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Assessment of Acromial Morphology in Association with Supraspinatus Pathologies Using MRI'

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Abstract: ***Context: Supraspinatus is the most frequently involved tendon in rotator- cuff pathologies. The purpose of this study is to characterize Acromion types and to recognize which type of Acromion could be the risk factor for supraspinatus pathologies.[1] Materials and Methods: 67 patients with rotator cuff pathologies were enrolled in this study and all were subjected to MRI examination by 1 .5 Tesla SIEMENS MAGNETON ESSENZA machine. The acromial shapes were classified into type I (flat), type II (curved), type III (hooked) and type IV (convex). Results: Type II Acromion(68.5%) is the most common type and is commonly associated with supraspinatus pathologies. Out of 45 patients with curved type II acromion , 43 had supraspinatus pathologies and all 7 subjects who had type III acromion had supraspinatus pathologies. No supraspinatus pathology was found in subjects with Type IV Acromion. Conclusion: Type II acromion is the most common type appears large in number with or without rotator cuff disease, Type- III acromion (hooked shaped) is strongly associated with supraspinatus pathologies.***

Keywords: MRI, Acromion , Supraspinatus pathology

1. Introduction

Rotator- cuff pathologies are the most common cause of shoulder pain and disability.[1]The tendons of the supraspinatus, infraspinatus, subscapularis and teres minor includes in the rotator-cuff. Out of which Supraspinatus is the most frequently involved tendon in rotator cuff pathologies.[2]Variations in the shapes of acromion can lead to rotator-cuff pathologies, mainly supraspinatus tendon. Acromion morphology was classified into four types : Type I (Flat), Type II(Curved), Type III(Hooked) and Type IV(Convex).[3](figure 1). The most common type of acromion is Type II(Flat) and is appears large in number with or without rotator cuff disease. The incidence of rotator cuff tear is highly increased with type III(Hooked) acromion[4] and least with Type IV(Convex) Acromion.[3] MRI is highly accurate in diagnosing rotator cuff pathologies and assessing the acromion morphology.[5]

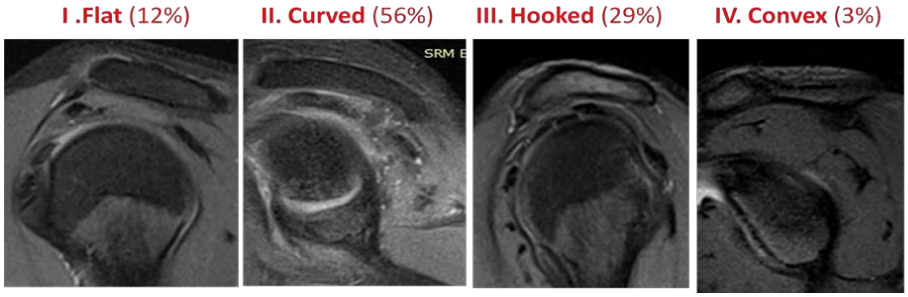

Figure 1: Types of Acromion

2. Aim

To assess Acromion morphology and its association with Supraspinatus pathologies using MRI.

3. Materials and Methods

This was a cross-sectional study and was done in the Department of Radiodiagnosis, SRM medical college hospital and research centre, Chennai for the period of January 2018 to September 2019.70 patients with clinically alleged rotator- cuff pathologies were enrolled in the study. Plain MRI was performed by **1. 5 Tesla SIEMENS MAGNETON ESSENZA** machine using shoulder coil. The following MRI protocol was used with field of view for about 16- 18cm and slice-thickness for about 3mm in our study.

Table 1: Protocol for MRI in evaluation of rotator-cuff injuries[6]

No	Orientation	Sequence type
I.	Axial	**i)** MEDIC/ GRE **ii)** PD- FS
II.	Coronal	**i)** PD- FS **ii)** T2 WI **iii)** T1 WI
III.	Sagittal	**i)** PD- FS **ii)** T2 WI

Inclusion Criteria

All patients who were referred to the radiology department with

- Clinically suspected rotator cuff injury
- History of restricted movements in shoulder.
- Age group: 18-70 years.

Exclusion Criteria:
Patients with

- Previous history of any shoulder surgery.
- Shoulder implants,
- Cardiac pacemakers,
- Claustrophobia,
- Uncooperative during the study.

Assessment of the acromion morphology:
The assessment of the acromion types was achieved by using a mathematical classification system described in Figure 2.

