ECRONICON OPEN ACCESS

EC CLINICAL AND EXPERIMENTAL ANATOMY

Research Article

Anatomical Analysis of Bicipital Groove of Dry Adult Human Cadaveric Humerus in Ethiopia

Bahiru Tenaw Goshu*

Department of Human Anatomy, School of Medicine, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

***Corresponding Author:** Bahiru Tenaw Goshu, Department of Human Anatomy, School of Medicine, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia.

Received: July 08, 2019; **Published:** August 28, 2019

Abstract

Background: Bicipital groove is a groove on the anterior aspect of upper end of humerus. Knowing the anatomy of bicipital groove is essential for understanding of variety clinical conditions. The aim is to describe the morphometric features of bicipital groove in human humerus

Methods: The study was undertaken on 51 dry humeri of unknown age and sex collected from Anatomy Department. Total length, anterio-posterior and transverse width of humeri at surgical neck along with length, width and depth of bicipital groove were measured. Data were statistically analyzed and compared with other studies.

Results: from this study the total length, anterio-posterior and transverse width of humeri were 30.28 ± .52, 2.28 ± .01 and 3.87 ± 0.18 cm on right and 29.36 ± .45, 2.28 ± .11 and 3.79 ± .18 cm on left sides respectively. The length, width and depth of bicipital groove were 7.46 ± .09, 8.36 ± 0.1 and 4.64 ± 0.08 cm on right and 7.45 ± 0.09, 8.32 ± 0.08 and 4.83 ± 0.07 cm on left sides respectively. The mean length of bicipital groove accounts to 24.44% and 25.37% of total length of right and left humeri respectively. The total length, width of humerus, width and depth of bicipital groove between right and left sides were significantly differences ($p < 0.05$).

Conclusion: The present study naked a morphometric parameters of bicipital groove anatomy that may be help for anatomists, surgeons and radiologists.

Keywords: *Bicipital Groove; Morphometry; Humerus*

Introduction

Bicipital Groove (BG) is anatomical signpost at hand on the anterior aspect of upper end of humerus that lies between lesser tubercle medially and greater tubercle laterally. Intertubercular sulcus is extended distally for about 5 cm on the shaft of humerus and altogether considered as BG. The groove has lateral lip, medial lip and floor. Its lateral lip, medial lip and floor provide attachment of pectoralis major, teres major and latissimus dorsi muscles tendon respectively. The BG along with transverse humeral ligament bridging it superiorly give passage to the tendon of long head of biceps brachii muscle with its synovial sheath and an ascending branch of anterior circumflex humeral artery [1]. Coracohumeral ligament directly overlies the transverse humeral ligament and continuous with rotator cuff. The BG with transverse humeral ligament bridging it provide stability and smooth functioning of tendon of long head of biceps brachii muscle and prevent its subluxation during multidirectional biomechanical movements of arms [2]. Given that bicipital groove and tendon of biceps are intimately related, it is quite sensible to believe that variation in morphology and morphometry of bicipital groove may influence the function of the tendon and consequently play vital role in a variety of causes of shoulder disability. Pathologic anatomical of biceps tendon in the form of primary entities has been discussed in a series of reports by various workers [3]. Biceps tendon causing impingement and instability of tendon at the entry into BG have been postulated to be among most frequent causes of pain and disability of shoulder region. A radiological study recommended that entire length of BG be examined to settle on the anatomy of the groove [4]. Recently, there has

been an expansion interest on anatomical knowledge of BG regarding its morphology and morphometry due to development of various advanced shoulder reconstruction technique for selection of suitable prosthesis device [5,6]. Taking into consideration of increasing clinical interest in recent past, data on this topic is paltry especially on Ethiopian. Therefore, the present study was attempted to provide additional information regarding morphometry of BG and to draw a parallel with its clinical implications all the way through similar studies.

