

ORIGINAL RESEARCH

A Study of Sulcus Intertubercularis and Its Clinical Importance

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ABSTRACT

Background: Sulcus intertubercularis(Intertubercular sulcus) is a groove present between the greater tubercle and the lesser tubercle of the humerus. The morphometric variations and the bony abnormalities of the intertubercular sulcus can predispose to biceps tendon lesion present in it.

Aim:To study the morphometry of the intertubercular sulcus and to find the incidence of the supratubercular ridge of Meyer, bony spur and the ossified transverse humeral ligament in the population of Tamilnadu.

Materials and Methods: This descriptive cross-sectional was done in 102 dry humerus bone (48 Right & 54 Left) from the Department of Anatomy, Government Medical College Pudukkottai, Tamilnadu. The parameters like length, width and the depth of the intertubercular sulcus were measured with the help of digital caliper. The bony variation like supratubercular ridge of Meyer and the bony abnormalities around the sulcus like bony spur from the wall and the floor of the sulcus, ossified transverse humeral ligament were also noted. The mean values, standard deviation and the range were calculated using SPSS statistical software (version 22.0).

Results: The mean length of the intertubercular sulcus was 84 ± 0.9 mm on the right side and 85 ± 1 mm on the left side. The mean width of the intertubercular sulcus was 7.7 ± 1.7 mm on the right side and 8.0 ± 1.7 mm on the left side. The mean depth of the intertubercular sulcus was 4.5 ± 0.9 mm on the right side and 4.6 ± 1.2 mm on the left side. The bony spur and the supratubercular ridge of Meyer were noted in 1.7% and 6.5% of the bones studied respectively. The ossified transverse humeral ligament was seen only in one humerus bone.

Conclusion: The morphometric parameters of the intertubercular sulcus in the population of Tamilnadu were reported in our study. The supratubercular ridge of Meyer was noted only in the wide and shallow groove, to prevent the medial dislocation of the biceps tendon. The incidence of spurs was noted only in 1.7% of the bone studied, which indicates its minimal role in biceps lesions. Our study data can help the radiologist and the orthopedic surgeons to diagnose and to treat the biceps tendon lesions.

Keywords: Sulcus intertubercularis, Supratubercular ridge of Meyer, Bony spur, Biceps tendon lesions.

INTRODUCTION

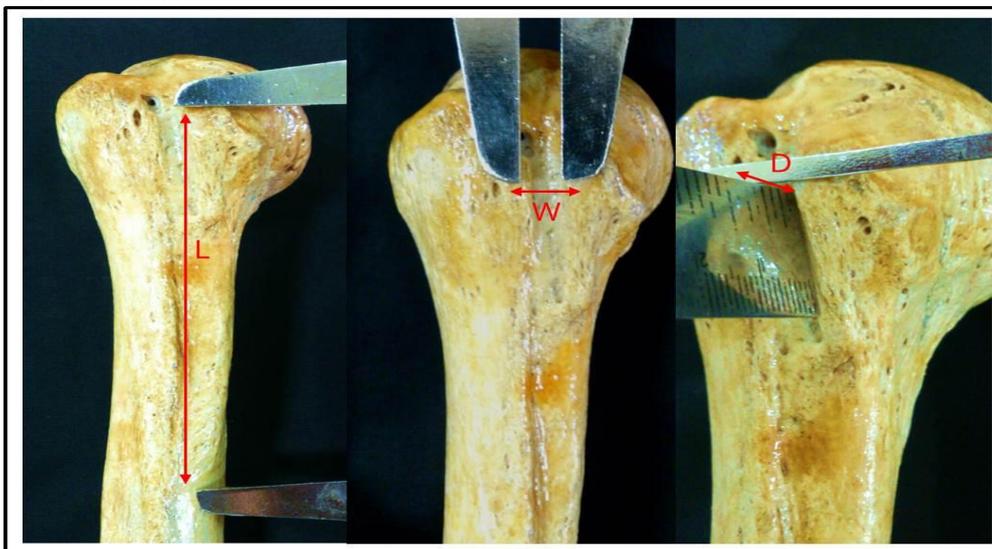
The Biceps tendon pathologies such as biceps tendonitis, dislocation of the tendon and the degeneration of the tendon were found to be the frequent cause for anterior shoulder pain affecting the large number of elderly population [1]. In the recent decades, the radiologist and the orthopedic surgeon could diagnose the various causes for biceps tendon lesion by studying the morphometric and the bony variations of the sulcus intertubercularis with the help of magnetic resonance imaging (MRI). Sulcus intertubercularis (Intertubercular sulcus) is a groove present in the anterior aspect of the proximal part of the humerus situated between the greater and the lesser tubercles. It continues distally on the shaft of the humerus for about 5 to 6 cms. It is superiorly bridged by the transverse humeral ligament, which converts the sulcus into a canal for the tendon of long head of biceps brachii muscle, its synovial sheath [2].

