

## Osteometric Study of Dry Human Clavicle with Reference to Rhomboid Fossa to Determine Sexual Dimorphism and Its Mid Shaft Circumference

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### Abstract

**Introduction:** The characteristic S-shaped clavicle bone provides communication between the chest and the upper limb, so it plays an important role in the whole function of the shoulder girdle. For clavicle, various parameters including length, midshaft circumference, sternal end, acromial end, and rhomboid fossa have been used to identify sex in anthropology and forensic sciences. The rhomboid fossa of clavicle, an area of the inferior surface of the sternal end of clavicle, could be present as an impression, tuberosity, depression, or fossa. **Methodology:** Total 123 dry clavicles were included in this study. The duration of study was over a period of one year. This study was conducted in Department of Anatomy, CIMS Medical college, Bilaspur, Chattisgarh. **Result:** The result of this study revealed that the elevated type of rhomboid fossa was more common in males than females, while smooth and flat types were more common in females than males. **Conclusion:** It can be concluded that, significant degree of sexual dimorphism of rhomboid fossa of clavicle and also in mid shaft circumference would be lightening to further studies on molecular bases which relate to sexual dimorphism and type of clavicle in recent specimens. The results of molecular studies can be correlated with type and the sex of clavicle which could be used as a qualitative criterion in differentiation of sex of clavicles from skeletal remains of cadavers in the population.

**Keywords:** Human Clavicle, Rhomboid Fossa, Mid Shaft Circumference.

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### Introduction

The clavicle is a long bone. It has a shaft[1] and two ends. When the costoclavicular ligament or rhomboid ligament, is inserted in the inferior surface on medial end of clavicle, it can lead to development of impressions, tuberosities, depressions, and even a fossa[2]. This formation is anatomically known as the rhomboid fossa. This fossa has a great anthropological importance. The depressed type of fossa may be very large sometimes. It is called as "excavated" type morphologically. The process of identification of humans, particularly in the determination of the sex of whole skeleton has become more and more[2] complex. The two most important attributes of biological identity of an individual are 'determination of gender' and 'estimation of age'. For establishing identity of a person, the morphological and morphometrical traits of human skeletal elements have been used extensively[3]. In anthropology and forensic sciences, parameters like length, midshaft circumference, sternal end, acromial end, and rhomboid fossa have been used to identify sex dimorphism. The rhomboid fossa of clavicle, an area of the inferior surface of the sternal end, could be present as impression, tuberosity or depression. As the rhomboid fossa is attached by costoclavicular or rhomboid ligament, it is usually called "impression for costoclavicular ligament.[4] The costoclavicular ligament connects the first rib to the clavicle, stabilizing the pectoral girdle. It produces skeletal traits. These traits may be tubercles, roughened impressions, shallow groove- like fossae, deep fossae, or leave no trace. A shallow

depression at this sternal end of clavicle is generally referred as "rhomboid fossa." [5] The costoclavicular ligament could produce landmarks at the site of its clavicular attachment. These impressions are called as the 'costal or rhomboid impression'. It may exhibit various morphological patterns such as tubercle, rough impression or a fossa[6-9]. It is also documented that lifestyle and geography have been responsible for its existence. This knowledge can be well utilised in forensic anthropology.

#### Materials & Methods

**Study Population:** Total 123 dry clavicles were included in this study.

**Study Duration:** The duration of study was over a period of one year.

**Study Area:** This study was conducted in Department of Anatomy CIMS Medical college, Bilaspur, Chattisgarh.

**Data Collection:** All clavicles firstly divided into male and female on the basis of ontological features. Then the mid shaft circumference was also measured by using measuring scale and tape. Morphological feature of the rhomboid fossa was recorded by physical observation of each clavicle.

