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Original Research Article

GENDER VARIATION OF CLAVICLE IN EASTERN ODISHA

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ABSTRACT

In clavicle the mid shaft circumference is considered as a consistent indicator for determining the sex however the same when combined with length increases its accuracy. The objective of this study was to determine the gender variation in adult dry human clavicles in Eastern Odisha population and to determine variations between clavicles of right and left side. An observational study was done on 100 dry clavicles of known sex, in the Department of Anatomy, KIMS. There was significant difference between the lengths of male and female clavicles and also the difference in mid shaft circumference between male and female clavicle was significant ($p<0.001$). The findings of this study will be useful for sex determination of human skeletal remains.

KEY WORDS: Clavicle, Mid shaft circumference, sex determination.

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INTRODUCTION

In forensic anthropology the skeletal remains serve as a vital element for gender estimation [1]. It reduces the chances of possible matching upto fifty percent i.e. whether it is either male or female [2]. The skeletal remnants such as pelvis,skull, clavicle, limb bones, sternum, and patella are being used for identification of the unknown individuals [3].

The clavicle, being wholly subcutaneous is extending laterally and more or less horizontally from the manubrium to the acromion across the neck [4]. The clavicles in case of females is thinner,shorter, smoother and less curved with its acromial end lower than the sternal end. In case of males it is either in level with or slightly higher than the sternal end when the arm is swinging by the side. In clavicle the mid shaft circumference is considered as a consistent indicator for determining the sex however the same when combined with its weight and length increases its accuracy [5,6]. Different levels of accuracy have been reported for gender determination using clavicle. These anthropometric measurements are unique in each race for different bones and specific geographical territory [3].

OBJECTIVES OF THE STUDY

1. To determine the gender variation in adult dry human clavicles in Eastern Odisha population.

2. To determine variations between clavicles of right and left side.

MATERIALS AND METHODS

An observational study was done on 100 dry clavicles of known sex, in the Department of Anatomy, KIMS. 57 male clavicles (Right-31 and Left-26) and 43 female clavicles (Right-24 and Left-19) were selected for the study. Mid point of the shaft of the clavicle was marked after

measuring the total length of the clavicle. The circumference of the clavicle at its mid point was measured by using a malleable wire and digital vernier caliper. Measurements were taken three times at different time intervals without reference to the previous measurements. Mean ± Standard Deviation of lengths and mid shaft circumference of clavicles was calculated for both sides and both sexes using statistical software. Variation between both sides and both sexes was estimated. A T-test p-value <0.05 was considered to be significant.

Inclusion criteria: Adult dry clavicle with completed ossification, No deformity/signs of injury/ tumor/pathological conditions.

Exclusion Criteria: Fractured/mutilated clavicles. Degraded and deformed clavicles. Non fusion of the secondary centre of clavicle.

Duration of study: 6 months

Fig. 1: Dry Clavicles used for the study.

Fig. 2: Measurement of length of clavicle.

Fig. 3: Mid shaft circumference measurement.

Fig.4: Measurement of Mid shaft circumference.

RESULTS

The length of male clavicles was found to be 143.28±4.67 mm. on the right side and 142.84±4.67 mm. on the left side. Female clavicles measured 128.37±5.86 mm. on the right side and 127.52±5.96 mm. on the left side. There was no significant difference observed between right and left sides. (Table 1)

The average length of male clavicles was calculated to be 143.08±4.64 mm. and female clavicles was calculated to be 127.99±5.84 mm. There was significant difference between the lengths of male and female clavicles ($p<0.001$). (Table 1)

The mid shaft circumference in male clavicles was found to be 42.83±2.19 mm. on right side and 42.14±2.01 mm. on left side. In females the mid shaft circumference was found to be 37.67±1.82 mm. on right side and 37.22±1.42 mm. on left side. There was no significant difference between two sides. (Table 2)

The average mid shaft circumference of male clavicles was calculated to be 42.52±2.12 mm. and in female clavicles to be 37.47±1.65 mm. The difference in mid shaft circumference between male and female clavicle was significant ($p<0.001$). (Table 2)

Table 1: Lengths (in mm.) of clavicles in male and female (Mean ± SD).

Male		Female		p- value
Right	Left	Right	Left	<0.001
143.28±4.67	142.84±4.67	128.37±5.86	127.52±5.96	
143.08±4.64		127.99±5.84		

Table 2: Mid shaft circumference (in mm.) of clavicles in male and female (Mean ± SD).

Male		Female		p- value
Right	Left	Right	Left	<0.001
42.83±2.19	42.14±2.01	37.67±1.82	37.22±1.42	
42.52±2.12		37.47±1.65		

DISCUSSION

Gender and side variations in clavicle have been observed by many researchers in different parts of India and in differents parts of the world. Manjula et al (2017) [7] had observed the lengths of clavicles in South India in males to be 134.57±10.26 mm (right), 138.44±7.58 mm (left) and in females 120.53±3.67 mm (right) and 121.78±4.61 mm (left). Kaewma et al (2017) [8] estimated the lengths of Thai clavicles to be 150.2±0.97 mm and 133.5±0.63 mm in males and females respectively. Ishwarkumar et al (2016) [9] found the length of male clavicles to be 153.52±8.79 mm (right), 151.82±10.96 mm (left) and in females to be 138.02±7.36 mm (right) and 141.04±5.72 mm (left). The difference in lengths between male and female clavicles was significant (p-0.0004).

