Patient Gender

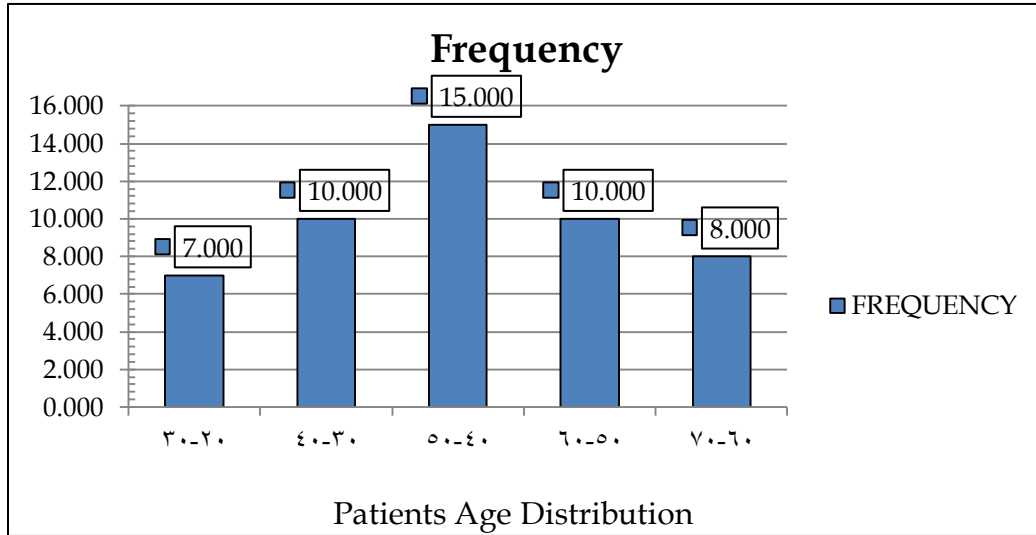
<b>Gender</b>	<b>Frequency</b>	<b>percentage %</b>
Male	29	58.00%
Female	21	42.00%
<b>Total</b>	<b>50</b>	<b>100.00%</b>



**Figure 4.1:** The Distribution of Patient Gender

**Table 4.2:**The Distribution of Patient Age

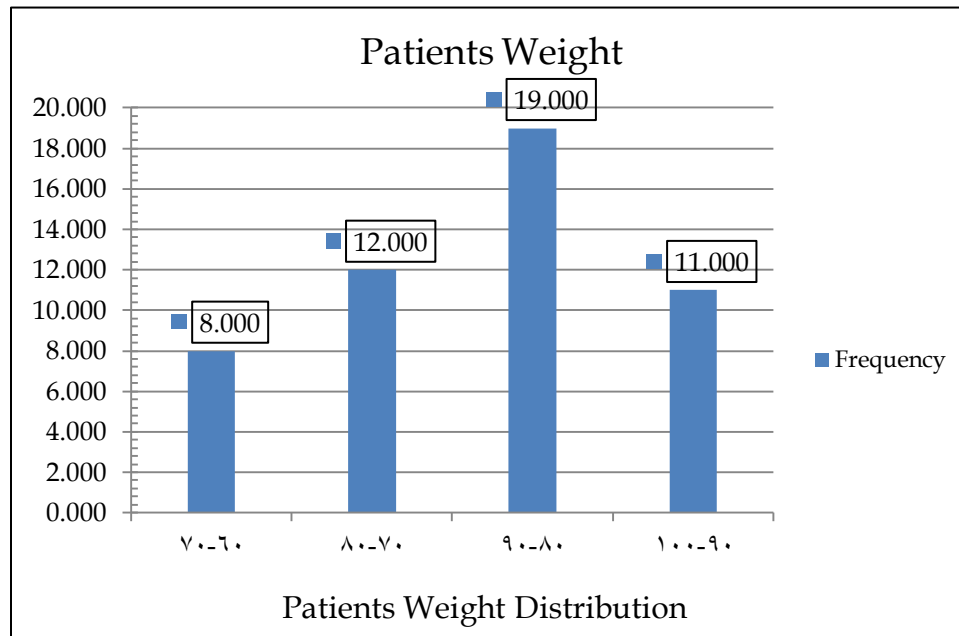
<b>Age</b>	<b>Frequency</b>	<b>Percentage %</b>
20-30	7.000	14.00%
30-40	10.000	20.00%
40-50	15.000	30.00%
50-60	10.000	20.00%
60-70	8.000	16.00%
<b>Total</b>	<b>50.000</b>	<b>100.00%</b>



