

Research Article

Incidence of rhomboid impression and subclavian groove in the adult human clavicles

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Abstract

Aim: Anthropology has been widely explored mainly when related to bones due to its morphologic characteristics, such as the rhomboid fossa and subclavian groove of the clavicle. The aim of this study was to examine the incidence of the rhomboid impression and also the subclavian groove in clavicles.

Materials and methods: 70 clavicles (40 right and 30 left) were collected from the Department of Anatomy, Teerthanker Mahaveer Medical College & Research Center and used for the study. Rhomboid impression was studied as per AJE Cave classification. Rhomboid impression and subclavian groove were also assessed as absent, small, medium or large in terms of area as per L.J Ray recommendation.

Results: We found that the most predominant type of rhomboid impression was flat rough type (40%) and least one was elevated smooth (2.9%) or elevated rough (2.9%). Size of the impression was small, medium and large in 37.1%, 30% and 33% clavicles respectively. Most of the right clavicles presented large and left clavicles presented small sized impression. Subclavian groove was absent in 15.7% and present in 84.3% clavicles. Most of the right and left clavicles showed predominance of small sized subclavian groove (42.5% and 40% respectively).

Conclusion: The side differences in the incidence of the rhomboid fossa and subclavian groove could be found in this study. The gender wise variation can be further analysed to corroborate sex determination of unidentified bodies in forensic medicine. These morphological skeletal traits are also of great value for anthropologists and anatomists.

Keywords: Rhomboid impression, Subclavian groove, Clavicle

1. Introduction

Clavicle is morphologically distinct bone. It is the first bone to ossify and begins its ossification in membrane with two primary centers of ossification. Clavicles are absent from forelimbs in ungulates and carnivores but are well developed in prehensile limbs in primates and in man^[1]. Costoclavicular ligament is a strong, dense band which extends from the first costal cartilage and the adjoining part of the first rib to the inferior surface of medial part of the shaft of the clavicle². It is disposed as an inverted, truncated cone, flattened antero- posteriorly³. The costoclavicular ligament (ligamentum costoclaviculare) or rhomboid, on its insertion in the lower portion of a clavicle, can produce impressions, tuberosities, depressions, and even a fossa, known anthropologically and anatomically as the rhomboid fossa⁴. Previous studies have evaluated the relationship between the presence of clavicular rhomboid fossa, and sex in skeletons of various populations worldwide, and found significant results related to incidence of the rhomboid fossa, being higher in males than females^{5,6}. Rogers *et al* (2000) examined the presence of the rhomboid fossa in relation to sex and to age of individuals in determining the sex of unidentified skeletons, since the rhomboid fossa was commonly associated with males more than females (36% for male left clavicles, 31% for male right clavicles, 3% for female left clavicles and 8% for female right clavicles)⁴.

In a well marked clavicle the subclavian groove is sharply defined and is the obvious structure on the inferior surface of the bone. It appears towards the medial end, gradually deepens and become well formed medial to the conoid tubercle at which it may terminate or else pass for short distance lateral and anterior to it. Even in cases where the subclavian groove is readily visible, it is usually palpable but in some male and female specimens, it would neither be felt⁷.

Due to the scarcity of studies dedicated to this theme in the Indian population, the anthropologists in India usually refer to foreign research findings which do not always correspond to the national reality. Therefore, the aim of the present study was to determine the presence of the clavicular rhomboid fossa and subclavian groove in the Indian population.

2. Materials and methods

The materials for the present study consisted of 70 (40 right and 30 left) adult clavicles which were collected from the Department of Anatomy, Teerthanker Mahaveer Medical College & Research Center, Moradabad. Bones showing pathological deformity or fractures were excluded from the study. Parameters studied were rhomboid impression and subclavian groove. Rhomboid impression was studied as per AJE Cave classification⁶. Rhomboid impression and subclavian groove were also assessed as absent, small, medium or large in terms of area as per L.J Ray recommendation⁸.

3. Results

We expressed the incidence of rhomboid impression and subclavian groove in terms of percentage. We found that the clavicles, both right and left mostly contained flat rough type of rhomboid impression (37.5% and 43.33%) where as flat smooth type was more common in left clavicle (30%). Deep

rough and deep smooth type was more frequent in right clavicles (22.5% and 15%). Least frequent type of rhomboid impression was elevated rough and elevated smooth in both right and left clavicle (Table 1). When incidence of subclavian groove was evaluated we found that 92.5 % of the right clavicles and 73.33 % of left clavicle contained subclavian groove (Table 2). Small sized rhomboid impression was mostly present in left clavicle (53.33%) whereas most of the right clavicles contained medium sized rhomboid impression (45%). Subclavian groove was absent in 10 % of the right and 26.66% of the left clavicles. In both right and left clavicles small sized subclavian groove was more common (42.5% and 40%, Table 3).

