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Original Article

A Study of Parameters of Lower Ends of Radius and Their Significance

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Abstract

Introduction: Lister's tubercle is the prominent bony tubercle over the dorsal aspect of the distal radius. Lister's tubercle is used as a standard anatomical landmark in hand surgery and arthroscopy procedures.

Material method and objective: In this study we aimed to identify the anatomical localization of Lister's tubercle in relation to the radial styloid process and the ulnar notch of radius and to evaluate its clinical and surgical importance. The present study was done on 50 (right = 23, left=27) dried adult cadaver radii. Vernier caliper was used to measure the distances from lister's tubercle to radial styloid process and to ulnar notch. Ratio of two measures was calculated.

Result and observations: We found that the position of lister's tubercle was variable. It was nearer to the radial styloid process in 13 radii and it was nearer to the ulnar notch in 37 radii. The radial Angle of inclination was found to be 15.55° in our study which is much less than other studies. This anatomical variation of Lister's tubercle and angle of has potential clinical implications for certain pathological conditions and pre-procedural planning

Key words: Extensor pollicis longus, Lister's tubercle, Radial styloid process, Ulnar notch

INTRODUCTION

Lister's tubercle is the prominent bony tubercle over the dorsal aspect of the distal radius. It acts as a pulley for the extensor pollicis longus (EPL) tendon before the tendon pivots and turns obliquely to insert onto the distal phalanx of the thumb. As a palpable structure, Lister's tubercle has been used as an anatomical landmark for localizing the first dorsal extensor compartment, posterior interosseous nerve, superficial branch of the radial nerve, and dorsal radiotriquetral ligament.[1] Lister's tubercle is also used as a landmark in wrist arthroscopy, wrist joint injections, and similar surgical and clinical procedures. However, there is no useful information in the reference anatomy books and literature. Besides being an anatomic landmark during surgery, there is also some clinical importance to the anatomical localization of Lister's tubercle. For example, when the screws are applied in unsuitable orientation and length, during volar plate fixation for distal radius fractures, they may irritate the EPL tendon which lies in the groove medial to the dorsal tubercle. This may cause EPL tendon ruptures over a long period. The aim of this study was to identify the anatomical localization of tubercle on the dorsum of radius in relation to the radial styloid or ulnar notch (sigmoid notch) of the radius and to demonstrate the clinical and surgical importance of its position.[2]

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MATERIALS AND METHODS

The present study was done on 50 (right = 23 and left = 27) dried adult cadaver radii. All radii were from separate individuals and had completed their development. In the present study, the parameters were measured on the radii using Vernier caliper.

Following were the various landmarks used for the measurements of parameters:

1. Point 1 – Midpoint of the Lister's tubercle
2. Point 2 – Midpoint of the distance between volar and dorsal borders of the ulnar notch (the height of the ulnar notch)

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3. Point 3 – The midpoint of radial styloid process
4. Point 4 – Point of intersection of two lines. First drawn from midpoint of the height of the ulnar notch (point 2) to the midpoint of the radial styloid process (point 3), second from Lister's tubercle to this line.

Measurements taken on the radii

1. Length of radius – distance between the most lateral portions of the radial head to tip of radial styloid
2. Distance from Lister's tubercle to radial styloid – distance between point 3 and point 4
3. Distance from Lister's tubercle to ulnar notch – distance between point 2 and point 4
4. Ratio – distance from Lister's tubercle to radial styloid/ distance from Lister's tubercle to ulnar notch
5. Angle of radial inclination – the angle between a line joining the tip of radial styloid and the medial edge of the distal end of radius and a line perpendicular to the long axis of the radius.

RESULTS

Study done on the 50 dried cadaver radii showed that Lister's tubercle was nearer to the styloid process in 13 of the radii while it was nearer to the ulnar notch in 37 radii. The distance from Lister's tubercle to the radial styloid process extended between 9 mm and 16 mm [Table 1], whereas the distance from Lister's tubercle and ulnar notch extended between 11 mm and 17.1 mm [Table 1]. The highest ratio of the two distance was 1.30 (the nearest distance to the ulnar notch) while the lowest was 0.52 (the nearest distance to the radial styloid) [Table 1].

The mean length of radius in all subjects was 23.17 cm. Mean angle of radial inclination in all subjects was 15.55° [Table 2]. In our study, we have found a statistically significant correlation between length of radius and angle of radial inclination [Table 3]. In our study, we observed that angle of radial inclination increases with the increase in length of radius [Figure 1].

DISCUSSION

The dorsal surface of lower end of radius displays a palpable dorsal tubercle also called Lister's tubercle which is in line with the cleft between the index and middle fingers. There is a wide, shallow groove medial to the tubercle divided by a faint vertical ridge. The dorsal tubercle of radius receives a slip from the extensor retinaculum and is grooved medially by the tendon of EPL.[3]

Anatomical variation of Lister's tubercle has potential clinical implications for certain pathological conditions and pre-procedural planning.[1] Although the function of the tubercle is defined in reference anatomy books and in related literature, the position of it is not defined. Lister's tubercle is used as a landmark in wrist arthroscopy and wrist injections.[2]

In the present study, there is variation in the position of the Lister's tubercle on the radius. Either it is close to radial styloid process or to the ulnar notch. This knowledge of the position of the Lister's tubercle may helpful during the procedures of wrist and hand.

