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Study of Variant Acromion Process of Scapula and its Clinical Significance

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Abstract

Shoulder pain is the common cause for the compromised quality of life of the individuals and is due to shoulder impingement syndrome (SIS). A variant acromial morphology and consequent subacromial space reduction is deliberated as the chief basis of subacromial impingement. There are four types of acromion process. Type 1 - flat shaped acromion process, Type 2 – curve shaped acromion process, Type 3 – hook shaped acromion process, Type 4 - convex or upturned acromion process. Type 2 – curved acromion process is most common. Rotator cuff diseases are associated with anatomical variations in the morphology of the acromion process. The aim of the study was to understand the variations of the acromion process, and note its clinical importance so as to help clinicians dealing with rotator cuff diseases.

Material and Methods: A total 100 dry ossified scapulae were studied in the Department of Anatomy of K. J. Somaiya Medical College, Sion, Mumbai. The acromia were classified into the 4 types, according to their shape. The length of the acromion and the acromio - glenoid distance was also taken into consideration. Photographs of the acromion process of scapula were taken for the ready reference.

Results: The number of specimens showing type II acromion is greater than Type I while Type III was present in the least number of specimens.

Conclusion: This correlation between length of acromion and acromio-glenoid length is due to the reduction in the subacromial space in the hooked acromia, which more often leads to shoulder impingement syndrome. The study thus helps in diagnostic studies on diseases of the shoulder and aids in treatment and in surgical correction.

Keywords: Acromion, Rotator Cuff, Acromio-Glenoid Distance, Subacromial Space, Shoulder Impingement Syndrome.

Introduction

The acromion process is one of the three processes of the scapula other two are coracoid process and spinous process. The acromion process continues as spinous process of the scapula and forms the summit of the shoulder. The acromion projects laterally overhanging the glenoid cavity. It articulates with the acromial end of the clavicle to form the acromioclavicular joint which is plain variety of synovial joint. Its superior surface gives attachment to the fibers of the deltoid muscle. Its inferior surface is related to subacromial (subdeltoid) bursa which is largest bursa in the body. The thick lateral border of acromion process gives tendinous origins of the middle fibres of the deltoid muscle. The medial border gives attachment to trapezius muscle. In its approximate centre, there is a small oval surface for articulation with the acromial end of the clavicle to form the acromioclavicular joint. The coracoacromial ligament is a triangular ligament, the apex of which is attached to the tip of the acromion and the base to the lateral border of the coracoid process. The three structures, namely the acromion process, the coracoacromial ligament and the coracoid process, together form coracoacromial arch, which is known as the secondary socket for the head of the humerus.[1] There are four types of acromion process. Type 1 - flat shaped acromion process, Type 2 – curve shaped acromion process, Type 3 – hook shaped acromion process, Type 4 - convex or upturned acromion process. Type 2 – curved acromion process is most common.[2]

Rotator cuff also known as muscolutendinous cuff of the shoulder is a fibrous sheath formed by the four flattened tendons which blend with the capsule of the shoulder joint and strengthen it. The muscles which form the cuff take their origin from the scapula and are inserted into the lesser and greater tubercles of the humerus, namely subscapularis muscle, supraspinatus muscle, infraspinatus muscle and teres minor muscle. Their tendons, while crossing the shoulder joint, become flattened and blend with each other on one hand and with the capsule of the shoulder joint on the other hand, before reaching their points of insertion.[3] The aim of the study was to understand the variations of the acromion process, and note its incidence so as to help orthopaedics to diagnose and treat pathologies related to acromion and rotator cuff. These anatomical findings are significant for dealing with rotator cuff diseases.

Material and Methods

Hundred ossified, dry human scapulas were taken for study in the Department of Anatomy of K. J. Somaiya Medical College. 55 were of the left side and 45 belonged to the right side. Damaged and degenerated bones were excluded from the study. The sliding Vernier Calliper was used to measure the length of the acromion. The highest point of the acromion process was noted. If the height of the acromion was less than 2% of the acromial length, it was classified as Type 1. If the highest point was above middle third of acromial length, it was classified as Type 2, If the highest point was above anterior third of acromial length, it was classified as Type 3. If the under surface of the acromion was convex (upturned) near the distal end, showing the presence of a lowest point it was classified as Type 4. To confirm our findings, the acromio glenoid distance, from the tip of the acromion to the supraglenoid tubercle was also taken into consideration. Photographs of the acromion process of scapula were taken for the ready reference.

