Measurement of rotator interval dimension using MRI and its significance in management of cases of shoulder instability

Gaurav Sen[1], Lokesh M Gowda[2], Vinay Kumaraswamy[3]

Introduction

The rotator interval structures, including the biceps tendon, SGHL, and coracohumeral ligament, play an important role in static and dynamic glenohumeral stability in conjunction with the MGHL [12].

The importance of rotator interval in pathogenesis of shoulder instability is increasingly being studied and appreciated. Rotator interval enlargement is being increasingly recognized as a independent pathology in addition to the primary pathology of labral tear in cases of shoulder instability. Closure of the rotator interval is one of the treatment options in treatment of recurrent dislocation shoulder to improve the results of arthroscopic shoulder instability surgeries. However, the methods of assessment of rotator interval are only subjective and done intra-operatively only. There are no objective methods of measurement of rotator interval and very few can be done pre operatively. We report our experience of measurement of rotator interval dimensions using MRI in cases of shoulder instability and its comparison with relatively normal shoulder MRI. There have been similar studies using MR arthrography. Our intention was to determine whether rotator interval dimension is significantly more in cases of shoulder instability and weather it can be done with routine MRI and how does it correlate with other studies done using MR arthrography.

Material and methods

We evaluated 124 cases of shoulder MRIs. We used criteria similar to Kim et al [reference] to categories our patients into two groups. Group A included cases of shoulder instability. Group B consisted of patients with other shoulder pathologies which do not affect the rotator interval dimensions. Group B included MRI of cases of normal shoulder, supraspinatus impingement, internal impingement, biceps tendinitis, rotator cuff impingement, calcific tendinits, partial thickness rotator cuff tears [supraspinatus and infraspinatus] involving less than 50% of the thickness of the tendon. Cases with obvious affections of the rotator interval like periarthritis, rotator cuff tears involving more than 50% of the tendon, any subsacpularis tear [partial or total] etc.

All MRI were done using 1.5T MRI GE. No contrast was used either intra-articular or intra venous.

Measurements were done as described by Kim et al [reference]. Measurements were taken by one orthopaedic surgeon and one radiologist with particular interest in shoulder.

Rotator interval was defined as a right angled triangle with base along the superior border of the subscapularis tendon. Its height is measured from the superior border of subscapularis at the lateral base of coracoids to the anterior border of supraspinatus in the sagittal images of shoulder. The base is measured from the lateral base of coracoid along the superior border of subscapularis to the lateral edge of bicipital groove in the axial sections. Biceps groove forms the apex of the interval and its contents include the superior gleno humeral ligament, coracohumeral ligament and bicipital tendon. The rotator interval measurement is akin to a right angles triangle. Hence its area is given by ½ x base x height.

The height, base and area were measured in MRI sequences in both the groups and were compared for statistical difference. Height of the rotator interval could be best measured T1 weighted sagittal cut. As Kim et al [5] pointed out it is very difficult to make out the anterior border of the supraspinatus if the joint is not distended. However the structures are well made out in T1 images. The base of rotator interval could be best measured in proton density fat saturated images [PD Fat Sat].

Results

The results showed a significant increase in height of rotator interval in cases of shoulder instability compared to other cases [18.2mm Vs 14.5mm

[1]Department of Orthopaedics, Sanjay Gandhi Institute of Trauma & Orthopaedics, Banglore, Karnataka, India.
[2]Department of Orthopaedics, Kampegowda Institute of Medical Sciences, Bangalore, Karnataka, India.
[3]Department of Orthopaedics, Bangalore Medica; College & Research Institute, Bangalore, India.
Address of correspondence :
Dr. Gaurav Sen,
Sanjay Gandhi Institute of Trauma & Orthopaedics, Banglore, Karnataka, India.

2020 © Authors | Journal of Karnataka Orthopaedic Association | Available on www.jkoaonline.com | DOI:10.13107/jkoa.2020.v08i01.005

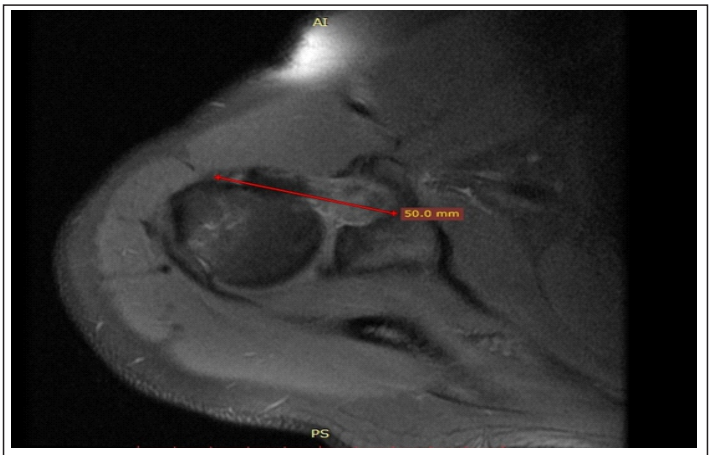

Figure 1: Assesment of Rotator Interval Base.

