Macroscopic and Morphometric Study of the Hypothenar Muscle Arch

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Abstract. A fibrous arch is described between the pisiform bone and the hamulus (arch of Uriburu, arch of hypothenar muscles) (Martinoli et al., 2000). It represents a preferential site of compression of the deep branch of the ulnar nerve (Uriburu et al., 1976). The aim of this work is to show the structure of the arch of the hypothenar muscles.

Keywords: macroscopic study, fibrou arch of hypothenarians, structure

Introduction

The piso-hamulus arch is a pearly white fibrous structure connecting the pisiform bone to hamulus of the hamatum bone, as its name suggests, will join, following a convex path inwards, the pisiform bone. The abductor and flexor digitorum brevis muscles of the hypothenar eminence are inserted into it (Martinoli et al., 2000).

Method

Our dissection study allowed us to investigate anatomical variations, including a muscle anomaly passing through the ulnar canal, and the fibrous arch forming the piso-hamulus hiatus which may play a role in the ulnar canal syndrome (Guyon's canal) (Guyon, 1861).

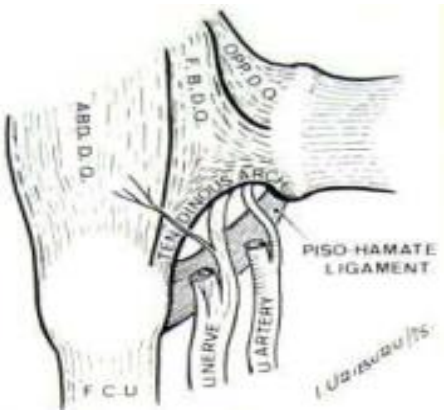

Figure 1. The piso-hamulian hiatus, and fibrous arch (Uriburu, Morchio, & Marin, 1976)

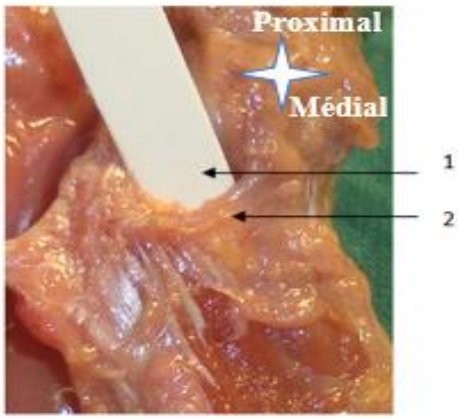

Photo 1. Right hand. Arcade of the hypothenar muscles (high magnification)
Note: 1: The piso-hamulian hiatus; 2: The tendon aspect of the arch.

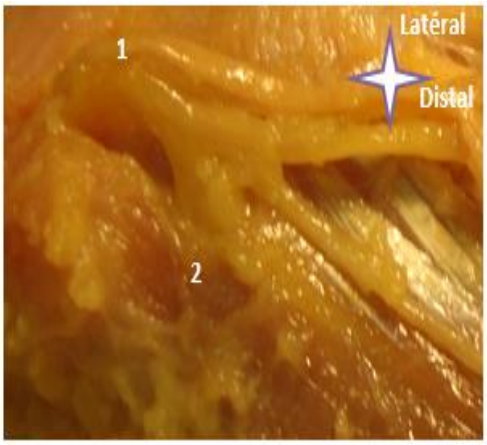

Photo 2. Muscular appearance of the arch of the hypothenar muscles
Note: 1: ulnar vasculo-nervous pedicle; 2: muscular arch.

We also emphasised the relationship of these anatomical structures to the ulnar canal. 28 cadavers (fresh and embalmed) were dissected, we observed the fibrous arch extending from the pisiform bone to the hamulus bone of the hamatum and it was present in 27 hands. All the muscles of the hypothenar eminence were found, namely the flexor pollicis brevis, which originates from the arch, as well as the abductor pollicis brevis and the opposator pollicis brevis.

The piso-hamulus hiatus lies between the piso-hamulus ligament in the depth and the fibrous arch of the hypothenaries in the superficial, and represents a preferential site of compression of the deep branch of the ulnar nerve (Uriburu, Morchio, & Marin, 1976) (Figure 1).

Of these structures observed, we noted two different types of structural variations in the arch of the hypothenar muscles, either a muscular aspect or a tendinous aspect.

- A tendinous structure, with a pearly white and hard network of fibres, connecting the pisiform bone to the hamulus of the hamate bone and at the level of which the flexor pollicis brevis of the little finger is most often inserted (Photo 1).

- A muscle-like structure with fibres of the same texture as the rest of the muscle body (Photo 2).

