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ORIGINAL RESEARCH

The Comparative Effectiveness of Clinical Evaluation and MRI in Diagnosing Patients with Shoulder Pain.

[1]Dr. Sarthak Katewa, [2]Dr. Sumit Anand, [3]Dr. Naveen Meena

[1]PG JR3, Department of Radiodiagnosis, Jaipur National University, Institute For Medical Science And Research Centre , Jaipur
[2]Assistant Professor, Department of Medicine, Nims Medical College, Jaipur
[3]Professor, Department of Radiodiagnosis, Jaipur National University, Institute For Medical Science And Research Centre, Jaipur

Corresponding Author: Dr. Sarthak Katewa
PG JR3, Department of Radiodiagnosis, Jaipur National University, Institute For Medical Science And Research Centre, Jaipur

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ABSTRACT
Introduction-Shoulder pain is a common complaint in primary health care resulting in significant pain and disability, loss of productivity and health care costs. With time various imaging modalities has come for establishing the diagnosis. MRI has become the "gold standard" for detecting both subtle and obvious internal derangement and assessing overall joint structure. The present study was done with an aim to study the spectrum of disease detectable with this technique and to know the advantages and usefulness of MRI in evaluation of shoulder pain
Material and methods-The prospective observational study was conducted at Jaipur National University , Institute for Medical Science and Research Centre , Jaipur among 30 patients who visited with complain of shoulder joint and referred during the study period of one year. Demographic and clinical history was recorded and MRI of patients was done according to protocol.
Results – More than 50% of the subjects were having age of >41 years. 64% and 36% of the subjects were male and female respectively. Thickness tear, full thickness tear and tendinosis were revealed among 26%, 2% and 36% of the subjects with SS. In case of SUB and IFS; partial thickness tear and tendinosis was reported among 4%, 8% and 2%, 4% of the subjects respectively. ACJ hypertrophy and labral tear was found among 32% and 18% of the subjects respectively. Bony pathology was found among 36% of the subjects.
Conclusion-In medicine, elaborate diagnosis obviously makes sense if there are means for adequate therapy and there is a good chance for better outcomes. MRI is non-invasive, contrast-free, nonionizing, and high-resolution.MRI shoulder helps determine which individuals need medical and surgical treatment.
Keywords- Evaluation, Joint, MRI, Pain, Shoulder

INTRODUCTION

The shoulder joint is an incongruous ball and socket joint which has a wide range of motion in multiple planes; hence stability is compromised for the cost of mobility. Shoulder pain is a common complaint in primary health care resulting in significant pain and disability, loss of productivity and health care costs [1]. The lifetime prevalence of shoulder pain in the general population is reported between 10% to 67% [2]. Shoulder pain is the third most common musculoskeletal complaint in the general population, and accounts for 5% of all musculoskeletal consultations. It can significantly affect a patient's ability to work and other activities of daily life. The diagnosis and management of painful shoulder syndrome was entirely based on history and physical examination which have shown less accuracy specially for peri-articular causes of painful shoulder [3]. With time various imaging modalities has come for establishing the diagnosis, which includes radiographs, arthrography, ultrasonography(USG), computed tomography(CT) and magnetic resonance imaging(MRI).

Plain film radiograph is still being the basic initial investigation required for assessing bony trauma, osteoarthritis and other arthropathies. They are often supplemented by other techniques for primarily soft tissue abnormalities, such as rotator cuff disease or masses. Conventional radiographic techniques demonstrate the osseous structure of the shoulder girdle but provide only limited evaluation of soft tissue anatomy, including the rotator cuff, the ligamentous attachments of the glenoid labrum capsule, and the sub acromial space. Routine radiographs do not allow direct visualization of the rotator cuff tendons, their defects and abnormalities, or their relationship to their

under surface of the acromion and the acromioclavicular [AC] joint. As a result, impingement disorders are difficult to characterize on plain-film radiographic studies [1,4]. Since the availability of Magnetic resonance imaging (MRI)) for medical use in early 1980s it has substituted other imaging modalities in evaluation of shoulder joint lesions as the most accurate imaging modality, due to its excellent soft tissue contrast, multiplanar imaging, non-ionising radiation and non-invasive nature. MRI has become the "gold standard" for detecting both subtle and obvious internal derangement and assessing overall joint structure. Finding a correlation between symptoms and images is a challenging task and is essential to ensure that the imaging finding explain the symptoms and can be used to adjust the therapy [1,4,5]. Hence, the present study is conducted to review the spectrum of disease detectable with this technique and to know the advantages and usefulness of MRI in evaluation of shoulder pain.

