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An anthtropometric study of bicipital groove of humerus with clinical correlation

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Abstract
Background: 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 costal Karnataka region, not only morphometric analysis of bicipital groove 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 Mangalore.

Keywords: Anthropometry, bicipital, groove, humerus

Introduction
Understanding of normal humeral morphology is important, since recreation of normal anatomy is the goal in prosthetic replacement of the upper end of the humerus. This knowledge can affect prosthetic sizing, positioning and design [1]. The bicipital groove (BG) offers a useful landmark for placement of the lateral fin of a prosthesis in shoulder arthroplasty. It was also reported that the BG can be used as a landmark for humeral head replacement in fractures of the upper end of the humerus [2]. The intertubercular sulcus is between the greater and lesser tubercles and it continues distally for about 5 cm on the shaft of the humerus, which altogether is called the BG [3]. It contains the long head of the biceps brachii muscle, its synovial sheath and an ascending branch of the anterior circumflex humeral artery. Its lateral lip is marked by the bilaminar tendon of the pectoralis major, its floor by the tendon of the latissimus dorsi and its medial lip by the tendon of the teres major. The transverse humeral ligament is a broad band which passes between its tubercles and converts the sulcus into a canal and acts as a retinaculum for the long tendon of the biceps [4]. Anatomical knowledge of the BG is important as abnormalities of the bicipital tendon and its synovial sheath have been implicated in a variety of causes of shoulder pain and disability [5, 6]. A radiological study recommended that the entire length of the BG be examined to determine the osseous anatomy of the groove [7]. This study puts in an effort to find the anthropometric measurements in coastal population.

Materials & methods
This study was done in the Department of Anatomy, Kanachur Institute of Medical Sciences, Mangalore from June 2015 to May 2016.
A total of 30 humerus bones were obtained. These include 18 right sided and 12 left sided humerus dry bones irrespective of the sex.

Exclusion Criteria
Partial, deformed and mutilated bones were excluded. The length, width and depth of the bicipital groove were measured usin digital vernier caliper.

Results

Sl. No	Parameters	Right Side	Left Side
1.	Medial Wall	37.06	38.02
2.	Lateral Wall	41.93	42.39
3.	Transverse Width	8.98	9.34
4.	Depth	5.34	5.26

Table 1: Comparison of parameters of Bicipital groove of Humerus

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

Discussion

Lesions due to pathology of biceps tendon have been postulated to be among the most frequent causes of pain and disability in the shoulder. Biceps tendon pathology has been visualized in three main categories, namely, instability, inflammatory, and traumatic [9]. Abboud *et al*. [8] divided the biceps tendon pathology in normal, inflamed, partially torn, or ruptured tendon. Acute inflammatory and chronic degenerative alterations causing partial/complete rupture and subluxation/dislocation can be found in the long head of the biceps tendon [10]. Instability of biceps tendon besides other factors may be attributed to length of medial/lateral walls, opening/medial wall angles depending on width/depth constituting shallowness of BG, and presence of supratubercular ridge [11]. The implication of longer walls is expected to ensure greater stability to biceps tendon lying in the bicipital groove than the shorter walls during multidirectional biomechanical movements. But the rider to this fact is that it may also cause attritional friction in a longer length of biceps tendon surrounded by longer walls creating inflammation under narrow conditions of BG. As the lengths of medial and lateral walls decrease, the instability increases and the tendon is likely to be damaged. The inference drawn is based on reconstruction of anatomical model of this part of the human body advancing the knowledge and experience of anatomy and clinical studies recorded in the literature supported by logical force as the study is on dry bones. Range provides an idea of length of these walls in north Indian population, whereas the mean ± SD reveals the average size of BG. The median may be very useful in planning surgical procedures in this part of the body. Mode is representative of most frequent incidence of lengths of these walls in the subject population. If the instability of biceps tendon is studied in relation to lengths of BG most frequent value of length of walls may play a vital role in diagnostics of tendon instability or attritional damage.

Cone *et al*. felt that a groove 3 mm deep or less and more than 17 mm wide may predispose to tendon subluxation or dislocation on patient radiographs. The flat groove of Pfahler *et al*. [12] was found to depict significant accumulation of pathologic changes in biceps tendon in 62% of cases on sonography. The supratubercular ridge of Meyer and a prematurely shallow bicipital or intertubercular sulcus have been postulated to result in a variety of lesions after repetitive use or acute trauma [13, 14, 15]. These include acute or chronic peritendonitis, varying degrees of attrition or damage to the tendon, and subluxation or complete dislocation.

As the biceps tendon is enshrined in BG, width may influence the pathology occurring in this tendon. In wider groove the tendon is freer to move and there are less chances of tendon getting damaged.

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.

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