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Study of the Clavicular Curvatures in North-Indian Population

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Abstract: ***Clavicle fractures are very common injuries in adults and children. 160 adult clavicles (100 males, 60 females) were retrieved from the Department of Anatomy, Pt. B.D Sharma PGIMS, Rohtak. The average lateral angle was observed to be 150.75° in males and 153.18° in females on the right side in the present study. On the left side, it was observed to be slightly more i.e. 153.45° in males and 155.47° in females. The average medial angle on the right side was 151.33° in males and 149.81° in females and on the left side, it was observed to be slightly more in males and females. The present study revealed that the medial and lateral angle of left clavicle were more as compared to right side in both the sexes.***

Keywords: clavicle, medial angle, lateral angle, males, females

1. Introduction

The human clavicle is described as a modified long bone. It has a shaft and two ends- sternal end and acromial end. The clavicle lies almost horizontally and is subcutaneous throughout its whole extent.It acts as a prop which braces back the shoulder and enables the limb to swing clear off the trunk and transmits part of the weight of the limb to the axial skeleton[1]. The clavicle has two curvatures- medial and lateral. Lateral curvature is shorter and medial curvature is longer and these curvatures exhibit difference between genders [2].

Clavicle fractures are very common injuries in adults and children. They constitute 44-66% of all the shoulder fractures.70-80% of these fractures occur at the junction of medial two-third and lateral one-third of the shaft. Insufficient attention has been paid to the curvatures of the clavicle. The purpose of this study is to focus on the curvature differences between right and left clavicle which can be of great help to Orthopaedic surgeons for intramedullary fixation.

2. Material and Methods

The present study was conducted in the Department of Anatomy, Pt. B.D Sharma PGIMS, Rohtak. The sample consisted of 160 adult clavicles (100 male, 60 female) in the age range of 30-40 years. Bones showing obvious pathological deformities were excluded from the study.

To measure the **curves of the clavicle**, the method described by Parsons was followed [3]. The bone was placed on the cardboard in such a position that its anterior and posterior borders were in the same horizontal plane. The clavicle was illuminated from above with the help of a pen torch so that its image appeared on the paper placed under it. The outline of the image was drawn on the paper. Care was taken that the light source, the bone and its image were in the same straight line. The distance of the cardboard from the light source was fixed. The midpoints at the sternal and acromial ends were obtained and marked as points „a" and „b" and were joined by a straight line. The central axis of clavicle was drawn as a curved line, midway between the anterior and posterior borders throughout the length of the clavicle. The deepest point on the two curves of the clavicle where the bone had maximum convexities were marked as points „c" and „d" and were joined by a straight line. Finally, these points were joined with mid points „a" and „b" at the corresponding ends with lines ca and db (Fig. 1).

Thus two angles were formed-medial angle acd which measured curvature of medial 2/3rd and lateral angle cdb which measured curvature of lateral 1/3rd. These angles were measured with the help of a protractor. (as shown in the Fig. 1). The same procedure was repeated for all the bones.

Collected data was entered in the MS Excel spreadsheet and coded appropriately in SPSS (Statistical Package for Social Sciences) for Windows version 20.0. Normally distributed quantitative data was presented as means and standard deviation. All tests were performed at 5% level significance; thus an association was significant if the value was less than 0.05 (p value< 0.05).

