

Gender Variation of Scapula in a Bangladeshi Population – A Radiological Study

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Abstract

The scapula is a complex anatomical unit; it connects the humerus with the clavicle. The scapula presents several variations, based on race, sex and region. Sexual dimorphism plays a key role in forensic anthropology. The scapula is sexually dimorphic and can potentially be used in forensic investigations. A cross-sectional study was conducted under Department of Anatomy, Dhaka Medical College, Dhaka, between July 2017 and June 2018, to observe the morphometric pattern of the left scapula in adult male and female Bangladeshi people for establishment of a baseline anatomical data for future studies. Shoulder radiograph of anterior-posterior view were taken from 100 apparently healthy adult male and female patients aged between 25 and 50 years who were attending the Department of Radiology & Imaging, Dhaka Medical College Hospital, Dhaka. From these images morphological measurements like the length and breadth of left scapula, the lengths of infraspinous line and scapular spine were measured by software named RadiAnt DICOM Viewer. The length and breadth of left scapula, the length of coracoid process, as well as the lengths of infraspinous line and scapular spine were found significantly higher in males. To summarize, a significant difference was observed in morphological measurements of the left scapula between the sexes in Bangladeshi people.

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Introduction

The Scapula, the shoulder blade or wing bone is the bone that connects the humerus with the clavicle. Scapulae are paired, with the scapula on the left side of the body being roughly a mirror image of the right scapula. Scapula forms an important component of the shoulder girdle. The triangular shape of scapula is a characteristic feature of mammals. Scapular shape has undergone modifications which can be expressed as scapular index indicating relationship of length to breadth of the bone. Shape change is mostly in the infraspinous portion.¹

Sexual dimorphism is a key role for forensic anthropology. The scapula is a bone sexually dimorphic and can potentially be used in forensic investigations. Increase in interest of studies in forensic anthropology has been noticed towards the identification of ancient populations through

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bone pieces. Evidence showed that after the growth of the human, the scapula becomes sexually dimorphic.^{1,2} The beak like coracoid process is superior to the glenoid cavity and projects anterolaterally. The anatomical and morphological variations of the acromion and related structures of shoulder joint have clinical importance. It is also useful for suitably interpreting the radiological images, during surgical procedures and in pathologies associated with shoulder joint.¹⁻³

Scapula gives attachment to various muscles which act on the gleno-humeral joint, stabilizing as well bringing about various movements at that joint. The glenoid cavity is a component of the gleno-humeral joint. The anatomy of its articular surface plays an important role in maintaining the stability of the joint and variations can predispose to recurrent dislocations.^{2,3} Rotator cuff tears can be due to trauma or degenerative changes. Glenoid anatomy plays an important role in the prognosis and treatment of the rotator cuff tears.²

While establishing the identification age, sex, stature, and race of a person are the primary criteria. Among them, determination of sex is most important criteria, as it immediately excludes approximately half of the population. It is not a difficult task to determine the sex of an adult deceased when a complete or almost complete skeleton is available for examination. However, it becomes difficult to determine the sex of the deceased if a single bone or only few bones are available.³ In many of such instances, forensic personnel frequently consult the anatomists for expert opinion. Sex can be determined using scapular dimensions with relative (80%) accuracy. Radiographic measurement of scapula gives more accurate

result than that of dry ossified scapula or scapula collected from the cadaver because radiological studies are carried out on living subject.⁴

Review of existing literature reveals that many works have been done on this topic in different countries. Considering Bangladeshi people, study regarding scapula, is very few. Hence, through performing this study, a baseline data can be produced from which we can compare different parameters of scapula in Bangladeshi population for future research.

Methods

This cross-sectional study was conducted in the Department of Anatomy, Dhaka Medical College, Dhaka, during the period from July 2017 to June 2018. Hundred adult Bangladeshi people, 50 males and 50 females, age ranging from 25 to 50 years were included in this study. The subjects of this study were selected from the Department of Radiology & Imaging, Dhaka Medical College Hospital, Dhaka for the shoulder radiograph of anterior-posterior view advised by their physicians.

At the beginning of the study, each subject was briefed about the total plan and purpose of the study. Written informed consent was taken after racial confirmation from them without exploiting any of their weakness or creating undue pressure. Subjects were assured of the confidentiality of the study. The radiograph of anterior-posterior view, oblique and lateral view of left scapula were taken. Then these images were transferred to CD or DVD and different dimensions of left scapula were measured from x-ray film with the help of computer image measuring software. Different variables of scapula measured by computer with image measuring software (DICOM viewer).

For measuring the left scapula, at first a line was drawn along the boundary of the left scapula on the x-ray film A-P view of left shoulder with the help of pencil option from measurement toolbox of DICOM software. All the procedures were done by adopting measurement toolbox of DICOM software with its length option.

Measurement of length of left scapula:

At first highest point of the superior angle on the superior border and another point taken on the lowest point of the inferior angle of left scapula was determined visually and marked by two dots. Then a vertical line was drawn by image measurement toolbox of DICOM software.

Measurement of breadth of left scapula:

The breadth of left scapula was measured from the A-P view of left shoulder by drawing a horizontal line from the medial border of the scapula, where the spine meets the body of the scapula, first point marked by red dot and the second point to the middle of the anterior lip of the glenoid fossa marked by blue dot.