Materials and Methods

The present study was performed on 51 dried cadaveric humeri (27 belonging to right side and 24 of left sides) of unknown age and sex collected from Department of Human Anatomy. The humeri which encountered any damage or pathological changes were excluded from study. Total length, anterio- posterior and transverse width of humeri at surgical neck along with length, width, depth of BG was measured. The total length was measured with the help of ruler. The anterio-posterior and transverse width of humeri at surgical neck along with length, width, depth of BG were analyzed by caliper. The length of BG was gritty as greatest distance between most proximal and distal point of the groove. Similarly, width was estimated as utmost distance between medial and lateral lips of the groove and depth as distance between greater or lesser tubercle to floor of the groove. All these parameters were accurately measured by two observers separately and average values were taken. Data obtained were tabulated as Mean ± SEM and statistically analyzed using SPSS version 20. The difference between right and left humeri were compared statistically by paired sample t-test, the difference was considered as significant if the p-value was found less than 0.05. Finally, results were compared with other similar type of studies (Figure 1 and 2).

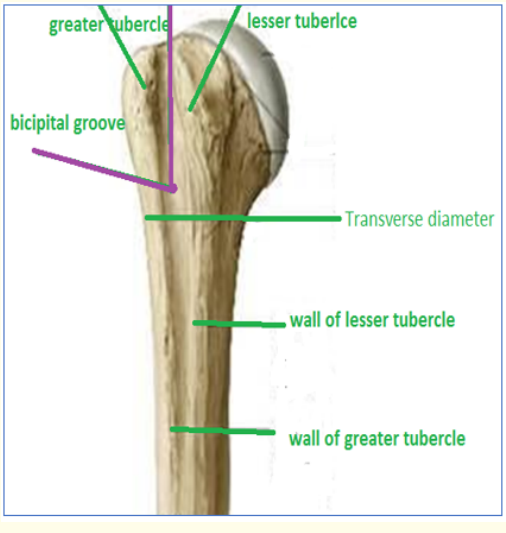

Figure 1: *Photograph of upper humerus that showed bicipital groove and other features.*

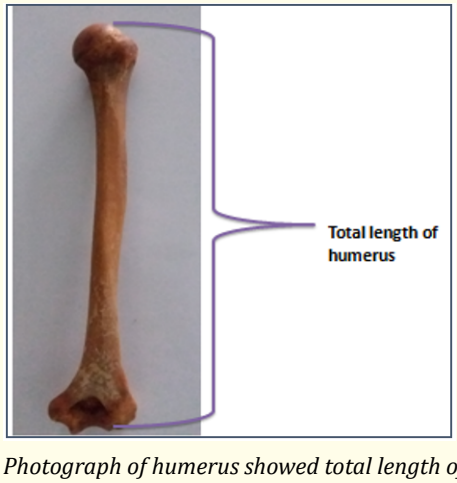

Figure 2: *Photograph of humerus showed total length of humerus.*

Result

Out of all samples of the present study, the mean length of BG on the right side was 7.46 ± .09 cm and that of the left side was 7.45 ± .09 cm. The width of BG on right side was 8.36 ± 0.1 cm and that on the left side was 8.32 ± 0.08 cm. The depth of BG on right side was 4.84± 0.08 cm and that on the left side was 4.83 ± 0.07 cm. Average length, anterio-posterior and transverse diameters of humeri were 30.28 ± .52, 2.28 ± .01 and 3.87 ± 0.18 cm. on right and 29.36 ± .45 , 2.28 ± .11 and 3.79 ± .18 cm on left sides respectively (Table 1). Bicipital groove accounts 24.44%, 25.37% of total average length of right and left humerus respectively. There were statistical significant difference between right and left side in respect to total length of humerus and width at surgical neck of humerus. When data was compared regarding bicipital groove, statistical significant difference was observed in respect to width and depth of bicipital groove between right and left sides.