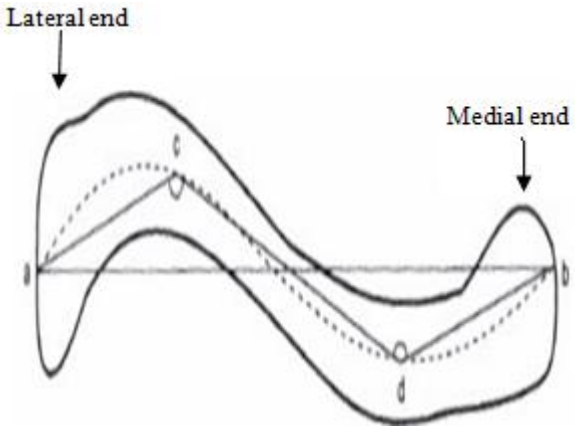


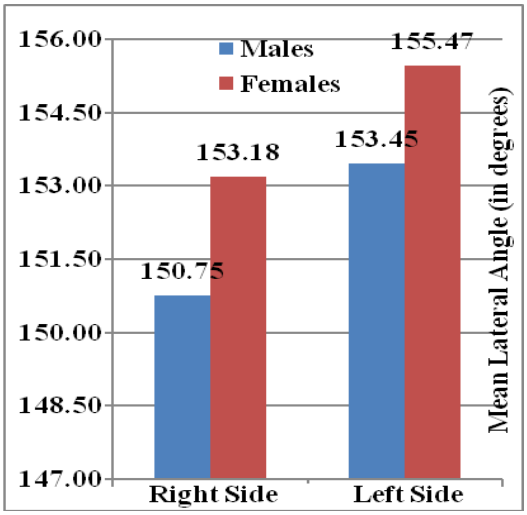
Figure 1: Contour of the Right Clavicle as seen from above
a: Midpoint of sternal End
b: Midpoint of acromial end
c: Deepest point of Medial Curvature
d: Deepest point of Lateral Curvature
a c d: Medial Angle
c d b: Lateral Angle

3. Observation and Results

Table 1: Mean Lateral angle of clavicles of right and left side in males and females

	Mean Lateral angle (in degrees)		
	Right side	*Left side*	*p value*
Males (n=50)	150.75°±8.56	153.45°±8.94	0.13
Females (n=30)	153.18°±8.33	155.47°±7.79	0.28
p value	0.22	0.3	

The mean lateral angle of clavicles of right and left side has been tabulated in Table 1. The average lateral angle was observed to be 150.75° in males and 153.18° in females on the right side in the present study. On the left side, it was observed to be slightly more i.e. 153.45° in males and 155.47° in females (Graph 1). The difference in lateral angle was not found to be significant on statistical analysis when compared between both sides and both sexes.

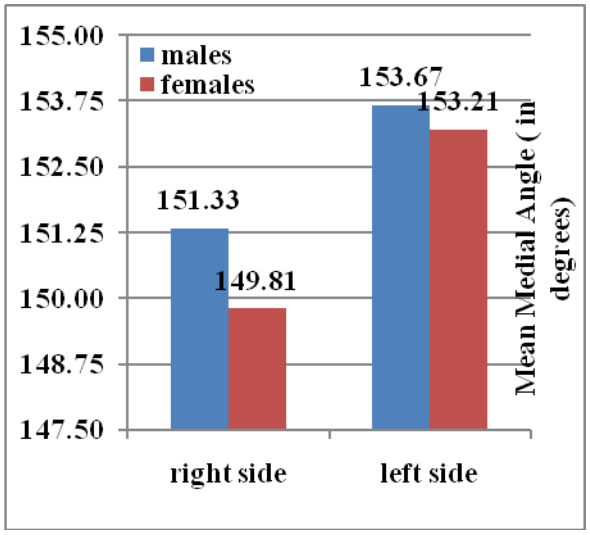


Graph 1: Mean lateral angle of clavicles of right and left side in both sexes

Table 2: Mean Medial angle of clavicles of right side and left side in males and females

	Mean Medial angle (in degrees)		
	Right side	*Left side*	*p value*
Males (n=50)	151.33°±6.51	153.67°±5.69	0.06
Females (n=30)	149.81°±5.84	153.21°±5.41	0.02
p value	0.3	0.72	

The mean medial angle of clavicles of right and left side has been tabulated in Table 2. In the present study, the average medial angle on the right side was 151.33° in males and 149.81° in females and on the left side, it was observed to be 153.67° in males and 153.21° in females (Graph 2). In both sexes, left sided clavicles had higher medial angle as compared to their opposite counterpart but this difference was found to be insignificant on statistical analysis in males. However, in females, the side difference was found to be significant on statistical analysis (p=0.02).



