Original Research Article

Radiographic study of anatomical basis of Coracoacromial arch impingement due to varied morphology of acromion process

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Abstract

The purpose of this study to know the different shapes of acromion process according to Beglani and Edelson and Traitz on radiographs. For this study 260 radiographs were taken - 200 radiographs of patients having shoulder pain due to impingement and 60 Radiograph of normal patients without shoulder pain. In this study according to Beglani, there were 33 radiographs of Type I, 137 radiographs of type II and 30 radiographs of Type III, Type II radiographs being more in number than Type I and Type III in case of symptomatic patients. In case of normal patients, there were 7 radiographs of Type I, 52 radiographs of type II and 1 radiographs of Type III, Type II radiographs are more in number than Type I and Type III and anatomically Type III acromion process is responsible for impingement. According to Edelson and Traitz classification, 56 radiographs of Cobra shape, 109 radiographs of Intermediate shape and 35 radiographs of Square tip were found in case of shoulder pain patients and in case of normal patients, 4 radiographs of Cobra shape, 47 radiographs of Intermediate shape and 9 radiographs of Square tip were found. In majority of cases Cobra shape acromion is responsible for impingement, also Cobra shape acromion gets rapidly converted into Type III acromion than Square tip and intermediate Shape acromion. Also, we see the Coracoacromial arch distance is very less in Type III acromion than other Type of acromion. According to Beglani, P value is 0.000. According to Edelson and Traitz also P value for coracoacromial arch is 0.001 which ishighly significant. In normal radiographs of patients without shoulder pain p value is not significant.

Key Words: coracoacromial arch, impingement, acromion process.

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INTRODUCTION

The shoulder joint is a complex joint consisting of four joints, two spaces, numerous stabilizing ligaments, many muscles and their respective tendons. The shoulder joint requires shoulder joint is acromion process and subacromial space. The space present below the coracoacromial arch is known as subacromial space in which following muscle tendons are present- Supraspinatus, infraspinatus and teres minor. The common problem is Subacromial impingement which is still not or partially understood. The rotator cuff tendons disorders have been grouped under the following diagnostic phrase called Impingement Syndrome (Nevaiser R. J. andNevaiser T. J. 1990)[10]. The space between the arch and the glenohumeral joint is 1 to 1.5 cms. In the middle range of abduction the tendon of synchronized movements to function properly. One of the most important structure around supraspinatus muscles impinges on the overlying coraco-acromial arch. This tendon and subacromial bursa are supposed to be compressed between humerus and the arch. The former is most exposed to injury from friction against the acromion

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or the coraco-acromial ligament, the outcome of Impingement.

Coraco-acromial arch impingement[12]: Coraco-acromial arch consist of the acromion process, coraco-acromial ligament (C-A) and coracoid process. The coraco-acromial ligament lies between acromion and the coracoid process. It is a triangular ligament, base being attached to lateral border of the coracoid process and apex to the acromion. The ligament is firm and unyielding and acts as a secondary socket for the head of the humerus, since it lies above the shallow glenoid cavity. The C-A arch with the underlying subacromial bursa and loose areolar tissue provides a gliding mechanism between deep and superficial muscle strata. Traction spurs may develop in the C-A ligament on the acromial side. Thus, it is suggested that because of its anatomical position and its physical rigidity the coraco-acromial ligament becomes a prime causative factor in chronic impingement syndrome (Sarkar K. *Et al* 1990)[19]. There is higher incidence of supraspinatus rupture as compared with other muscle of the rotator cuff due to two factors-

1. Repeatedly friction against the overlying acromion
2. The greater functional importance of the supraspinatus muscle. It ordinarily acts in any movement of the humerus being necessary to allow the free play of the arm.

The common conditions met with in orthopaedic practice are

1. Chronic tendinitis (painful arc syndrome)
2. Frozen shoulder (Adhesive Capsulitis)
3. Rotator cuff tears

Tears are common above 40 years and also in young athletes. The main causes of rotator cuff tear are (Nevaiser R. J. and Nevaiser T.J. 1990)

a) Anatomical or Mechanical
b) Traumatic
c) Degenerative
d) Vascular

The supraspinatus outlet is narrowed by following factors

1. By a long hooked acromion
2. By a flat acromion where degree of curvature is decreased.

The standard operative procedure for impingement lesions up till now is Acromioplasty. and their incidence[8,11] has been increased in number. Indication for acromioplasty is mostly based on clinical diagnosis of the patient. The diagnosis is mostly supported by changes in acromial morphology on radiographs[2,8,11,20, 21,22.] The classification of acromion is done according to Beglani *et al*. (1986)[2] – Type I is nothing but flat undersurface, Type II nothing but a curved undersurface, and Type III is nothing but a hooked undersurface of the acromion on radiographs. The relation between acromion morphology, subacromial impingement and rotator cuff pathology is nicely stated[3,15]. In number of studies, a type-III acromion have found to be major causative factor for rotator cuff tear[3,7.] but not all authors have state that[11,13]. Majority of the studies have been carried out in an attempt to support or oppose Neer's original theory of extrinsic mechanical impingement as the primary causative factor of rotator cuff disease, but the role of the acromion process is up till now is unclear[11.]