Results

Out of the 100 acromion process examined, type 1 (flat shape) was seen in 46% of the specimens and type 2 (curved shape) was seen in 47% of the specimens. Hence, they contributed to the majority of the specimens. Type 3 (hook shape) seen in 5% of the specimens while type IV was observed in 2 specimens. Variations of the acromion process of

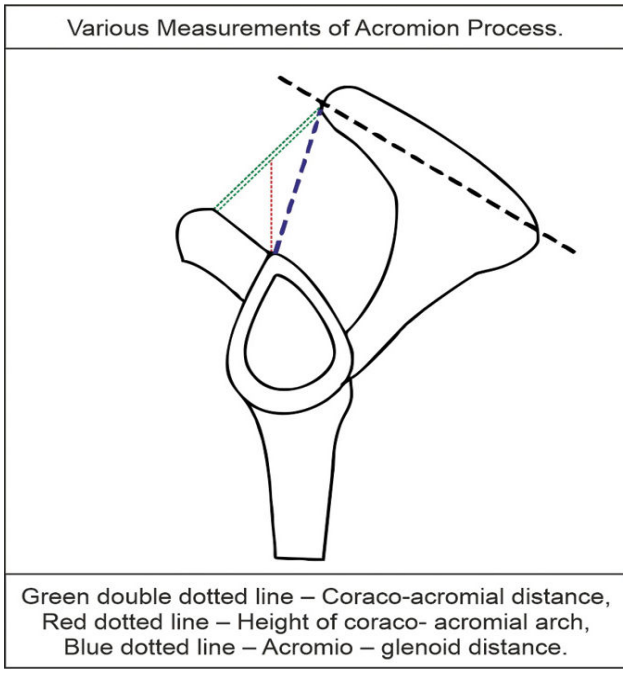

Fig. 1: Showing line diagram of various measurements of acromion process.

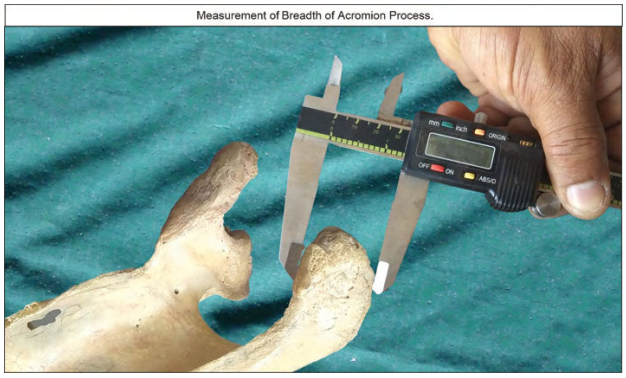

Fig. 2: Showing photographic presentation of measurement of breadth of the acromion process

Fig. 3: Showing photographic presentation of measurement of the acromio glenoid distance.

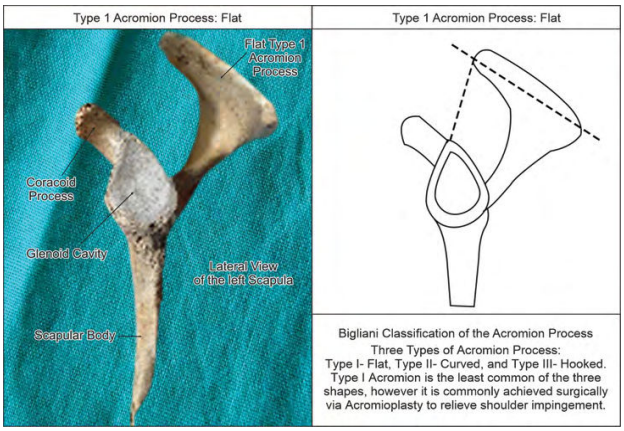

Fig. 4: Showing photographic presentation of Type 1 Flat acromion process.

scapula were unilateral.

The average length of the acromion process is 41.72±5.20 mm, breadth is 21.42±3.06 mm and thickness is 6.68±1.76 mm of the both right and left scapulae.

Discussion

Rotator cuff tendinopathy or rotator cuff injury can be a cause of pain with disability in the shoulder region and may sometimes require

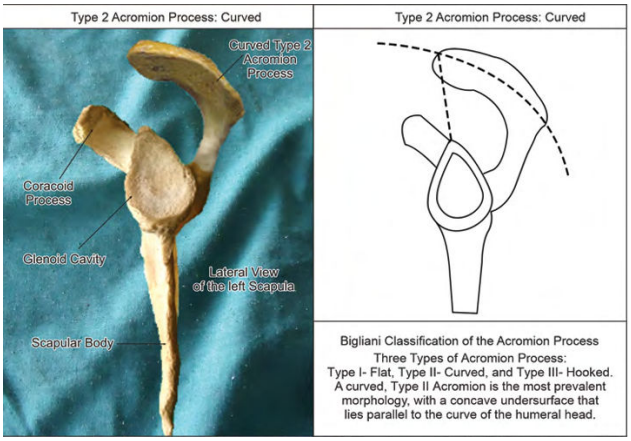

Fig. 5: Showing photographic presentation of Type 2 Curved acromion process.

