

Evaluation of Sex Assessment Using Clavicle Measurements in Indian Population

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Abstract

Background: Many studies have used a variety of skeletal remains for identification, however clavicle sex determination has been reported to have varying degrees of accuracy. clavicles of adult humans in the Indian population to determine their sex. **Material and Methods:** A total of 106 clavicles (50 men and 56 females) had their length, mid-clavicular circumference, and weight assessed. Statistics were used to analyse the data. **Results:** Three clavicles' parameters underwent a statistical examination. Adult male and female clavicles' range, mean, and standard deviations for length, mid-clavicular position, and weight have been computed and are presented in three separate tables 1, 2 & 3. **Conclusion:** The left clavicle of an adult was longer than the right side. Among the Indian population, the mid clavicular circumference was the most accurate measurement for classifying the sex of female clavicles. **Keywords:** Left & right clavicle, sex evaluation.

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Introduction

The foundation for precisely identifying unidentified human skeletal components is sex determination. Certain bones, particularly the clavicle, may aid in this process at least partially if not entirely, according to numerous researchers who have been studying the identification of sex using the entire skeleton or boney remains for more than a century.^[1] For forensic identification, sometimes only skeleton remains are available.^[2] The key criterion of identification is the individual's sex, however this is a very tough challenge that is made more difficult when only one bone, such the clavicle, is available.^[3] An important and crucial stage in identifying an unknown human from skeletal remains is sex determination. Many studies have used a variety of skeletal remains for identification, although clavicle sex determination has been documented to have varying degrees of accuracy.^[4-6] In comparison to the male clavicle, the female clavicle is shorter, thinner, less curved, smoother, and its acromial end is carried lower than the sternal end. When the arm is hanging, the acromial end of the male is level with or slightly higher than the sternal end. The most accurate sex predictor is the circumference of the clavicle at its midshaft; better findings are obtained when this measurement is combined with weight and length.^[7-9] observed the differences between whites and Negroes in various clavicle characteristics. They introduced the idea of the demarking point (+3SD), which was incredibly helpful and offered nearly 100% specificity in sex determination. Clavicle is one of the long bones and is comparatively resilient to environmental deterioration and corruption. Nonetheless, it has been shown in the literature that this bone can be used to differentiate between sexes, while on the other hand, the anthropometric proportions of several bones vary depending on a person's race and location.^[10] As a result, this study was conducted to evaluate the precision of clavicle length, mid shaft circumference, and clavicle weight for determining sex in the Indian population.

Methodology

This research examined 106 clavicles, 50 of which were on the right side and 56 on the left. The bones were gathered between February, 2020 and November, 2020 at the Veer Surendra Sai Institute of Medical Sciences and Research in Burla from the Departments of Forensic Medicine & Toxicology. The length of the clavicle is determined by measuring the distance between the sternal end and the scapular articular end using a digital vernier calliper and recording the results in millimetres (MM) [Figure-A]. With the aid of a measuring wire or metal tape, the clavicle's mid shaft circumference, which lies halfway between the articular ends, was measured and recorded in (MM) [Figure-B]. A single pan electric balance was used to measure the clavicle's weight in grammes. To avoid interobserver error, each Forensic Medicine reading was taken three times by the same person. Clavicles that were unfused or had pathological alterations were eliminated. The relationship between these parameters and the sex of people was examined using statistical programmes for social sciences (SPSS-18), which was used to gather, analyse, and statistically analyse the data. Compare the mean variations between the sexes with the means and standard deviations for each measurement. Statistic analysis: The t-test was used to determine the significance of the difference between the mean length, midshaft circumference, and weight of the right and left clavicles. P-values lower than 0.05 were deemed significant. Demarking points (D.P) [11] were determined from the computed range (Mean \pm SD), and the percentage of clavicles found beyond D.P was recorded.