Agir *et al*. studied 27 cadaver radii and found that there is variation in the position of Lister's tubercle along the dorsal surface of the lower end of radius between the radial styloid process and ulnar notch. Their study suggested possible implications in various procedures of the region. In the present study, we also found differences in the location of Lister's tubercle.[2]

Pichler *et al*. measured the size of Lister's tubercle and also the extent of the EPL groove using computed tomography and three-dimensional analysis of 30 forearms. There is considerable variation in their study results. They suggested that increased height of Lister's tubercle and a deep EPL groove may increase the risk of dorsal screw penetration and lead to EPL rupture.[4]

Hazani *et al*. defined Lister's tubercle as an anatomical landmark for the first dorsal compartment. A point for the injections into the first dorsal compartment is determined by them in their study to manage de Quervain's disease.[5]

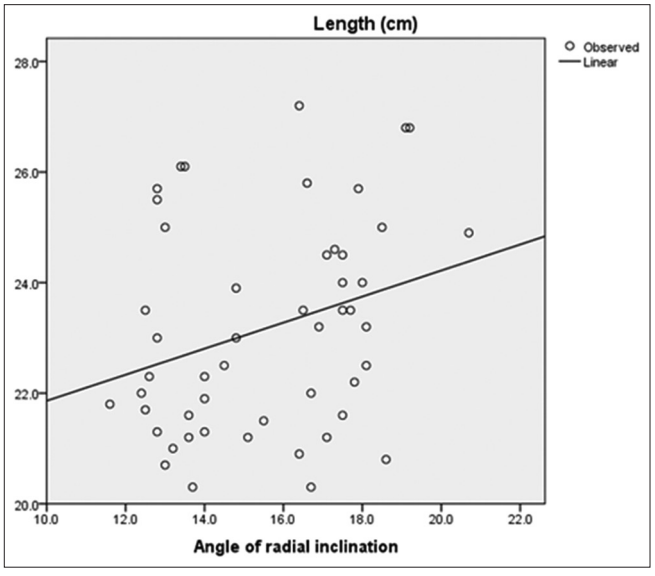

Figure 1: Graph showing correlation between length of radius and angle of radial inclination

Table 1: Distance from lister's tubercle to radial and ulnar notch and ratio between two measurements

	Distance from lister's tubercle to radial styloid (mm)	Distance from lister's tubercle to ulnar notch (mm)	Ratio
1	10	14.5	0.68
2	13.5	15	0.9
3	14	12.7	1.10
4	12.5	14	0.89
5	15	14	1.07
6	10.5	12.5	0.84
7	15	13.8	1.08
8	11.2	16	0.7
9	11.3	14.7	0.76
10	12.2	12.7	0.96
11	13	15.2	0.85
12	12.1	14.5	0.83
13	10.5	15	0.7
14	11.5	14.5	0.79
15	10.5	15	0.7
16	13.5	13	1.03
17	13.5	15.5	0.87
18	12	14	0.85
19	11	13	0.84
20	10	15	0.66
21	12	13	0.92
22	10	14.2	0.70
23	10.5	13.1	0.80
24	16	16.5	0.96
25	11	15.4	0.71
26	11	15	0.73
27	14	12.5	1.12
28	12	14.2	0.84
29	11	17	0.64
30	11	16	0.68
31	15	13.3	1.12
32	12	15.2	0.78
33	12	15	0.8
34	13	11	1.18
35	13	12	1.08
36	15	13	1.15
37	9	17.1	0.52
38	11	13	0.84
39	10.5	12.4	0.84
40	9.2	15	0.61
41	13.3	12	1.10
42	11.2	17	0.65
43	12	16.9	0.71
44	10	14	0.71
45	15.2	14	1.08
46	15.1	14.2	1.06
47	14	14.1	0.99
48	12	15	0.8
49	14.3	11	1.3
50	14	15.5	0.90

Table 2: Measurements of length of radius and angle of radial inclination

	Mean	Std. Deviation	N
Length (cm)	23.172	1.9099	50
Angle of radial inclination	15.558°	2.3333	50

Clement *et al.* measured the morphometry of Lister's tubercle in 100 cadaver radii. They measured the height of Lister's tubercle and depth of the EPL groove. The increased height of Lister's tubercle and a deep EPL groove in certain individuals could potentially obscure the field of view of surgeons during volar plate fixation. Greater differences in

Table 3: Correlation between length of radius and angle of radial inclination

		Length (cm)	Angle of radial inclination
Length (cm)	Pearson Correlation	1	0.288*
	Sig. (2-tailed)		0.043
	N	50	50
Angle of radial inclination	Pearson Correlation	0.288*	1
	Sig. (2-tailed)	0.043	
	N	50	50

*Correlation is significant at the 0.05 level (2-tailed)

Table 4: The comparison of angle of inclination given by different authors[6-9]

Parameter	Gupta *et al*. (Indian Cadaveric Study)	Prithishkumar *et al*. (Indian cadaveric study)	Werner *et al*	Schuind *et al*.	Our Study
Angle of inclination	Total: 25.05°	Left side: 21.8°±2.5	30°	24 (19-29)°	15.55°
	Left side: 24.0°	Right side: 22.1°±2.9			
	Right side: 25.6°				

heights of the radial and ulnar peaks are possibly associated with an increase in the perceived height of Lister's tubercle.[3]

In our study, we also found correlation between length of radius and angle of inclination which increased with length of radius. Among fractures of forearm bones, fracture of distal end of radius contributes around 15–18% of upper extremity fractures.[5] These parameters are useful in obtaining restoration of original angle and volar tilt. They also help in knowing success of the operation.

In literature, different studies show the angle of radial inclination varying from 24 to 30 [Table 4].[6-9] In our study, we found 15.5°.

CONCLUSION

In our study, we found that mean length of radius in all subjects was 23.17 cm. Mean angle of radial inclination in all subjects was 15.55°. We also found a statistically significant correlation between length of radius and angle of radial inclination and the angle of radial inclination increased with the increase in length of radius. These parameters help in regaining the original shape and angle postoperatively.

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