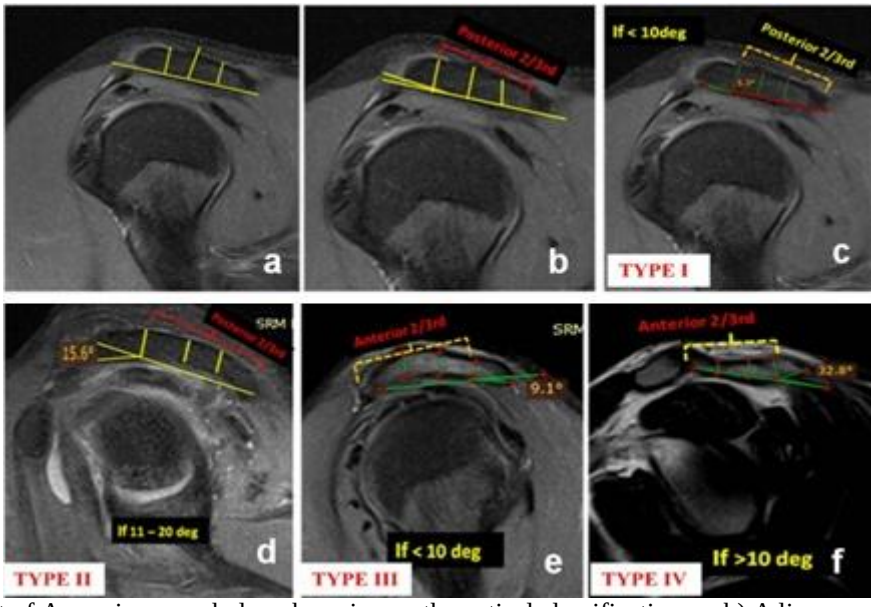

Figure 2: Assessment of Acromion morphology by using mathematical classification; a- b) A line was drawn connecting the most caudal margins of the under surface of the acromion and this line was divided by two orthogonal planes into 3 equal segments. c) Angle between anterior 1/ 3rd and the posterior 2/3 rd of the acromion was measured If this angle was 10° or less, TYPE- I acromion was considered. d) If 11°-20° then ,TYPE- II acromion was considered. e) If the angle was more than 20°,then angle between posterior ⅓ and anterior ⅔ was further measured. If the last-mentioned angle was, 10° or less,TYPE - III was considered. f) If the angle was morethan 10°,then TYPE- IV was considered.[7]

4. Results

Out of 70 patients, 67 patients were found to have supraspinatus pathologies. They were 50 males and 20 females. Their age ranged from 16 to 72 years and the mean age of population was 39 years. In our study, we found four different types of Acromion mainly on sagittal T2WI/PDFS. Majority of subjects 48 (68.5%) have curved type (II) of acromion followed by Type I (Flat) type- 13(18.6%) and the least common type is Type IV(Convex) . In our study out of 45 patients with curved type II acromion , 43 had supraspinatus pathologies and all 7 subjects who had type III acromion had supraspinatus pathologies. No supraspinatus pathology was found in subjects with Type IV Acromion.

Table 2: Cross tabulation of acromion types and supraspinatus pathologies (n= 67)

Acromion types	Pathology of supraspinatus muscle		Chisquare value	p value
	Present	**Absent**		
Type I(Flat)	12(92. 3%)	1(7.7 %)	10.94	0.03*
Type II (Curved)	43(95. 6%)	2(4.4 %)		
Type III(Hooked)	7(100 %)	0		
Type IV (Concave)	0	2(100 %)		

*Fischer's exact p value<0 .05 is significant

5. Discussion

'Rotator-cuff' pathologies are the 'most frequent' finding in patients with shoulder pain. In our study 67(95.7%) out of 70 patients presented with rotator cuff pathologies and this correlates with the study carried out by Mitchel C et al in 2005.[8] In our study, we found 4 different types of Acromial shapes mainly on sagittal T 2WI/PDFS based on mathematical classification by **Raina E Mohammed et al 2013**.[3] Only 2 out 70(2.9%) has Type IV acromion and 'most' of the patients have Type II (68.5 %) curved acromion, which correlates with the study conducted by **Sachin kumar yadhav et al 2017**[4] and **Raina E Mohammed et al 2013**[3]. In contrary to our study, **Farley et al (1994)**[9] and **Hirano et al (2002)**[10] showed type I acromion is the most common type.