RESULTS

Three clavicles' parameters underwent a statistical examination. Adult male and female clavicles' range, mean, and standard deviations for length, mid-clavicular position, and weight have been computed and are presented in three separate tables [1,2,3]. It was determined that there was a significant (P0.01) difference between the means of each of these measurements between the sexes. About the clavicle's length [Table-1]: Right clavicle: Male clavicles range in length from 124.3-167.1 mm, with a mean of 142.8 \pm 12.6 mm, whereas female clavicles vary from 118.6-148.5 mm, with a mean of 127.4 \pm 10.3 mm. In this series, the average length of the right clavicle in women is 86.7% longer than that of the right clavicle in men. In this series, no female right clavicle has been measured to be longer than 148.5mm. The smallest male right clavicle in this series is also male and measures 125.2mm. For the male clavicles, the demarking point was 148.2 mm, while for the female clavicles, it was 112.4 mm. Male clavicles exceeded the demarking point in a proportion of 26.2%, whereas female clavicles did so in a percentage of 2.71%.

Table 1: Shows the statistical study of the number of clavicles inspected and their lengths (in mm). 25 males and 28 females.

Side determination	Sex	Details of measurements			Demarking point	% of clavicles beyond demarking point
		Range	Mean \pm SD	P value		
Right	Male	124.3-167.1	142.8 \pm 12.6	<0.01	>146.2	26.2
	Female	118.6-148.5	127.4 \pm 10.3		<112.5	2.71
Left	Male	133.4-167.6	145.1 \pm 13.2	<0.02	>152.6	14.5
	Female	116.4-148.7	129.2 \pm 9.4		<112.9	7.9

Left Clavicle

The male left clavicle measures 145.1 ± 13.2 mm on average, with a range of 133.4 to 167.1 mm. The female clavicle measures 116.4–148.7mm in length, with a mean of 129.2 ± 9.4 mm. The average female clavicle is 87.9% longer than the average male collarbone. In this series, no female left clavicle was discovered to be longer than 148.7 mm. The smallest male left clavicle in this series is also male and measures 133.4mm. For the male clavicles, the demarking point was 152.6 mm, while for the female clavicles, it was 112.9 mm. 14.5% of male clavicles and 7.9% of female clavicles were found to extend past the demarking point. Circumference of the midclavicle [Table 2] Male right clavicle: The mid circumference ranges from 32.2 to 48.4 mm, with a mean of 37.4 ± 10.2 mm. Female right clavicle mid-circumference measurements range from 26.1-37.5 mm, with a mean of 30.8 ± 9.4 mm. The mean clavicular circumference in women is 82.4% smaller than the mean clavicular circumference in men. The largest male circumference in this series was 32.4 mm, whereas the smallest female circumference was no more than 36.7 mm. The demarking point +3SD [11] was 38.6 mm for male clavicles and 26.9 mm for female clavicles. Among the male clavicles, 44.74% were beyond the demarking point, whereas 14.2% of the female clavicles were.

Table 2: Shows the investigation of the mid-clavicular circumference using statistics (in mm) How many clavicles were examined? 25 males and 28 females.

Side determination	Sex	Details of measurements			Demarking point	% of clavicles beyond demarking point
		Range	Mean \pm SD	P value		
Right	Male	32.2-48.4	37.4 ± 10.2	<0.01	>38.6	44.74
	Female	26.1-37.5	30.8 ± 9.4		<27.8	14.2
Left	Male	32.2-51.6	37.6 ± 10.7	<0.01	>40.9	32.86
	Female	22.3-37.2	31.6 ± 9.8		<26.9	7.35

