

## EVALUATION OF RHOMBOID FOSSA AND MID SHAFT CIRCUMFERENCE IN THE WEST HARYANA POPULATION BY CLAVICLE ANTHROPOLOGICAL STUDY

Rajeev Mukhiya<sup>1</sup>, Jay Prakash<sup>2</sup>, Sohinder Kaur<sup>3</sup>

Received : 15/10/2022  
Received in revised form : 25/11/2022  
Accepted : 12/12/2022

### Keywords:

Rhombic fossa, clavicle morphology, anthropology, and sexual dimorphism.

### Corresponding Author:

Dr. Rajeev Mukhiya,

Email: rajeevmukhia123@gmail.com

DOI: 10.47009/jamp.2023.5.2.254

Source of Support: Nil,  
Conflict of Interest: None declared

Int J Acad Med Pharm  
2023; 5(2); 1198-1201



<sup>1</sup>Assistant Professor, Department of Anatomy, World College of Medical Sciences Research and Hospital, Jhajjar, Haryana, India.

<sup>2</sup>Tutor, Department of Anatomy, World College of Medical Sciences Research and Hospital, Jhajjar, Haryana, India.

<sup>3</sup>Professor & Head, Department of Anatomy, World College of Medical Sciences Research and Hospital, Jhajjar, Haryana, India.

### Abstract

**Background:** According to definitions, the clavicle is a long bone with two ends and a shaft. Anatomically known as the rhomboid fossa, the costoclavicular ligament (ligamentum costoclaviculare) or rhomboid ligament can leave behind impressions, tuberosities, depressions, and even a fossa that is significant from an anthropological perspective. The depressed kind of fossa is occasionally rather large and is referred to as the morphologically excavated type. **Materials and Methods:** A hundred & ten (110) clavicles in total were used for the investigation. By examining its gross osteological characteristics, the Clavicles were divided into male and female groups. With the aid of a scale and measuring tape, the mid shaft's circumference is determined. Physical examination of each clavicle yields information on the morphological characteristics of the rhomboid fossa. **Result:** Overall, the rhomboid fossa is more common in males (87.32% and 15.38%), while smooth and flat kinds (30.76% and 51.28%) are mostly seen in female clavicles. The results of the Fischer's Exact Probability test between the sexes are highly significant (p 0.01) for both the right and left sides. This demonstrates that the prevalence of rhomboid fossa exhibits definite sexual dimorphism. **Conclusion:** The results of the current study showed that smooth and flat rhomboid fossae are more common in female clavicles while depressed and elevated types are more common in male clavicles. This study revealed a considerable level of sexual dimorphism in the mid shaft circumference and rhomboid fossa of the clavicle.

## INTRODUCTION

The clavicle is described as a long bone with two ends and a shaft.<sup>[1]</sup> The costoclavicular ligament (ligamentum costoclaviculare) or rhomboid ligament, on its insertion in the inferior surface of the medial end of the clavicle, can produce impressions, tuberosities, depressions, and even a fossa, known anatomically as the rhomboid fossa, which is important from an anthropological perspective. According to morphology, the depressed variety of fossa can occasionally grow to be quite enormous. The method of identification becomes increasingly hard when it comes to identifying humans, particularly when determining the sex of entire skeletons or isolated portions.<sup>[2]</sup> The two most crucial aspects of a person's biological identity are the determination of gender and age. Human skeletal elements' morphological and morphometrical characteristics have both been

extensively utilised in defining a person's identification.<sup>[3]</sup> The clavicle is the only long bone that is horizontally positioned in the body and has various non-metric characteristics that are specific to gender and age. One of these morphological characteristics that has been investigated as a sex and age estimate by numerous researchers is the rhomboid fossa of the clavicle.<sup>[4,5]</sup> Sexing procedures are only appropriate for the population group from which they were created, and when they are used on a different, unrelated population group, their reliability declines.<sup>[2,6]</sup> In skeletal samples from different human communities around the world, previous research have examined the association between the clavicular rhomboid fossa and sex and discovered substantial findings on the incidence of the rhomboid fossa being higher in males than in females.<sup>[7,8]</sup> There were no statistically significant gender differences in the incidence of the rhomboid fossa in Indian people, according to Jit and Kaur