Table 1: Types of rhomboid impression on right and left clavicles

Types	Rhomboid impression	Right(n=40)	Left(n=30)	Total(n=70)
1	Flat rough	15(37.5%)	13(43.33%)	28(40%)
2	Flat smooth	7(17.5%)	9(30%)	16(22.8%)
3	Deep rough	9(22.5%)	5(16.67%)	14(20%)
4	Deep smooth	6(15%)	2(6.67%)	8(11.4%)
5	Elevated rough	1(2.5%)	1(3.33%)	2(2.9%)
6	Elevated smooth	2(5%)	-	2(2.9%)

Table 2: Presence of subclavian groove

SN	Subclavian groove	Right(n=40)	Left(n=30)	Total (n=70)
1	Present	37(92.5%)	22(73.33%)	59(84.3%)
2	Absent	3(7.5%)	8(26.67%)	11(15.7%)

Table 3: Size of rhomboid impression and subclavian groove

Size of rhomboid impression			Total
Size	Right (n=40)	Left (n=30)	n=70
Absent	-	-	-
Small	10(25%)	16(53.33%)	26(37.1%)
Medium	18(45%)	3(10%)	21(30%)
Large	12(30%)	11(36.67%)	23(33%)
Size of subclavian groove			Total
Size	Right (n=40)	Left (n=30)	n=70
Absent	4(10%)	8(26.66%)	12(17.1%)
Small	17(42.5%)	12(40%)	29(41.4%)
Medium	13(32.5%)	5(16.67%)	18(25.7%)
Large	6(15%)	5(16.67%)	11(15.7%)

4. Discussion

Due to the recent advancements in the field of imaging techniques, the structural details are easily visualized. A deficient knowledge of normal morphological variants becomes crucial while differentiating between normal and abnormal. The morphology of attachment area of costoclavicular ligament on the clavicle (as well as the first rib) is a relatively neglected entity that can potentially cause diagnostic errors.

Most of the authors believe that the costoclavicular ligament is made up of anterior and posterior lamina with an intervening constant bursa⁶, while other deny the bifascicular nature of the same^{9,10}. The roughened architecture of the attachment area of costoclavicular ligament on clavicle and first rib suggests that there is no intervening bursa and the ligament is attached throughout this roughened impression, forming a fibrous articulation between the clavicle and first rib. This articulation between clavicle and first rib by costoclavicular ligament is regarded as fibrous joint by Hollinshed¹¹.

Whereas those clavicles and first ribs where this ligamentous attachment area showed smoothness indicates the presence of bursa between the two lamina of costoclavicular ligament. In cases where circumscribed elevated and smooth type of impression is present (facets), it is hypothesized that this bursa will form the synovial cavity of the diarthrodial articulation between clavicle and first rib. The presence of this synovial variety of costoclavicular joint is also confirmed in a radiological study by Johnell¹². The probable factors responsible for the above morphological variations are environment, genetic constitution, rate and pattern of growth and type of bone remodeling^{13,14}.

In the present study we found that flat and rough type of rhomboid impression was predominantly present in both right (37.5%) and left clavicle (43.33%). Our finding was similar to that of Balvir *et al* who showed 30% incidence of flat and rough type of impression in right clavicle and 33.33% in the left. But according to Rani *et al*, most predominant type of rhomboid impression is depressed and rough. They found 30.97% of the clavicles to contain depressed and smooth type of rhomboid impression which was in accordance with Jit and Kaur who exclusively studied a large population of adult clavicle (789) in Indians for the presence of rhomboid fossa and reported that 37.3% incidence of deep and rough type of impression¹⁵.

The presence of rhomboid fossa is correlated with the age and sex of the individual by many workers^{16,17,18}. Paraskevas *et al* studied 80 chest radiographs and found 26.88% incidence of excavated type of rhomboid fossa which was correlated with the gender, sidedness and handedness. They found higher incidence of fossa on right side in right handed person and on left side in left handed person. So they proposed mechanical theory for the formation of fossa¹⁸.

In this present study we also found that 37.1% of the clavicles contained small sized and 33% of the clavicles contained large sized rhomboid impression. Likewise 41.4% of the clavicle showed small sized subclavian groove and only 15.7% clavicles had larger subclavian groove. The subclavian groove was absent in 17.1% of cases. Balvir *et al*¹⁵ found that the incidence of large rhomboid impression and large subclavian groove were 48.33% and 38.33% respectively whereas the incidence of small rhomboid impression and subclavian groove according to them were 17.5% and 20.83% respectively. In their study the subclavian groove was absent in 6.7% clavicles.

5. Conclusion

The knowledge of various types of ligamentous impression and groove for subclavian vein on clavicle is important clinically because these morphological varieties can be misinterpreted by radiologists while observing clavicular region. Rhomboid fossa and subclavian groove can be misdiagnosed as simple benign fibrous dysplasia or chronic osteomyelitis whereas elevation on clavicle may be confused with hyperostotic changes. These morphological skeletal traits are also of great value for anthropologists and anatomists. The genderwise variation can be further analysed to corroborate sex determination of unidentified bodies in forensic medicine.

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