The intertubercular sulcus in the proximal part of the humerus glides on the tendon of biceps brachii during the multidirectional movements of the arm. Many authors [3-5] have studied that the morphometric variations of the intertubercular sulcus, such as narrow or shallow groove could predispose to biceps tendon lesion. In 1928, Meyer [6] described the supratubercular ridge as a bony ridge extending from the superior aspect of the lesser tubercle. It could displace the biceps tendon from the intertubercular sulcus, which ends up in subluxation and dislocation of the tendon. The bony abnormalities around the intertubercular sulcus like bony spur, ossified transverse humeral ligament could injure the biceps tendon and its synovial sheath [7]. The aims of the study were to examine the morphometry of the intertubercular sulcus and to find the incidence of supratubercular ridge of Meyer, bony spurs and the ossified transverse humeral ligament in the population of Tamilnadu.

MATERIALS AND METHODS

This descriptive cross-sectional was done in 102 dry humerus bone (48 Right & 54 Left) from the Department of Anatomy, Government Medical College Pudukkottai, Tamilnadu. Digital caliper, scale and the metal probe were used to measure the morphometric parameters. The length of the intertubercular sulcus was measured from the highest point of the groove till the margins merge with the shaft of the humerus. The width of the intertubercular sulcus was measured between the margins of the tubercles. The depth of the intertubercular sulcus was measured with the help of scale and the metal probe at the midpoint of the two tubercles [Figure 1].

Figure 1: Morphometric measurements. L- Length of the sulcus, W- Width of the sulcus, D- Depth of the sulcus.



The presence of bony variation like supratubercular ridge of Meyer was noted. The bony abnormalities around the sulcus like bony spur from the wall and the floor of the sulcus, ossified transverse humeral ligament were also noted. Statistical analysis such as mean, standard deviation and the range were calculated using SPSS statistical software (version 22.0).

RESULTS

The mean length of the intertubercular sulcus on the right side was 84±0.9mm and it was 85±1mm on the left side. The mean width of the intertubercular sulcus on the right side was 7.7±1.7mm and it was 8.0±1.7mm on the left side. The mean depth of the intertubercular sulcus on the right side was 4.5±0.9mm and it was 4.6±1.2mm on the left side[Table1].

