Morphology and Morphometry of Bicipital Tuberosity – An Aid for Biceps Tendon Repair

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ABSTRACT

Introduction: Distal biceps tendon rupture is a rare injury that usually occurs in middle-aged men after a forced eccentric contraction of the dominant arm.Understanding the anatomy bicipital tuberosity aids in proper orientation and trough placement during distal biceps tendon repair. Study aims and objectives were to estimate width, length, circumference of bicipital tuberosity and to determine morphological variants of bicipital tuberosity.2)To compare these parameters between right and left side.

Material and methods: Above parameters were measured on 142 dry radii from Department of Anatomy, St. John's Medical college Bangalore. Morphological variants were categorized into single ridge,bifid ridge and smooth ridge tuberosity. Statistical analysis was done using SPSS. Difference in sides was measured using independent sample T test (p value < 0.05 considered significant).

Results: Mean values of width, length, circumference of bicipital tuberosity were 11.52mm, 25.11mm and 4.82 cm respectively. Single ridge was most common type of morphological variant. There was side significant difference in values of circumference of radial tuberosity.

Conclusion: Mean values of measurements of bicipital tuberosity were comparable with previous studies. Side difference should be considered while implanting prosthesisas well as tendon repair on affected side.

Keywords: Distal Biceps Tendon, Bicipital Tuberosity, Footprint, Tendon Repair, Tendon Rupture

INTRODUCTION

Distal biceps tendon is attached to the rough posterior area of the radial tuberosity; a bursa separates the tendon from the smooth anterior area of the tuberosity. As it approaches the radius, the tendon spirals, and its anterior surface becomes lateral before being applied to the tuberosity. The recognition and treatment of distal biceps tendon ruptures have increased over time. Previously, this injury was considered rare; only 65 cases were reported before 1941.[1,2] However, a more recent retrospective study identified the incidence to be 1.2 per 100,000.[3] The anatomy of the distal biceps tendon and bicipital tuberosity is relevant to tendon rupture and repair. Further, understanding of the dimensions of bicipital tuberosity and its angular relationship to radial head is important in pathophysiology of biceps tendon rupture as well as to facilitate surgical procedures like reconstruction of biceps tendon, radial head prosthesis and implantation and reconstruction of proximal head trauma. Familiarity with the normal radial tuberosity dimensions can assist with correct suture-anchor and bone-trough placement. This can improve clinical outcome and minimize post operative complications.

Aims and objectives were to estimate Bicipital tuberosity dimensions:

a) Width of bicipital tuberosity (Wbt).
b) Length of bicipital tuberosity (Lbt).
c) Circumference of radius at bicipital tuberosity (Crbt).
d) Prevalence of morphological variants of bicipital tuberosity.

To estimate the differences in parameters between right and left radii.

MATERIAL AND METHODS

142 adult dry cadaveric radii (71 right and 71 left) were randomly selected from the department of Anatomy, St John's Medical College, Bangalore. Radii with broken proximal end and ones showing obvious pathology like healed fractures were excluded from the study.

Sample size was calculated using N Master software with mean and standard deviation from previous literature.

Methodology

Width (Wbt) and length (Lbt) of bicipital tuberosity

Width (Wbt) of bicipital tuberosity is defined from most anterior point to most posterior point on tuberosity and length (Lbt)of bicipital tuberosity is defined from most superior point to most inferior point on tuberosity. Both measured using digital calipers.

Circumference at radial tuberosity (Crbt)

Circumference at radial tuberosity is defined as point marked at maximum convexity of radial tuberosity measured with the help of ruler and thread.[5]

Morphological variants of bicipital tuberosity

Morphological variants were categorized into single ridge, bifid ridge and smooth ridge tuberosity.

STATISTICAL ANALYSIS

Statistical analysis was done using SPSS. Difference in sides was measured using independent sample T test (p value < 0.05 considered significant).

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S. No	Parameter	Mean left	Mean right	Mean	P value
1.	Length of bicipital tuberosity (mm)	24.80	25.42	25.11	0.437
2.	Width of bicipital tuberosity (mm)	11.60	11.45	11.52	0.581
3.	Circumference of bicipital tuberosity (cm)	4.62	5.02	4.82	0.000*
*p value is significant					

Table-1: Mean values of the bicipital tuberosity parameters of radii

Variant	Right	Left	Total	Percentage (%)
Bifid ridge	5	3	8	5.63
Smooth ridge	18	17	35	24.64
Single ridge	48	51	99	69.71

Table-2: Prevalence of type of bicipital tuberosity

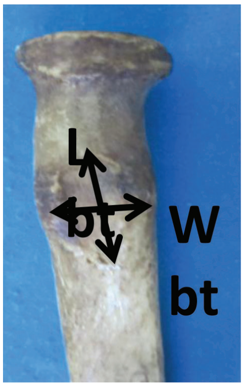

Figure-1: Measurement of length (Lbt) and width (Wbt) of bicipital tuberosity

Figure-2: Morphological variants of bicipital tuberosity

RESULTS

Mean values of length and width of bicipital tuberosity was 25.11 mm and 11.52mm respectively. Mean values of circumference of bicipital tuberosity was 4.82 cm. There was significant side difference in values of circumference of bicipital tuberosity. Single ridge tuberosity was most prevalent type of bicipital tuberosity (table-1, 2).

