Anatomical Variants of Lister's Tubercle. Presentation of an Imaging Classification and Its Clinical Utility

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ABSTRACT

Objective: To retrospectively evaluate the different variants of Lister's tubercle (LT) and extensor pollicis longus (EPL) using magnetic resonance imaging (MRI) of the wrists, and based on these findings propose variables for classification. **Materials and Methods:** Retrospective study using images from MRI database files between 03/01/19 to 11/10/19. We included MRI of the wrist of healthy patients (axial, sagittal, and coronal slices of 1 mm thickness) who were older than 18 years, with no history of previous or current wrist or carpal fracture, excluding those who did not meet these criteria. We analyzed LT, height of the radial and ulnar peaks, the angle, tubercle length, depth of the grooves and septum height. We evaluated the EPL, analyzing the height, thickness, surface, and presence of associated inflammation. **Results:** We evaluated 500 MRI of the wrist, obtaining 11 different subtypes of LT. We found 411 type 1 Lister tubercles, 58 type 2, and 26 type 3. Among these, the most frequent were types 1b. 26.6% presented asymptomatic inflammation in 3rd and 4th compartments. **Conclusion:** Lister's tubercle is of importance in many procedures and serves as an anatomical landmark, meriting to know its most frequent pattern and its anatomical variants. We propose an extension of the classification, adding new types of tubercles to be known and their relationship with the EPL.

Key words: Lister's tubercle; inflammation; classification; MR.

Level of Evidence: IV

Variantes anatómicas del tubérculo de Lister. Presentación de una clasificación imagenológica y su utilidad clínica

RESUMEN

Objetivo: Evaluar, en forma retrospectiva, las diferentes variantes de los tubérculos de Lister y el extensor largo del pulgar en imágenes de resonancia magnética de muñecas y, sobre la base de dichos hallazgos, proponer variables a la clasificación. **Materiales y Métodos:** Estudio retrospectivo utilizando imágenes de resonancia magnética entre el 1 de marzo y el 10 de noviembre de 2019. Se incluyeron imágenes de muñeca de pacientes sanos (cortes axiales, sagitales y coronales de 1 mm de espesor), >18 años, sin fractura de muñeca o del carpo, previa o actual, y se excluyó a quienes no cumplían estos criterios. Se analizaron el tubérculo de Lister, la altura de los picos radial y cubital, el ángulo, la longitud del tubérculo, la profundidad de los valles y la altura del tabique. Se evaluó el extensor largo del pulgar analizando la altura, el espesor, la superficie y la presencia o no inflamación asociada. **Resultados:** Se analizaron 500 imágenes de muñeca, y se obtuvieron 11 subtipos de tubérculo de Lister: 411 tipo 1, 58 tipo 2 y 26 tipo 3. Dentro de estos, el más frecuente fue el tipo 1B. El 26,6% tenía inflamación asintomática en el tercero y cuarto compartimento. **Conclusiones:** El tubérculo de Lister es importante en muchos procedimientos y sirve como punto de referencia anatómico; por lo tanto, es preciso conocer su patrón más frecuente y sus variantes anatómicas. Proponemos una ampliación de la clasificación, adicionando nuevos tipos de tubérculo por conocer y su relación con el extensor largo del pulgar.

Palabras clave: Tubérculo de Lister; inflamación; clasificación; resonancia magnética.

Nivel de Evidencia: IV

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INTRODUCTION

Lister's tubercle (LT) is the main bony prominence of the distal radius in its dorsal surface and constitutes an anatomical landmark in the physical and surgical examination that fulfills the function of pulley of the extensor pollicis longus (EPL) before it pivots to continue its oblique path to the thumb.[1]

From the surgical point of view, it guides us on the location of the tendon compartments, the posterior interosseous nerve and the radiocarpal joint. It serves as a guide, for example, to perform arthroscopic portals, dorsal capsulotomies, or microsurgery procedures, mark the location of the dorsal radiotriquetral ligament, take bone grafts, or place nails or plates in fractures of the distal radius and carpal bones.[1-3]

LT was addressed, in a limited way, in the international literature and knowing its variants contributes to a better semiology and implementation of surgical techniques.

Chan and Chong described the anatomical variants of LT, while other authors, such as Agir et al., and Netscher and Hamilton mentioned differences in height and depth of tubercles, but in the context of pathologies, without mentioning classifications.[1,2,4]

The objective of this study was to evaluate, retrospectively, by magnetic resonance imaging (MRI) of wrists the different variants of LT and EPL, and based on these findings, propose variants to the established classification.