Table 1: Mean values of morphometric parameters of the both sides

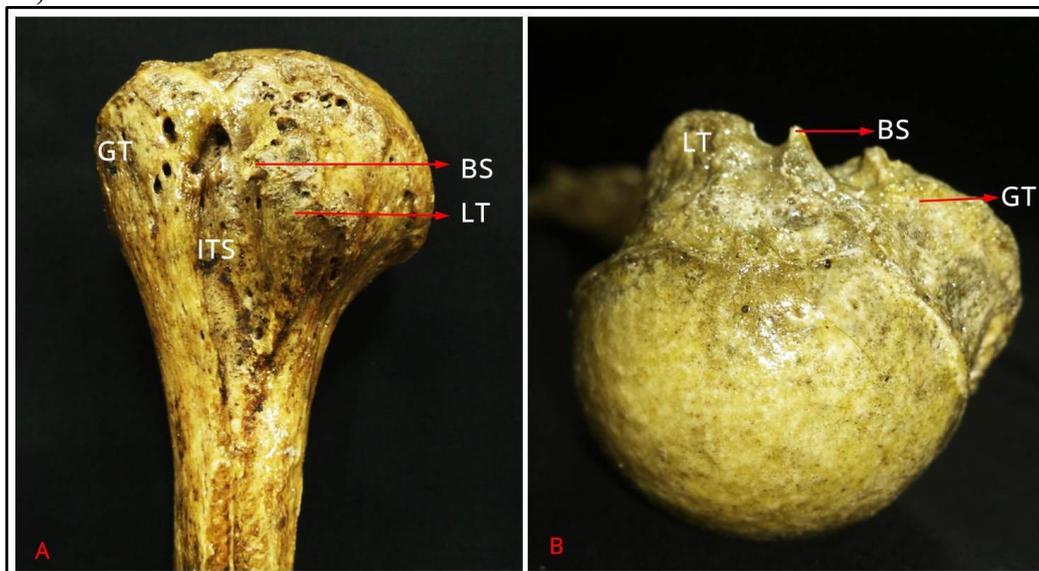
Parameters (mm)	Mean ± SD		Range	
	Right	Left	Right	Left
Length	84±0.9	85±1	64-105	57-109
Width	7.7±1.7	8±1.7	3-11	5-13
Depth	4.5±0.9	4.6±1.2	2-7	1.5-8

Table 2: Comparison of mean values with other authors

Parameters (mm)	Con e et all [9]	Wafa e et all [10]	Murlimanju et al [11]		Singh Rajani et all [12]		YaminiSoundararajan et al [13]		Present study	
			Right	Left	Right	Left	Right	Left	Right	Left
Length	N/A	81	86±10.1	83.3±11.5	85±9	83±10.1	84.79±5.84	87.33±6.4	84±0.9	85±1
Width	8.8	10.1	8.3±2.4	8.7±2.2	9±2.1	8.9±1.1	6.84±1.01	7.74±1.96	7.7±1.7	8±1.7
Depth	4.3	4	4.7±2	4.2±1.6	5±1	6±1	4.21±0.58	4.21±0.58	4.5±0.9	4.6±1.2

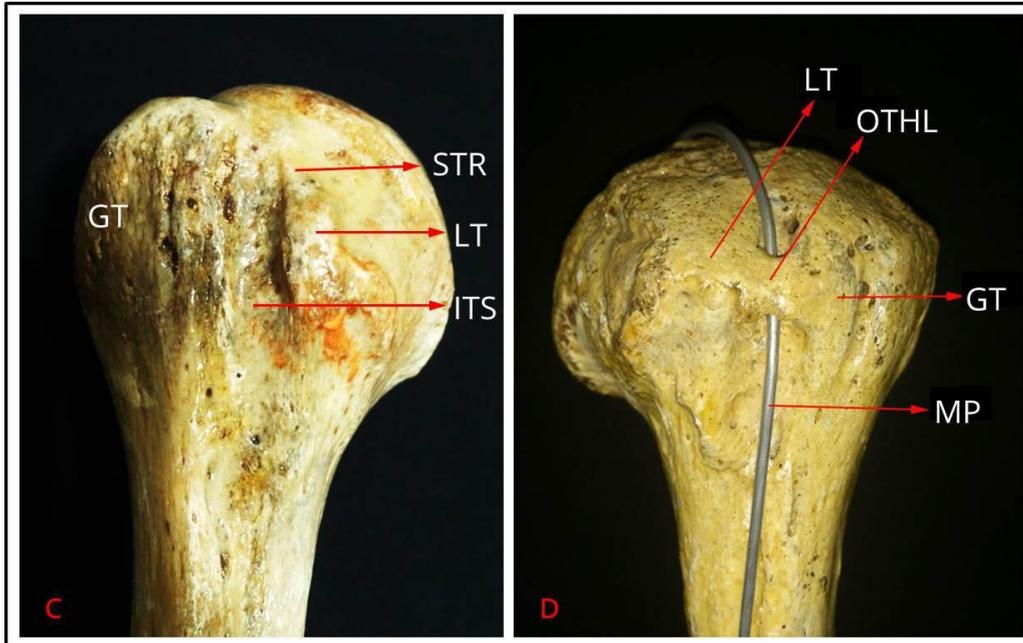
The bony spur was noted in 2 right humeri and it was only 1.7% of the bones studied. One bony spur was projecting from the lesser tubercle and another one was present on the floor of the sulcus[Figure2].