MATERIAL AND METHODS

The prospective observational study was conducted at Jaipur National University, Institute for Medical Science and Research Centre , Jaipur among patients who visited with complain of shoulder joint and referred during the study period of one year. Ethical permission for conducting the study was taken from institution ethical committee before commencement of study. Patients were asked to sign an informed consent form before after explaining them the complete procedure.

Sample size- Total 30 patients were selected for the study through convenience sampling after following the inclusion and exclusion criteria.

Inclusion Criteria- All patients with skeletally mature bones of either gender referred to the radiology department for MRI evaluation with clinical history of shoulder pain.

Exclusion Criteria- Patients who have contraindication for MRI like pacemaker, metallic implants, claustrophobia, patients who already have undergone interventional intra-articular procedures and patients with operative history over involved shoulder.

Methodology - After obtaining clinical history and relevant clinical examination, MRI examinations was done on 1.5TSIEMENS sempra scanner and based on MR imaging findings evaluation of shoulder lesions were done.

Technique- Every patient was laid supine with the head pointing towards magnet (head first supine), shoulder in positioned in small parts coil and immobilised with sand bags and laser beam localiser is centred over shoulder or in midline of the coil.

Protocol of MR imaging- Patients included in the study were subjected to routine MRI of the shoulder joint by various pulse sequences consisting:3 plane localization; AXA PD FSE fat SAT; COR PD FSE fat SAT; SAG PD FSE fat SAT; AX 3D FSPGR special fat sat and PROSP SAG T2 fr FSE.

Statistical analysis- All data were analyzed with SPSS software version 25.0. The data was presented as mean± SD for continuous variables and as frequency or percentage for categorical variables.Chi Square test or Fisher's exact test was used for statistical comparison of qualitative variables and Student's t test for parametric variables. P values of less than 0.05 were considered statistically significant.

RESULTS

More than 50% of the subjects were having age of >41 years. Only 6% of the subjects were having age between 13-18 years. 40% of the subjects belonged to age group of 31-50 years. 64% and 36% of the subjects were male and female respectively. Hence there was male dominancy in our study as shown in table 1.

Table: 1 Demographic data of patients

Variable		**N (%)**
Age Group (in years)	13-18	2 (6)
	19-30	5 (16)
	31-40	7 (24)
	41-50	4 (14)
	51-60	7 (24)
	>60	5 (16)
Gender	Male	19 (64)
	Female	11 (36)

Figure: 1 History among the study subjects

History of trauma was reported among 44% of the study subjects as shown in figure 1.

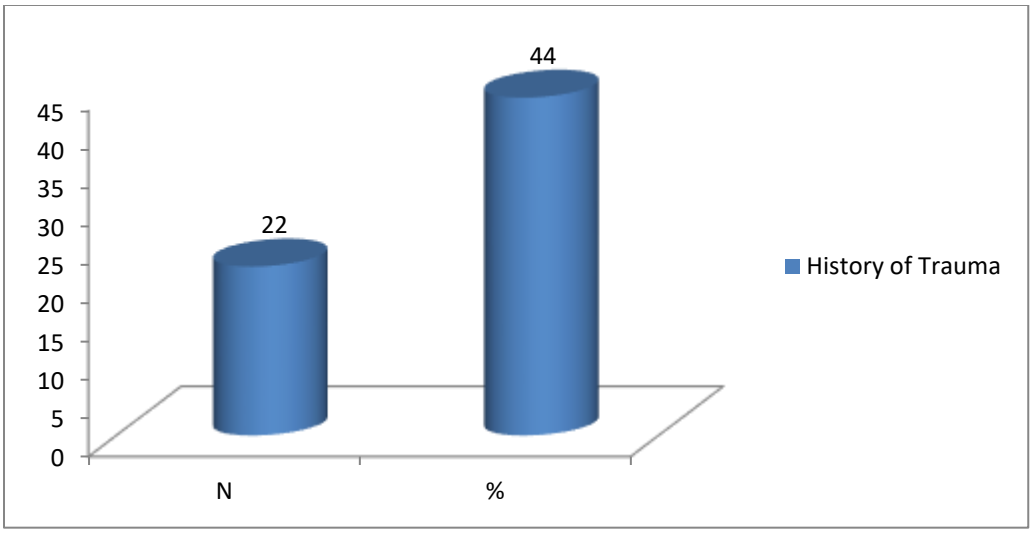


Table 2 shows the symptomatology among the study subjects. 88% of the subjects revealed symptoms since 6 months. Right side (72%) was the most common affected shoulder as well as the dominant side (96%).Tenderness was present among 46% of the subjects. Range of motion<30^0, 30^0-45^0 and >45^0 was found among 8%, 2% and 14% of the subjects respectively.