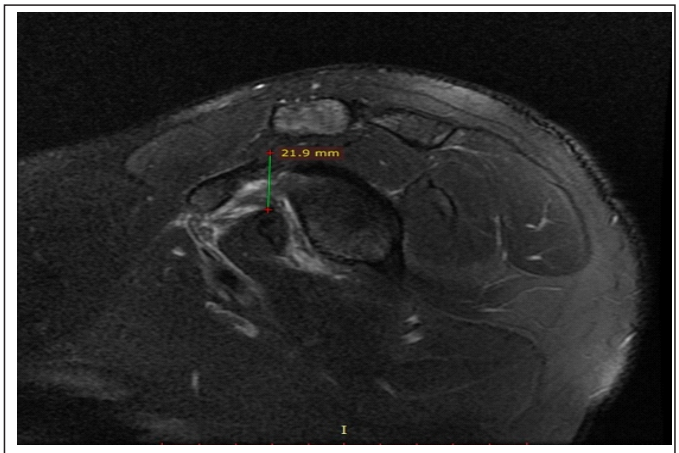

Figure 2: Assesment of Rotator Interval Height.

respectively] [p value = 0.03]. There was no significant difference between the two groups in terms of rotator interval base length or rotator interval area.

Out of 124 patients included in the study, 76 were male patients and 48 were female patients. The mean age group among the male patients was 42 years and in female patients was 38 years. The P value among the male patients was 0.03 and in female patients was 0.04. 11 out of 124 patients were in athletics or competitive sports.

Discussion

Rotator interval dimensions vary significantly between the shoulder instability group and normal population. However there was significant difference between the groups only in term of the height of the rotator interval. The height of the rotator interval was significantly more in the instability group. Our hypothesis is that, this is an independent variable in addition to the labral tear and the Hill Sach's lesion. Weather adding the rotator interval closure to the routine instability surgery shall improve the results of the surgery is a subject for future research.

In order to understand the pathology of the rotator interval, it is important to realize that any single structure or combination of structures can be affected [1].

Rotator interval contractures constitute a spectrum of disease ranging from mild rotator cuff impingement to debilitating adhesive capsulitis. In its most incapacitating form, it is characterized by painful motion and frequently causes rest and night pain. It is thought to occur more frequently and respond less readily in diabetic populations [13,14].

Radiographs are typically normal, and decreased capsular volume may be apparent with arthrography. Magnetic resonance imaging (MRI) studies report obliteration of the subcoracoid fat plane and anatomic changes in the rotator interval [15,16].

The opposite end of the spectrum encompasses redundancy of rotator interval structures. Laxity may contribute to instability and resultant pain [4,7,10].

Patients presenting with laxity of rotator interval ligamentous or capsular structures often report a history of acute trauma or overuse injuries that eventually lead to tissue insufficiency and laxity. Many of these patients will complain of instability or early fatigue. The presence of a persistent sulcus sign despite glenohumeral external rotation may suggest pathologic laxity when symptoms are elicited [3,10,17,18].

There have been other studies in literature [18] which have measured the rotator interval dimensions on MR Arthrography. The results of the present study suggest that similar results can be obtained using conventional MRI also, thus avoiding the risks of contrast injection and the complications associated with invasive procedure of a joint.