Figure 2: A- Anterior view of the proximal part of the humerus: Bony spur projecting from the lesser tubercle, B- Superior view: Bony spur present in the floor of the intertubercular sulcus, BS- Bony spur, ITS- Intertubercular sulcus,GT-Greater tubercle, LT-Lesser tubercle



The supratubercular ridge of Meyer was seen in 7 humeri. Out of which 5 were present in the right humeri. i.e. 6.5% of the bones studied. The ossified transverse humeral ligament was seen only in one humerus bone [Figure3].

Figure 3: C- Supratubercular ridge of Meyer projecting from the superior aspect of the lesser tubercle, D- Ossified transverse humeral ligament bridging the intertubercular sulcus, STR-Supratubercular ridge of Meyer, ITS- Intertubercular sulcus, GT-Greater tubercle, LT-Lesser tubercle, OTHL-Ossified transverse humeral ligament, MP-Metal probe.



DISCUSSION

Biceps tendon lesions such as inflammation, impingement, instability and the rupture of the tendon were found to be the major cause for pain and disability of the shoulder. The variation in the morphology of intertubercular sulcus such as wide or shallow groove could cause subluxation or dislocation of the biceps tendon by pushing the tendon against the lesser tubercle during sudden violent external rotation of the arm or by forceful flexion of the internally rotated arm [8]. A shallow groove could freely expose the tendon for impingement against the acromion and the coracoacromial ligament during the movement of the arm. According to Yamini Soundararajan et al study [13] the mean length of the intertubercular sulcus was 84.79 ± 5.84 mm on the right side and it was 87.33 ± 6.40 mm on the left side. The mean width of the intertubercular sulcus was 6.84 ± 1.01 mm on the right side and it was 7.74 ± 1.96 mm on the left side. The mean depth of the intertubercular sulcus was 4.21 ± 0.58 mm on the right side and it was 5.01 ± 1.05 mm on the left side. All these morphometric parameters were similar to our study values. In the present study, the morphometric parameter between the right and the left intertubercular sulcus doesn't show any marked difference due to right handedness which was contrary to the study done by the S. Vettivel et al [14].

In 1928, Meyer described the incidence of supratubercular ridge and the presence of bony spur projecting from the wall and floor of the intertubercular sulcus [6]. The variation in the intertubercular sulcus such as supratubercular ridge of Meyer could displace the biceps tendon from the sulcus, which favors the dislocation of the tendon. The repeated displacements of the biceps tendon could result in tendinitis followed by the rupture of the biceps tendon. In 1948, Hitchcock and Bechtol observed 100 humeri and found that the supratubercular ridge was seen

in 8% of the bones studied [15]. In the present study the supratubercular ridge was seen in 6.7% of humeri which were close to the Hitchcock et al study.

In K.Ueberham et al study the incidence of bony spurs was 23% of the bone studied [16]. In our study the bony spur was noted in 1.7% of humeri which was less than K.Ueberham et al study. The ossified transverse humeral ligament was reported by Singh R in his case study [17]. Similarly we observed one ossified transverse humeral ligament bridging the intertubercular sulcus. The bony abnormalities around the intertubercular sulcus like bony spur from its wall and floor, ossified transverse humeral ligament could traumatize the biceps tendon and its synovial sheath during the movement of the arm. These abnormalities could cause repeated fraying of the biceps tendon inside the narrow groove which could end up in chronic biceps tendinitis and chronic degeneration of the biceps tendon.

CONCLUSION

We reported the morphometric parameters of the intertubercular sulcus in the population of Tamilnadu. From the present study we found that the supratubercular ridge of Meyer was noted only in the wide and shallow groove, to prevent the medial dislocation of the biceps tendon. The incidence of bony spurs was noted only in 1.7% of the bone studied, which indicates its minimal role in biceps tendon lesions. The knowledge of these data is helpful for the radiologist and the orthopedic surgeons to diagnose and treat the biceps tendon lesions.

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