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Original Article

Morphometric Study of Shape of Glenoid cavity of Scapulae

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Abstract:

Background: The glenoid cavity of the scapula is crucial for shoulder joint stability, forming the articulation with the humeral head. Variations in its shape and size can influence joint mechanics, affecting shoulder stability and the risk of injuries like dislocations. Understanding these variations is important for orthopedic procedures, such as shoulder arthroplasty, and in diagnosing shoulder pathologies. The cavity typically appears in shapes like oval, pear-shaped, or inverted comma, with variations across different populations.

Objective: To evaluate the morphometric characteristics of the shape of the glenoid cavity of the scapula.

Methods: It was a cross-sectional analytical study in the department of Anatomy, Sylhet MAG Osmani Medical College, Sylhet from 1st July 2021 to 30th June 2022. Among 200 dried, grossly normal scapulae 104 were male and 96 were female which was determined by the discriminative function analysis technique, and then grouping was done as male and female. Purposive sampling technique was followed. Data was collected in a pre-designed data collection sheet. The Measurement equipment was a digital vernier caliper.

Results: This study shows in right side, the pear shape was the most prevalent among both males (55.7%) and females (56.3%), followed by the oval shape (33.6% for males and 35.4% for females), while the inverted comma shape was the least common (6.7% for males and 8.3% for females). On the left side, the pear shape remained predominant among males (57.7%), whereas females exhibited a higher frequency of the oval shape (50.0%), with the pear shape at 47.9%. These findings suggest a general trend of pear-shaped glenoid cavities in both genders, with notable variations in shape distribution between the sexes, particularly on the left side.

Conclusion: In summary, the morphometric examination of glenoid cavity shapes indicated that pear-shaped configurations were more prevalent in both male and female scapulae on the right side, whereas the left side showed a greater occurrence of oval-shaped glenoid among females. These differences imply possible anatomical variations related to sex and side, emphasizing the need to consider these factors in clinical evaluations and surgical procedures involving the shoulder joint. Additional research is needed to investigate the clinical significance of these results and their implications for shoulder-related conditions.

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Introduction:

Morphometrics (derived from the Greek words morphe, meaning "shape" or "form," and metria, meaning "measurement") involves the quantitative assessment of form, encompassing both size and shape.

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The scapula is a flat, triangular bone located on the posterior-lateral aspect of the chest wall, spanning from the second to the seventh ribs. Together with the clavicle, it plays a crucial role in the shoulder girdle, linking the appendicular skeleton to the axial skeleton.

The scapula is a large, flat, triangular bone situated on the posterolateral side of the chest wall, spanning from the second to the seventh ribs. The glenoid cavity, which connects to the scapula, is broad and somewhat truncated, often considered the head of the scapula. The shape of the glenoid cavity shows significant variation, and a notch is typically present on the upper and anterior parts of the glenoid rim.[1]

The shoulder joint possesses a wide range of motion, but this comes at the cost of stability due to the shallow, short glenoid cavity, the relatively larger size of the humeral head, and the loose nature of the articular capsule.[2] It is the most frequently dislocated joint in the body. The stability of the Glenohumeral joint is influenced by dynamic factors like the rotator cuff muscles and static factors including the ligaments, labrum, and joint capsule. Proper alignment between the humerus and the glenoid articular surfaces is a key factor in glenohumeral joint stability and is a contributing risk factor for rotator cuff disorders.[3] A detailed understanding of the glenoid cavity's anatomy is essential for surgical procedures involving the scapula, such as arthroscopic surgeries, metal fixation, drill hole placement, and prosthesis positioning.[4] In this context, the present study aimed to gather morphometric data from the scapulae, specifically focusing on the diameters and various shapes of the glenoid cavity. With this objective, the study was conducted to evaluate the morphometric features of the glenoid cavity's shape in the scapula.

Materials and methods:

This cross-sectional, analytical study was conducted in the Department of Anatomy at Sylhet MAG Osmani Medical College, Sylhet, from 1st July 2021 to 30th June 2022. The study focused on dry, ossified scapulae obtained from the department, adhering to specified inclusion criteria. A total of 200 samples, including dried, grossly normal scapulae from both right and left sides, were analyzed. Scapulae that were fragmented, deformed, or showed signs of prior trauma or skeletal disorders were excluded. The dry ossified scapulae collected were of unknown sex. Then the sex was determined by the discriminant function analysis technique.[5] The technique was applied to the collected data, and discriminant functions were generated by the discriminant function analysis technique, the sex was determined, and the grouping was done.

Constant +Co-efficient x Variable, Z=bo+b1X x 1,
Here Z = Discriminant function, b0 = constant, b1= co-efficient, X1 =variable.