Left clavicle

The male left clavicle's midclavicular circumference ranges from 32.2 to 51.6 millimetres, with a mean of 37.6 ± 10.7 mm. The female left clavicles' mid-clavicular circumference spans from 22.3 to 37.2 mm, with a mean of 31.6 ± 9.8 mm. In this series, the largest female mid clavicular circumference was 37.2mm, while the smallest male mid circumference was 32.1mm. For male clavicles, the demarking point was 40.9mm, while for female clavicles, it was 26.9mm. Only 7.35% of the female clavicles were past the demarking point, compared to 32.86% of the male clavicles. Body mass [Table 3] Criminal Medicine correct clavicles Male clavicles range in weight from 15.3 to 34.8 gm, whereas female clavicles weigh between 11.4 and 20.9 gm. Male clavicles weighed an average of 21.4 ± 6.3 g, whereas female clavicles weighed 14.2 ± 5.7 g. The right male clavicles weigh 65.9% more on average than their female counterparts. Right female bone can weigh up to 22.1 grammes, but it can also weigh as little as 15.2 grammes. The male clavicles' demarking point, or +3SD[11], was 24.3gm, while the female clavicles' was 6.4gm. While none of the female bones were past the demarking point, only 2.3% of the male clavicles were.

Table 3: Shows the investigation of the mid-clavicular circumference using statistics (in mm) How many clavicles were examined? 25 males and 28 females.

Side determination	Sex	Details of measurements			Demarking point	% of clavicles beyond demarking point
		Range	Mean±SD	P value		
Right	Male	15.3-34.8	21.4±6.3	<0.01	>22.9	28.2
	Female	11.4-20.9	14.2±5.7		<6.4	0.0
Left	Male	15.2-33.1	21.2±6.4	<0.01	>22.6	29.3
	Female	9.4-11.8	13.1±4.3		<6.7	0.0

Male clavicles range in weight from 15.2 to 33.1 grammes, whereas female clavicles weigh between 9.4 and 11.8 grammes. Male clavicles had a mean weight of 21.2±6.4 g, whereas female clavicles weighed 13.1±4.3 g. The left male clavicles' mean weight is 62.4% more than that of the female clavicles. The left female bone's greatest weight was 21.2g, whereas the left male bone's minimum weight was 15.2g. The male clavicles' demarking point, or +3SD,^[11] was 22.6gm, while the female clavicles' was 6.7gm. None of the female bones were beyond demarking point, compared to only 29.3% of none of the male bones.



Figure 1: ?



Figure 2: ?

DISCUSSION

The typical male skeleton is thought to be longer and stronger than the average female skeleton, though the extent varies from population to population. This variation can be related to hereditary variables as well as environmental factors that affect growth and development, such as diet and exercise. Long bones differ across genders, with male long bones often being longer and larger than female long bones.^[12] According to Olivier^[13](1951), the left clavicle of the French is longer than the right. Similar findings were made by who discovered that the Indian left collarbone was longer than the right.^[11-17] In the Indian population, the left clavicle was longer than the right, according to the current study [Table 1]. According to Kaur et al,^[16] (1997) observation, the right bone has more curves than the left, which accounts for its shorter length, whereas the right bone's curvilinear length is longer than the left bone's. According to the current study, the mid-circumference of the female clavicle is smaller than that of the male. This is consistent with a study by Terry (1932),^[8] who discovered that in negros, female bones' mid-circumferences were around 5 mm shorter than those of men. In French bones, Olivier,^[13] (1951) discovered the difference to be 6.8 mm. The female clavicular circumference was around 6.6 mm shorter than the male clavicular circumference, according to research by Jit and Singh,^[11] (1966) and Patel et al,^[17] (2014). The current study also demonstrates that the most helpful criterion for sexing clavicle is mid-clavicular circumference. It is well knowledge that women's bones tend to be lighter than those of men. Due to significant variation in the range of bone weights, it was discovered in the current study that the average weight of the female bone was approximately 64.8% that of the male bone. In contrast, none of the female bones were found to be heavier than the demarking point, as Forensic Medicine illustrates in [Table 3]. This study concurs with Jit and Singh,^[11] (1966) and Patel et al,^[17] (2014) that the weight criteria (value) is of little use in determining the gender of the female bone.

CONCLUSION

These results imply that it was determined that the adult left collarbone was longer than the right side. Among the Indian population, the mid clavicular circumference was the most accurate measurement for classifying the sex of female clavicles. The most crucial factor in determining a woman's sex was her collarbone length.

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