



Article

Morphological and morphometric study on human glenoid cavity with correlation to its functions

Mary Alkesan^{1,*}, Ahmed Galal², Salwa Ouies¹, Zahraa Ismael¹

¹Anatomy and Embryology Department, Faculty of Medicine, Sohag University, Sohag, Egypt 82524

²Anatomy and Embryology Department, Faculty of Medicine, Assiut University, Assiut, Egypt

*Corresponding author: marymelad159@gmail.com

Abstract

The shoulder joint is one of the most important joints in the human body. The lateral angle of the scapulae becomes broadened and forms the glenoid cavity, which articulates with the head of the humerus to form the shoulder joint. This paper studies morphological features of the glenoid cavity and measures various dimensions of the glenoid in dry human scapulae bone that are important to designing proper glenoid prostheses for total shoulder arthroplasty. This study was done on 40 dry human scapulae to study the parameters of the glenoid cavity (superior-inferior diameter, anterior-posterior diameter, and shape of the glenoid cavity). The results illustrated that the superior-inferior diameter of the glenoid on the right side was 35.85 ± 2.15 mm and 34.41 ± 1.75 mm on the left side. The glenoid shapes were pear, with 50 % on the right side and 45 % on the left, inverted comma, with 40% on the right and 45 % on the left, and oval, with 15 % on the right and 15% on the left. Anatomical variations of the glenoid cavity are important for understanding the various diseases of the shoulder joints and in the design of glenoid components for total shoulder arthroplasty.

Keywords

Glenoid, Morphological, Morphometric study

Article info.

Citation: Alkesan M., Galal A., Ouies S., and Esmael Z. (2022). Morphological and morphometric study on human glenoid cavity with correlation to its functions. *Sohag Journal of junior Scientific Researchers*, vol. 2 (5), 19 - 26.

<https://doi.org/10.21608/sjyr.2022.228560>

Received: 12/01/2022

Accepted: 27/02/2022

Published: 31/03/2022

Publisher's Note: SJYR stays neutral regarding jurisdictional claims in published maps and institutional affiliations.

1. Introduction

The shoulder joint is the most dynamic joint in the body. It is a ball-and-socket joint in which the humeral head is attached to the glenoid fossa (Yoon et al., 2020). The scapulae are paired bone of the shoulder girdle, they are situated postero-lateral over the chest wall and extend from the second rib to the seventh rib (Singh et al., 2019). The glenoid cavity is a shallow, comma-shaped mark on the lateral angle of the scapula, which articulates with the head of the humerus to form the glenohumeral joint. (Drake et al., 2020) The surface of the glenoid cavity is covered with hyaline cartilage and its margins are slightly raised, which gives attachment to the glenoid labrum. The glenoid labrum is a fibrocartilaginous structure that deepens the cavity (Saha & Vasudeva, 2020).

The Glenoid cavity has a variable morphology due to the presence of a notch on its anterosuperior side of the glenoid rim (pear-shaped, oval, or inverted comma shape) (Vardhan et al., 2019).

The knowledge of normal anatomical features and variations in the shape and size of the glenoid cavity is important to understand the mechanics of the shoulder joint. This information has clinical application in shoulder arthroplasty, glenohumeral instability, and rotator cuff tear management (Yadav et al., 2019).

It is important to know the morphological and morphometric variations of the glenoid fossa to understand and diagnose dislocations of the joint and diseases of the shoulder joint. It may also help to choose the appropriate size of the prosthesis in shoulder arthroplasty and reduce the morbidity associated with this (Singh et al., 2019).