(1986). Additionally, it was observed that the clavicle's length varied depending on the region of India. Compared to American Negroes, American Whites, and English clavicles, those of the French and Northwest Indians were more bent in their medial two-thirds.<sup>[1]</sup> India, which comprises human populations with a variety of genetic and cultural features, is home to practically all of the major ethnic strains. Proto-Australoid (dark brown complexion), Mediterranean (light brown skin), Mongoloid (yellow skin), Negrito (black skin), and a variety of hybrid strains.<sup>[9]</sup> There has been very little research on rhomboid fossa in the North Indian population because the North India is primarily occupied by the dravidian racial group. Therefore, the objective of the current study was to evaluate the validity of the rhomboid fossa of the clavicle as a gender indicator in an isolated clavicle specimen from a member of the north Indian population.

## MATERIALS AND METHODS

The department of anatomy at the World College of Medical Sciences Research and Hospital in Jhajjar, Haryana, India, conducted the current study. Only healthy clavicles were chosen once the bones had been separated. The mangled and fractured clavicles were not included in the study. For our research, we used 110 clavicles in total. On the basis of their gross osteological characteristics, the Clavicles were divided into male and female. With the aid of a scale and measuring tape, the mid shaft's circumference is determined. Physical examination of each clavicle yields information on the morphological characteristics of the rhomboid fossa. In order to establish the relevance of the data, all the aforementioned parameters were statistically compared between the sexes. The student unpaired 't' test and Fischer's exact probability test were used for the statistical analysis. Fischer's exact probability test is used to compare the physical characteristics of the rhomboid fossa between sexes. For small sample sizes, the Fisher's exact test is a statistical significance test. It is one of many tests

used to examine contingency tables, which show how two or more variables interact. As opposed to utilising an approximation, it calculates statistical significance precisely, hence the name "exact." Using an unpaired student 't' test, the mid shaft circumference is compared.



Figure 1: Clavicle of right and left side

## RESULTS

We originally divided these clavicles in the current investigation into male and female varieties. [Table1]. The medial end displayed several outlines, including quadrilateral, oval, and triangular shapes. In the current study, the male clavicles were longer, curvy, and strong, whereas the female clavicles were shorter, thinner, and less curved. Rhomboid fossa was visible on the inferior surface of the clavicle close to its sternal end. It has an oval shape and comes in three different varieties: flat, elevated, and depressed. Rhomboid fossae that appeared smooth in some of the clavicles are known as the smooth kind of rhomboid fossa. The existence of the various morphological rhomboid fossa types in both sexes on the left and right sides was noted. [Table1]. In contrast to females (7.69% each on both sides), male clavicles exhibited depressed-type rhomboid fossa on the right and left sides (60.56% and 26.76%, respectively). Males on both sides had a higher percentage of raised rhomboid fossa than females. Contrarily, females tended to have flatter and smoother rhomboid fossa (left side 20.51%, right side 30.76%; left side 17.94%, right side 12.82%) and less of the former (left side 17.94%, right side 12.82%).

Table 1: Shows the rhomboid clavicle fossa types in males and females.

Type of rhomboid fossa of clavicle	Side	Gender		Total	
		Male(71)	Female(39)	Male(71)	Female (39)
Smooth	Right	00 (0.0%)	05 (12.82%)	00 (0.0%)	12 (30.76%)
	Left	00 (0.0%)	07(17.94%)		
Flat	Right	00 (0.0%)	12 (30.76%)	01 (1.40%)	20 (51.28%)
	Left	01 (1.40%)	08 (20.51%)		
Depressed	Right	43 (60.56%)	03 (7.69%)	62 (87.32%)	06 (15.38%)
	Left	19 (26.76%)	03 (7.69%)		
Elevated	Right	06 (8.45%)	01 (2.56%)	08 (11.26%)	01 (2.56%)
	Left	02 (2.81%)	00 (0.0%)		

Table 2: Shows the clavicle midshaft circumference in both males and females.