Table 2: Symptomatology among the study subjects

Symptomatology	N	%
Duration		
<6 Months	26	88
>6 Months	4	12
Affected Shoulder		
Left	8	28
Right	22	72
Dominant Hand		
Left	2	4
Right	28	96
Tenderness		
Absent	16	54
Present	14	46
Range of Motion		
Normal	23	76
<30^0	2	8
30^0-45^0	1	2
>45^0	4	14

Table: 3 shows the MRI findings w.r.t. Subcapslaris tendon (SUB), Supraspiantous Tendon (SS), Infraspinatous tendon (IFS), Teres Minor tendon (TM) and Biccipital Tendon (BT). Partial thickness tear, full thickness tear and tendinosis were revealed among 26%, 2% and 36% of the subjects with SS. In case of SUB and IFS; partial thickness tear and tendinosis was reported among 4%, 8% and 2%, 4% of the subjects respectively.

Table 3: MRI findings

Parameters	Normal	Partial Thickness Tear	Full Thickness Tear	Tendinosis

	N	%	N	%	N	%	N	%
Subcapslaris tendon (SUB)	26	88	2	4	0	0	3	8
Supraspiantous Tendon (SS)	11	36	8	26	1	2	18	36
Infraspinatous tendon (IFS)	28	94	1	2	0	0	2	4
Teres Minor tendon (TM)	30	100	0	0	0	0	0	0
BiccipitalTendon (BT)	30	100	0	0	0	0	0	0

Table 4 shows the bursal fluid findings on MRI. PBT (Peribiccipital Tendon Fluid), SASD (Subacromanian Subdeltoid Bursae) and SC (Subcapularis Bursae) was found to be present in 30%, 46% and 20% of the study subjects.

Table 4: Bursal fluid on MRI findings

Parameters	Absent		Present	
	N	%	N	%
PBT (Peribiccipital Tendon Fluid)	21	70	9	30
SA-SD (Subacromanian Subdeltoid Bursae)	16	54	14	46
SC (Subcapularis Bursae)	24	80	6	20

Table 5 shows the ACJ hypertrophy, acromion type and labral tears on MRI findings. ACJ hypertrophy and labral tear was found among 32% and 18% of the subjects respectively. Acromion type 1, 2 and 3 was reported in 70%, 18% and 12% of the subjects respectively.

Table 5: Acromio-clavicula joint (ACJ) hypertrophy, acromion type and labral tears on MRI findings

Parameters	N	%
Acromio-clavicular joint (ACJ) hypertrophy		
Absent	20	68
Present	10	32
Acromion Type		
1	21	70
2	6	18
3	3	12
Labral Tears		
Absent	24	80
Present	5	18
Gleno Labral Articular Disruption	1	2

According to MRI, bony pathology was found among 36% of the subjects. Most common bony pathology was Hill Sach Injury (10%) followed by Humeral Head Cyst (6%) and Joint Effusion (6%). Avascular necrosis of head of right humerus and osteomyelitis at distal end of right clavicle was found in 1 subject each as shown in table 6.