2. Materials and Methods

In this study, human adult dry scapulae bone 40 (20 right and 20 left) of unknown sex and age were collected from the anatomy departments of the Sohag Faculty of Medicine, Assiut Faculty of Medicine, and Qena Faculty of Medicine. Only scapulae with a clear and intact glenoid cavity were used for the study. Bones with gross damage or anomalies were excluded from the study. The following parameters of the glenoid cavity were studied:

2.1. Morphological parameters

2.1.1. The shape of the glenoid cavity

Shapes of the glenoid cavity were classified based on presence or absence of notch on the anterior margin of fossa, these are oval shape when an absence of notch, Pear shape when a presence of an indistinct notch, and Inverted comma shape when a presence of distinct notch. (Khalkar et al., 2020)

2.1.2. Morphometric parameters

2.1.2.1. Superior-Inferior glenoid diameter (SI)

The maximum distance from the inferior point on the glenoid margin to the most prominent point of the supraglenoid tubercle (Rajput et al., 2012).

2.1.2.2. Anterior-Posterior glenoid diameter (AP-1)

The maximum breadth of the lower half of the glenoid cavity (Kumar, 2017).

2.1.2.3. Anterior-Posterior glenoid diameter (AP-2)

The maximum breadth of the upper half of the glenoid cavity. (Khalkar et al., 2020)

Method of measurement: All morphometric parameters were measured by using a Vernier caliper in millimetres with an accuracy of 0.01 mm (Singh et al., 2019).

2.2. Statistical analysis

All the measurements were analyzed by using SPSS version 16. Statistical evaluations were performed for each measurement (mean values and standard deviation of the mean).

The student comparison t-test and value were performed to determine if there was a significant difference between the right and left sides (Khalkar et al., 2020).

Correlation was considered significant at p -value < 0.05 and highly significant at p -value < 0.01 and non-significant at p -value > 0.05 (Emad et al., 2017).

3. Results

In this study, 40 dry human scapulae of unknown age and sex were studied, of which 20 were right scapulae and 20 were left scapulae.

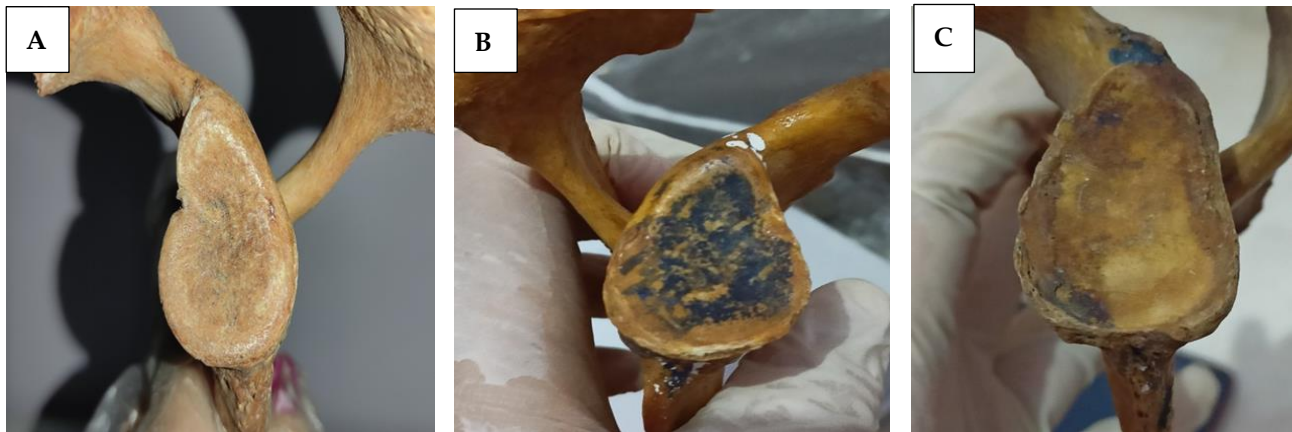
3.1. various shapes of the glenoid

In our study, various shapes of the glenoid cavity and the percentage of incidence were recorded. The pear shaped 50 % on the right side and 45 % on the left side, with an indistinct notch.