**Figure 4.2:** The Distribution of Patient Age

**Table 4.3:**The Distribution of Patients Weight

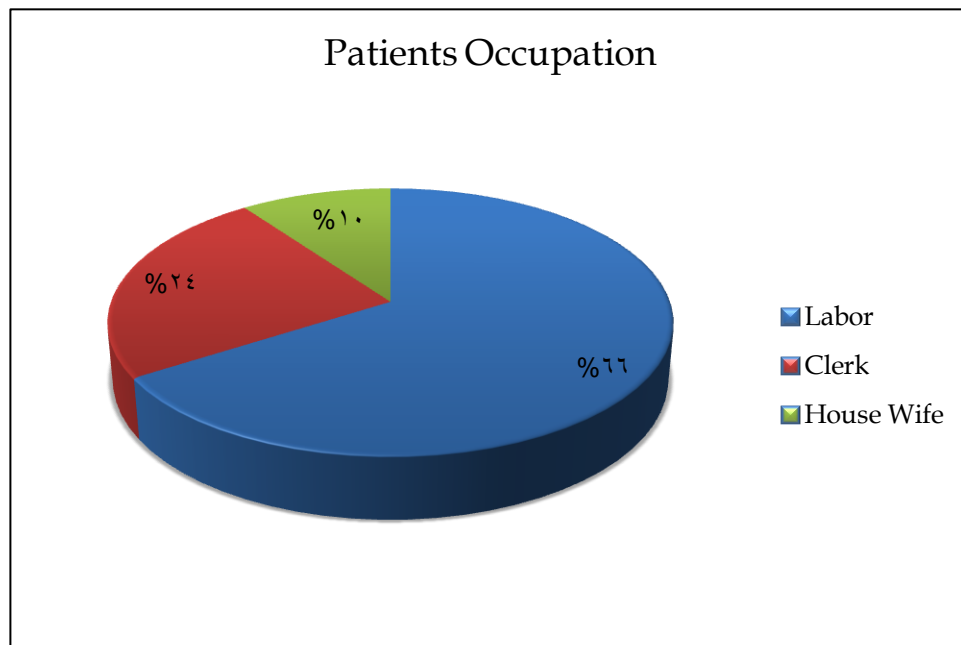
<b>Weight</b>	<b>Frequency</b>	<b>Percentage %</b>
60-70	8.000	16.00%
70-80	12.000	24.00%
80-90	19.000	38.00%
90-100	11.000	22.00%
<b>Total</b>	<b>50.000</b>	<b>100.00%</b>



**Figure 4.3:**The Distribution of Patients Weight

**Table 4.4:**The Patients Occupation

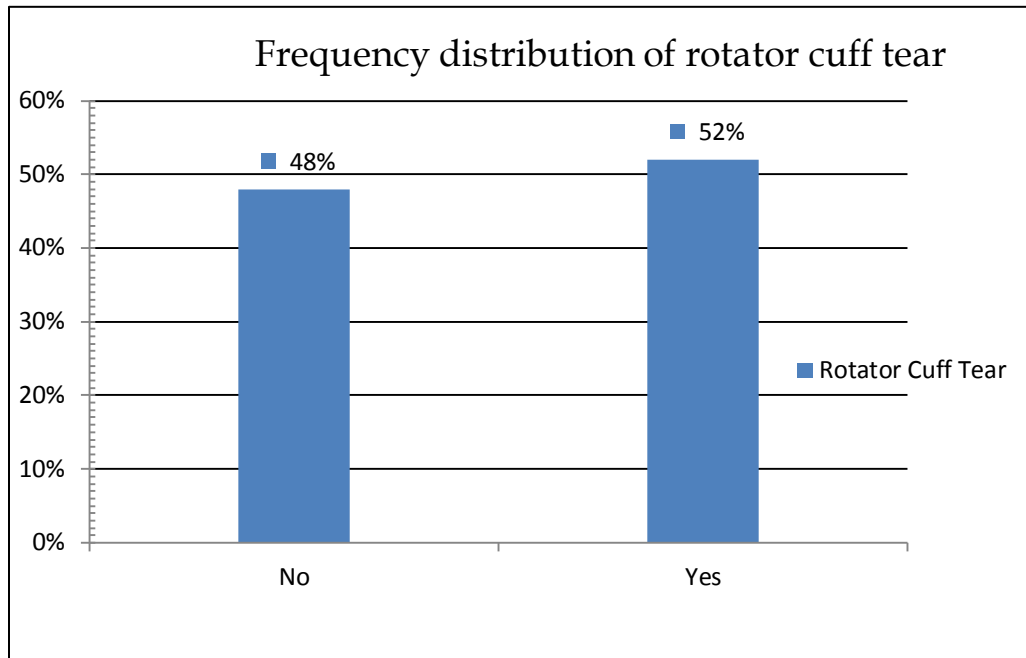
<b>Occupation</b>	<b>Frequency</b>	<b>percent %</b>
Labor	33.000	66%
Clerk	12.000	24%
House Wife	5.000	10%
<b>Total</b>	<b>50.000</b>	<b>100%</b>



