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## Linear dimensions of clavicle in East Indian population of Bihar

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### Abstract

The clavicle is a sigmoid-shaped bone that is easily visible in thin people and is palpable in all except the morbidly obese. The atypical asymmetric pattern and varied diaphyseal breadths are results of patterns of an individual, mechanical behaviour and unique developmental pathway of clavicle. The varied diaphyseal breadths are being more sensitive to the effects of loadings than the lengths. This study was conducted in the Department of Anatomy, AIIMS, Patna. The sample size was of 30 adult clavicles. Bones showing obvious pathological deformities were excluded from the study. Factors such as mechanical load, pressure and tension created by muscular attachments, and genetic endowments might be responsible for such asymmetries not only in various metric traits of clavicle but also among the non-metric traits of both side human clavicles. The fact of lesser intake of calcium in the form of milk and milk products by the East Indian population and this may have led to decreased thickness of the bone and hence lesser midclavicular circumference.

**Keywords:** Clavicle, mechanical behaviour, genetic endowments, asymmetries, midclavicular circumference

### Introduction

The clavicle is a sigmoid-shaped bone that is easily visible in thin people and is palpable in all except the morbidly obese. Its medial two-thirds are rounded and convex anteriorly and the lateral third is flat and concave anteriorly. Before birth i. e. in early foetal life, much of the adult morphology of human clavicle (a double-curved S-shaped outline) is attained<sup>[1]</sup>.

The atypical asymmetric pattern and varied diaphyseal breadths are results of patterns of an individual, mechanical behaviour and unique developmental pathway of clavicle. The varied diaphyseal breadths are being more sensitive to the effects of loadings than the lengths. Clavicle has been found thicker and more curved in manual workers. Significant shortening or asymmetry of clavicle in skeletally mature adults can affect clinical/surgical treatment strategies. Properly explained data of anatomical and biomechanical features (like dimensions, diameters, robusticity) of this bone helps in understanding and preventing the pre- and post-operative complications of clavicle fixations. Increased rates of non-unions and more demands for use of nail and plate fixative devices for treating clavicular fractures have necessitated some extensive studies based on examination of its anatomical and morphological features<sup>[2, 3]</sup>.

The present study was conducted on the clavicles retrieved from Eastern India population with the

### Objectives

1. To estimate mean value of anatomical dimensions of clavicle.
2. To highlight inter-disciplinary significance, if any, of various morphometric and non-metric features of clavicle.

### Materials & Methods

This study was conducted in the Department of Anatomy, AIIMS, and Patna. The sample size was of 30 adult clavicles. Bones showing obvious pathological deformities were excluded from the study.

Parsons<sup>[6]</sup> method was followed to measure the following:

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(i) **Clavicular length (CL):** It is measured as the maximum distance between the outermost tips of the sternal and acromial ends of clavicle placed on an osteometric board (ignoring curves of the bone) accurate to within 0.01 cm [4, 5].

(ii) **Articular Length of Clavicle (AL):** It is the straight distance between the mid-points of the sternal and acromial articular ends of clavicle measured with the help of a spreading caliper with pointed ends, accurate to within 0.01

cm as per the technique used by Parsons [6].

(iii) **Mid-point Circumference (CC):** The midpoint of clavicular shaft is marked between acromial and sternal ends of clavicle placed in anatomical position on the osteometric board and circumference is measured at this point with a strip of graph paper marked in centimetres, accurate to be within 0.01 cm