Patel et al (2009) [10] did a study in Gujarat and observed the lengths of clavicles to be 141.85 mm (right) and 142.30 mm (left) in male and 125.90 mm (right) and 125.88 mm (left) in female. Jit & Sahni (1983) [11] had found the lengths of male clavicles to be 148.00 mm (right) and 149.80 mm (left) and lengths of female clavicles to be 132.40 mm (right) and 134.00 mm (left). In another study Jit & Singh (1966) [6] had observed the lengths of male clavicles to be 145.58 mm (right), 147.59 mm (left) and in female clavicles to be 130.36 mm (right) and 129.80 mm (left). In the present study we found the lengths of male clavicles to be 143.28±4.67 mm (right), 142.84±4.67 mm (left) and female clavicles measured 128.37±5.86 mm (right) and 127.52±5.96 mm (left). The average lengths of male and female clavicle were 143.08±4.64 mm and 127.99±5.84 mm respectively. We observed that there was significant difference in lengths of clavicles between male and female (p<0.001). (Table 3)

Table 3: Variations in Mean length of clavicle.

Sl. No.	Races	N	Mean length (mm) Males		Mean length (mm) Females		Reference
			Right	Left	Right	Left	
1	South India (Trivandrum)	120	134.57±10.26	138.44±7.58	120.53±3.67	121.78±4.61	Manjula et al (2017) [7]
2	Thai	476	150.2±0.97		133.5±0.63		Kaewma et al (2017) [8]
3	South Africa (Durban)	100	153.52±8.79	151.82±10.96	138.02±7.36	141.04±5.72	Ishwarkumar et al (2016) [9]. P-0.0004
4	India (Gujarat)	216	141.85	142.3	125.9	125.88	Patel et al (2009) [10]
5	Indian	360	148	149.8	132.4	134	Jit & Sahni (1983) [11]
6	Indian	348	145.58	147.59	130.36	129.8	Jit & Singh (1966) [6]
7	Odisha (India)	100	143.28±4.67	142.84±4.67	128.37±5.86	127.52±5.96	Present study (p<0.001)

The mid shaft circumference has also been observed by various researchers to have differences. Manjula et al (2017) [7] had measured the mid shaft circumference in male clavicles to be 35.50±3.37 mm (right), 34.36±4.08 mm (left) and in female clavicles to be 26.82±2.40 mm (right) and 27.0±3.02 mm (left). Kaewma et al (2017) [8] had observed mid shaft circumference to measure 40.7±0.37 mm in male and 34.9±0.28 mm in female clavicles.

Ishwarkumar et al (2016)[9] estimated the mid shaft circumference in male clavicle to be 38.60±3.55 mm (right) and 38.68±3.82 mm (left) and in female to be 33.58±2.52 mm (right) and 34.93±3.28 mm (left). He reported significant difference in mid shaft circumference of clavicles between male and female (p-0.0004). Patel et al (2009) [10] estimated mid shaft circumference to be 37.10 mm (right) and 36.44 mm (left) in male clavicles and 30.15 mm (right) and 30.16 (left) in female clavicles. Jit & Sahni

Table 4: Variations in Mid Shaft Circumference of clavicles.

Sl. No.	Races	N	Mean Mid Shaft Circumference (mm) in Males		Mean Mid Shaft Circumference (mm) in Females		Reference
			Right	Left	Right	Left	
1	South India (Trivandrum)	120	35.50±3.37	34.36±4.08	26.82±2.40	27.0±3.02	Manjula et al (2017) [7]
2	Thai	476	40.7±0.37		34.9±0.28		Kaewma et al (2017) [8]
3	South Africa (Durban)	100	38.60±3.55	38.68±3.82	33.58±2.52	34.93±3.28	Ishwarkumar et al (2016) [9] P-0.004
4	India (Gujarat)	216	37.1	36.44	30.15	30.16	Patel et al (2009) [10]
5	Indian	360	36.2	35.9	30.4	30	Jit & Sahni (1983) [11]
6	Indian	348	36.17	35.7	26.69	29.51	Jit & Singh (1966) [6]
7	Odisha (India)	100	42.83±2.19	42.14±2.01	37.67±1.82	37.22±1.42	Present study (p<0.001)

(1983) [11] observed that the mid shaft circumference of male clavicles was 36.20 mm (right) and 35.90 (left) and that of female clavicles was 30.40 mm (right) and 30.00 mm (left). Jit & Singh (1966) [6] found the mid shaft circumference to be 36.17 mm (right), 35.70 mm (left) in male clavicles and 26.69 mm (right) and 29.51 mm (left) in female clavicles. In the present study, we found that the mid shaft circumference of male clavicles was 42.83±2.19 mm (right) and 42.14±2.01 mm (left), with average of 42.52±2.12 mm. The mid shaft circumference of female clavicles measured 37.67±1.82 mm (right) and 37.22±1.42 mm (left), with an average value of 37.47±1.65 mm. There was a statistically significant difference (p<0.001) in the mid shaft circumference between male and female clavicles. (Table 4)

Our observations were similar to that of previous studies done in India and abroad. There was significant difference in the length and mid shaft circumference of clavicle between male and female.

CONCLUSION

This study will add a feather in sex determination of human skeletal remains in Eastern Odisha population to solve the medicolegal problems using clavicle in addition to other methods which are already in use.

Declaration: This study has been approved by Ethics Committee of KIMS, Bhubaneswar.

There is no conflict of interest. All authors have been actively involved in this study starting from planning, including collection and analysis of data, till preparation of final draft for publication.

Conflicts of Interests: None

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