Original Article

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Morphometrical Study of Scapula for Determination of Sex in Marathwada Region

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Abstract

Objective: The aim of this study was to calculate the morphometric values of scapula and to determine the scapular index in Marathwada population. *Material and Methods:* The study was carried out on 142 adult dry human scapulae of known sex in department of Anatomy, Government Medical College, Aurangabad. Out of these, 102 belong to males and 40 belong to females. *Result:* Mean scapular length and breadth were statistically significant as having p value <0.05. The mean scapular length was 141.8 $\pm$ 8. 23 mm and 123.887.57 mm in males and femalesrepectively. The mean scapular breadth was102.836.24 mm in males and 90.456.19 mm in females. The correlation between scapular length and breadth was expressed as scapular index. The mean scapular index was 72.34.2mm in males and 73.12 4.75mm in females. *Conclusion:* Knowledge of scapular measurements like scapular length, breadth and index can be useful to determine the sex of an individual in medicolegal cases.

Keywords: Scapular Length; Scapular Breadth; Scapular Index.

Introduction

Scapula is a triangular flat bone situated on the posterolateral aspect of thoracic wall between second to seventh rib. It gives attachment to number of muscles. Morphologically, scapula is a composite bone and formed by fusion of dorsal and ventral elements. Dorsal segment is represented by body of scapula and ventral segment is represented by the coracoid process and pre coracoid bone at the tip of coracoid process [1]. Scapula plays an important role in movements of shoulder girdle. Scapula also provides additional protection to the thoracic cage from behind [2].

The development of scapula has been studied and concluded that the triangular shape of scapula is not due to the forces applied on it during development but is a mammalian characteristic. The most obvious modifications have occurred in scapular shape which is studied as scapular length and scapular breadth.[3]

In forensic and medico legal cases, the determination of sex of an individual is important for identification. The present study was carried out on the scapulae of known sex. We had studied the mean scapular length, breadth and index in male and female scapulae.This may be useful in comparative anatomy and also to find out the sex of an individual.

Material and Methods

The present study was conducted on 142 adult dry human scapulae of known sex available in Bone Bank, in department of Anatomy, Government Medical College, Aurangabad. Out of these, 102 were of males and 40 were of females. All the scapulae studied were dry, intact and showed normal anatomical features. All the measurements were carried out manually with the help of ofosteometric board and digital vernier caliper. The measurements were recorded in millimeters. The following morphometric measurements of scapulae were studied.

1. Maximum scapular length: It was measured from

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the highest point of superior angle to the lowest point of the inferior angle. (In Fig No.1: Point A to B).

2. Maximum scapular breadth : It was measured from the point at the middle of the outer border of glenoid cavity to the prominent point where the spine intersects the vertebral border. . (In Fig No.1: Point C to D).
3. Scapular index: was calculated from scapular length and breadth by formula

Scapular index=Breadth/Length x 100

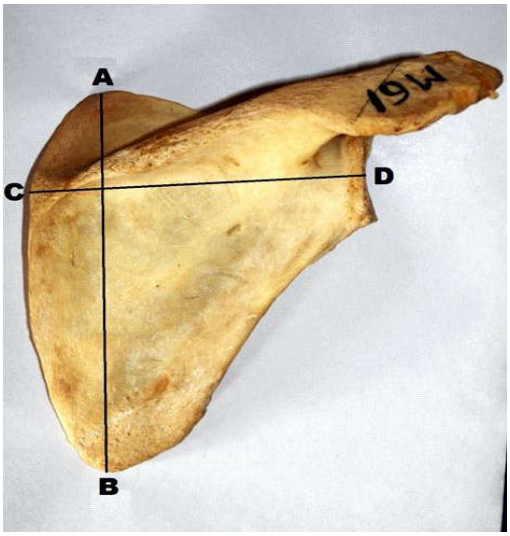

Fig. 1: Showing measurements of Scapula

A-B : maximum scapular length
C-D : maximum scapular breadth

Fig. 2: Showing measurement of scapular length with osteometric board

Fig. 3: Showing measurement of scapular breadth with digital vernier caliper

Observations and Results

142 dry human scapulae of known sex were studied . Out of these 102 were male scapulae and 40 were female scapulae. The mean scapular length and breadth was measured separately in male and female scapulae and tabulated. The mean and standard deviation of scapular measurements were studied and these values were analyzed using an unpaired T test. The observed scapular diameters were -

1. Scapular length: In present study, scapular length in male and female scapulae was statistically significant as having p value with < 0.05.