**Figure 4.4:**The Patients Occupation

**Table 4.5:** The Frequency Distribution of Rotator Cuff Tear

	<b>Frequency</b>	<b>Percentage %</b>
No	24	48%
Yes	26	52%
Total	50	100%

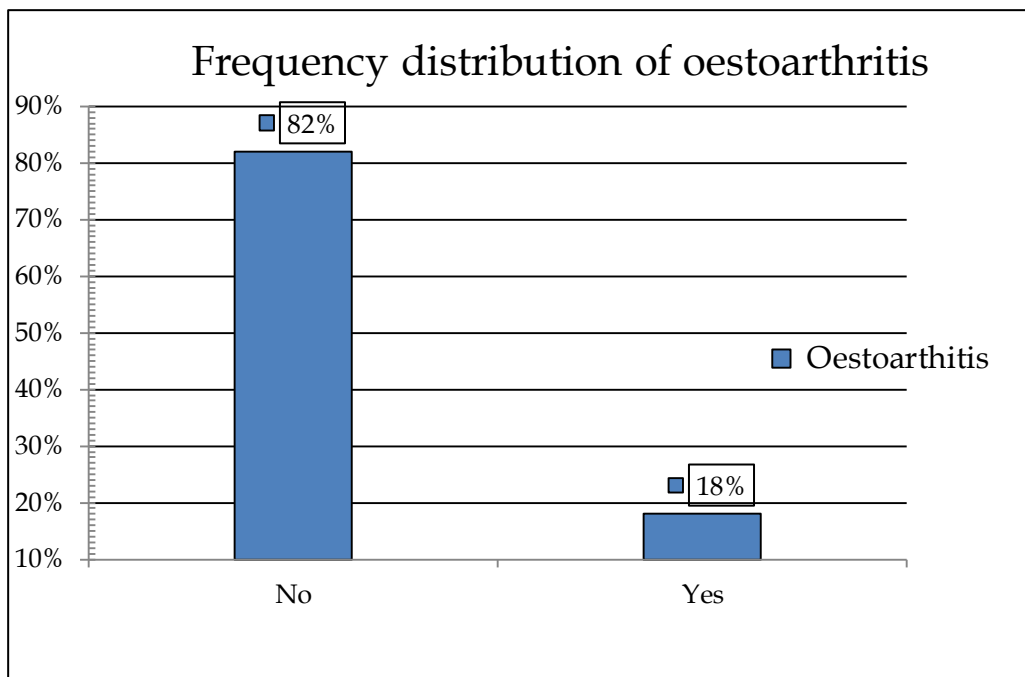


**Figure 4.5:** The Frequency Distribution of Rotator Cuff Tear



**Table 4.6:** The Frequency distribution of osteoarthritis

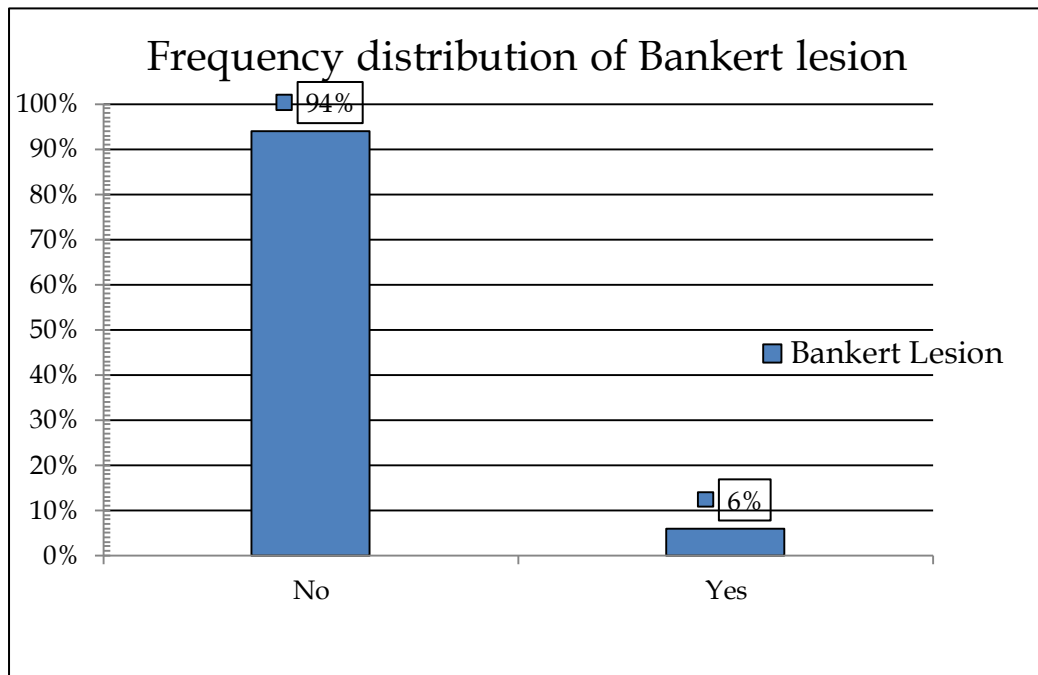
	<b>Frequency</b>	<b>Percentage %</b>
No	41	82%
Yes	9	18%
<b>Total</b>	<b>50</b>	<b>100%</b>