MATERIALS AND METHODS

A retrospective descriptive study of MRI images in database files was carried out, evaluating the axial, sagittal, and coronal planes of 1 mm thickness in the T1-weighted, T2-weighted, and fat/water suppression T2-weighted (x bone) sequences.

A dedicated open resonator was used for a low-field permanent magnet MSK Esaote S-scan (0.25 Tesla with dedicated coil for wrist/hand) in a medical center in the city of La Plata, Buenos Aires, Argentina, between March 1, 2019 and November 10, 2019.

The inclusion criteria were MRI of the wrist of healthy patients (1 mm thick axial, sagittal, and coronal planes), >18 years, without previous or current wrist or carpal fracture. The exclusion criteria were a history of wrist fracture or fracture at the time of MRI, history of osteomyelitis, congenital alteration of the radius, rheumatoid arthritis or any other degenerative disease, and technical alterations of the MRI or observers.

We considered as a basis the three types of LT proposed in the classification of Chan and Chong: type 1 (radial peak larger than the ulnar peak), type 2 (similar radial and ulnar peak) and type 3 (ulnar peak larger than radial peak or absent radial peak).[1]

In the slices, the LT, the height of the radial and ulnar peaks, the angle, the length of the LT, the depth of the grooves, and the height of the septum were analyzed. In turn, the EPL was evaluated, analyzing the height, thickness, surface, and the presence of inflammation.

All MRIs were evaluated by two observers who are physicians, traumatologists, and hand surgeons (JMS and JFG) and who analyzed the aforementioned variants on a case-by-case basis.

RESULTS

We evaluated 500 MRI of the wrist (378 right and 122 left) that met inclusion criteria in 328 women and 172 men, with an average age of 42 years (range 18-87). Based on the findings, we performed a sub-classification of LT types, detached from the Chan and Chong classification, and obtained 11 different subtypes.

LT Classification

Type 1: Radial peak larger than ulnar peak

1A: The radial peak is rounded and larger than the ulnar peak, which also ends in a rounded peak.

1B: The radial peak is rounded and larger than the ulnar peak, which is much smaller than the type 1A ulnar peak and ends with a more elongated shape.

1C: The radial peak is high and ends rounded or pointed, it is not followed by the ulnar peak, but presents a long groove and ends in a small ulnar peak.

1D: The radial peak is larger than the ulnar peak, but both peaks are pointed.

1E: The radial peak is rounded and does not have an ulnar peak; the groove encompasses the third and fourth compartments.

1F: The radial peak is pointed and has no ulnar peak; its groove encompasses the third and fourth compartments.

2A: The radial and ulnar peaks have the same height, >1 mm.

2B: The radial and ulnar peaks have the same height, <1 mm and >0.5 mm.

2C: The radial and ulnar peaks have the same height, but <0.5 mm.

3A: The ulnar peak is larger than the radial peak.

3B: There is no radial peak with a prominent ulnar peak.

Figure 1 shows an outline of the LT types. Figure 2 shows MRI images of the different types of LT.