The inverted comma-shaped glenoid was 35% on the right side and 40 % on the left side. The oval shape glenoid was 15 % on the right side and 15 % on the left side (Table 1, and Figure 1, 2, and 3)

Table 1. Comparison between shape of glenoid cavity on right and left side

Shapes	Right	Left
Pear	50 %	45 %
Inverted comma	35 %	40 %
Oval	15 %	15 %



A. Comma shape

B. Pear shape

C. Oval shape

Figure 1. Various shapes of the glenoid cavity

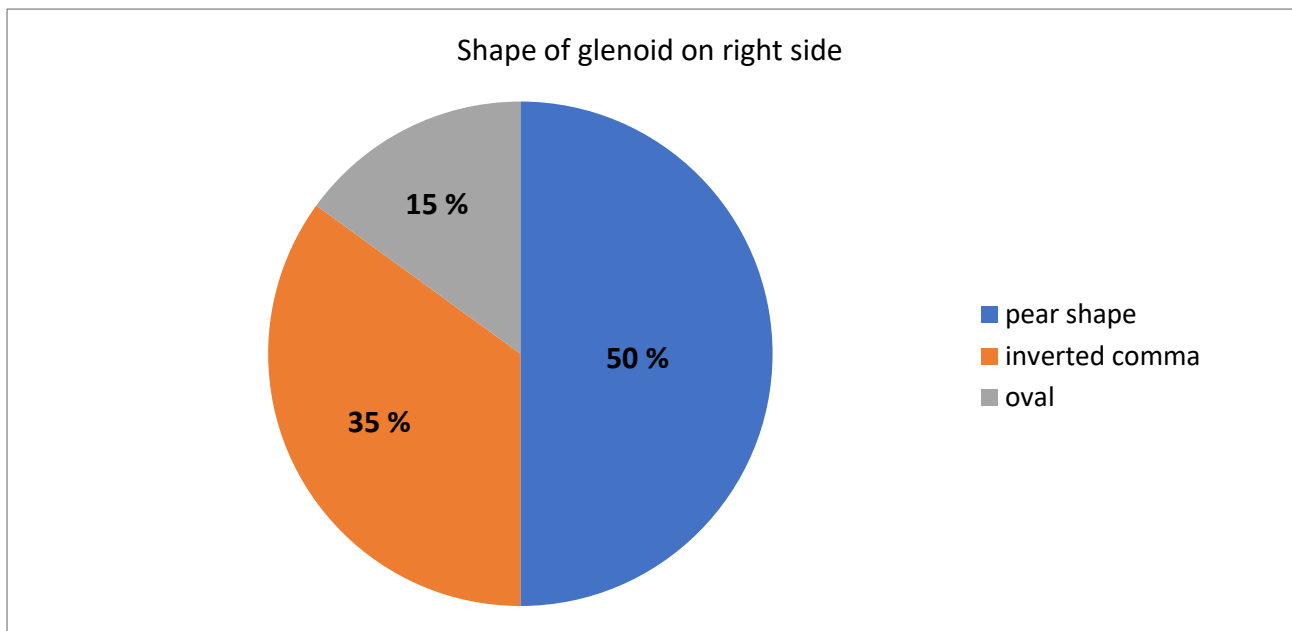


Figure 2. Shapes of glenoid cavity on right side

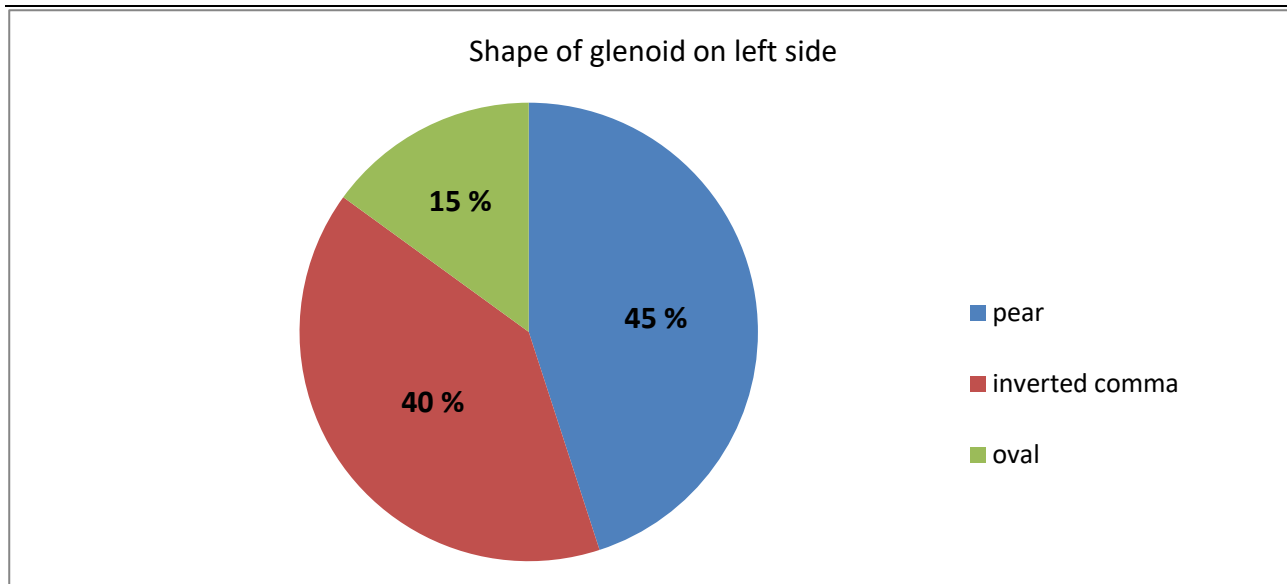


Figure 3. Shapes of glenoid cavity on left side

3.2. Morphometric parameters of the glenoid cavity

In this study, Superior-Inferior (SI) glenoid diameter on the right side ranged from 31.03 to 39.21 mm, with a mean of 35.85 ± 2.15 mm and on the left side ranged from 32.38 to 37.17 mm, with a mean of 34.41 ± 1.75 mm, Anterior-Posterior glenoid diameter (AP-1) on the right side, varied from 21.74 to 28.93 mm, with a mean of 25.02 ± 1.99 mm, and on the left side, (AP-1) diameter varied from 21.60 to 27.10 mm, with a mean of 24.36 ± 1.45 mm, and Anterior-Posterior glenoid diameter (AP-2), on the right side ranged from 15.53 to 21.39 mm, with an average of 18.66 ± 1.43 mm, on the left side, (AP-2) diameter ranged from 15.22 to 21.17 mm, with an average of 18.15 ± 1.61 mm. There was a right to left on the AP-1 and the significant difference in the SI diameter of the right side compared to the left side and no significant change from AP-2 diameters. (Figure 4, and Table 2).

Table 2. shows the mean SI diameter, AP-1 diameter, and AP-2 diameter of the glenoid cavity.

	Mean of SI diameter	Mean of AP-1	Mean of AP-2
Right	35.85 ± 2.15 mm	25.02 ± 1.99 mm	18.66 ± 1.43 mm
Left	34.41 ± 1.75 mm	24.36 ± 1.45 mm	18.15 ± 1.61 mm