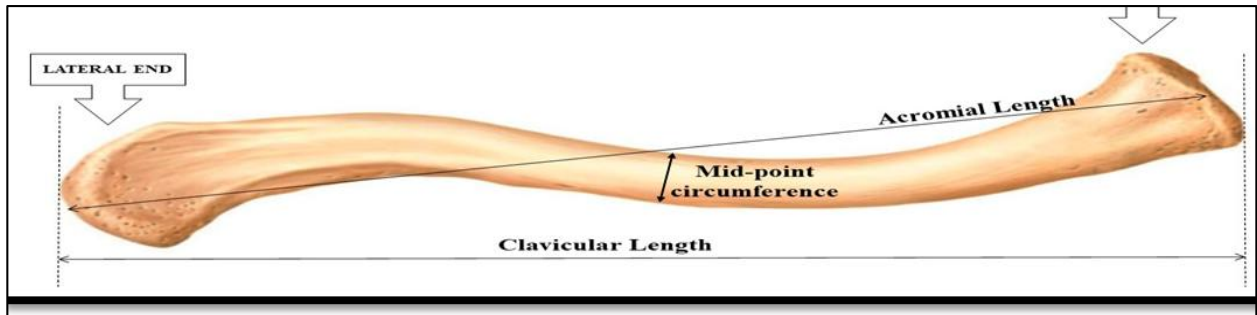
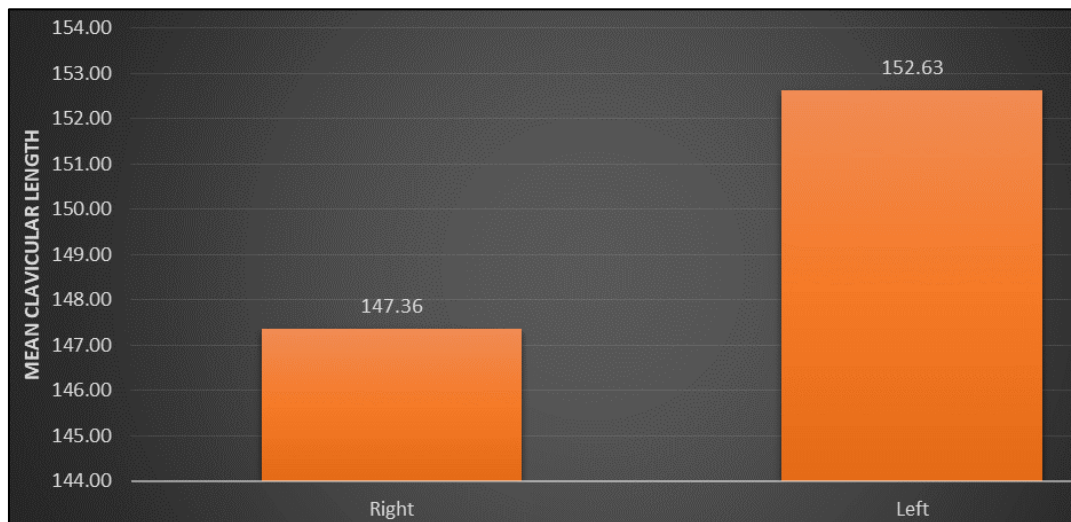


Fig 1

**Results**

**Table 1:** Showing mean values of Clavicular length (in mm) on both sides

	Clavicular length (in mm)	
	Right	Left
Mean	147.36	152.63
Std. Dev	15.34	13.60
p value	0.51	



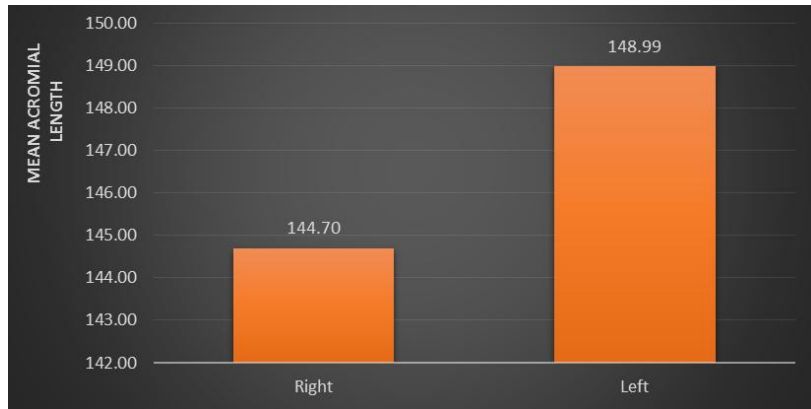
**Graph 1:** Showing bilateral variation in clavicular length

Table 1, shows the mean values of clavicular length as 14.69 cm in left and 15.21 cm on the right side with standard deviation of 1.53 cm and 1.37cm respectively. So, on the

right side the clavicular length was more as compared to the left side of East Indian population (Graph 1).