**Figure 4.6:**The Frequency distribution of osteoarthritis

**Table 4.7:** The Frequency Distribution of BankertLesion

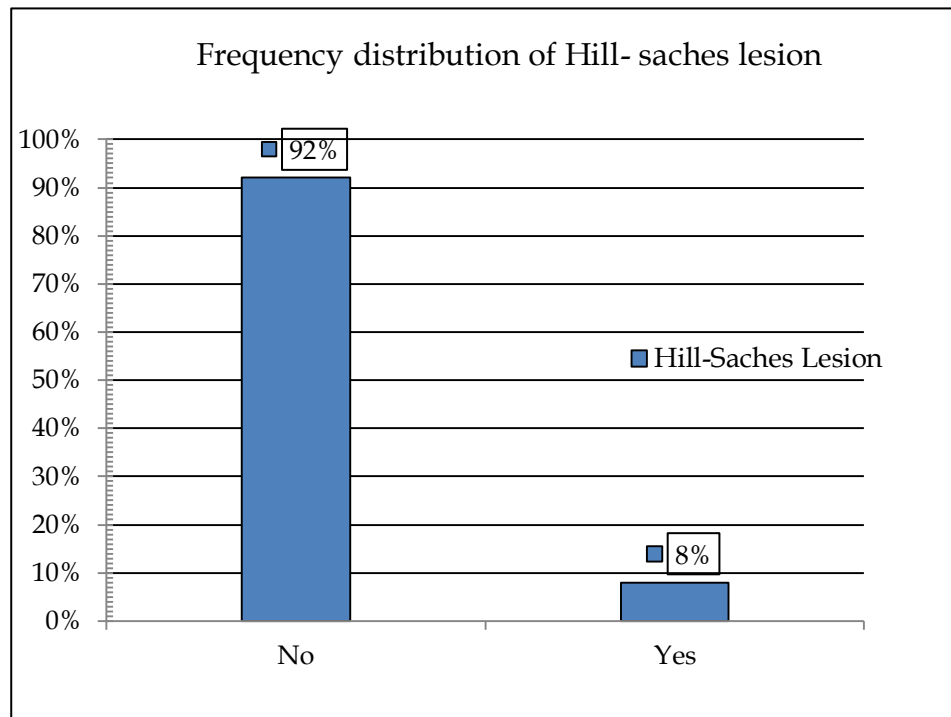
	<b>Frequency</b>	<b>Percentage %</b>
No	47	94%
Yes	3	6%
<b>Total</b>	<b>50</b>	<b>100%</b>



**Figure 4.7:** The Frequency Distribution of BankertLesion

**Table 4.8:** TheFrequency distribution of Hill- SachesLesion

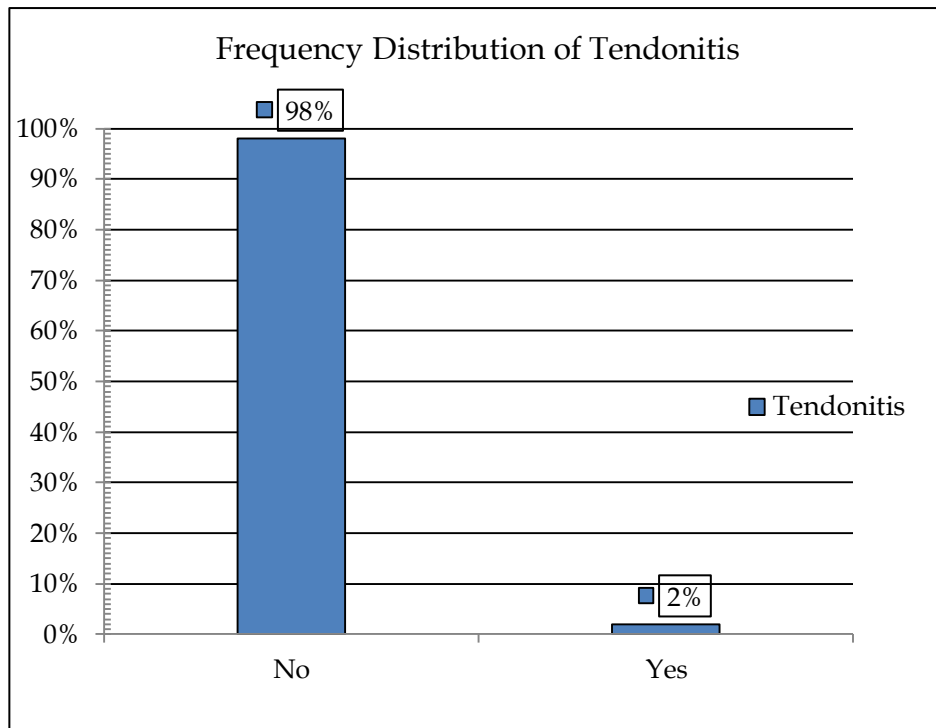
	<b>Frequency</b>	<b>Percentage %</b>
No	46	92%
Yes	4	8%
<b>Total</b>	<b>50</b>	<b>100%</b>