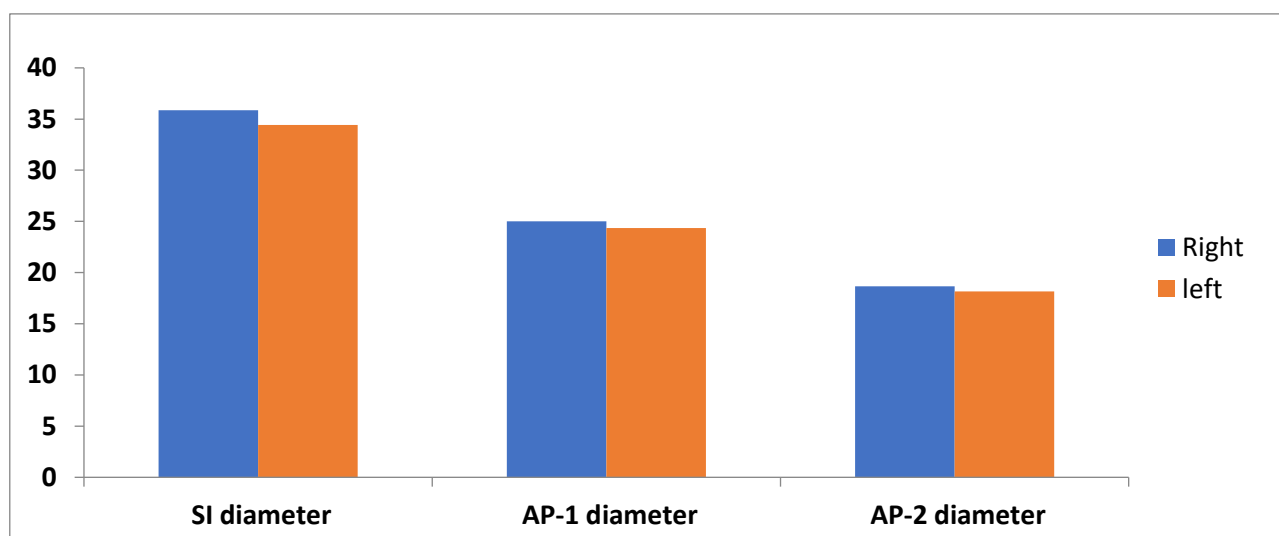


Figure 4. shows the mean of SI diameter, AP-1 diameter, and AP-2 diameter of the glenoid cavity.

4. Discussion

In the current study, the various dimensions and incidence of various shapes of the glenoid cavity have been measured and compared with other studies (Rajput et al., 2012).

In the present study, a pear shaped glenoid was found in 50 % of the samples on the right side and 45 % on the left side, which was the most common type we observed. The second most common type was the inverted comma, which was found at 35 % on the right side and 40 % on the left side, and the oval shape was found at 15 % on the right side and 15 % on the left side.

In the study done by Mamatha et al. (2011) the pear shaped glenoid cavity was 46 % on the right side and 43 % on the left side, the inverted comma was 34 % on the right side and 33 % on the left side, and the oval shape was 20 % on the right side and 24 % on the left side, (Rajput et al., 2012) recorded that pear shape glenoid cavity was 49 % on the right side and 46 % on the left side, inverted comma was 35 % on the right side and 39 % on the left side and oval shape was 16 % on the right side and 15 % on the left side, in Akhtar et al. (2016) recorded that the pear shaped glenoid cavity was 51.59 % on the right side and 49.02 % on the left side and the inverted comma was 34.92 % on the right side and 37.25 % on the left side, and the oval shape was found at 13.49 % on the right side and 13.73 % on the left side, Shubhangi B. et al. (2018) observed that a pear shaped glenoid cavity was found at 50 % on the right side and 52.38 % on the left side and an inverted comma which was found at 30 % on the right side and 38.1 % on the left side, and an oval shape was found at 20 % on the right side and 9.52 % on the left side, and these were near to our study.

In the present study, the average of Superior-Inferior (SI) diameter of the right glenoid was 35.85 ± 2.15 mm and that of the left glenoid was 34.41 ± 1.75 mm. The right glenoid value was slightly higher than the left. Our findings of the (SI) diameter of the right glenoid were nearer to those of Kavita et al. (2013) in which, the (SI) diameter of the right glenoid was 35.2 ± 3.0 mm and the left glenoid was 34.7 ± 28 mm and Sarwar et al (2017) in which (SI) diameter of the right glenoid was 35.22 ± 3.26 mm and the left glenoid was 34.53 ± 3.21 mm and Shubhangi B. et al. (2018) (SI) diameter of the right glenoid was 35.55 ± 3.48 mm and the left glenoid was 35.04 ± 3.61 mm.

In studies done by Wael Amin et al. (2015) the (SI) of the right glenoid was 38.88 ± 2.63 mm and the left glenoid was 39.01 ± 2.49 mm, and in Akhtar et al. (2016) the right glenoid was 36.03 ± 3.15 mm and the left glenoid was 35.52 ± 3.12 mm which were higher than in our study.