Parameters (in cm)	Right side	Left side	p-value
TLH	30.28 ± .52	29.36 ± .45	0.036*
APD	2.28 ± .1	2.28 ± .11	0.547
TD	3.87± .18	3.79± .18	0.017*
LBG	7.46± .09	7.45 ± .09	0.544
WBG	7.96 ± 0.1	8.12 ± .08	0.012*
DBG	4.84 ±0.08	4.43 ± .07	0.009*

Table 1: *Showing different morphometric parameters of humerus and bicipital groove (n = 51).*

*Values are presented as Mean + SEM, Statistical significance (paired t- test, * p < 0.05). BG: Bicipital Groove; TLH: Total Length of Humerus; APD: Antero-posterior Diameter at Surgical Neck; TD: Transverse Diameter at Surgical Neck; LBG: Length of Bicipital Groove; WBG: Width of Bicipital Groove; DBG: Depth of Bicipital Groove; cm: Centimeter.*

Discussion

Human body variations which could be developmental or acquired give augment to abnormal functions of the body system. Bicipital groove of humerus show variations in their morphology and morphometry. Since BG and biceps tendon are intimately related, it is understood that variation of BG may influence the function of biceps tendon and consequently play important role in causing tendon instability and attritional damage [2,3]. Therefore, morphometry of BG allowing space for the passage of biceps tendon can be determined by various dimensions of the groove in the form of its length, width and depth along with their correlation with respective dimensions of humeri. The results of the present study have been compared with other anthropometric studies of BG carried out by various authors available in accessible literature which are shown in table 2. The study by different authors showed that length of medial and lateral walls of BG of both sides ensure greater stability of the tendon within BG during multidirectional movement of shoulder joint [2,7]. However, in this study, no measure of the length of the walls separately rather average total length which when compared with that of previous studies it was found lower [8]. But higher than that observed by Kaur and Gupta [1] and was close to the findings of Gupta., *et al* [1]. The depth and width of BG have been caught up to be the most important contributing factors for retention of tendon of long head of biceps brachii muscle in position. In this study, width of the present study is compared with those of similar parameters reported by other authors [7]. A wide groove of more than 1.7 cm is often shallow which together may predispose subluxation ordislocation of the tendon [9,10]. Shallow BG may lead to chronic trauma or impingement by the overlying acromion, rotator cuff and coracoacromial arch while deep groove are more likely to cause constriction of the tendon as propounded by Depalma [11]. It is quite evident that a shallow and wide groove promotes subluxation and dislocation of biceps tendon often than a deep and narrow groove which on the other hand can cause irritation and tenosynovitis. Therefore, measurement of width and height of biceps tendon itself were undertaken by Rajani to reach precise definition of narrow and shallow groove [2].

Authors	LBG (cm.)	WBG (cm.)	DBG (cm.)
Murlimanju., *et al*. 2014 [10]			
Right	8.6 ± 1.0	8.7 ± .20	4.7 ± .20
Left	8.3+ 1.10	8.3 ± .20	4.2 ± .16
Rajani., *et al*. 2013 [2]			
Right	8.5 ± .60	6.84± 1.00	4.21 ± .50
Left	8.3 ± .10	8.90 ± 1.10	6.00 ± .10
Present study			
Right	7.46± .09	7.96 ± 0.1	4.84 ±.08
Left	7.45 ± .09	8.12 ± .08	4.43 ± .07

Table 2: *Showing comparison of morphometric parameters of Bicipital Groove between present and other previous studies.*

Values are presented as Mean + SEM, LBG: Length of Bicipital Groove; DBG Depth of Bicipital Groove; WBG: Width of Bicipital Groove; cm: Centimeter.

In this study, the average depth of BG of left humerus was 4.83 ± .08 cm which coincide more or less observations of Murlimanju., *et al*. [7] but lower than the results of study of Abboud., *et al*. [12] and found higher than that of Waefae., *et al* [7]. In this study, width and depth of BG were statistically more significant on right side as compared to left side. This can be explained on the basis that the higher pressure exerted by long tendon on the right side in manual workers may consequently alter the morphometry of BG on the respective side in terms of increase in its width and depth [13]. In the present study, average length of BG corresponded to 24.44% and 25.37% of total length of right and left humeri respectively which showed minor degree of variations when compared with other studies [1,6]. It could be due to the fact that humans are unique among primates in presenting marked variations in the configuration of BG as mentioned by Rockwood [14].