MATERIAL AND METHOD

For present study, we have taken data of 200 radiographs of shoulder pain patients and 60 radiographs of normal patients without shoulder pain. Radiographs were collected from Dr G.S Kulkarni Memorable hospital and P.G Institute Miraj, Shinde Orthopaedic hospital Miraj, Date trauma centre, Sangli.

1. View of radiographs-
2. 100 radiographs of AP view of shoulder pain patients.
3. 30 radiographs of AP view of Normal patients.
4. 100 radiographs of Supraspinatus out let view of shoulder pain patients.
5. 30 radiographs of Supraspinatus out let view of Normal patients

Inclusive Criteria

1. Patients above age 18yr who attended orthopaedic OPD for shoulder pain.

Exclusive Criteria

1. Patient with surgery on shoulder.
2. Patient with inflammatory diseases of shoulder joint.
3. Patient with congenital abnormality of shoulder joint.

Types of Acromion process:

The types Acromion process classified according to Beglani *et al*. (1986) [2]

1. Type I - flat under surface,
2. Type II - curved under surface, and
3. Type III - hooked under surface of the acromion
4. **The type Acromion process classified according to (Edelson J.G. and Taitz C.1992) Classification[4]**

The acromion has been classified depending on their shape as viewed from superior surface:

1. Cobra shape
2. Square tipped
3. Intermediate shape

Measurement taken on Radiographs as follows-

Acromion- distance- (ad): The coraco-acromial ligament (C-A ligament): The distance is measured between tip of acromial process and the tip of the supra-glenoid tubercle with the help of digital Vernier calliper in mm.

Figure 1:

Figure 2:

Figure 3:

Figure 4:

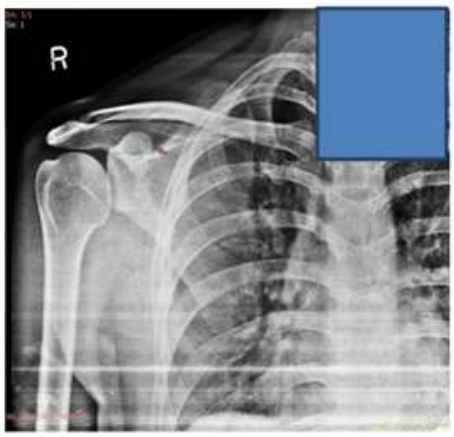


Figure 5:

Figure 6:

Figure 1: Flat under surface Square tipped; **Figure 2:** Curved under surface, Intermediate shape; **Figure 3:** Hooked under surface of the acromion Cobra shape; **Figure 4:** Type I is a flat under surface Square tipped; **Figure 5:** Is a curved under surface Intermediate shape; **Figure 6:** Is a hooked undersurface of the acromion Cobra shape

OBSERVATIONS

In this study we had taken 260 radiographs, out of which 200 radiographs are of shoulder pain patient and 60 radiographs of normal patients without shoulder pain. We studied the shape of acromion process according to Beglani et.al and according toEdelson J.G. and Taitz. Also, we had measured coracoacromial arch distance in both Shoulder pain patient and normal patients as shown in following tables.

Table 1: Coracoacromial arch distance (ad) in shape of acromion according to Edelson J.G. and Taitz C.1992 In Normal patients

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	F	P value
					Lower Bound	Upper Bound				
Total	60	12.50	5.26	0.68	11.14	13.86	1.06	24		
Cobra	4	11.78	2.69	1.34	7.50	16.06	9.68	15.58		
Intermediate	47	13.13	5.40	0.79	11.55	14.72	6.12	24	1.907	0.158
Square tip	9	9.49	4.59	1.53	5.96	13.02	1.06	19.11		

Mean +/- SE of Coracoacromialarch distance of normal patient In this table out of 60 radiographs of normal patients without shoulder pain, 47 radiographs showed intermediate shape of acromion and coracoacromial arch distance (ad) ranging between 6.12mm -24 mm: 9 radiographs showed the square tip shaped of acromion and Coracoacromial arch distance (ad) ranging between 1.06mm -19.11mm and 4 radiographs showed cobra shaped acromion and coracoacromial arch distance (ad) ranging between 9.68mm -15.58mm. P value is0.1580, which is not significant.

