Original Research Article

An Anthtropometric Study of Bicipital Groove of Humerus with Clinical Correlation

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Abstract

Background: Keeping in mind the frequency at which the surgeries are performed for shoulder arthroplasty, the antropometric measurements of the bicipital groove are essential for prosthesis manufacture and replacement. The knowledge of anthropometry and its variations in different region are helpful to have a desired clinical outcome. So, there is lack of data pertaining to central Karnataka region, not only morphometric analysis of bicipitalgroove and logical explanation for association of pathologies of biceps tendon on groove morphology is carried out along with a review of the literature. The present study aims at measuring the length, width and depth of Bicipital groove in the population in and around Davangere.**Methods:** The study was carried out on 51 adult humerus, 25 belonging to the right side and 26 to the left side. The length, width and depth of the bicipital groove were measured using digital verniercaliper. The data obtained calculated as mean +/- SD, which is compared on both sides. **Results:**The mean length of Medial wall, lateral wall, Transverse width and depth of bicipital groove on the right side were 38.06+/-5.20, 42.93+/-5.97, 9.34+/-1.62, 5.86+/-1.32respectively and on the left side were 37.24 +/- 5.13, 41.98+/-5.28, 9.02+/-1.51, 5.35+/-0.91 respectively.
Conclusion: The results of the study demonstrate the anthropometric parameters are higher on the left side compared to right side in the population in and around Davangere. We hope this study will be useful for further clinical research and prosthesis surgeries.

Keywords: Bicipital groove, Anthropometry, Medial wall, lateral wall, Depth, Width.

Introduction

The humerus is the longest and largest bone in the upper limb; It has expanded ends and a shaft. The rounded head occupies the proximal and medial part of the upper end and forms an enarthrodial articulation with the glenoid cavity of scapula. The lesser tubercle projects from the front of the shaft, near the head and is limited on the lateral side by a well-marked groove, the greater tubercle is the most lateral part of the proximal end of the humerus.The distal end articulates with the forearm bones[1].The intertubercular sulcus is between the greater and lesser tubercles, and it continues distally for approximately 5cm on the shaft of the humerus, which overall is termed as the bicipital groove[2].It contains the long head of biceps brachii, its synovial sheath and an ascending branch of the anterior circumflex humeral artery. Its lateral lip has the insertion of bilaminar tendon of the pectoralis major, its floor has the tendon of latissimusdorsi and its medial lip has the tendon of teres major, Transverse humeral ligament bridges the sulcus and converts it into a canal acting as retinaculum for tendon of long head of biceps brachii.Morphometry of bicipital groove can affect the functions of neighboring structures leading to several anatomical and orthopaedic disorders[3].As it contains long head of biceps brachii preventing its subluxation during multiaxial bio mechanical movement of shoulder joint, it is clinically significant to study morphometry of bicipital groove and its subsequent role in pathologies of shoulder joint.With the recent development in image based shoulder reconstruction modalities, the morphology and morphometry of bicipital groove achieved significance and is vital in manufacturing the prosthesis[4].Supratubercular ridge of meyeris a bony protruberance extending from superior aspect of lesser tubercle more than the half distance to the head of the humerus, it may prevent medial dislocation of tendon.The morphometric variations of bicipital groove are observed to be related to disorders of biceps tendon and are handful in shoulder surgeries. The pathologies of biceps tendon are frequent causes of shoulder pain.This study was conducted to determine the variations in the different parameters of bicipital groove which include length of the medial &lateral walls, transverse width and depth of bicipital groove of 51 adult humeri.

Materials & Methods

The study was conducted in the anthropometry laboratory in the department of anatomy. A total of 51 humerus bones were obtained. These include 25 right sided and 26 left sided humerus dry bones irrespective of the sex. Partial, deformed and mutilated bones were excluded. The length, width and depth of the bicipital groove were measured using digital vernier caliper.The length of the bicipital groove was determined as maximum distance between most proximal and distal point of the groove. Similarly, width was estimated as maximum distance between medial and lateral lips of the groove and depth as distance between greater or lesser tubercle/tuberosity to floor of the groove.

The data obtained were analyzed using SPSS software. The mean, standard deviations were calculated and compared on both sides. Representative photographs were taken using a Sony Cybershot R (DSC W50, 7.2 MP) digital camera.

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Fig 1: Measurement using digital calipers.

Results

Table 1:Comparison of parameters

Sl.No	Parameters	Right Side	Left Side
1.	Medial Wall	38.06+/- 5.20	37.24+/-5.13
2.	Lateral Wall	42.93 +/- 5.97	41.98 +/-5.28
3.	Transverse Width	9.34 +/- 1.62	9.02 +/- 1.51
4.	Depth	5.86 +/- 1.32	5.35 +/- 0.91

The mean length of Medial wall, lateral wall, Transverse width and depth of bicipital groove on the right side were 38.06+/-5.20, 42.93+/-5.97, 9.34+/-1.62, 5.86+/-1.32 respectively and on the left side were 37.24 +/- 5.13, 41.98+/-5.28, 9.02+/-1.51, 5.35+/-0.91 respectively.