Male clavicles	Mid shaft circumference	3.9cm	4.0cm	4.1cm	4.2cm	4.3cm	4.4cm	4.5cm	4.6cm	4.7cm	4.8cm	4.9cm
Number of Male (n=71)		06	11	11	06	05	04	02	05	10	08	03
Female clavicles	Mid shaft circumference	2.4cm	2.5cm	2.6cm	2.7cm	2.8cm	2.9cm	3.0cm	3.1cm	3.2cm	3.3cm	3.4cm
Number of female (n=39)		01	02	04	02	04	05	05	06	04	05	01

{Note: Male Clavicles: Average=4.4 cms; Female Clavicles: Average=2.9 cms}

Overall, the rhomboid fossa is more common in males (87.32% and 15.38%), while smooth and flat kinds (30.76% and 51.28%) are mostly seen in female clavicles. In [Table 1], this is displayed. The results of the Fischer's Exact Probability test between the sexes are highly significant ( $p < 0.01$ ) for both the right and left sides. This demonstrates that the prevalence of rhomboid fossa exhibits definite sexual dimorphism. Table 2 illustrates the mid shaft circumference for both male and female clavicles. Male and female circumferences average 4.3 cm and 3.0 cm, respectively. When using the unpaired "t" test, the "p" value is less than 0.01 and indicates that the result is highly significant. This demonstrates that the mid shaft circumference of the clavicles of males and females differs clearly according to sexual orientation.

## DISCUSSION

The two most crucial aspects of a person's biological identity are their gender and age.<sup>[3]</sup> Previous research on the rhomboid fossa of the clavicle in people from many regions and ethnic groups, including North Indians, Brazilians, and Nepalese, demonstrated its anthropological and forensic value.<sup>[3-5]</sup> Rhomboid fossae were displayed in varied patterns by Rani et al. in north Indian.<sup>[10]</sup> Rhomboid fossas are more common in males than females, which will make it easier to determine the sex of clavicle samples.<sup>[3]</sup> Rhomboid fossae were more noticeable in younger people than in older people, and males between the ages of 20 and 30 had larger fossae.<sup>[11]</sup> A relatively underutilised anatomical component that may pose diagnostic challenges is the excavated kind of rhomboid fossa. The doctors may mistake its unilateral occurrence for osteomyelitis, avascular necrosis, or even a tumour that appears on chest or shoulder radiography.<sup>[12]</sup> Most of the female clavicles in the Brazilian population lacked a rhomboid fossa. Rhomboid fossae were bilaterally prevalent in very few female clavicles and in one-third of male clavicles.<sup>[3]</sup> In their study, Jit and Kaur found that the clavicular rhomboid fossa did not significantly differ across genders, with 59% of men and 54% of females.<sup>[4]</sup> According to Shobha's study, the morphometry of the rhomboid fossa and other clavicular measures like length, midshaft circumference, robustness index, weight, and volume are statistically highly significant indicators of sex. Rhomboid fossa was more frequently seen in the male clavicles. The left clavicle's mid shaft circumference revealed a sexual difference.<sup>[13]</sup> In compared to the male clavicle, the female clavicle is shorter, thinner, less curved, and smoother, and its acromial end is carried lower than the sternal end. Acromial ends in men are either level with or somewhat higher than sternal ends. The most accurate single sex indicator is mid-clavicular circumference; findings are improved