Results of the Macroscopic and Morphometric Study of the Arch of the Hypothenar Muscles

Macroscopic Study

The macroscopic study of the arch of the hypothenar muscles formed by the insertion of the muscles of the hypothenar eminence revealed the existence of the arch in 27 hands *(96.42%)*, in one case the fibrous arch does not exist *(3.57%)* and in this second case, the flexor pollicis brevis of the little finger originates from the hamulus of the hamatum.

Our observations made with the naked eye have enabled us to note different aspects of the proximal edge of the flexor pollicis brevis. These aspects are classified according to the difference in structure between the proximal insertion of the flexor pollicis brevis muscle and the rest of the muscle body.

We found two types of structures:

- *Tendon structure*, observed in most cases, 23 cases, i.e. 82.14%.

Macroscopically, these arches are characterised by the presence of a network of pearly white fibres, shining at the point where the deep branch of the ulnar nerve enters the piso-hamular hiatus.

- *Muscular structure*, found in 5 cases *(17.85%)*. In this case, the arcade formed by the proximal edge of the flexor pollicis brevis of the little finger has the same texture as the rest of the muscle body.

We did not find any variation in the origin of the hypothenar muscles. During movement, membrane structure was not found in all dissected hands.

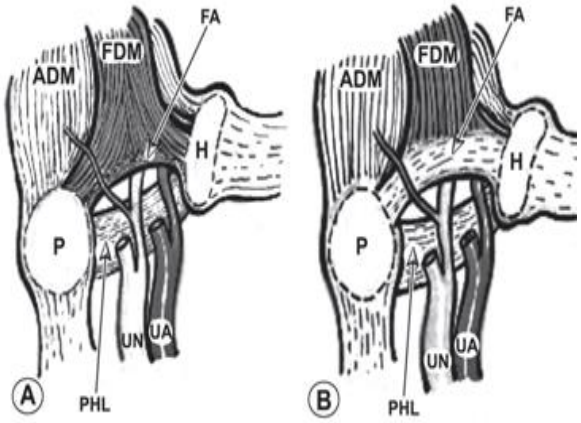

Figure 2. Composition of the arch of the hypothenarians

Note: A: Muscular aspect of the arch, B: Fibrous aspect of the arch; ADM: Abductor pollicis brevis muscle, FDM: Flexor digitorum brevis muscle, P: Pisiform bone, H: Os hamatum, FA: Piso-Hamulian arcade (of the hypothenarians), PHL: piso - hamulus ligament, A: ulnar nerve, UA: ulnar artery.

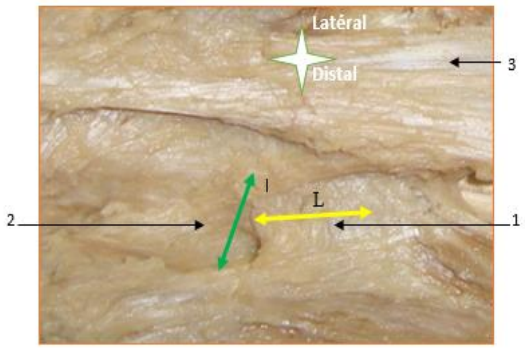

Photo 3. Tendon aspect of the arch of the hypothenar muscles

Note: 1: Arch of the hypothenar muscles; 2: Hiatus piso – Hamulien; 3: Palmar fascia; L: length of the arch; l: width of the arch.

Morphometric Study of the Arch of the Hypothenar Muscles (AH)

This study was carried out on the various dissection specimens, and with the aid of a ruler, the width and length of the arch of the hypothenaries (AH) were measured.

- The HA length is a vertical line midway from the arch to the distal part of the hypothenar fascia. The mean 24.4 mm ± 2.57 (18-29) mm.

- The width of the hypothenar arch is a horizontal line extending from the pisiform bone to the hamulus of the hamatum bone. The average is 9.7 ±1.3 (5.3-15) mm.

- The shape of the piso-hamalar arch or arch of the hypothenar muscles changes, and the length increases to 24.5 mm (19.3 to 28.6mm), as wrist flexion is a position that induces a change in the tunnel, arch and piso-hamalar hiatus.