However, the present study has certain limitations. It was not confirmed whether rotator cuff abnormalities in the group B had contributed to the rotator interval pathology, because there was no arthroscopic evaluation to effectively rule out associated rotator interval pathology. To minimize these effects on the rotator interval according to the clinical circumstances, we selected shoulders that were otherwise normal on magnetic resonance arthrography without range-of motion limitation and shoulders with rotator cuff tendinitis or a partial-thickness rotator cuff tear without range-of motion limitation. Another limitation was the retrospective nature of the review. Therefore, the dimension measurements in the instability and normal groups were not confirmed with use of an arthroscopic evaluation. Only one observer measured the rotator interval dimensions, although the images were evaluated by the consensus of two shoulder surgeons with particular attention being paid to identifying and evaluating the rotator interval. An ideal study design would have compared MRI of patients of shoulder instability with equal number

Group	Rotator interval height [mm][Mean]	Rotator interval base[mm] [Mean]	Rotator interval area[mm2] [Mean]
A	18	41	376
B	15	42	304
P value	0	0	0.9
Difference	Significant	Insignificant	Insignificant

	Males	Females
Sex determination (no. of patients)	76	48
Mean Age group (in years)	42	38
P value	0	0

Results

of MRI of normal population. However getting MRI for normal population would increase the cost of the study significantly and would bring in ethical issues also. Hence the next best alternative is to select patients in whom the pathology is not expected to affect the rotator interval dimensions, which was done in the present studies. Despite all these limitations, this study is important as it helps to define the dimensions of the normal rotator interval with the use of magnetic resonance imaging and to compare these dimensions with those in shoulders with known chronic anterior instability, in order to determine if the abnormalities of the rotator interval might be better understood and estimated preoperatively.

Conclusion

The rotator interval continues to be an area of intense interest for shoulder surgeons. Although precise roles for the ligamentous and capsular structures are debated, our ability to satisfactorily treat pathology of the rotator interval has become more reliable. Anterior glenohumeral instability may be treated nonsurgically in older age group patients. The indication for surgical stabilization is established by analyzing risk factors and the implications of recurrence. In young, competitive athletes involved in contact sports, early surgical treatment should be considered. Arthroscopic surgery has given satisfactory results in such cases. Henceforth, an understanding of the normal and pathological anatomy of the rotator interval may be helpful for the successful diagnosis and treatment of lesions in this region.

References

1) Fitzpatrick MJ, Powell SE, Tibone JE, Warren RF. The anatomy, pathology, and definitive treatment of rotator interval lesions: current concepts. Arthroscopy.2003;19 Suppl 1:70-9.

2) Griggs SM, Ahn A, Green A. Idiopathic adhesive capsulitis. A prospective functional outcome study of nonoperative treatment. J Bone Joint Surg Am 2000;82:1398-1407.

3) Massoud SN, Pearse EO, Levy O, Copeland SA. Operative management of the frozen shoulder in patients with diabetes. J Shoulder Elbow Surg 2002;11:609-613.

4) Mengiardi B, Pfirrmann CW, Gerber C, Hodler J, Zanetti M. Frozen shoulder: MR arthrographic findings. Radiology 2004; 233:486-492.

5) Kim KC, Rhee KJ, Shin HD. Adhesive capsulitis of the shoulder: Dimensions of the rotator interval measured with magnetic resonance arthrography. J Shoulder Elbow Surg 2009 18:437-442.

6) Jost B, Koch PP, Gerber C. Anatomy and functional aspects of the rotator interval. J Shoulder Elbow Surg 2000;9:336-341.

7) Boardman ND, Debski RE, Warner JJ, et al. Tensile properties of the superior glenohumeral and coracohumeral ligaments. J Shoulder Elbow Surg 1996;5:249-254.

8) Harryman DT II, Sidles JA, Harris SL, Matsen FA III. The role of the rotator interval capsule in passive motion and stability of the shoulder. J Bone Joint Surg Am 1992;74:53-66.

9) Nobuhara K, Ikeda H. Rotator interval lesion. Clin Orthop Relat Res 1987:44-50.10)

10) Harryman DT II, Sidles JA, Harris SL, Matsen FA III. The role of the rotator interval capsule in passive motion and stability of the shoulder. J Bone Joint Surg Am 1992;74:53-66.

11) Field LD, Warren RF, O'Brien SJ, Altchek DW, Wickiewicz TL. Isolated closure of rotator interval defects for shoulder instability. Am J Sports Med 1995;23:557-563.

12) Fitzpatrick MJ, Powell SE, Tibone JE, Warren RF. The anatomy, pathology, and definitive treatment of rotator interval lesions: Current concepts. Arthroscopy 2003;19: 70-79 (Suppl 1).

13) Griggs SM, Ahn A, Green A. Idiopathic adhesive capsulitis. A prospective

Conflict of Interest: NIL
Source of Support: NIL

How to Cite this Article

Sen G, Gowda L, Kumaraswamy V | Measurement of rotator interval dimension using MRI and its significance in management of cases of shoulder instability | Journal Of Karnataka Orthopaedic Association | Jan-Feb 2020; 8(1): 18-21.