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Original Research Article

Morphometric Analysis of Scapular Glenoid Cavity to Determine Sexual Dimorphism

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Abstract

The scapula is a triangular bone with thick edges and a thin centre. It articulates with the humerus at the glenohumeral joint (shoulder joint) and with the clavicle at the acromioclavicular joint on the posterolateral part of the thoracic wall. The scapula is a triangular bone with thick edges and a thin centre. It articulates with the humerus at the glenohumeral joint (shoulder joint) and with the clavicle at the acromioclavicular joint on the posterolateral part of the thoracic wall. Glenoid cavity height is 34.87 ± 2.5 in male and 31.14 ± 1.52 in female, glenoid cavity breath is 24.19 ± 2.23 in male and 21.61 ± 1.87 in female respectively. The present study morphometric analysis of scapular glenoid cavity to determine sexual dimorphism clearly shows that males have significantly higher statistical values for all parameters when compared to females.

Keywords: Sexual Dimorphism, Acromioclavicular Joint

Introduction:

When seeking to establish identity from skeletal remains, the right assessment of sex is critical, since it can limit the number of probable matches in half. Furthermore, estimating age from skeletal remains, particularly those of juveniles, is challenging. Traditionally, the skull, pelvis, and long bones have been used for identification, with metric procedures being used as a backup. Other bones in the body, on the other hand, may provide useful information on sex and ontogeny. As a result, the scapula was investigated in this study to learn more about its development and sexual dimorphism[1].

The scapula is a triangular bone with thick edges and a thin centre. It articulates with the humerus at the glenohumeral joint (shoulder joint) and with the clavicle at the acromioclavicular joint on the posterolateral part of the thoracic wall. Various muscles suspend it from the spinal column, ribs, and skull.

Sex determination is critical in forensic and medicolegal circumstances to establish an individual's identity. Essential skeleton bones should be present entire and undamaged for this purpose. The skull, pelvis, long bones, clavicle, patella, sacrum, and sternum are the bones on which sex determination investigations have been conducted[1,2,3].

The most common methods for determining sex are the skull and pelvis. However, using skulls and pelvis for sex determination has a disadvantage in that they do not produce trustworthy results when they are damaged. During forensic exams, the other bones indicated above are frequently absent or found incomplete[4,5].

In comparison to the other bones, the scapula is usually found in good condition. When we use suitable statistical approaches and scapular measurements, we may determine an individual's sex. Scapular measures can be used to determine sex in medicolegal cases, natural disasters, and other situations where the standard skeleton bones are either missing or broken[6,7].

The name scapula, which is a synonym for shoulder blade, comes from Latin [8]. Scapula is a little shovel that looks like a trowel. The scapula (shoulder blade) is a triangular flat bone that overlies the 2nd to 7th ribs on the posterolateral aspect of the thorax. Superior, lateral, medial borders, inferior, three processes, the spine, its continuation the acromion, and the coracoid process three angles superior, inferior, lateral, and three fossa supraspinatus, infraspinatus, sub scapular. The lateral angle is shortened, and the glenoid cavity is present for articulation with the humeral head[9].

The determination of the gender of human skeletal remains is an important first step in their identification and is required for subsequent analysis. In a review of the literature, it was discovered that sexual dimorphism exists in practically every bone of the human skeleton. According to previous research, the skull is the most dimorphic and easily sexed part of the bones after the pelvis, with a 92 percent accuracy rate. However, in the absence of an entire skull, the scapula, which is dimorphic, plays an important role in determining sex. The length, breadth, and slope of the glenoid fossa, coracoid, and acromion processes all show dimorphism in the scapula. A variety of investigations have been conducted to determine the sex of unidentified scapula discovered in skeletal remains. In comparison to descriptive qualities, metric analyses are typically found to be of greater use when determining skeletal sex because of their objectivity, accuracy, reproducibility, and lower level of inter and intra-observer errors[10].

The assessment of similarity between groups of items is an issue that researchers regularly face while analysing biological data. Researchers may derive diverse conclusions from the same results since qualitative methods may not provide statistical testing of group differences[11]. Morphological analysis is based on the observer's experience, and can be influenced by inter- and intra-observer mistakes, as well as standardisation and statistical analysis issues[12]. There are two techniques to determining sex: morphological and metrical[12]. Morphological techniques are qualitative in nature and are concerned with shape. The pelvis and cranium are generally involved in these methods. Metrical analysis is a type of quantitative analysis that focuses on bone dimensions. When the bones are fragmented or when studying long bones with little morphological changes, this method is frequently used[13]. Using discriminant function statistics, a set of measurements can be chosen to maximise sex diagnosis. One of the key drawbacks of this method is that standards are demographic specific, making it impossible to apply standards developed for

American or European people to populations in South Africa[12].

Geometric morphometrics, a different technique, has recently been utilised to successfully assess morphological similarities and differences in biological material[14,15]. This technique quantifies shape using x/y co-ordinates or landmarks, and is especially useful for investigating bulges and curves that are difficult to quantify using typical metric measurements[16,17,18].