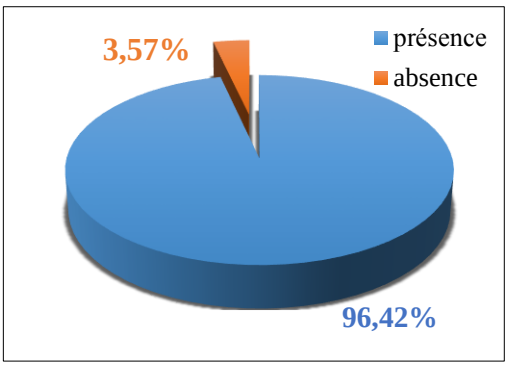

Figure 3. Frequency of the hypothenar muscle arch

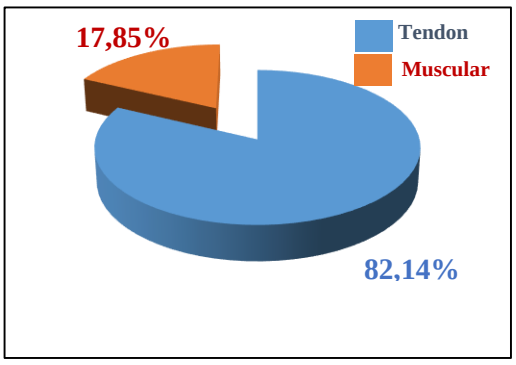

Figure 4. Impact of the different types of arches of the hypothenar muscles

Table 1. Percentage of the different types of arches of the hypothenar muscles

Types of arches	Number of cases	Percentage
Tendon (type 1)	23 cases	82,14%
Muscular (type 2)	4 cases	17,85%
Membranous (type 3)	00 cases	00%

Table 2. Incidence of the length (in mm) of the arch of hypothenarians

Number of pieces	The width (in mm) of the arch of the hypothenar muscles
3	5,3
2	5,5
4	6
3	8
2	11
6	13
3	14
4	15

Table 3. Incidence of the width of the arch of the hypothenar muscles

Number of pieces	The length of the arch of the hypothenrian muscles (in mm)
3	18
2	20
4	23
3	24
1	25
5	26
3	27
4	28
2	29

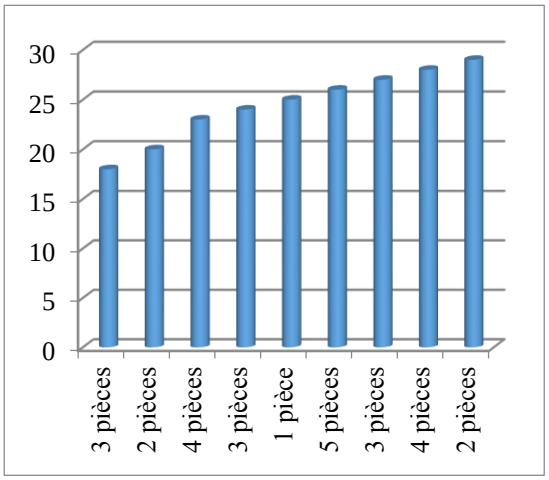

Figure 5. Graphical representation of the length of the arch of the muscles

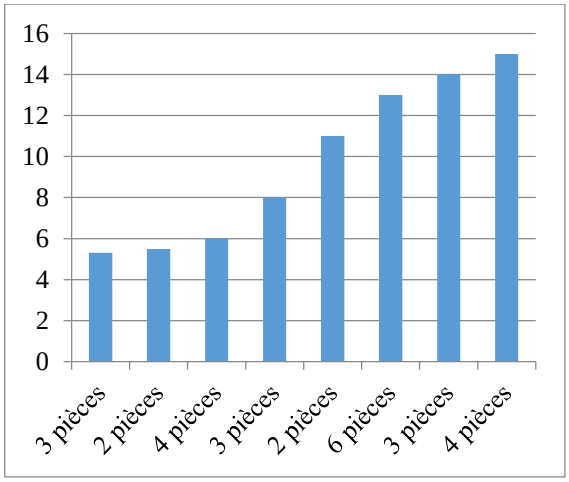

Figure 6. Graphic representation of the width of the arch of the hypothenarians

Discussion

According to Hayes, Mulholland and O'Connor (1969), there is a constant fibrous piso-hamulus arch giving insertion to the hypothenar muscles and delimiting with the classic hamulus ligament, the piso-hamulus hiatus where the deep branch of the ulnar nerve and the ulnar artery engage.

In our study, 28 corpses (fresh and embalmed) were dissected, and we observed the fibrous arch extended from the pisiform bone to the hamulus of the hamatum bone and this arch was present in 27 hands.

Conclusion

Our study allowed us to study variations in the structures of the arch of the hypothenar muscles forming the piso-hamulus hiatus and which may play a role in ulnar canal syndrome (Guyon's canal) (Guyon, 1976). This arch has been found in 27 hands (96.42%). The fibro-tendon aspect of this arch is capable of trapping the motor branch of the ulnar nerve.

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