**Data Analysis:** Data was analysed by using Microsoft excel.

#### Results

In this study we included 123 clavicle bones for Osteometric analysis with reference to rhomboid fossa. Firstly, we categorized the bones into male & female, which were 79 & 44 respectively. In the present study we had seen, the smooth, flat, elevated & depressed surface of rhomboid fossa. We observed the morphology of rhomboid fossa in the both the sexes. We had observed that male clavicle was showing depressed rhomboid fossa on the left in 22 bones and on the right side in 48 bones as compared to female. In the Present study the elevated type was more in male than female. While smooth and flat types were more in females than males.

#### Discussion

In one subject with rhomboid fossa, the costoclavicular ligament had a deeper insertion on the superior surface of the first rib which was analogous to rhomboid fossa. The appearance of bilateral rhomboid fossa

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was found to be asymmetric. In another patient, the costo clavicular ligament enthesopathy was reported. There was a significant difference in frequency of the rhomboid fossa between male and females. The side or gender differences in the incidence of the fossa has been reported and in the forensic medicine with the help of qualitative analysis, the corroborate sex determination of unidentified bodies could be established[10]. Two types of data can be used for the determination of the sexual dimorphism of a body. Quantitatively, it can be determined by measurements of weight, perimeter, length, etc [2,11] and the sexual dimorphism can be determined qualitatively by examining the shape and the presence/absence of character of a particular bone by macroscopic methods [12,13]. The gender difference in sides of presence of rhomboid fossa has been shown in previous studies[14]. It has been reported to be more common in the left clavicle of men while in the right clavicle of women. It has also revealed a probability of 81.7% fossa in the right clavicle while 92.2% in the left for males[14]. However, the values between sides and genders in relation to the incidence of a rhomboid fossa in different populations are varied among different researchers. In the present study, the rhomboid fossa was present only in 35.7% of the examined female clavicles and these fossae appeared on both sides (right and left). No case has been reported in which a rhomboid fossa was present in only one of the clavicles on the same individual[5]. A variety of costoclavicular

ligaments insertion is seen on rhomboid fossa and these findings have reported mainly in male subjects and this finding is used in forensic determination of gender of deceased. The point of Rhomboid fossa is an anatomical point in bone, not a weak point for fracture formation. If there is enthesopathy of the costoclavicular ligament and rhomboid fossa, it can lead to suspicion of osteolytic process. Biopsy of rhomboid fossa should be avoided. Sometimes, just like rhomboid fossa, insertion of costoclavicular ligament can exceptionally be found on the first rib. 97.1% of females do not have any rhomboid fossa on their clavicles. Therefore, the presence of a rhomboid fossa can be used as a qualitative criterion for the sex determination and differentiation.

**Conclusion**

The study concludes that, the rhomboid fossa morphologically elevated & depressed are more common in male clavicles than female clavicles. This study elucidated significant degree of sexual dimorphism of rhomboid fossa of clavicle and also in mid shaft circumference. This observation of study will be enlightening to further studies on molecular bases which relate to sexual dimorphism and type of clavicle in recent specimens. The results of molecular studies can be correlated with type and the sex of clavicle which could be used as a qualitative criterion in differentiation of sex of clavicles from skeletal remains of cadavers in the population.

**Table 1: Distribution of cases according to types of Rhomboid Fossa of Clavicle among males and females**

Gender	Smooth		Flat	
	Right	Left	Right	Left
Male	0	0	0	1
Female	6	8	14	9
Total	6	8	14	10

**Table 2: Distribution of cases according to types of Rhomboid Fossa of Clavicle among males and females**

Gender	Depressed		Elevated	
	Left	Right	Left	Right
Male	22	48	2	6
Female	3	3	0	2
Total	25	51	2	8

**Table 3: Distribution of cases according to Mid Shaft Circumference of Clavicle among males and females**

Male Clavicle	Mid Shaft Circumference (cm)	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0
Male (n=79)		7	9	9	8	6	4	3	5	10	10	8
Female Clavicle	Mid Shaft Circumference (cm)	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5
Female (n=44)		1	2	4	2	4	5	5	8	4	6	3

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