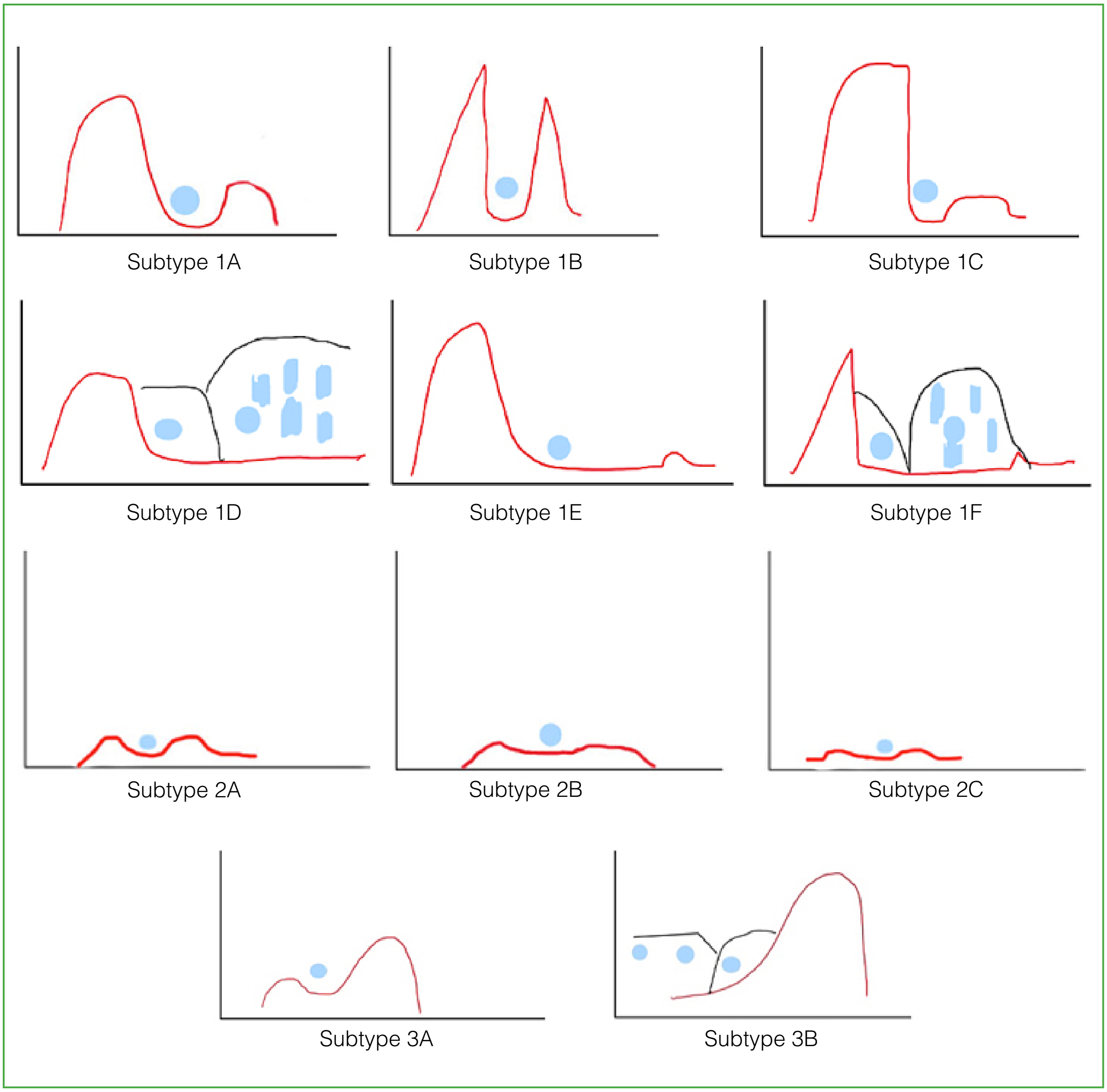

Figure 1. Scheme of different Lister tubercles.