**Table 2:** Showing mean values of Acromial length (in mm) on both sides

	Acromial length (in mm)	
	Right	Left
Mean	144.70	148.99
Std. Dev	16.45	13.99
p value	0.52	

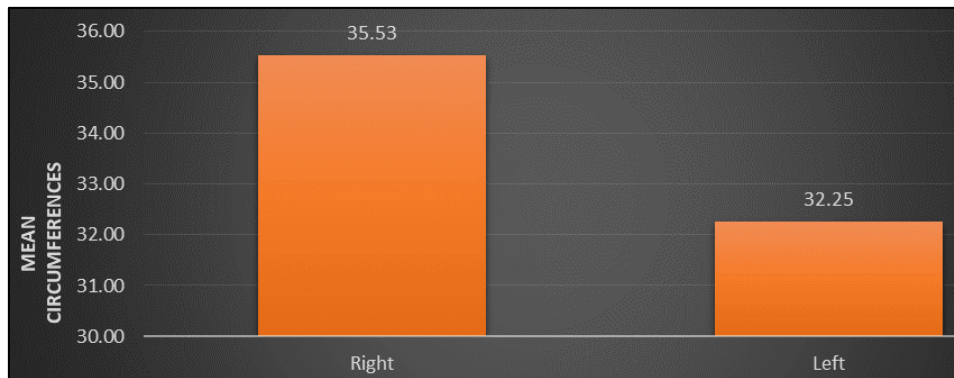


**Graph 2:** Showing bilateral variation in acromial length

As shown in table 2 and Graph 2, the mean values of articular length on the right side was 14.34 cm and that on the left was slightly higher being 14.86 with standard deviation of 1.58 cm and 1.41cm. Hence both the articular and clavicular lengths were higher on the left side than the right.

**Table 3:** Showing mean values of Mid-Point Circumference (in mm) on both sides

	Mid – point circumference, CC (in mm)	
	Right	Left
Mean	35.53	32.25
Std. Dev	4.47	3.44
p value	0.13	



**Graph 3:** Showing bilateral variation in Mid-Point Circumference of Clavicle

The mid-point circumference of clavicle was higher on the right side than the left (graph3) with values of 3.54 cm and 3.2 cm respectively (table 3).

All the three dimensions were statistically insignificant with p-value >0.05.

**Discussion**

**Table 4:** Comparison of mean length of clavicle reported in different populations.

Authors	Right (in mm)		Left (in mm)	
	Males	Females	Males	Females
Parsons [6] (English)	152	138	154	139
Singh [11] (USA Whites)	151.40	133.68	153.37	134.84
Terry [12] (USA Negroes)	153.30 ±0.83	140.98 ±0.76	155.86 ±0.92	141.78 ±0.03
Singh [11] (USA Negroes)	155.72	137.60	157.32	140.80
Olivier <sup>13</sup> (French)	154.20	137.90	155	138.70
Patel <i>et al</i> [14] (Western India)	141.85 ±9.5	125.9 ±7.4	142.3 ±8.98	126.88 ±8.86
Sayee <i>et al</i> [15] (South India)	137 ±9.0	123.9 ±8.0	142.3 ±8.98	128.20 ±9.0
Sehrawat & Pathak [2] (North India)	148.52 ± 8.88	135.22 ± 8.27	151.87 ±8.98	138.22 ± 8.3
Kaur <i>et al</i> [3] (North India)	135.20 ± 9.24	130.51±11.51	137.29 ±9.20	132.67 ±11.51
Present Study	147.36 ± 15.34		152.63 ± 13.6	