A sectioning point was created by using the mean discriminant scores. To assign the case to either male or female sex, the product Z was compared to the constant and the co efficient for each variable was calculated to the sectioning point derived by the discriminant function analysis. A value higher than the sectioning point was considered to be male and a value below it was consideredto be female. Value of the constant and the co efficient for each variable was calculated by using SPSS version 22.0. If Z is more than cut point the bone is classified as male. If Z is less than cut point the bone is classified as female. After completion of data collection, the data collection form was rechecked. Finally, data were processed and analysed by a software programme on SPSS (Statistical Package for Social Sciences) for Windows (Version 23.0).

Illustration of shape of glenoid cavity

Figure 1: Pear-shaped glenoid cavity

Figure 2: Oval- shaped glenoid cavity

Figure 3: Inverted comma - shaped glenoid cavity

Results:

The frequency of the shape of the right and left glenoid cavities was 55.56% pear shaped glenoid cavity on the right side, while on the left side the percentage was 56.36. The Percentage for the oval shaped right glenoid was 38.88 while for left side was 32.73. The percentage of inverted comma shaped glenoid cavity for right side was 5.56% and for the left side was 10.91%. P value was 0.24 which was not significant (Table 1).

Table 1: Frequency of the shape of glenoid cavity for left and right side

Shape of glenoid cavity	Male (n=104)		Female (n=96)		P value
	No	Percent	Number	Percent	
Right					
Pear	60	57.7	54	56.3	0.390
Oval	30	28.8	34	35.4	
Inverted comma	14	13.5	8	8.3	
Left					
Pear	60	57.7	46	47.9	0.001
Oval	30	28.8	48	50.0	
Inverted comma	14	13.5	2	2.1	

P value calculated by chi-square test
n = sample size

Discussion:

Discussion of the shape of glenoid cavity

In the present study, there was no significant difference found in the shape of the glenoid cavity between the male and female glenoid cavities in right side. But there was a significant difference found in the shape of the glenoid cavities between the male and female glenoid cavities on left side. In the right male, total 104 glenoid cavities were present. Among them, 58(55.7%) were pear shaped, 35(33.6%) were oval-shaped was and 1(6.7%) were comma shaped in left scapula. In female, total 96 glenoid cavities were present. Among them, 54(56.3%) were pear-shaped, 34(35.4%) were oval shaped and 8(8.3%) were comma shaped in left scapula. In male, total 104 glenoid cavities were present. Among them 60(57.7%) were pear shaped, 30(28.8%) were oval shaped was and 14(13.5%) were comma shaped in left scapula. In the left side female, total 96 glenoid cavities were present. Among them 46(47.9%) were pear shaped, 48(50%)were oval shaped and 1(2.1%) were comma shaped in left scapula. Singroha et al.[7] reported that on left side pear shaped 52%, oval 20% and comma 28%, on the right side pear shaped 36%, oval 24% and comma 40%.Whereas in other study pear shape was more common shown by Ankushrao SD and Dombe DD[8] in right side 57 were pear shaped, 30 were inverted comma shaped, 13 were oval shaped. Whereas on the left side, 50 were pear shaped, 35 were inverted comma shaped, 15 were oval-shaped.

A Morphometric study on the glenoid cavity done by Tiwari V et al.[9] among 100 scapulae, pear-shaped glenoid cavities presented with the highest incidence, and the oval- shaped showed the lowest incidence.[7] Another study Rajendra et al.[10] showed the most common shape observed was of pear-shaped GC in 69 (56.09%) of 123 scapula.43 (34.95%) were of inverted comma- shaped, 8(6.5%) of oval- shaped and 3 (2.4%) were triangular. A Similar study Akhtar et al. showed the most common shape of glenoid cavity recorded in the study was pear shape (50.44%) , followed by inverted comma shaped (35.96%). The least common shape was oval (13.6%).[11]An in-depth study conducted by Dhindsa et al.[12] where the measurements of the glenoid cavity were taken in

total of 80 scapulae of, which 41 were on the right side and 39 on the left side. The shape of the glenoid cavity the right side 9(21.95%) had oval shaped, 20(48.78%) had pear shaped and 12(29.26%) had inverted comma shaped glenoid cavity. Out of the 39 scapulae of the left side 7(17.94%) had oval- shaped, 18(46.15%) had pear shaped and 14(35.89%) had inverted comma shaped glenoid cavities.

Conclusion:

The morphometric analysis of the glenoid cavity shapes revealed a predominance of pear-shaped configurations in both male and female scapulae for the right side, while the left side exhibited a higher frequency of oval-shaped glenoids in females. These variations suggest potential anatomical differences based on sex and side, highlighting the importance of considering such factors in clinical assessments and surgical interventions involving the shoulder joint. Further research is warranted to explore the clinical implications of these findings and their relevance to shoulder pathologies.

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