**Figure 4.8:** TheFrequency distribution of Hill- SachesLesion

**Table 4.9:** The Frequency Distribution of Tendonitis

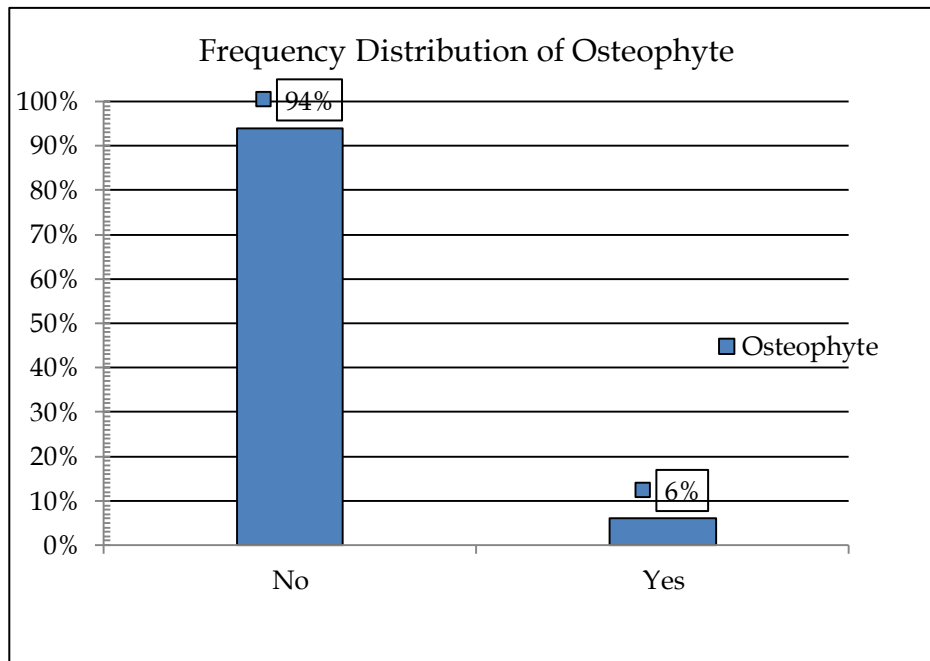
	<b>Frequency</b>	<b>Percentage %</b>
No	49	98%
Yes	1	2%
<b>Total</b>	<b>50</b>	<b>100%</b>



**Figure 4.9:** The Frequency Distribution of Tendonitis

**Table 4.10:** The Frequency Distribution of osteophyte

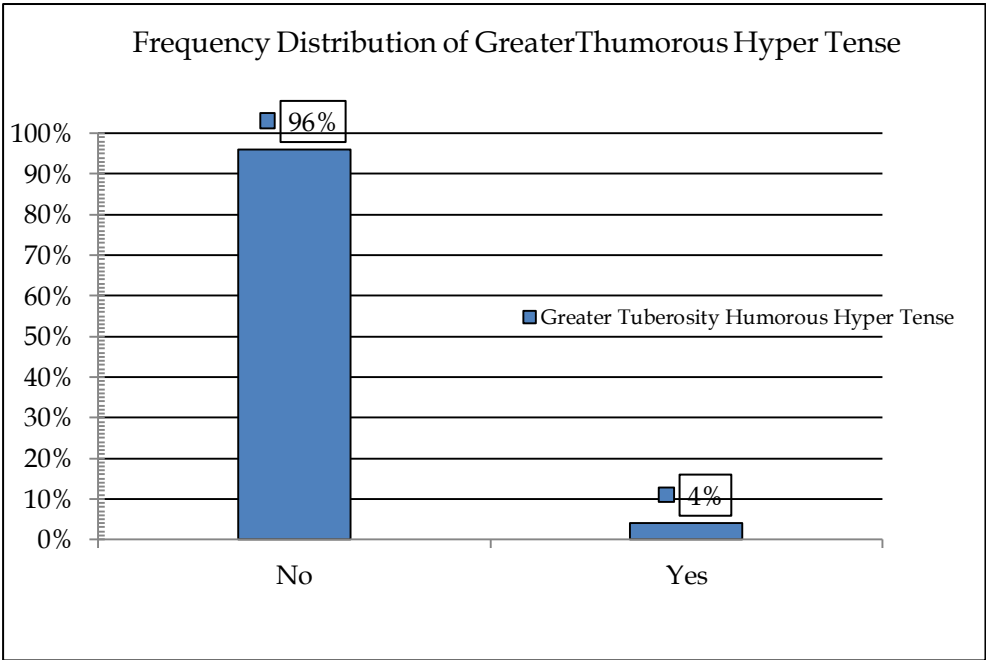
	<b>Frequency</b>	<b>Percentage %</b>
No	47	94%
Yes	3	6%
<b>Total</b>	<b>50</b>	<b>100%</b>