Table 2: Coracoacromial arch distance (ad) in shape of acromion according to Edelson J.G. and Taitz C.1992 in shoulder pain patients

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	F	Sig.
					Lower Bound	Upper Bound				
Total	200	21.92	8.17	0.58	20.78	23.06	0.08	40.24		
Cobra	56	19.51	8.14	1.09	17.33	21.69	0.08	30.77		
Intermediate	109	21.80	8.42	0.81	20.20	23.40	10.01	40.24	7.648	0.001
Square tip	35	26.16	5.46	0.92	24.28	28.04	16.7	30.9		

In this table, out of 200 radiographs of shoulder pain patients,109 radiographs showed intermediate shape of acromion and coracoacromial arch distance (ad) between 10.01mm - 40.24 mm, 35 radiographs showed square tip acromion and coracoacromial arch distance (ad) between 16.7mm -30.9mm and 56 radiographs showed cobra shape of acromion and Coracoacromial arch distance (ad) between 0.08mm-30.77mm. P value is 0. 001.which is most significant.

Table 3: Coracoacromial arch distance (ad) in shape of acromion according to Beglani *et al*. (1986)[3] In Normal patients

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	F	Sig.
					Lower Bound	Upper Bound				
Total	60	12.50	5.26	0.68	11.14	13.86	1.06	24		
Type-I	7	10.98	3.60	1.36	7.65	14.31	9.34	19.11		
Type-II	52	12.64	5.48	0.76	11.12	14.17	1.06	24	0.473	0.626
Type-III	1	15.58	.	.	.	.	15.58	15.58		

In this table, out of 60 radiographs of asymptomatic patients, 52 radiographs showed Type II shape acromion and Coracoacromial arch distance (ad) is ranging between 1.06mm -24 mm; 1 radiograph showed Type III shape of acromion and Coracoacromial arch distance (ad) between 15.58mm -15.58mm and 7 radiographs showed Type I shape of acromion and Coracoacromial arch distance (ad) between 9.34mm -19.11mm. P value is 0.626, non-significant.

Table 4: Coracoacromial arch distance (ad) in shape of acromion according to Beglani *et al*. (1986)[3] In Shoulder pain patient patients

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	F	P value
					Lower Bound	Upper Bound				
Total	200	21.92	8.17	0.58	20.78	23.06	0.08	40.24		
Type-I	33	26.49	5.43	0.95	24.56	28.42	14.93	30.9		
Type-II	137	22.10	8.23	0.70	20.71	23.49	0.08	40.24	14.634	0.000
Type-III	30	16.08	6.93	1.26	13.49	18.67	0.8	30.45		

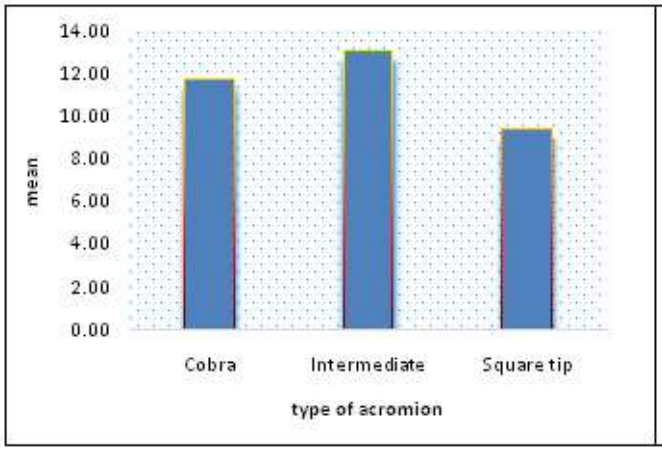
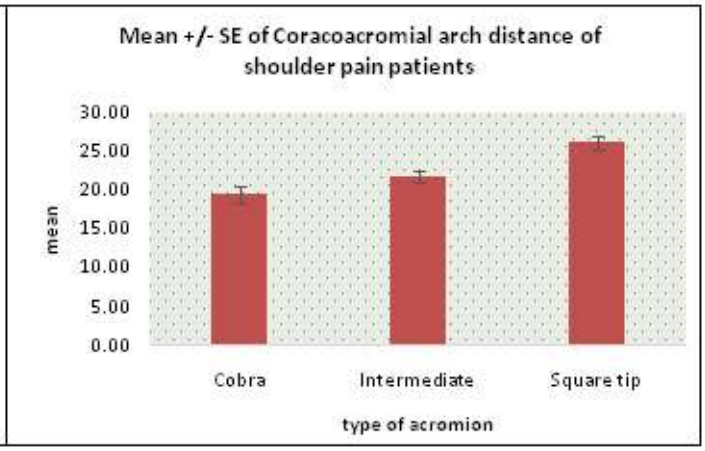