In this study, the mean of the AP-1 diameter of the right glenoid was 25.02 ± 1.99 mm and that of the left glenoid was 24.36 ± 1.45 mm. The right glenoid value was slightly higher than the left. The mean of AP-2 diameter of the right glenoid was 18.66 ± 1.43 mm and that of the left glenoid was 18.15 ± 1.61 mm.

Kavita et al. (2013), found that the AP-1 diameter of the right glenoid was 25.07 ± 2.7 mm and the left glenoid was 24.9 ± 2.0 and the AP-2 diameter of the right glenoid was 16.8 ± 1.8 mm and the left glenoid was 16.3 ± 2.0 , in Sarwar et al. (2017) noticed that the AP-1 diameter of the right glenoid was 23.95 ± 2.78 mm and left glenoid was 23.64 ± 2.3 mm, the AP-2 diameter of the right glenoid was 16.16 ± 2.38 mm and left glenoid was 15.34 ± 2.17 mm, Shubhangi B. et al. (2018) found that the AP-1 diameter of the right glenoid was 22.51 ± 2.51 mm and the left glenoid was 22.81 ± 2.88 mm, Wael Amin et al. (2015) recorded that, the AP-1 diameter of the right glenoid was 21.33 ± 2.49 mm and the left glenoid was 21.69 ± 2.06 mm and the AP-2 diameter of the right glenoid was 28.31 ± 2.38 mm and the left glenoid was 27.99 ± 2.55 mm and Akhtar et al. (2016), found that the AP-1 diameter of the right glenoid was 23.67 ± 2.53 mm and the left glenoid was 23.59 ± 2.47 mm and the AP-2 diameter of the right glenoid was 16.30 ± 2.16 mm and the left glenoid was 16 ± 2.34 mm.

5. Conclusion

The knowledge of normal anatomical features and variations in the shape and size of the glenoid cavity is important for a complete understanding of the mechanics of the shoulder joint. This information has clinical application in shoulder arthroplasty, gleno-humeral instability, and rotator cuff tear management. It may also help to choose the appropriate size of the prosthesis in shoulder arthroplasty.

References

- Akhtar, M., Kumar, B., Fatima, N., & Kumar, V. (2016). Morphometric analysis of glenoid cavity of dry scapulae and its role in shoulder prosthesis. *International Journal of Research in Medical Sciences*, 4(7), 2770–2776.
- Drake, R. L., Vogl, A. W., & Mitchell, A. W. M. (2020). Upper limb. In R. L. Drake, A. W. Vogl, & A. W. M. Mitchell (Eds.), *Gray's Anatomy for Student* (4th ed.). Elsevier HealthSciences (chapter upper limb pages 674-676 and 690-698).
- Emad, M., Fahmy, S., Abdel Fattah, S., & Hasan, E. (2017). Anatomical Variations of the Scapula in Adult Egyptian Population and their Clinical Implication: Morphological and Morphometric Study on Dry Bone and Radiograph. *The Egyptian Journal of Anatomy*, 40(2), 301–322.
- Kavita P, Jaskaran S, Geeta. Morphology of coracoids process and glenoid cavity in adult human scapulae. *International Journal of Analytical, Pharmaceutical and Biomedical Sciences*. 2013;2(2):19-22.
- Khalkar, A. A., Jadhav, S. D., & Pawar, S. E. (2020). Morphology-and-morphometry-of-glenoid-cavity-and-it-s-clinical- significance. *Indian Journal of Applied Research*, 10(6), 49–51.
- Kumar, R. (2017). Assessment of variation of scapula- A Morphological study Rajeev. HECS *International Journal of Community Health and Medical Research*, 3(3), 95–98.
- Mamatha, T., Pai, S. R., Murlimanju, B. V., Kalthur, S. G., Pai, M. M., & Kumar, B. (2011). Morphometry of glenoid cavity. *Online Journal of Health and Allied Sciences*, 10(3), 1–4.
- Rajput, H. B., Vyas, K. K., & Shroff, B. D. (2012). A Study of Morphological Patterns of Glenoid Cavity of Scapula. In *National Journal of Med Res* (Vol. 2, Issue 4, pp. 504–507)
- Saha S, & Vasudeva N. (2020). Morphological Variations of Glenoid Cavity of Human Scapulae: an Anatomical Study With Clinical Relevance. *International Journal of Anatomy and Research*, 8(1.2), 7288–7293
- Sarwar MOS, Diwan COV, Rahamn H, Raheman H, Moosa SM. A Morphometric study of glenoid cavity of adult human scapula. *International Journal of Recent Trends in Science and Technology*. 2015;15(3):486-90.
- Shubhangi B. G., Kailash B., W., & Amrut A., M. (2018). Morphometric Study of Glenoid Cavity of Human Scapula. *Indian Journal of Anatomy*, 7(3), 233–23
- Singh, A., Singh, A., Agarwal, P., & Gupta, R. (2019). A Morphological and Morphometric Study of Glenoid Fossa of Scapula and its Implication in Shoulder Arthroplasty. 8(3), 10–13.
- Vardhan, H., Chuhan, S. K., & Modi, S. (2019). Study of morphology of glenoid cavity of scapula; done on dry bone specimen in the department of anatomy of MGM medical college Jamshedpur. 2, 91–94.
- Wael Amin NED, Mona Hassan MA. A Morphometric Study of the Patterns and Variations of the Acromion and Glenoid Cavity of the Scapulae in Egyptian Population. *Journal of Clinical and Diagnostic Research*. 2015;9(8):8-11.