**Figure 4.10:** The Frequency Distribution of osteophyte

**Table 4.11:** The Frequency Distribution of Greater Tuberosity Humorous Hyper Tense

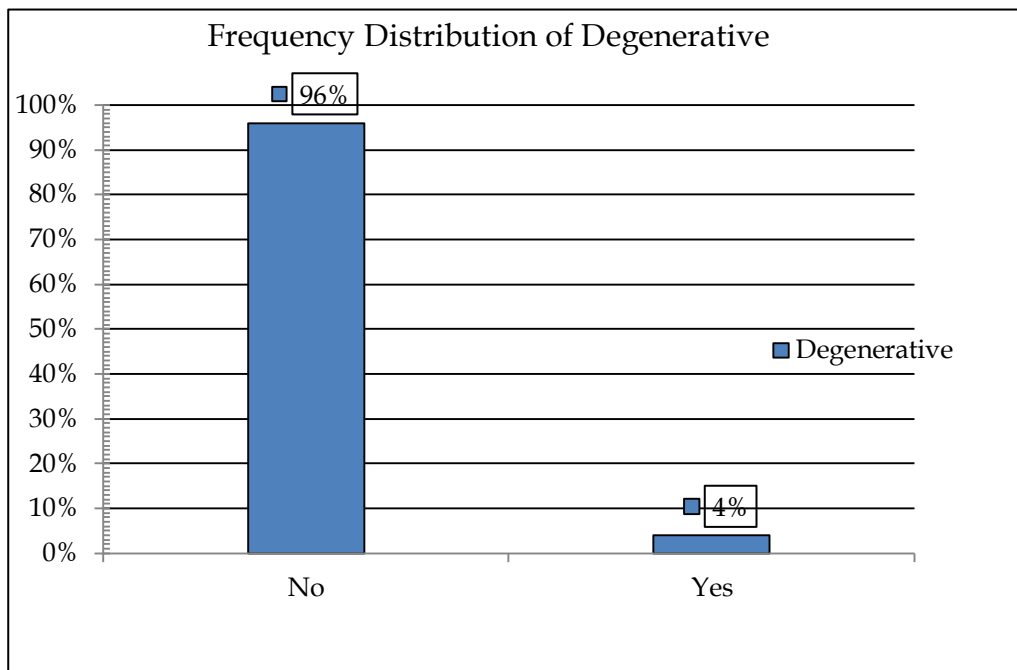
	<b>Frequency</b>	<b>Percentage %</b>
No	48	96%
Yes	2	4%
<b>Total</b>	<b>50</b>	<b>100%</b>



**Figure 4.11:** The Frequency Distribution of Greater Tuberosity Humorous Hyper Tense

**Table 4.12:** TheFrequency Distribution of Degenerative

	<b>Frequency</b>	<b>Percentage %</b>
No	48	96%
Yes	2	4%
<b>Total</b>	<b>50</b>	<b>100%</b>



**Figure 4.12:** TheFrequency Distribution of Degenerative

**Table 4.13: The Diagnosis Weight Cross Tabulation**

<b>Diagnosis</b>	<b>Weight</b>			<b>Total</b>
	<b>60-75</b>	<b>76-85</b>	<b>86-100</b>	
Rotator Cuff Tear	3	9	15	<b>27</b>
Osteoarthritis	2	4	3	<b>9</b>
Bankart Lesion	0	2	1	<b>3</b>
Hill-Sachs Lesion	0	1	2	<b>3</b>
Tendonitis	0	1	0	<b>1</b>
Osteophyte	0	2	1	<b>3</b>
Greater Tuberosity Humorous Hypertens	0	1	1	<b>2</b>
Degenerative	0	1	1	<b>2</b>
<b>Total</b>	<b>5</b>	<b>21</b>	<b>24</b>	<b>50</b>



**Table 4.14:** The Diagnosis Age Class Cross Tabulation

<b>Diagnosis</b>	<b>20-30</b>	<b>30-40</b>	<b>40-50</b>	<b>50-60</b>	<b>60-70</b>
Rotator cuff tear	4	5	6	8	3
Tendonitis	1	0	0	0	0
Banker lesion	0	0	1	2	0
Hill saches lesion	0	1	2	1	0
Osteoarthritis	0	1	3	3	2
Oestophyte	0	1	1	0	0
Greater tubersity humorous hypertens	1	0	1	0	0
Degenerative	0	0	0	1	1