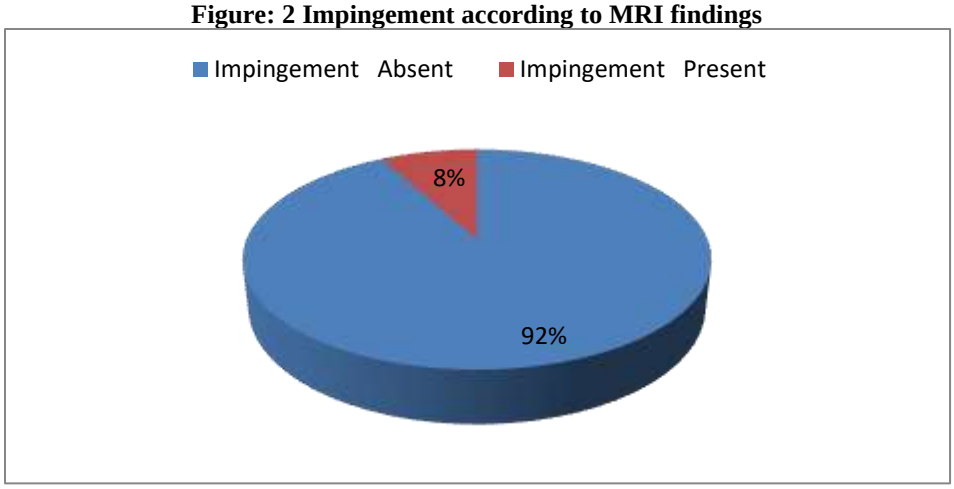
Table 6: Bony pathology on MRI findings

Bony Pathology	N	%
Absent	19	64
Avascular Necrosis Of Head Of Right Humerus	1	2
Chip Fracture Of Glenoid With Marrow Edema With Detachment Of Anterior And Posterior Labrum	1	2
Contusion At Humeral Head	1	2
Dislocation Of Acromio Clavicular Joint	1	2
Fracture Of Scapula Involving Superiar Glenoid Rim	1	2
Glenohumeral Joint Osteoarthrirtis	1	2

Hill Sach Injury	4	10
Humeral Head Cyst	2	6
Joint Effusion	2	6
Osteomyelitis at distal end of right Clavicle	1	2

According to MRI, impingement was present in 8% of the subjects as shown in figure 2.

Figure: 2 Impingement according to MRI findings



DISCUSSION

Shoulder pain is a common complaint in medical practice and leads to significant disability. A compromised shoulder due to pain, stiffness or weakness causes substantial disability and affects the person's ability to carry out daily activities. This not only reflects on the person's occupation but also on his social life. It is estimated toaffect 17% of men and 25% of women in the elderly population [6]. Incidence increases with age. 21%of people over 70 years have shoulder pain. Women have more shoulder problems than men but the frequency in both sexes increases with age [7]. The burden of taking care of the musculoskeletal problem is enormous to the society in terms of lost man-hours, direct hospital bills and workers compensation. This has a tremendous strain on a nation's economy.

Clinical examination alone is not adequate in identifying the cause of pain, thus various imaging modalities are employed to increase the accuracy of identifying the source of the pain. Plain radiography, arthroscopy, contrast arthrography, Ultrasonography, computed tomography and Magnetic resonance (MRI)are the diagnostic modalities used [8]. More than 50% of the subjects were having age of >41 years. Only 6% of the subjects were having age between 13-18 years. 40% of the subjects belonged to age group of 31-50 years. Shoulder pain affects mainly adults, and those with highest incident of shoulder pathology were aged between 46 and 60 years. The incidence of shoulder pathology increases with age and this explains why this age group had more lesions. Similarly Pankaj Chaudhari et al in their study found that 70% were males and 30% were females [9].C.K. Onyambu et al [8] in their study reported that the youngest was 20 years and the oldest was86 years. Those between 30-45 years were 24.3%.Those in the 46-60 years age group were 45.7% and those over 60 years were17.1%.Shilpa Chudasama et al [10] in their study showed that the age distribution in our study was in range of 15 years to 70 years with maximum population within 45-54 year range. 64% and 36% of the subjects were male and female respectively. Hence there was male dominancy in our study. C.K. Onyambu et al [8] in their study revealed that of the 70 patients scanned 54.3% were males and 45.7% were females which is similar to our study. Shilpa Chudasama et al [10] in their study showed that the majority of the cases in their study were male.

88% of the subjects revealed symptoms since 6 months. Right side (72%) was the most common affected shoulder as well as the dominant side (96%).This is likely due to right handedness in majority of the people. Tenderness was present among 46% of the subjects. Range of motion<30^0, 30^0-45^0 and >45^0 was found among 8%, 2% and 14% of the subjects respectively. A study by Krief and Huguet [11], involving1079 patients found that 916 (85%) had right hand dominance and 163(15%) were left handed. Six sixty nine (62%) of these presented with pain on the right shoulder. This study compares well with western studies which have shown the right shoulder is more affected due to right handedness. Shilpa Chudasama et al [10] in their study revealed that the most common involved side was right shoulder. C.K. Onyambu et al [8] in their study found that a total of 120lesions were seen and were more common on the rightshoulder 104(86.7%) compared to the left which had only 16(13.3%) lesions.