Table 3: Distribution of acromion types in various articles

Author/ Year	Method	Acromion Types (%)			
		I	II	III	IV
Bigliani et al. (1986) [11]	Radiographs	18.6	42	38.6	-
Epstein et al.(1993)[12]	MRI	29.7	37.8	32.5	-
Gagey et al.(1993)[13]	MRI	27.5	58.8	12.1	1.6
Farley et al.(1994) [9]	MRI	47	39	11	3
Vanarthos et al.(1995) [14]	MRI	40	36.7	10	13.3
Hirano et al.(2002) [10]	MRI	36.3	24.2	39.6	-
OUR STUDY	**MRI**	**18.6**	**68.5**	**10**	**2.9**

In our study, all 7 subjects (100%) who had Type III acromion had supraspinatus pathologies, which was statistically significant (p value = 0. 03). Similar to our study, **Raina E.Mohamed et al 2013**[3] study shows that type III acromion is strongly associated with supraspinatus pathologies(p value = 0.016).

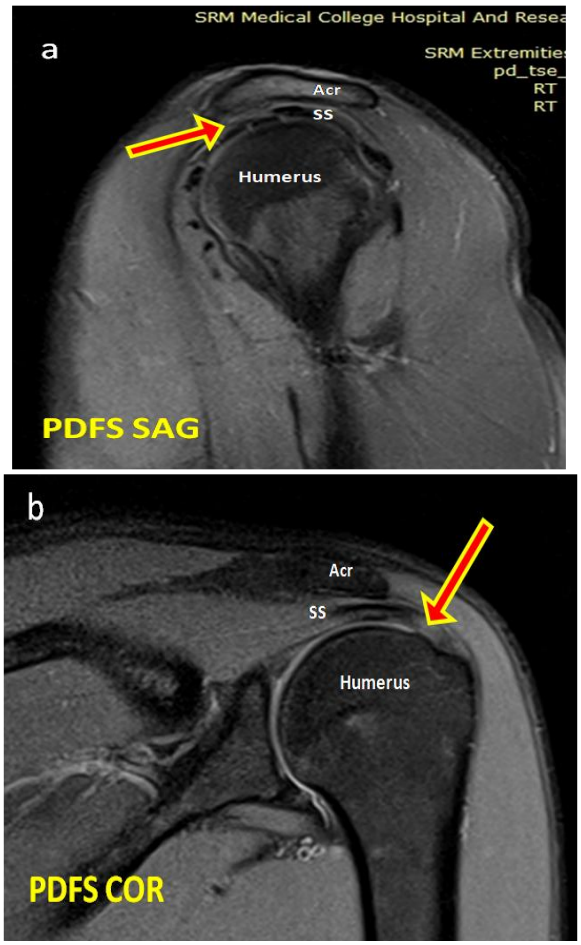

Figure 3: Supraspinatus tendinosis : MRI PD-FS Sagittal(a) and coronal(b) images shows Type III Hooked Acromion(Acr) impinging on supraspinatus(ss) tendon showing hyperintense signal

In our study, out of 45 study subjects with curved Type II acromion, 43(95. 6%) had supraspinatus pathologies. Concordance to our study, few studies conducted **Raina E.Mohamed et al 2013**[3], **Sachin kumar yadhav et al 2017**[4], **Epstein et al 1993**[12], **Hirano et al 2002**[10] and **Farley et al 1994**[9]showed 'type II' acromion (Curved) is the most common type and is commonly associated with supraspinatus pathologies, However, all type II acromion was not associated with supraspinatus pathologies.

In our study, out of 2 subjects with type IV acromion, 'none' of the subjects had supra-spinatus pathologies, which correlates with the study conducted by **Maurice Balke/2013**[15], which showed 'no' recognized supraspinatus pathologies in subjects with Type IV acromion. This also correlates with the study performed by **Raina E.Mohamed et al 2013**[3] which showed that type- IV acromion shape was ' not familiar' in patients with complete supraspinatus tear, and only 2 (5.2%) patients with type- IV acromion had ' partial supraspinatus tear'.

Table 4: Correlation of Acromial Morphology Types with Supraspinatus Pathologies in various articles

Author/ Year	Study population (n)	Patients with supraspinatus Pathology (%)			
		Type I	Type II	Type III	Type IV
David A. Toivonen/1995[89]	91	37	43	20	NA
Maurice Balke/2013[98]	150	28	52	20	0
Raina E. Mohammed/2013[65]	86	31.6	50.0	13.2	5.2
Our Study	70	19	70	11	0

6. Conclusion

Type II acromion is the most common type, appears large in number with or without rotator cuff disease. Type- III acromion is strongly associated with supraspinatus pathologies. To conclude that, Type III hooked acromion could be considered as a risk factor for supraspinatus pathologies. Type IV acromion is the least common type in our study with no associated supraspinatus pathologies.

7. Limitations

Small number of subjects with Type IV acromion was found in our study, So further studies with more number of subjects with Type IV acromion are suggested to look for its association with supraspinatus pathologies.

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