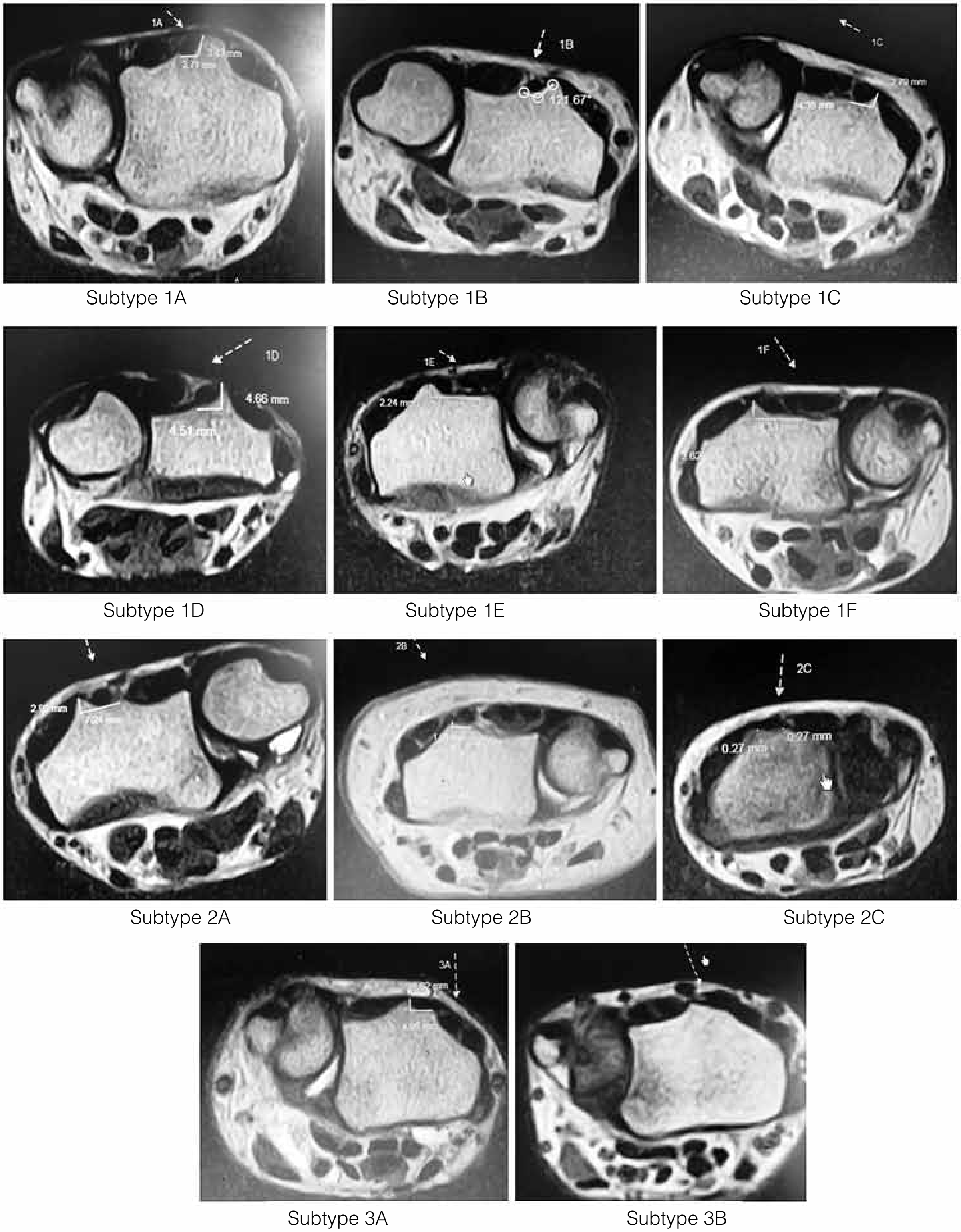

Figure 2. Magnetic resonance imaging of the different types of Lister's tubercle.

We found 411 type 1, 58 type 2, and 26 type 3 LTs, and the most frequent was type 1B. The average height was 2.4 mm (range 0.2-5.1). The length averaged 4.4 mm (range 1.5-17). The average angle was 114° (range 68-172). The septum had an average height of 0.5 mm (range 0.1-3).

The average height of the EPL was 2 mm (range 0.3-3.9); the average thickness, 2 mm (range 0.3-4); and the average surface area, 4.1 mm (range 1.5-9.9). Up to 26.6% of inflammatory processes compromised the EPL; subtype 1F (pointed radial peak and no ulnar peak, where its groove includes the third and fourth compartment) was the one that, most frequently, had inflammation in the third and fourth compartments, while the least related to this finding was type 2B (radial and ulnar peaks of the same height, <1 mm and >0.5 mm) (Tables 1 and 2).