The length of BG may be related to height and build of the individuals. Thus, a more detailed analysis could have been done. It would have been very much useful if additional information regarding occupation and pattern of upper limbs usage of the individuals could be known. A functional correlation with the value of morphometric data obtained could have been performed. As a limitation the accuracy of method used in the present study cannot of course be compared to methods using sophisticated tools and imaging techniques [15].

Conclusion

Seeing as abnormality of biceps tendon and its synovial sheath have been drawn in in a variety of causes of shoulder pain and disability. Morphometric assessment of BG could propose useful information for wellbeing of patients with a view to undertake better shoulder reconstruction surgery. Despite the fact that minor differences have been observed between past and present study, knowledge of present study highlighting anatomical variant of BG seemed to be relevant and clinically worth mentioning. Therefore, the implications of this study include recognition of clinical anatomy of BG for its application.

Acknowledgement

Author sincerely acknowledges the Department of Human Anatomy Laboratory technicians for their support in sample preparation.

Disclosure

There is no funding support of this research and conflicts of interests.

Bibliography

1. Gupta S., *et al*. "Variations in the bicipital groove in north Indian population: a morphological and morphometric study and review of literature". *International Journal of Health Sciences and Research* 5.9 (2015): 220-226.

2. Rajani S and Man S. "Review of bicipital groove morphology and its analysis in North Indian Population". *ISRN Anatomy* (2013): 243780.

3. Levinsohn EM and Santelli ED. "Bicipital groove dysplasia and medial dislocation of the biceps brachii tendon". *Skeletal Radiology* 20.6 (1991): 419-423.

4. Farin P and Jaroma H. "The bicipital groove of the humerus: sonographic and radiographic correlation". *Skeletal Radiology* 25.3 (1996): 215-219.

5. Meyer AW. "Spontaneous dislocation of the tendon of the long head of the biceps brachii: Report of four cases". *Archives of Surgery* 13.1 (1926): 109-119.

6. Meyer AW. "Chronic functional lesions of the shoulder". *Archives of Surgery* 35.4 (1937): 646-674.

7. Wafae N., *et al*. "Morphometry of the human bicipital groove (sulcus intertubercularis)". *Journal of Shoulder and Elbow Surgery* 19.1 (2010): 65-68.

8. Murlimanju B., *et al*. "Anthropometric study of the bicipital groove in indians and its clinical implications". *Chang Gung Medical Journal* 35.2 (2012): 155-159.

9. Rajan YS and KumAr SKS. "Morphometric study on bicipital groove among south indian population". *Journal of Clinical and Diagnostic Research* 10.7 (2016): AC01-AC03.

10. Cone R., *et al*. "The bicipital groove: radiographic, anatomic, and pathologic study". *American Journal of Roentgenology* 141.1 (1983): 781-788.

11. DePalma AF. "The classic. Surgical anatomy of the rotator cuff and the natural history of degenerative periarthritis". *Clinical Orthopaedics and Related Research* 466.3 (2008): 543-551.

12. Abboud JA., *et al*. "Bicipital groove morphology on MRI has no correlation to intra-articular biceps tendon pathology". *Journal of Shoulder and Elbow Surgery* 19.6 (2010): 790-794.

13. Vettivel S., *et al*. "Variations in the intertubercular sulcus of the humerus related to handedness". *Journal of Anatomy* 180.2 (1992): 321-326.

14. Travis RD., *et al*. "Tendon ruptures about the shoulder". *Orthopedic Clinics* 31.2 (2000): 313-330.

15. Motagi M., *et al*. "Estimation of the angle of humeral torsion from digital images of dry humeri of South Indian origin". *Anatomy* 7 (2013).

Volume 2 Issue 7 September 2019