Figure 7



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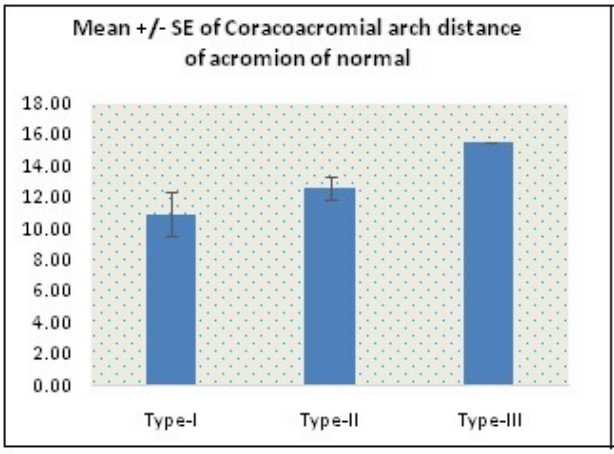

Figure 9

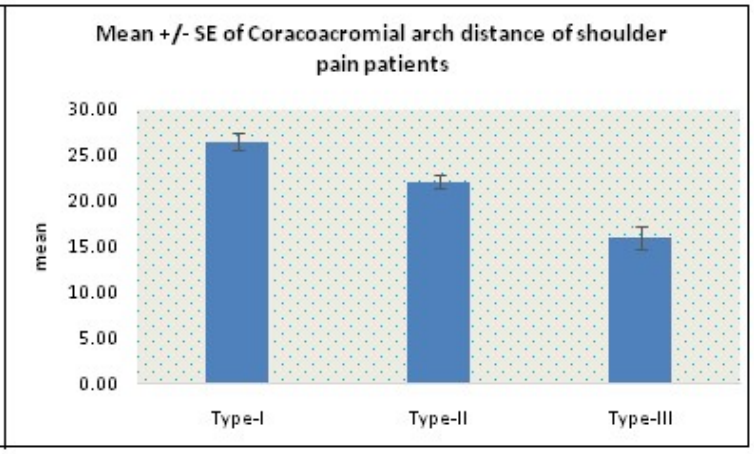

Figure 10

This table showed that out of 200 radiographs of shoulder pain patients,137 radiographs showed Type II shape of acromion and Coracoacromial arch distance (ad) between 0.08mm -40.24 mm; 33 radiographs showed Type I shape of acromion and Coracoacromial arch distance (ad) between 14.93mm -30.9mm and 30 radiographs showed Type III shape of acromion and coracoacromial arch distance (ad) between 0.8mm -30.45mm. P value is 0.000, highly significant. This radiographic study of shoulder joint shows that mostly cobra shape acromion is causative factor for impingement. and mostly cobra shape acromion easily converted in Type III acromion than Square tip and intermediate acromion and it is the main causative factor of impingement. Also, coracoacromial arch distance is reduced in these cases, p – 0.000 is highly significant.

DISCUSSION

In our study highest number of acromion is of type II followed by Type I and least number is of Type III. The result of our study is similar to study of, Getz *et al*[5] and Shah *et al*, Nigar *et al*[13], Paraskevas *et al*[16]. But it differs from study of Bigliani *et al*[1,2] and Natsis *et al* [14] (II>III>I). There are 30 acromion of type III in our study in symptomatic patients of younger age group. We may say that as type of acromion goes higher, there is small subacromial space making patient symptomatic at younger age. There are limitations in our study as the patient designated to each group are classified according to clinical examination and not based on MRI. But MRI is a relatively costlier investigation. Thus, only by basis of clinical and radiographical examination, we can decide which patient to be aggressively investigated with MRI. Other limitation is that only two aspects of Acromion Morphology i.e. type and coracoacromialdistance are taken into consideration.

CONCLUSION

Our study concludes that

1. Type III acromion process
2. Cobra shape acromion process
3. Reduced coracoacromial arch distance

are anatomical causative factors predisposing for shoulder impingement. Though acromion type is not the only indicator for shoulder impingement, it serves as a valuable guide in deciding which patient to be treated aggressively. Type II acromion and Cobra shape acromion get converted in to Type III acromion rapidly due to degenerative changes as comparable to other types of acromion process; so, these can be taken care of at an early age in younger individuals.

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