when this measurement is combined with weight and length.<sup>[5]</sup> In the current study, the occurrence of rhomboid fossa in male and female clavicles varies somewhat [Table1]. Rhomboid fossae of the high and depressed forms were more common in men than in women. Both the right and left sides between the sexes are very significant in the Fischer's Exact Probability test. This demonstrates that the incidence of rhomboid fossa exhibits a distinct degree of sexual dimorphism. Males have a larger average mid shaft circumference than females do [Table2]. When using the unpaired "t" test, the "p" value is less than 0.01 and indicates that the result is highly significant. The results of this study confirmed that there is a moderate degree of sexual dimorphism in the circumference of the mid shaft of male and female clavicles.<sup>[2-5,14]</sup> Along with this kind of osteological research, information acquired from other sources will help in effectively determining the sex of the bone or bone fragments in forensic instances.<sup>[3,5,13]</sup> Rhomboid fossa in such cases would reveal whether the clavicle is descended from a male or a female.<sup>[7,14]</sup>

## CONCLUSION

The results of the current study showed that smooth and flat rhomboid fossae are more common in female clavicles while depressed and elevated types are more common in male clavicles. This study revealed a considerable level of sexual dimorphism in the mid shaft circumference and rhomboid fossa of the clavicle. This finding will facilitate future research on molecular study of sexual dimorphism and clavicle type in contemporary specimens. As a qualitative criterion for differentiating the sex of clavicles from skeletal remains of cadavers, the results of molecular research can be connected with the type and sex of the clavicle.

## REFERENCES

1. Kaur H, Harjeet, SD, Jit I. Length And Curves Of The Clavicle In Northwest Indians. *J Anat Soc India*. 2002;51(2):199-9.
2. Prado FB, De Mello Santos LS, Caria PH, Kawaguchi JT, Preza Ad, Daruge JE, da Silva RF, Daruge E. Incidence of clavicular rhomboid fossa (impression for costoclavicular ligament) in the Brazilian population: forensic application. *J Forensic Odontostomatol*. 2009;27(1):12-16.
3. Singh M, Singh D (2009) Rhomboid Fossa of Clavicle: Is It A Reliable Estimator of Gender and Age of Northwest Indian Subjects of Chandigarh Zone. *Journal of Punjab Academy of Forensic Medicine and Toxicology*, 9(1): 58-65.
4. Jit I, Kaur H. Rhomboid fossa in the clavicles of North Indians. *Am J Phys Anthropol*. 1986;70: 97-3.
5. Haque MK, Mansur ID, Krishnamurthy A, Karki R, Sharma K, Shakya R. Morphometric analysis of clavicle in nepalese population. *Kathmandu Univ Med J (KUMJ)*. 2011; 9(35):193-7.
6. Calcagno JM. On the applicability of sexing human skeletal material by discriminant function analysis. *J Hum Evol*. 1981;10:189-98.
7. Parsons FG. On the proportions and characteristics of the modern English clavicle. *J Anat*. 1916;51:71-93.

8. Cave AJE. The nature and morphology of costoclavicular ligament. *J Anat.* 1961;95:170-79.
9. Williams PL. *Gray's Anatomy.* 38th edition, ELSEVER Churchill Livingstone. 1995.
10. Rani A, Chopra J, Mishra SR, Srivastava AK, Sharma PK, Diwan R (2011) A Study of Morphological Features of Attachment Area of Costoclavicular Ligament on Clavicle and First Rib in Indians and its Clinical Relevance. *Biomedical Research.* 2011;22(3):349-54.
11. Rogers NL, Flournoy LE, McCormick WF. The Rhomboid Fossa of the Clavicle as a Sex and Age Estimator. *J Forensic Sci.* 2000;45(1):61-7.
12. Paraskevas G, Natsis K, Spanidou S. Excavated Type of Rhomboid Fossa of the Clavicle – A Radiological Study. *Folia Morphol(Warsz ).*2009; 68(3):163-6.
13. Shobha. Determination of sex of adult human clavicle by morphometric parameters. [dissertation]. Bangalore, Karnataka, India. Rajiv Gandhi University of Health Sciences. 2010.
14. Mc Cormick WF, Stewart JH, Greene H. Sexing of human clavicles using length and circumference measurements. *Am J Forensic Med Pathol.* 1991;12(2): 175-81.