Clavicular length has been the most discussed parameter among various reported ones. The left human clavicle is generally found longer than the right one due to the differences laid down in early intra-uterine life of an individual [7, 8]. King *et al* reported that, left clavicle was longer than the right one in 65% male (4.55 mm) and 67%

female (3.14 mm) cases [9]. Cunningham *et al.*, found that 28% clavicles were dimensionally (length-wise) asymmetric (up to 5 mm side differences), but 7% clavicles had clinically significant asymmetry with more than 10 mm side differences that could affect treatment decisions [10]. Factors such as mechanical load, pressure and tension created by

muscular attachments, and genetic endowments might be responsible for such asymmetries not only in various metric traits of clavicle but also among the non-metric traits of both

side human clavicles. In present study, mean clavicular length results were lesser than the Western population but higher than other Indian population.

**Table 5:** Comparison of mid-Clavicular circumference of clavicle as reported by various authors

Authors	Right (in mm)		Left (in mm)	
	Males	Females	Males	Females
Jit & Singh <sup>[3]</sup> (Amritsar)	36.17 ±3.02	29.69 ±1.74	35.7 ±3.16	29.51 ±1.97
Singh & Gangrade <sup>[3]</sup> (Varanasi)	35.09 ±3.17	28.52 ±2.37	34.64 ±3.17	28 ±2.22
Jit & Sahni <sup>3</sup> (Chandigarh)	36.2 ± 3.50	30.4 ± 2.70	35.9 ± 2.70	30 ± 2.80
Kaur <i>et al</i> <sup>[3]</sup> (Patiala)	36.97 ±3.62	30.83 ±2.89	36.91 ±3.57	30.69 ±2.98
Patel <i>et al</i> (Gujarat)	37.1 ±2.99	30.15 ±2.46	36.44 ±3.46	30.16 ±2.72
Sehrawat & Pathak (North India)	38.52 ± 3.28	32.66 ± 2.57	37.24 ± 3.38	31.76 ± 2.70
Kaur <i>et al</i> <sup>[3]</sup> (North India)	39.3 ±0.42	39.2 ±0.75	38.8 ±0.37	38.8 ±0.69
Present Study	35.52 ± 4.47		32.25 ± 3.44	

The present study mean values for mid – clavicular circumference of clavicle as shown in table 5, was found to be lesser than that reported by various authors from different parts of India. This can be attributed to the fact of lesser

intake of calcium in the form of milk and milk products by the East Indian population and this may have led to decreased thickness of the bone and hence lesser midclavicular circumference.

**Table 6:** Comparison of acromial length of clavicle as reported by various authors

Authors	Right (in mm)		Left (in mm)	
	Males	Females	Males	Females
Sehrawat & Pathak (North India)	143.6 ± 8.68	131.17±7.75	147.0 ± 9.01	134.19±7.81
Present study	144.7±16.45		148.98±13.99	

As shown in table 6, literature regarding the acromial length of clavicle is scarce. So, comparing the present study value to the literature available reveals that they are in congruence to the values of North Indian population.

## Conclusions

From this comparative study we can conclude that:

1. Factors such as mechanical load, pressure and tension created by muscular attachments, and genetic endowments might be responsible for such asymmetries not only in various metric traits of clavicle but also among the non-metric traits of both side human clavicles.
2. The fact of lesser intake of calcium in the form of milk and milk products by the East Indian population and this may have led to decreased thickness of the bone and hence lesser midclavicular circumference.
3. Knowledge of clavicular length and its curvature is required for fixing external plates, whereas the diameter and width are needed for planning inter-medullary nailing for fixation of clavicular fractures. Fracture fixation plates need be anatomically contoured and locked.

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