## **CHAPTER FIVE**

### **DISSCUSION, CONCLUSION AND RECOMENDATIONS**

#### **5.1 DISCUSSION**

This was a analytic descriptive study. In this study we found the shoulder pain from the different aspects to obtain useful results. We found that the male is more effected than female (58% to 42%) table (4 -1) . the rotator cuff tear are most pathology found( 52%) this is agree with( Nada , 2016 ) then come osteoarthritis (18%) , Hill-Saches (8%) , Bankert lesion (6%) , osteophyte (6%) , degenerative and greater tuberosity humorous hyper tense (4%) and tendonitis (2%) table (4\_(5-12)).

The most age group effected above 50 (50-60) with rotator cuff tear (16%) that agree with (Teunis et al ,2004 ) table ( 4-14) .

the heavy weight also effected in shoulder joint the most group effected above (80) kg with rototr cuff tear (30%) that agree with ( Nada , 2016 ) table (4-13)

.The occupation the labor is the most effected (66%), clerk (24%) and the house wife (10%) that agree with( Nada , 2016 ) table (4-4)

The coronal T1 FSE the best protocol to evaluate rotator cuff tear and also additional protocol seen rotator cuff tear coronal PD.The T2 was excellent for visualization of humeral head .also Axial T1 SE anterior glenoid labrum to best show bankart lesion.

## **5.2 CONCLUSION**

Rotator cuff tear is common cause of shoulder pain in aged people above 50year. Other risk factors that contributing in shoulder pain are patient weight, age. MRI is a method of choice in assessments of shoulder joint pain due to it is high quality diagnostic ability and best demonstrates of soft tissue, muscle, tendons and ligament of shoulder joint.

### **5.3 RECOMMENDATIONS:**

For future recommendation in studying the Shoulder Pain Using MRI, following important factors must be taken in to considerations.

1. Magnetic resonance imaging examination for persistent shoulder pain is recommended to be routine examination.
2. The exam must be done by will trained technologist who is familiar with the scan protocols to give full diagnosable image.
3. MRI machine and its accessories such as flexible coil should be available in radiology department
4. Further study is recommended to increase number of data to find new protocols.

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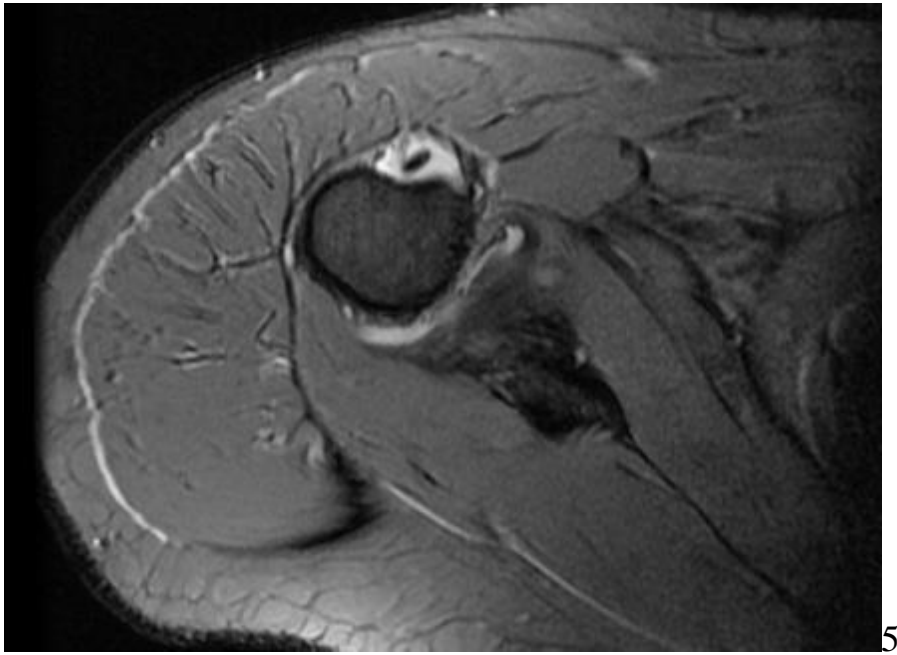


Image -1

Axial T2\*GRE MRI male patient 43 years old show Bankart lesion.