- Yadav, Y., Potdar, P., & Dhakar, J. (2020). Morphometric study of glenoid cavity of scapulae in north Indian population with clinical significance. *Santosh University Journal of Health Sciences*, 5(2), 78–81.
- Yoon, J. H., Song, K. J., Ji, M. Y., Lee, B. S., & Oh, J. K. (2020). Effect of a 12-Week Rehabilitation Exercise Program on Shoulder Proprioception, Instability and Pain in Baseball Players with Shoulder Instability. *Iranian journal of public health*, 49(8), 1467–1475.

الملخص العربي

دراسة شكلية وقياسية على الجوف الحُقاني وملائمته للوظيفة في الإنسان

ماري الكسان^{1*}، احمد جلال²، سلوى عويس¹، و زهراء اسماعيل¹

¹قسم التشريخ الادمي وعلم الاجنة، كلية الطب البشري، جامعة سوهاج ، سوهاج، مصر 82524

²قسم التشريخ الادمي وعلم الاجنة، كلية الطب البشري، جامعة أسيوط، أسيوط، مصر

*الباحث المسؤل: marymelad159@gmail.com

يعتبر مفصل الكتف من أهم المفاصل في جسم الإنسان ويتكون التجويف الحُقاني من اتساع الزاوية الجانبية للكتف والتجويف الحُقاني يتمفصل مع رأس عظم العضد لتكوين مفصل الكتف وهذا البحث يدرس السمات المورفولوجية للتجويف الحُقاني وقياس الأبعاد المختلفة للحُقاني في عظم الكتف البشري. وتمت هذه الدراسة بجمع 40 كتف بشري جاف لدراسة التجويف الحُقاني (القطر العمودي ، القطر المستعرض، وشكل التجويف الحُقاني) واطهرت الدراسة ان القطر العمودي للحُقاني على الجانب الأيمن 2.15 ± 35.85 ملم و 1.75 ± 34.41 ملم على الجانب الأيسر وكانت الأشكال الحُقانية عبارة عن كمثرى في 50% على الجانب الأيمن و 45% على اليسار ، وفاصلة مقلوبة في 40% على اليمين و 45% على اليسار ، وبيضاوية في 15% على اليمين و 15% على اليسار والاختلافات التشريحية للتجويف الحُقاني مهمة لفهم الأمراض المختلفة لمفاصل الكتف وفي تصميم المكونات الحُقانية من أجل تقويم مفصل الكتف الكلي.