Measurement of length of coracoid process:

The length of coracoid process measured from the most lateroventral point of the coracoid process and another point on the most medial point of the coracoid process, often just above supra scapular notch, marked by a horizontal line joining these two points was the length of coracoids process.⁴ The procedure was done on the A-P view of x-ray film of left shoulder.

Measurement of length of infraspinous line:

The length of infra spinous line was taken on the A-P view of left shoulder. At first, one point on the medial border of the scapula where spine meets and second point to the inferior angle. Then an oblique line joining these two points was the length of infra spinous line.⁵

Measurement of length of scapular spine:

The length of spine was measured from the medial border of the scapula at the point where spine meets and another point to the most lateral point on the scapular spine, drawing a oblique line from this two point was the length of scapular spine.⁶ The length of the scapular spine was taken on the A-P view of the left shoulder.

Data were expressed as mean \pm SD. Gender variation was determined using Unpaired Student's 't'-tests. A P value <0.05 was taken as level of significance. The study was approved by the Ethical Review Committee of Dhaka Medical College, Dhaka, Bangladesh.

Results

The lengths of left scapula were found 157.22 \pm 2.91 mm and 136.10 \pm 3.11 mm and breadths were found 106.92 \pm 2.09 mm and 101.11 \pm 3.50 mm in male and female respectively. The difference was statistically significant (P<0.001) (Table-I). Differences were also observed in the lengths of coracoid process (31.88 \pm 2.03 mm vs. 33.18 \pm 1.85 mm; P<0.001), lengths of infraspinous line (116.68 \pm 2.52 mm vs. 107.42 \pm 2.52 mm; P<0.001) and lengths of scapular spine (107.83 \pm 1.66 mm vs. 106.94 \pm 1.98 mm; P<0.05) (Table-II).

Table-I: Length and breadth of left scapula in male and female

| Variables | Male (n=50) | Female (n=50) | P value |
|------------------------------|--------------------------------------|--|--------------------|
| Length of left scapula (mm) | 157.22 \pm 2.91 (151.20-162.20) | 136.10 \pm 3.11 (130.20 – 140.60) | 0.000 ^S |
| Breadth of left scapula (mm) | 106.92 \pm 2.09 (102.60-110.60) | 101.11 \pm 3.50 (95.30-105.70) | 0.000 ^S |

Data were expressed as mean \pm SD. Figures in parentheses indicate range. Comparison of values

between male and female was done by Unpaired Student's 't'-test; S=Significant.

Table-II: Length of coracoid process, length of infraspinous line and length of scapular spine of left scapula in male and female

| Variables | Male (n=50) | Female (n=50) | P value |
|----------------------------------|--------------------------------|--------------------------------|--------------------|
| Length of coracoid process (mm) | 31.88±2.03 (28.30-36.20) | 33.18±1.85 (30.20-36.80) | 0.001 ^S |
| Length of infraspinous line (mm) | 116.68±2.52 (110.80-122.20) | 107.42±2.52 (102.40-110.60) | 0.000 ^S |
| Length of scapular spine (mm) | 107.83±1.66 (105.20-112.20) | 106.94±1.98 (102.70-110.80) | 0.016 ^S |

Data were expressed as mean±SD. Figures in parentheses indicate range. Comparison of values between male and female was done by Unpaired Student's 't'-test; S=significant.

Discussion

Morphometric variations of the bone are clinically important. Scapula has few, but important anatomical variations which have significant relevance in understanding different shoulder pathologies, useful in treating different disorders of the shoulder joint and designing the shoulder implants. Different populations have differences in scapular morphology and the female morphology is different from that of males.⁴⁻¹²

In the present study, the mean length of left scapula was significantly higher ($p < 0.01$) in male than female. Other researchers such as Morsi *et al.*, Paraskevas *et al.*, Polgaj *et al.*, Di Vella *et al.* and Sinha *et al.* also showed significant difference between the length of adult male and female left scapula.⁷⁻¹¹ They reported higher value in the male than female like the present study. The mean breadth of left scapula was significantly higher in male than female in the present study. According to Di Vella *et al.*, the

mean breadth of left scapula was larger in male than female, but the mean breadth of female left scapula was significantly lower than present study.¹⁰ In the present study, the mean length of coracoid process of left scapula was significantly higher in female than male. According to study of Frank *et al.*, the mean length of coracoid process was higher ($P < 0.001$) in male than female.¹² However, Vella *et al.* and Sinha *et al.* recorded that the mean length of coracoid process was higher in male which was dissimilar to present study.^{10,11}

In the present study, the mean length of infraspinous line was significantly higher in male than female. Chhabra *et al.* studied 126 scapulae in the Department of Anatomy, Army Medical College of Medical Sciences, Delhi, India. They reported that mean length of infraspinous line was significantly lower than present study.⁴ In the present study, significant difference was observed between male and female length of scapular spine of left scapula. Morsi *et al.* reported that the mean length of scapular spine was significantly ($P < 0.000$) higher in male than female left scapula.⁷ Polgaj *et al.* also reported that mean length of scapular spine was higher in male. They stated that the mean length of scapular spine was 139.95±5.07 mm in male and 124.91±5.85 mm in female. The findings were higher than that of the present study.⁹

Conclusion

In the present study, significantly higher values of the length and breadth of left scapula, the length of infraspinous line and scapular spine were found in males. However, the mean length of coracoid process is found higher in females.

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