Partial thickness tear, full thickness tear and tendinosis was revealed among 26%, 2% and 36% of the subjects with SS. In case of SUB and IFS; partial thickness tear and tendinosis was reported among 4%, 8% and 2%, 4% of the subjects respectively. In a study by Hema Chaudhary et al [12], supraspinatus tendinopathy found in 67.65% cases (55 patients), subscapularis tendinopathy were in 9.9% (8 patients) cases, infraspinatus tendinopathy were in 2.47% cases (2 patients). Shilpa Chudasama et al[10] in their study reported that supraspinatus was the most commonly involved tendon followed by subscapularis, infraspinatus and Teres minor in decreasing order of frequency. C.K. Onyambu et al [8] in their study showed that the commonest pathology was tendinosis. Tendinosis involved mainly the supraspinatus tendon. Twenty one (17.5%) lesions were seen on the supraspinatus, twelve (10.0%) were on the biceps tendon and the subscapularis tendon had 2(1.6%) lesions. Suhail Rafiq et al [13] in their study reported that supraspinatus tears with partial tears in 7 patients and complete tear in 5 patients. Infraspinatus tear was seen in one patient. Peribiccipital fluid¸ fluid in Subacromanian Subdeltoid Bursae and Subcapularis Bursae was found to be present in 30%, 46% and 20% of the study subjects. In a study by Hema Chaudhary et al[12], subacromian subdeltoid bursitis accounts for 37.04% (30 patients).

ACJ hypertrophy and labral tear was found among 32% and 18% of the subjects respectively. Acromion type 1, 2 and 3 was reported in 70%, 18% and 12% of the subjects respectively. Shilpa Chudasama et al[10] in their study showed that Type I and type II acromion morphology was most commonly observed. Similarly Pankaj Chaudhari et al[9] in their study found labral tear among 12.5% of the subjects.

Bony pathology was found among 36% of the subjects. Avascular necrosis of head of right humerus and osteomyelitis at distal end of right clavicle was found in 1 subject each. Most common bony pathology was Hill Sach Injury (10%) followed by Humeral Head Cyst (6%) and Joint Effusion (6%). These lesions are common in those with dislocation ofthe shoulder joint. HillSach Injury is the most common injury associated with anterior glenohumeral instability. It consists ofbony injury of the posterosuperior humeral head manifesting as cortical bony loss, impaction fracture orassociated bone marrow edema in acute cases. In a study by C.K. Onyambu et al [8], there were4(3.3%) Bankart and seven (5.8%), Hill-Sach's lesions. Shilpa Chudasama et al [10] in their study found bony pathologies among 30% of the subjects.

Primary impingement is due to narrow space between the humeral head and the coraco-acromial arch (superior impingement) or between humeral head and coracoid process (anterior impingement). In primary impingement all structures forming the coraco-acromial arch can cause the impingement. Most frequently osteophytes arising from the acromion or thickening of coracoacromial ligament cause supraspinatus compression i.e. impingement [14-16]. According to MRI, impingement was present in 8% of the subjects in our study. Pankaj Chaudhari et al [9] in their study reported that impingement was present in 12.5% of the subjects which is slightly more as compared to our study.

MRI is extremely sensitive to alterations in the bone marrow and fluid in joint space that may represent pathology occult to plain radiography and bone scintigraphy of shoulder. MRI is a practical, well accepted and accurate non-invasive imaging technique in patients presenting with shoulder pain and is imaging modality of choice when clinical examinationis suspect of shoulder disease and plain radiographs are normal or equivocal. The development of MR imaging afforded improved comprehensive visualization of the shoulder joint in a noninvasive manner. We evaluated MR imaging of the shoulder as become an important imaging modality for that joint. Excellent soft tissue contrast and multiplanar acquisition provide optimal assessment of muscle, tendons, hyaline and fibrous cartilage, joint capsules, fat, bursae and bone marrow.

CONCLUSION

As in medicine, elaborate diagnosis obviously makes sense if there are means for adequate therapy and there is a good chance for better outcomes. In the field of musculoskeletal disease, MRI nowadays fulfils these criteria and in many cases it replaces other investigations. MRI is a non-invasive, lack of contrast exposure, nonionizing radiation, and high degree of resolution mode ofimaging.MRI shoulder is also helping in deciding which patients will benefit from medical and surgical treatment. The chronic shoulder pain is most common in dominant hand. Trauma and degenerative changes are the most common etiologies. The commonest pathology causing shoulder pain is rotator cuff pathology, like tendinosis, partial or full thickness tears.

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