The scapula is a triangular bone with thick edges and a thin centre. It articulates with the humerus at the glenohumeral joint (shoulder joint) and with the clavicle at the acromioclavicular joint on the posterolateral part of the thoracic wall. **Material and Methods**

The study was done in the Department of Anatomy of Index Medical College and Research Center, Indore (MP). The present study Morphometric analysis of scapula to determine sexual dimorphism was conducted on 300 scapulae of unknown sex, of which 195 male bones and 105 female bones were found in the current study. The bones were be already present in the Department and had been collected from dissected cadavers.

Following parameters of scapula were measured with the help of sliding calliper

1. **Glenoid cavity height (GCH)**

Maximum distance from the inferior point of the glenoid margin to the most prominent point of the supraglenoid tubercle.

2. **Glenoid cavity breadth (GCB):**

Maximum breadth of the articular margin, perpendicular to the glenoid cavity height.

3. **Calculated Area of Glenoid cavity (CAG):**

It is the product of breadth and height of glenoid cavity. It is not the actual area of glenoid cavity so called as calculated area of glenoid area of glenoid cavity.

Results:

This was observed that the average (Mean ± SD) of glenoid cavity height was found in male 34.87 ± 2.5 and in female 31.14 ± 1.52, the Mean ± SD of glenoid cavity breadth was found in male 24.19 ± 2.23 and in female 21.61 ± 1.87 and the Mean ± SD of calculated area of glenoid cavity was found in male 859.35 ± 125.83 and in female 651.7 ± 49.28. The glenoid cavity height, glenoid cavity breadth and calculated area of glenoid cavity were found significantly higher in male comparison to that in the female, with a p value of < 0.001.

Table 1: Comparison of glenoid cavity height, glenoid cavity breadth and calculated area of glenoid cavity

Variable	**Male (cm)**	**Female (cm)**	**p – Value**
	Mean ± SD	**Mean ± SD**	
Glenoid cavity height	34.87 ± 2.5	31.14 ± 1.52	0.001
Glenoid cavity breadth	24.19 ± 2.23	21.61 ± 1.87	0.001
Calculated Area of Glenoid cavity	859.35 ± 125.83	651.7 ± 49.28	0.001

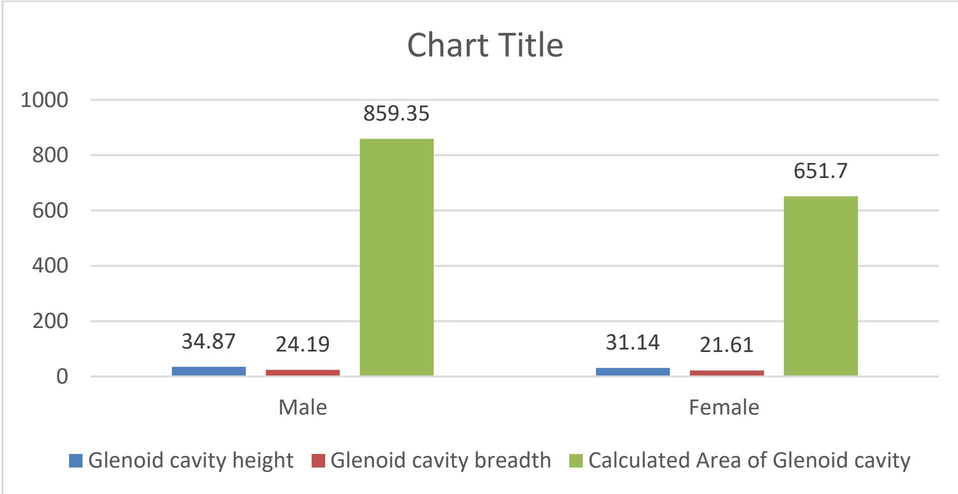

Figure 1: Represents the glenoid cavity height, glenoid cavity breadth and calculated area of glenoid cavity in the form of bar diagram.

Discussion

The mean ± SD concentration of glenoid cavity height, glenoid cavity breadth and calculated area of glenoid cavity were found significantly higher in male comparison to that in the female, with a p value of < 0.001. These findings were concordant with the results of the studies, which were previously done by Phad et al., (2019)[19], Patel et al., (2013)[20], Macaluso (2011)[21], Dabbs et al., (2010)[22] and Scholtz et al., (2010)[23] determined the sex of scapular glenoid cavity and established baseline parameters. In contrast to males and females, all of the parameters were highly significant. In comparison to females had lower value of glenoid cavity height, glenoid cavity breadth and calculated area of glenoid cavity and males had higher standards of glenoid cavity height, glenoid cavity breadth and calculated area of glenoid cavity.

Conclusion

The present study morphometric analysis of scapular glenoid cavity to determine sexual dimorphism clearly shows that males have significantly higher statistical values for all parameters when compared to females. The findings of this study are extremely beneficial in forensic anthropological and medicolegal sex determination.

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