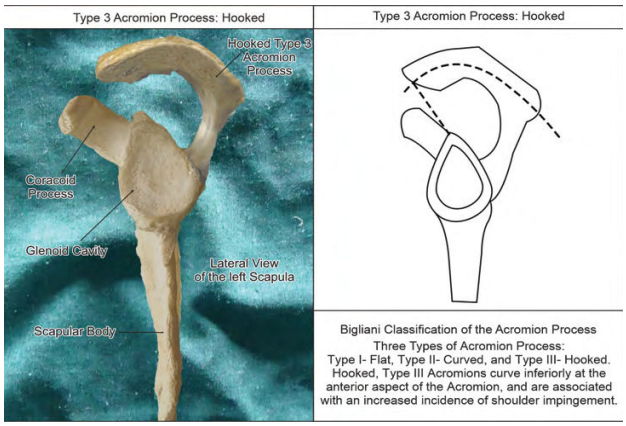

Fig. 6: Showing photographic presentation of Type 3 Hooked acromion process.

surgical correction. In 1931, Codman and Akerman suggested that degeneration of the tendons are responsible for rotator cuff tears.[4] Subsequently, in 1949, Armstrong and later Neer stated that impingement was the main cause for up to 95% of rotator cuff tears and treated successfully with anterior acromioplasty.[5,6]

In 1986, Bigliani et al classified the shape of the acromion process into three types: Type 1 -- flat shaped acromion process, Type 2 – curve shaped acromion process, Type 3 – hook shaped acromion process. He found a more incidence of rotator cuff tears in patients with a hook shaped acromion process than with a curve shaped or flat shaped acromion process. It was the first classification system to try to define morphology of acromion process. They also observed that slope of acromion process increased from Type 1 to Type 3 and thus influenced tear of rotator cuff.[7] Epstein et al proposed a modified classification in which Type 1 acromion had a height less than 2% of the length of acromion process and distinguished between Type 2 and Type 3 acromion process.[8] Park et

Table 1: Types of acromia as obtained by different authors.

	Type 1 %	Type 2 %	Type 3 %
Nicholson et al (1996)[10]	32	42	26
Natsis et al (2007)[11]	12.1%	56.5	28.8
Paraskevas et al (2008)[12]	26.1	55.6	18.1
Schetino et al (2013)[13]	5.6	57.89	36.84
Naidoo et al (2015)[14]	34.6	51.1	14
Saha et al (2016)[15]	35	61	4
Vinay G and Sivan S (2017)[16]	37.1	47.5	15.2
Sinha et al (2018)[17]	24.59	49.18	26.22
Present study (2020)	39	47	12

Table 2: The correlation between length of acromion and acromio-glenoid length as obtained by different authors

	Mean Length of acromion (mm)	Mean Acromio-glenoid length (mm)
Torrens et al[11]	49.6	29.5
Paraskevas et al (2008)[14]	46.1	17.7
Mansur et al[22]	46.6	31.4
Saha et al (2016)[23]	41.9	26.6
Present study (2020)	42.8	25.7

al proposed a different evaluation criterion for classifying morphology of acromion process which was more objective.[9]

Literature has shown the types of acromia as obtained by different authors.

On comparison it is seen that our study is consistent with that obtained from other authors.[10-17]

The number of specimens showing type 2 acromion is greater than Type 1 while Type 3 was present in the least number of specimens.

Xiaoguang Guo studied 292 scapulas. He attributed the higher type 1 and type 2 numbers and lower type 3 numbers.[18] In the most recent classification of acromion process, Prescher observed that type 2 and type 3 acromion process have a close anatomical feature as morphology of type 3 acromion process is quite similar to type 2 acromion process.[19] Farley et al. introduced a classification which includes a type 4 of acromion. [20] It was observed in literature in the study of Natsis et al as 2.6%.[11] In our study we observed Type IV acromion in 2 (2%) specimens.

The correlation between length of acromion and acromio-glenoid length is suggestive of reduction in the dimensions of the subacromial space in the hook shaped acromion process, which leads to tear of the rotator cuff.[21]

In our study the mean length of the acromion was 42.8mm which was more than the length observed by Saha et al. but less than Torres et al, Paraskevas et al and Mansur et al.[11,14,22,23]

Many researchers had reported impingement and its association with acromion process. In coming days, a reliable classification is needed to diagnose rotator cuff disease and their surgical corrections in order to avoid recurrence.[24,25]

Clinical significance

Moderate to severe pain is associated with both type 2 – curve shaped and type 3 – hook shaped acromion process and mild pain has been associated with type 1 – flat shaped acromion process. The acromion plays an vital role in shoulder pathology diagnosis of shoulder joint diseases and its treatment like intra articular shoulder injection, and arthroscopic surgeries on shoulder joint.[26]

An acromioplasty is a procedure performed on acromion process. If the procedure has to be done with accuracy, it is important have knowledge of morphology of acromion process.[27] Acromioplasty usually alleviates impingement pain but it is a problem during arthroscopic procedure. Advance acromioplasty can lead to fracture of acromion process or weakness of deltoid muscle. Hence several authors have opined the importance of morphological parameters of acromion process before planning surgery.[28]

Conclusions

Variations in the morphology i.e. size and shape of the acromion process and length of acromio-glenoid space, which were documented in the present study, will be of immense help for orthopaedicians to deal with impingement syndromes. The study thus contributes towards diagnostic studies on shoulder pathologies and aids in treatment and in surgical planning.

Competing interests

The authors declare that they have no competing interests.

Authors' Contributions

SR drafted the manuscript, performed the literature review & SPS assisted with writing the paper.

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