The length of scapulae in males varied from 125.1 mm to 160. 8 mm with a mean value 141.8 $\pm$ 8. 23 mm. The statistical value of mean3 SD is 166.49-117. 11 mm. The demarcating point in males was > 146.59 mm.

The length of scapulae in females varied from 108. 7 mm to 140.2 mm with a mean of 123.887.57 mm. The statistical value of mean 3 SD was 146.59-101.17 mm with a demarcating point <117.11 mm in females.

2. Scapular breadth: In present study, the scapular breadth in males ranged from 81.7 mm to 120.1 mm with a mean of 102.83 $\pm$ 6.24 mm. 121.55-84.11 mm is the statistical value of mean 3SD. The demarcating point was >109.02 mm for scapular breadth in males.

The value of scapular breadth in females was 77.5 mm to 99.8 mm. The mean scapular breath was 90.456.19 mm. The statistical value of mean 3SD was 109.02-71.88 mm with demarcating point as <84.11 mm.

The values of scapula breadth in males and females for statistical significant as having the P <0.05.

Scapular index : In present study, scapular index ranged from 63.36mm to 82.08mm with a mean of 72.3 ± 4.2mm in males. In females, scapular index ranged from 60.61mm to 81.62mm and had a mean of 73.124.75mm.

Table 1: Scapular length in males and females

Measurements	Male(mm)	Female(mm)
Range	125.1 to 160.8	108.7 to 140.2
Mean ± SD	141.8 ± 8.23	123.88 ± 7.57
Mean ± 3 SD	166.49_117.11	146.59_101.17
D.P.	> 146.59	< 117.11
P value	< 0.05	< 0.05

Table 2: Scapular breadth in males and females

Measurements	Male(mm)	Female(mm)
Range	81.7 to 120.1	77.5 to 99.8
Mean ± SD	102.83 ± 6.24	90.45 ± 6.19
Mean ± 3 SD	121.55_84.11	109.02_71.88
D.P.	> 109.02	< 84.11
P value	< 0.05	< 0.05

Table 3: Scapular index in males and females

Measurements	Male(mm)	Female(mm)
Range	63.36 to 82.08	60.61 to 81.62
Mean ± SD	72.3 ± 4.2	73.12 ± 4.75

Table 4: Comparison of scapular length andscapular breadth by various authors

Authors	No. of Specimens			Mean Scapular length(mm)	Mean Scapularbreadth(mm)
Flower W.H. (1879)[5]		200		155.54	105.6
GeetaSingal et al (2013)[6]		162		141.7 ± 8.9	96.4 ± 7
Dr. M.Krishnaiah et al (2014)[7]		50		143.28 ± 11.44	105.6 ± 5.08
Chhabra N.et al (2015)[8]	126	Right	55	141.93 ± 12.88	103.64 ± 6.41
		Left	71	141.94 ± 12.76	103.76 ± 7.16
Md. Jawed Akhtar et al (2016)[9]	228	Right	126	135.70 ± 14.32	97.97 ± 9.07
		Left	102	134.29 ± 14.14	97.02 ± 0.30
Present study (2017)	142	Male	102	141.8 ± 8.23	102.83 ± 6.24
		Female	40	123.88 ± 7.57	90.45 ± 6.19

Table 5: Comparison of scapular index by various authors

Authors	No. of specimens			Scapular index Range (mm)	Mean Scapular index (mm)
GeetaSingal et al (2013)[6]		162		57 to 76.9	68.5 ± 4
Dr. M.Krishnaiah et al (2014)[7]		50		67.16 to 80.63	73.99 ± 4.6
Chhabra N.et al (2015)[8]		126		62.5 to 89.6	73.32 ± 4.8
Present study (2017)	142	Male	102	63.36 to 82.08	72.3 ± 4.2
		Female	40	60.61 to 81.62	73.12 ± 4.75

Discussion

In present study, the average scapular length, breadth and index of the scapulaewere studied and compared the findings of present study with that of previous workers. This had been done by various ways including direct measurements on dry scapulae, direct measurements of fresh or embalmed cadavers, radiographic measurements in living patients and radiographic measurements of scapulae derived from the cadavers [4].

