

Determination of dimensions of Glenoid cavity from other scapular parameters in North Indian Population

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ABSTRACT

Background: The Glenoid cavity dimensions can help to predict the incidence of glenohumeral dislocations in a population.

Purpose of study: The present study involved the measurements of the body of the scapula and the glenoid cavity and to draw the relationship of them to predict the chances of glenohumeral dislocations in North Indian Population.

Methods: A total number of 130 adult scapulae of unknown sex showing complete ossification and without any damage were included in the study. The various shapes of glenoid cavities both on right and left sides were noted and analysed. A digital Vernier calliper was used to measure all the dimensions of scapula as well as glenoid cavity. The data was analysed and regression formulae to estimate the glenoid cavity dimensions were drawn.

Results: Most common shape of the glenoid cavity in the present study was pear shaped (52.30%) followed by inverted comma shaped (33.07%) and least common was oval shaped (14.63%). Mean maximum height of scapula (MSH) was 142.45 ± 2.32 mm, mean maximum width of scapula (MSW) was 102.65 ± 0.21 mm. Mean maximum glenoid height (MGH) was 38.77 ± 3.15 mm, mean maximum glenoid width I (MGW I) was 23.82 ± 2.11 mm, mean maximum glenoid width II (MGW II) was 14.78 ± 9.11 mm. Mean scapular index (SI) was 71.32 ± 0.61 (60-73) % and mean glenoid index (GI) was 60.43 ± 5.43 (60-69%). Bilateral differences in these parameters were statistically insignificant. Mean maximum scapular height was significantly correlated with both mean maximum glenoid height and mean maximum glenoid width. There was also found highly significant interglenoid dimension correlation.

Conclusion: Glenohumeral dislocations are expected if indices are <50% or > 89%. A deviation from the normal relation between maximum glenoid width and maximum glenoid length also indicates glenohumeral instability.

KEY WORDS: Glenoid cavity, Gleno humeral, Scapula.

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INTRODUCTION

The role of scapula in shoulder instability, rotator cuff disease and shoulder impingement can not be underestimated [1]. At the lateral

angle of scapula lies pear shaped glenoid cavity which articulates with the head of the humerus to form shoulder joint. The morphometric study of shape as well as size of the

glenoid cavity help to predict the stability of the glenohumeral articulations as well as for designing prosthesis for shoulder arthroplasty. Glenoid cavity appears pear shaped when the notch on its anterosuperior aspect is indistinct and appear inverted comma when notch is distinct and is oval when the notch is absent [2]. The wide range of movements of shoulder joint predisposes to various injuries and articular dislocation [3]. The knowledge of morphological variations of the glenoid cavity can help surgeons in shoulder arthroplasty [4]. Morphometry of glenoid cavity can help orthopaedic surgeons in cases of rotator cuff tear [5] and in shoulder reconstruction [6]. The present study aims at study of morphology of glenoid cavity, to measure various scapular and glenoid cavity dimensions and to predict glenoid cavity dimensions from other scapular dimensions.

MATERIALS AND METHODS

The present study after approval from Institutional Ethical Committee was done on 130 dry adult human scapulae (72 right and 58 left) taken from Department of Anatomy SGRDIMSR Amritsar. All the scapulae without any damage to glenoid cavity were included. Damaged scapulae were excluded from the study. The various shapes of glenoid cavity were noted and analysed. The various dimensions of the body of the scapula and glenoid cavity were measured using Digital Vernier calliper calibrated to 0.01mm in accordance with Solanki [7] and Camposso et al [8]. These are

- 1- Maximum height of the body of scapula (distance between summit of superior angle of scapula and inferior angle) (MSH)(AB as in Fig1)
- 2- Maximum breadth of the body of scapula (distance between lowest point of glenoid cavity and point of intersection of the spine to the medial border)(MSW)(CD as in Fig 1)
- 3- Maximum glenoid cavity height (distance between supraglenoid tubercle and lowest point on glenoid cavity) (MGH)(GH as in Fig2)
- 4- Maximum glenoid cavity width I (distance between anterior and posterior rim) (MGWI) (EF as in Fig2)

- 5- Glenoid cavity width II (anteroposterior diameter of upper half of the glenoid cavity) (IJ as in Fig2)



Fig. 1: Showing maximum scapular height from summit of superior angle (A) to inferior angle (B)



Fig. 2: Showing maximum glenoid height (MGH) from most superior point of supraglenoid tubercle(G) to inferior angle of scapula(H), maximum width of glenoid cavity (EF) as MGW1 perpendicular to maximum glenoid height, anteroposterior diameter of the glenoid cavity of upper half of the glenoid cavity (IJ).K represent the midpoint of maximum glenoid height.

Following two indicis were noted

- 1-Scapular index-maximum scapular width (MSW)/ maximum scapular height (MSH) multiplied by 100
- 2-Glenoid cavity index- maximum glenoid width I(MGWI)/maximum glenoid height(MGH) multiplied by 100

To predict the dimensions of glenoid cavity from scapular dimensions all the factors were

analysed using regression statistics. The data was analysed using IBM SPSS Statistics (version 21 IBM, Armonk New York)

RESULTS AND DISCUSSION

Three types of shapes of Glenoid cavity were noted and shown as Table 1.