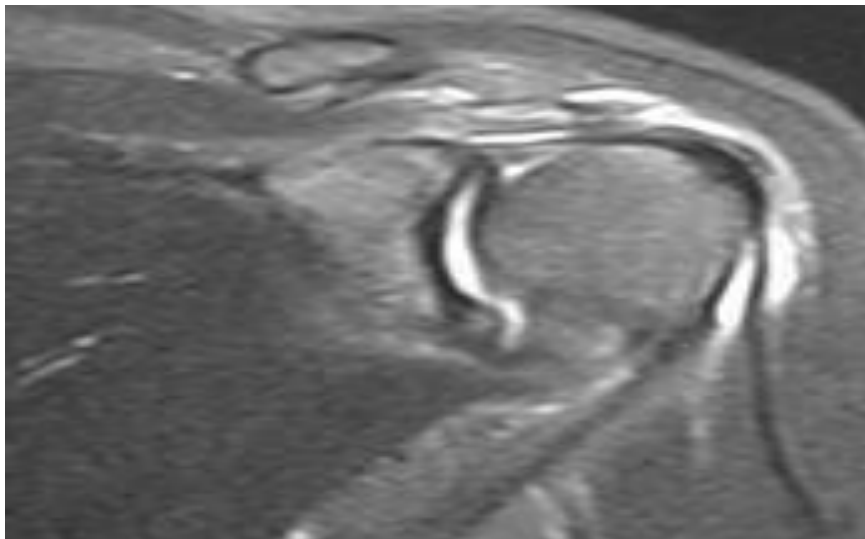


Image2

Axial T1 FSE MRI male patient 55 years old show Greater tuberosity humeros hypertense

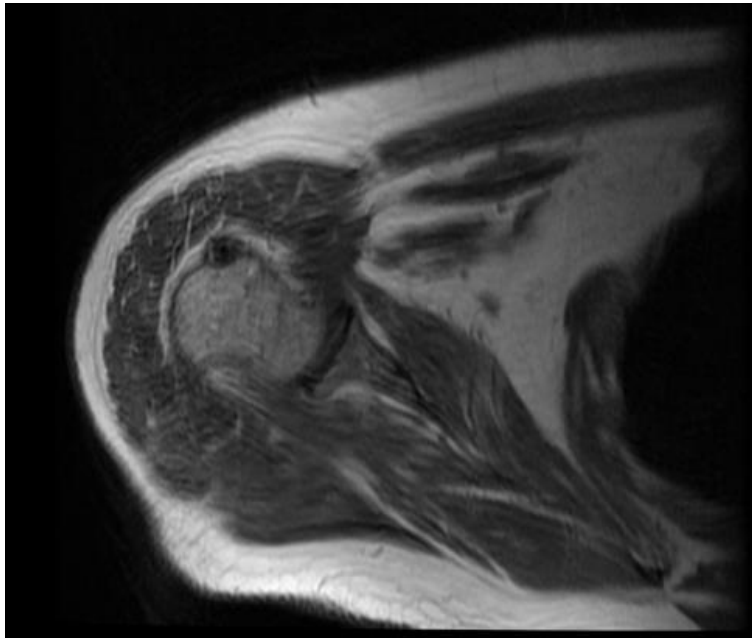


Image 3

Axial MRI T1 SE female patient 64 years old show rotator cuff tear

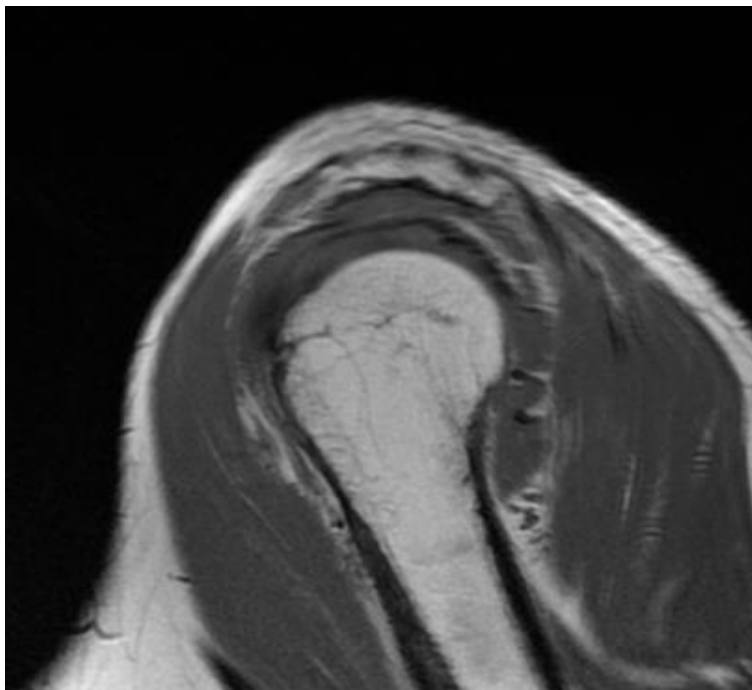


Image 4

Sagittal T1 SE MRI male patient 52 years old show Osteoarthritis.