These studies have been performed on different groups of population. While evaluating the data obtained in present study , we observed several differences as well as similarities with previous studies.

Scapular Length

In present study, the length of scapula varied between 125.1 mm to 160.8 mm with a mean of 141.8±8.23 mm in males.The length of scapula was in the range of 108. 7 mm to 140.2 mm in females with a mean of 123.887.57 mm.

Md. Javed Akhtar et al [9] observed scapular length ranged from 112.10 to 157.79mm on right side and 111.79 to 157.20 mm on left side. Total mean SD was 135.0714.23 mm.

Chhabra N. et al [8] observed the length of scapula ranged from 118mm to 176mm with a total mean SD was 141.9412.76 mm. The mean value observed by Chhabra N. et al [8] is simillar to mean scapular length in males in present study. The mean scapular length observed in Md. Jawed Akhtar et al [9] study is less as compared to present study.

Dr. M. Krishnaiah et al [7] observed mean scapular length was 143.2711.44mm in population of Nalagonda region.

Geeta Singal et al [6] recoarded a mean scapular length of 141.78.9mm in ranged from 115 to 160mm in Saurashtra region, Gujrat. The values observed in Nalagonda and sausrashtra region populatoion are similar to values observed in males in present study.

Flower W.H [5] study was in European population and observed the mean scapular length was 155.54mm. The value observed by Flower WH [5] is very much higher than that of present study.

The previous studies were done on right and left sides separately and had observed values on right sides were more than that of left sides. We had studied scapular length in males and females separately and observed mean scapular length was more in males than that of females.

Scapular Breadth

Mean scapular breadth observed in present study was 102.836.24mm in males and 90.456.19mm in females.

Md. Jawed Akhtar et al [9] observed range of scapular breadth was 79.56mm to 118.20mm on right side and 78.86 to 116.98mm on left side. The value of total mean SD was 97.559.63mm. The values observed are lower than that of present study. Chhabra N. et al [8] observed the breadth of scapula ranged betweeen 86.5mm and 121mm with total a mean of 103.656.82mm. The values observed by Chhabra N. et al [8] was similar to that of observed in males in present study.

Dr. M. Krishnaiah et al [7] studied the scapular breadth in Nalgonda region and observed that maximum number of scapulae were in the range of 105 mm to 110 mm and minimum scapulae were in the range of 90mm to 100mm. They observed the scapular breadth ranged from 90.3mm to 113.3mm. The total mean SD was 105.65.08mm. The observed value is much more greater than that of the present study.

The values observed by Flower W.H. [5] in European population was almost similar to that of observed in males of present study. Geeta Singal et al [6] observed the scapular breadth in the range of 80 to 110 mm with a mean SD was 96.47mm. The value observed is less than that was observed in males and it was much more greater than that of females observed in present study.

Scapular Index

In present study, range of scapular index was 63.36mm to 82.08mm with a mean of 72.34.2mm in males. In females, scapular index was in the range of 60.61mm to 81.62mm and had a mean of 73.12 4.75mm.

In Chhabra N. et al [8] study, mean scapular index observed was 73.32 4.8 mm in North Indian population. They distributed the scapulae according to the scapular index and observed that maximum number of scapulae were found in the scapular index range of 70mm to 74mm (32.5%). Dr. M. Krishnaiah et al [7] observed mean scapular index73.994.6mm in Nalgonda region and maximum number of scapulae were found in the range of scapular index 71mm to 74mm (52%). The mean scapular index observed in both the studies is similar to that of the present study.

Geeta Singal et al [6] recorded the mean scapular index 68.54mm which is less than the present study. They found maximum number of scapulae were found to be in the range of 69mm to 73mm (32.7%).

In most of the previous studies, values were observed on right and left sides separately and did not show very much differences between the values on both sides. In present study, we observed that the values of scapular length and breadth were higher in male scapulae than that of female scapulae, but scapular index was more in female than in male scapulae.This indicate that the male scapulae were longer and broader than female scapulae. This may be due to larger size of scapulae in males.

Conclusion

The knowledge of scapular measurements like scapular length and breadth is used for comparative anatomy and also for determining race of an individual. Our study is an attempt to use the parameters to determine the sex of an individual. These findings will also useful in surgical procedures such as hardware fixation, prosthetic positioning and also for manufacturing prosthetic products. In the present study , the various parameters studied can also be useful to determine the sex of an individual in medicolegal cases.

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