Table 2:Comparison of parameters of Bicipital groove of Humerus

Sl.No	Authors	Width	Depth
1.	Cone et al. 1983	8.8	4.3
2.	Abboud et al. 2010	-	5.1
3.	Murlimanju et al. 2012	8.5 +/-2.4	4.5 +/-2.0
4.	Rajani et al. 2013	9.0 +/-2.1	5.0 +/-1.0
5.	Rajan et al. 2016	6.84 +/- 1.01	4.21 +/- 0.58
6.	Present study	R- 9.34 +/- 1.62 L- 9.02 +/- 1.51	R- 5.86 +/- 1.32 L- 5.35 +/- 0.91

Discussion

Owing to the intimate relations between tendon of long head of biceps brachii and bicipital groove, the morphometry of bicipital groove allowing passage of tendon of long head can be determined by various dimensions.Rajani et al reported that the long wall ensure the greater stability of the tendon during multiaxial movement of shoulder joint and her observations showed mean length of medial wall as 22mm and 23 mm respectively, mean length of lateral wall as 31mm on both sides[5]. In our study the values are on higher side as observed in the table 1.The depth and width of bicipital groove have been implicated to be the most important factors for retention of tendon in position.Kaur M et al observed that the mean values of the length of right bicipital groove&left bicipital groove in males were 32.68±2.58mm and 31.32±2.53mm respectively. While in females, the corresponding values were 28.61±3.80mm and 27.96±3.21mm. Thus bicipital groove was found to be longer in males as compared with females and the difference was statistically significant ($p<.001$)[6].In the present study the measurements are on higher side and statistically significant.Cone et al opined that wide groove more than 17mm are often shallow and predispose to subluxation and dislocation of the tendon[7].Pfalher et al studied the sex related difference in width and depth and also studied the significant accumulation of pathological changes in biceps tendon in 62% of cases on sonography[8]. In our study mean width 9.34 on the right side and 9.04 on the left side which is similar to the study done by Muralimanju et al[9].De palma et al propounded that deep and narrow groove may cause constrtiction of the tendon and tenosynovitis[10]. In our study, length, width and depth of bicipital groove of right side were significantly higher as compared to the 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 bicipital groove on the respective side in terms of increase in its length, width and depth.As the lengths of medial wall and lateral walls decrease, the instability increases and tendon is likely to get damaged.A narrow groove can cause the attritional damage to the tendon.However in contrast to previous studies, Abboud et al did not find any significant anatomic findings of bicipital groove in the shoulders affected by rotator cuff diseases but his observation revealed that Anterior shoulder pain involves elderly people often around the world. Pathologies affecting the tendon of Left bicepsbrachii have been documented to be among the most common reason of pain and disability in the shoulder. This pain may be caused by rotator cuff, supraspinatus, and biceps tendon diseases thesupratubercular ridge of meyer and a prematurely shallow bicipital sulcus have been postulated to involve in acute / chronic peritendonitis, attrition and subluxation/ dislocation[11]. Laxity of biceps tendon along with other factors may be related to length of medial/lateral walls, opening/medial wall angles depending on width/depth constituting shallowness of bicipital groove, and presence of supratubercular ridge[12].It is postulated that presence of shallow bicipital groove would make the tendon susceptible to long standing attrition due to impingement by the overlying acromion, rotator cuff, and coraco-acromial arch during shoulder movement [10]. A shallow intertubercular sulcus is prone to impingement injury and subluxation[12,13].Smith et al observed bicipital groove types as narrow, normal and shallow depending on mean opening angle less than 66°,94°, and 118°.Biceps tendon ruptures frequently in glenoidlabrum proximally and bicipital groove distally[14].A shallow sulcus can cause the tendon to develop frictional damage. Continual mechanical stress at anatomically narrow sites such as distal bicipital groove, beneath the acromion or the coracoacromial ligament and attrition of the biceps tendon in the coracoacromial arch

during flexion may cause these well-known degenerative changes [15]. In the present study the data of bicipital groove and biceps tendon observed from 51 humerido not indicate narrow bicipital groove as per new definition of narrowness and shallowness given in the different studies.

Conclusion

The present study demonstrates the anthropometric parameters are higher on the right side compared to the left side in the population in and around the central Karnataka region.The present data on bicipital groove will be helpful to the anatomists, radiologists, orthopedic surgeons and physicians in carrying out the diagnosis of pathologies related to shoulder region.

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