Mean MSH calculated was 142.45±2.32mm with 143.75±9.95mm on the right side and 141.05±13.03mm on left side. Mean MSW was 102.65±0.21mm with 102.34±3.4mm on the right side and 103.05±8.12mm on the left side. Mean glenoid height was 39.25±6.56mm as seen by Kwon et al [9] with 38.78±5.29mm on the right side and 39.06±6.75mm on the left side. Mean glenoid width was 23.82±2.11mm as seen by Churchill et al [6] and as 23.12±2.13mm on the right side and as 23.21±1.65mm on the left side. There was no significant difference in scapular index as well as glenoid index on right and left side. Regression formula for estimation of MGH and MGW from scapular dimensions in the present study in North Indian population is

MGH=15.03+0.16 MSH (R2=0.304)
(p value<0.001)

MGW=9.43+0.09MSH (R2=0.413)
(p value<0.001)

MGH=14.66+0.96 MGW (R2=0.591)
(p value<0.001)

Where R2 represent coefficients of determination

The present study showed that MSH has low significant correlation while MSW has no significant correlation with any glenoid dimension. Significant positive interglenoid correlation indicates MGW will increase with the increase in MGH as shown by Polguy et al [14].

This can help to understand the causes of glenohumeral dislocations. More the difference between MGH and MGW indicates lower Glenoid index and possible GH dislocations. Most predominant shape of the glenoid cavity in the present study was pear shaped (52%) followed by inverted comma shape (33%) and least common was oval shaped (14%) as seen in other studies done in Indian population [10,11] as compared to the study which showed comma shaped as most common and pear

shaped as second most common shape in Egyptian population[12]. Mean glenoid index in the present study was calculated as 60.43±5.43%, and as 60.62±5.11% on the right side and 60.12±4.78% on the left side, with minimum of 53% and maximum as 86.8% as compared to mean glenoid index given by Dhindsa and Singh[13] (70.37±4.08% on right side and 68.59±4.36% on the left side), Polguy et al[14](as combined 72.355±.55%), Akhtar et al[15](66.13± 8.67% on right side and 66.73±7.47% on the left side) and Singh et al [16](69.87±1.54% on right side and 70.44±7.59% o the left side) and Tiwari et al[17] (66.94±6.47% on right side and 68.04±4.66% on left side), Hassanein [18](73.67% on right side and 76.71% on the left side).A positive correlation was seen to exist between scapular height and glenoid dimensions and also between maximum glenoid height and maximum glenoid width in the present study as seen by Aigbogun et al[19]. Glenoid index towards 50% or lower means narrower the glenoid cavity and glenoid index of 80-89% indicates round glenoid cavity. Both these conditions lead to glenohumeral dislocations [19].

Table 1: Showing Various shapes of Glenoid cavity.

S No	Shapes of Glenoid cavity	Right Glenoid cavity (72)	Left Glenoid cavity (58)	Total -130
1	Pear shaped	36(50%)	32(55.17%)	68(52.30%)
2	Inverted comma	23(31.9%)	20(34.48%)	43(33.07%)
3	Oval	13(18%)	06(10.34%)	19(14.63%)

Table 2: Showing Various Scapular Parameters.

S No	Parameters	Right	Left	Total
		(mean±SD) mm	(mean±SD) mm	(mean±SD) mm
1	Max Scapular Height(MSH)	143.75 ± 9.95	141.05±13.03	142.452±2.32
2	Max Scapular width(MSW)	102.34±8.89	103.058±.12	102.65±0.21

Table 3: Showing Scapular Index (SI).

S No	Scapular Index	Right side - 72	% age Right side	Left side-58	% age Left side	Total
1	57-<61	8	11.11	2	3.44	10
2	61-<65	13	18.05	7	12.06	20
3	65-<69	18	25	20	34.48	38
4	69-<73	27	37.5	22	37.93	49
5	>73	6	8.33	7	12.06	13

Table 4: Various Glenoid Cavity Parameters.

S No	Parameters	Right side	Left side	Total
		(mean±SD) mm	(mean±SD) mm	(Mean±SD mm)
1	Max Glenoid Height (MGH)	39.78±5.29	37.06±6.75	38.77±3.15
2	MaxGlenoid Width1 (MGW 1)	23.12±2.13	23.21±1.65	23.82±2.11
3	Max Glenoid Width 2 (MGW11)	14.12±2.02	15.30±2.11	14.78±9.11

Table 5: Glenoid Index.

Glenoid Index	Right SideNo (72)	Right Side % age	Left Side No (58)	Left Side %	Total -130
49%	-	-	-	-	-
50-59%	4	5.55	6	9.23	10
60-69%	31	43.05	37	56.92	68
70-79%	27	37.05	11	18.96	43
80-89%	10	13.88	4	6.15	9
>90%	-	-	-	-	-

CONCLUSION

The present study will help to determine the glenoid cavity dimensions from other scapular measurements like height and width in North Indian population. This can guide the orthopaedic surgeons in glenoid reconstruction operations.

ABBREVIATIONS

MSH- Maximum scapular height

MSW- Maximum scapular width

MGH- Maximum glenoid height

MGW I- Maximum glenoid width I

MGW II- Maximum glenoid width II

Author/s Contributions:

Seema Sehmi- Procuring scapulae, taking the dimensions of scapulae, applying statistics

Anupama Mahajan- Rechecking the data & validation

Conflicts of Interests: None

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