DISCUSSION

Morphometry of bicipital tuberosity will help in tendon reconstruction in distal biceps injuries. Cho C H et al, measured tuberosity length and width in 25 cadaveric specimens.[4] The average footprint length, width, and area of the tendon's insertion on the radial tuberosity were 20.5 mm ± 2.0 mm, 9.7 mm ± 1.3 mm, and 156.3 mm2 ± 29.4 mm2, respectively. Waghmare et al, from India studied length, width and circumference of bicipital tuberosity on 198 cadaveric dry radii in 2012. Length, width and circumference was 22.53 ± 2.69 mm, 14.13 ± 1.22 mm and 50.08 ± 3.37 mm respectively in males and 20.12 ± 2.11 mm, 12.38 ± 1.13 mm and 44.89 ± 3.27 mm respectively in females.[5]

Mazzocca et al, in 2007 measured length and width of bicipital tuberosity on 178 cadaveric radii. Average length and width were 22mm and 15mm respectively. They also classified different types of bicipital tuberosity as smooth, single and bifid ridge. The prevalence of each tuberosity ridge type was as follows: A single ridge was present in 88% of specimens, a smooth type (no ridge) was present in 6%, and a bifid ridge was present in 6%.[6] It has been suggested that a prominent edge of the tuberosity erodes the tendon during pronation, rendering it vulnerable to rupture when exposed to high forces.[7,8] In present study a single ridge was present in 69.71% of specimens, a smooth type (no ridge) was present in 24%, and a bifid ridge was present in 6%. Hence prevalence of single ridge is more which is comparable with previous study done on western population and this suggests that a prominent edge of the tuberosity might erode the tendon during pronation, rendering it vulnerable to rupture when exposed to high forces. The radial tuberosity and distal biceps insertion footprint are critical structures affecting forearm supination mechanics, and anatomical repair of a ruptured tendon is necessary for restoration of power, endurance, and terminal forearm rotation. The supination torque of the biceps is related to its insertion site on the radial tuberosity.[9,10] Biceps tendon injury also depends on handedness and occupation of individual which was not taken into consideration in present study. Further radiological correlation will be definitely aid in increasing postoperative outcomes after tendon repair.

REFERENCES

1. Dobbie RP. Avulsion of the lower biceps brachii tendon. Analysis of 51 previously unreported cases. Am J Surg. 1941; 51:662-3.
2. Johnson S. Avulsion of biceps tendon from the radius. N Y Med J. 1897; 66:261-2.
3. Safran MR, Graham SM. Distal biceps tendon ruptures incidence, demographics and the effect of smoking. Clin Orthop Relat Res. 2002; 404:275-83.
4. Cho CH, Song KS, Choi IJ, Kim DK, Lee JH, Kim HT, Moon YS.Insertional anatomy and clinical relevance of the distal biceps tendon. Knee Surg Sports Traumatol Arthrosc. 2011;19:1930-5.
5. Waghmare JE, Deshmukh PR, Waghmare PJ. Determination of Sex from the Shaft and Tuberosity of Radius- A Multivariate Discriminant Function Analysis. J Biomed Res. 2012; 23: 115-118.
6. Mazzocca AD, Cohen M, Berkson E, Nicholson G,

Carofino BC, Arciero R, et al. The anatomy of the bicipital tuberosity and distal biceps tendon. J Shoulder Elbow Surg. 2007; 16:122-7.
7. Davis WM, Yassine Z. An etiological factor in tear of the distal tendon of the biceps brachii. Report of two cases. J Bone Joint Surg Am. 1956; 38:1365-8.
8. Seiler JG III, Parker LM, Chamberland PD, Sherbourne GM,Carpenter WA. The distal biceps tendon. Two potential mechanismsinvolved in its rupture: arterial supply and mechanical impingement. J Shoulder Elbow Surg. 1995; 4:149-56.
9. Eames MH, Bain GI, Fogg QA, van Riet RP. Distal biceps tendon anatomy: a cadaveric study. J Bone Jt Surg Am 2007; 89:1044–1049.
10. Henry J, Feinblatt J, Kaeding CC, Latshaw J, Litsky A, Sibel R, Stephens JA, Jones GL. Biomechanical analysis of distal biceps tendon repair methods. Am J Sports Med 2007; 35:1950–1954.

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