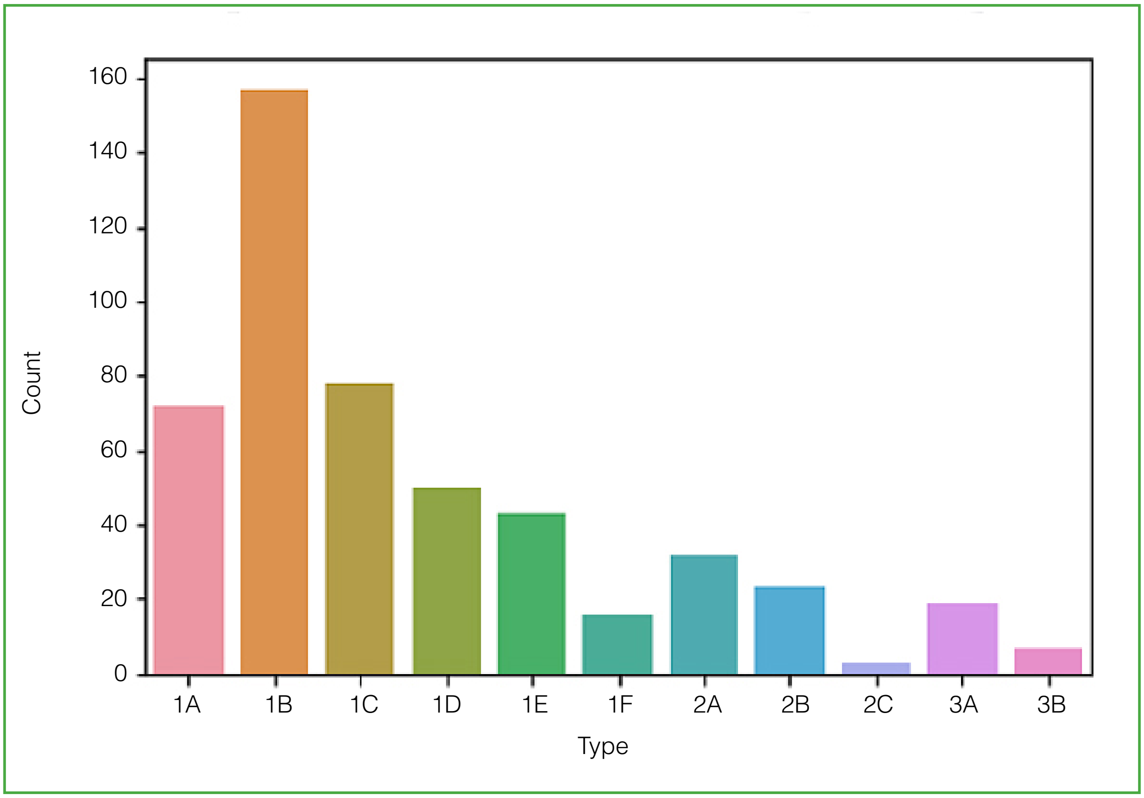

Figure 3. Types of tubercles and quantity by subtype

DISCUSSION

In this study, MRI images of wrists in previously healthy patients were evaluated retrospectively to establish different variables of LT and EPL, looking for parameters that contribute to their clinical application.

Few published studies address the description of LT and its anatomy. Some authors assessed the size and depth of LT grooves, albeit in the context of surgical or post-traumatic complications.[2-6]

Benson et al. described penetration of the screws by the dorsal cortical bone at the level of LT as the first cause of rupture of the EPL in patients operated on for radius fracture. They suggested evaluating LT before surgery to avoid erroneous radioscopic images.[7]

Table. Comparison of tendon inflammation by subtype, expressed in percentages

Type	Inflammation	Percentage
1A	No	11.2
	Yes	3.2
1B	No	23.6
	Yes	7.8
1C	No	9.8
	Yes	5.8
1D	No	6.6
	Yes	3.4
1E	No	5.6
	Yes	3.0
1F	No	1.8
	Yes	1.4
2A	No	5.8
	Yes	0.6
2B	No	4.4
	Yes	0.2
2C	No	0.4
	Yes	0.2
3A	No	3.2
	Yes	0.6
3B	No	1.0
	Yes	0.4

De Maeseneer et al. described tubercle types using ultrasound and cadaveric dissection. They pointed out that when the EPL ran between both peaks of equal magnitude (radial and ulnar), the incidence of rupture was higher.[8] In this sense, Perugia et al. recognized a high incidence of EPL rupture for this type of tubercle, perhaps associated with the micro-instability of the EPL in the groove, added to the chronic inflammation resulting from rubbing.[9]

Park et al. divided the radius into safe and unsafe zones, taking LT as a landmark. They evaluated the antero-posterior diameter of the radius in its entire circumference and concluded that LT is the safest location for the placement of longer screws.[10]

Chan and Chong proposed a classification into three types of LT with two subtypes each, and a total of six variants.[1] In our case studies, we recognized five different subtypes added to the six variants described. There were 11 subtypes of LT, and the most frequent was type 1 (radial peak larger than ulnar peak). Among these, variable 1B (rounded radial peak larger than ulnar peak, which, in this case, is much smaller than the ulnar peak of type 1A and ends with a more elongated shape) is the most frequent. In turn, we found that up to 26% had inflammation of the EPL.

The strengths of this study are the assessment of a homogeneous sample of patients, an adequate amount of MRI scans, and the evaluation by two different specialists. However, the weaknesses are its retrospective design and the use of a 0.25 Tesla resonator, which did not allow us to obtain images of the highest quality. Many MRI images were excluded because the specialists could not reach an agreement and had obtained so many subtypes that made the proposed classification complex.

CONCLUSIONS

It is of utmost importance for hand and upper limb surgeons to know the anatomy and variants of LT, as it serves as an anatomical landmark. We propose an extension of the classification of Chan and Chong, opening a range of types of LT to be known and their relationship with the EPL and with the inflammation of the third and fourth compartments.

Conflict of interests: The authors declare they do not have any conflict of interests.

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