Graph 2: Mean medial angle of clavicles of right and left side in both sexes

4. Discussion

Several authors have attempted to determine side and sexual differences in the curvatures of the clavicle in their course of research. These studies have been performed on different populations. Evaluation and comparison of the present data with the studies conducted in the past reveals some differences as well as similarities.

Lateral angle of clavicle

Comparison of lateral angle of clavicle as reported by various authors is shown in the table below:

Table 3: Comparison of mean lateral angle of clavicle in males and females as reported by different authors

Authors	Males		Females	
	Right (in degrees)	Left (in degrees)	Right (in degrees)	Left (in degrees)
Parsons [3] (English)	148	148	150	151
Terry [4] (American Negroes)	138.42	143.54	144.06	145.82
Terry [4] (American Whites)	139.25	142.66	-------	-------
Olivier [5] (French)	141.8	143	145	-------
Kaur et al[6] (Chandigarh)	143.27	148.2	144.65	148.73
Present study	150.75 ±8.56	153.45 ±8.94	153.18 ±8.33	155.47 ±7.79

Parsons reported the mean lateral angle on the right and left side to be almost similar in both males and females. His values were less than those observed in the present study in both sexes. In the present study, it is observed that the mean lateral angle is 150.75° on the right side and 153.45° on the left side in males. In females, it is found to be 153.18° on the right side and 155.47° on the left side.

The present study showed that the mean lateral angle of clavicles in both sexes was higher on the left side as compared to the right side. This trend was found to be in concordance with the findings of the previous work conducted by Terry in American population, Olivier in French population and Kaur et al in population of Chandigarh.

Medial angle of clavicle

The medial angle of clavicle as reported by different workers has been tabulated below:

Table 4: Comparison of medial angle of clavicle in males and females as reported by previous authors

Authors	*Males*		*Females*	
	Right (in degrees)	Left (in degrees)	Right (in degrees)	Left (in degrees)
Parsons [3] (English)	153	153	155	155
Terry [4] (American Negroes)	153.52	151.58	151.12	153.62
Terry [4] (American Whites)	153.12	151.42	-------	-------
Olivier [5] (French)	150.2	151.4	151	-------
Kaur et al [6] (Chandigarh)	150.76	150.94	152.61	152.82
Present study	**151.33 ±6.51**	**153.67 ±5.69**	**149.81 ±5.84**	**153.21 ±5.41**

In the present study, the mean medial angle of clavicle in males was greater on the left side (153.67°) as compared to right side (151.33°). This finding was different from the previous studies of Parsons and Kaur et al where the medial angle was equal on both sides. Parsons reported the medial angle in males to be 153°on both the sides and Kaur et al reported the medial angle to be 150° on both the sides in males.

Terry reported that the medial angle was greater on the right side as compared to left side in American Whites (153.12° on the right and 151.42° on the left side) and American Negroes (153.52° on the right side and 151.58° on the left side). This trend was different from that found in the males of the present study.

In females, the trend was similar as in males of the present study. The mean medial angle was greater on the left side (153.21°) than the right side (149.81°). This finding was in concordance with the findings of Terry in American Negroes. This seems to be Negroid feature in the females of the present population.

5. Conclusion

In the present study, it was observed that the medial and lateral angle of left clavicle was more as compared to right side in both the sexes. From this we infer that with the use of right hand, the curvatures of the right clavicle became greater than that of the left side which led to a shorter right bone as compared to the left.

The study on the curvatures of clavicle can be of help to Orthopaedic surgeons during application of external fixation devices in clavicular fractures. This may also be of help to anthropologists in their study of evolution of mankind and migration of races.

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