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Original Research Article

ANATOMICAL STUDY OF THE ACCESSORY HEADS OF THE DEEP FLEXOR MUSCLES OF THE FOREARM (GANTZER MUSCLES)

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ABSTRACT

Background and Objectives: Proper knowledge of muscular variations is essential not only for anatomists but also for surgeons. Forearm flexors are known to exhibit such variations. Such anomalous muscle bellies should be kept in mind while approaching the forearm for FDS tendon transfer and other surgical procedures around it.

Materials and Methods: The present study was consisted of 20 upper limbs. The dissections were carried out in all the limbs on the right and left sides. All the muscles were examined for their presence, position, and their attachments, and then the superficial compartment was cut to expose the deep compartment muscles; If any abnormality was found in the muscular pattern, it was recorded in detail and photographed.

Result: The incidence of the Gantzer muscle was detected in 9 (45%) of the 20 dissected forearms, three of these cases presented duplicated muscle bellies. It originated from the medial epicondyle in 8(88.9%), and from the coronoid process of ulna in 1(11.1%) of cases. It was inserted in the flexor pollicis lungus in 9(75%) and in the flexor digitorum profundus in 3 (25%). In this study the Gantzer muscle was innervated by the anterior interosseous nerve which crosses posterior to the muscle in all cases. The muscle was 11.022 cm in length and 0.55 cm in width.

Conclusion: This study will supplement our knowledge on the possible variations of the muscles in this region, which would be useful for hand surgeons.

KEY WORDS: Gantzer muscle, anomalous, variations.

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INTRODUCTION

In 1813, Gantzer described an accessory muscle in the forearm; this muscle could join the flexor pollicis lungus muscle and the deep finger flexor muscle [1,2]. However, Kaplan [3] describes that this muscle was described by Albinus almost a century before.

Gantzer described two accessory muscles in the human forearm which are named Gantzer's muscle. This muscle arises as small belly from forearm flexors and is inserted either into FPL of FDP [4]. The Gantzer's muscle mostly originated from the medial epicondyle of the humerus or from the under surface of flexor digitorum superficialis (FDS) muscle. The Gantzer's muscle has clinical importance as it

may compress both the median nerve and its branch, anterior interosseous nerve [5].

The anterior interosseous nerve syndrome (AINS) is a relatively rare but well-described clinical entity. It is characterized by pure weakness of the flexor pollicis longus (FPL), the flexor digitorum profundus muscles (FDP) of the index and middle fingers, and the pronator quadratus (PQ) muscle of the forearm, producing a square pinch deformity [6-8].

Proper knowledge of muscular variations is essential not only for anatomists but also for surgeons. Forearm flexors are known to exhibit such variations. Such anomalous muscle bellies should be kept in mind while approaching the forearm for FDS tendon transfer and other surgical procedures around it [4].

The prevalence of the Gantzer muscle was reported variously as 73.7% [9], 45% [10], 52% [11], and 55% [12]. It originated from medial epicondyle of the humerus [9-11], coronoid process [9] and medial epicondyle and coronoid process [9-11]. The insertion was reported to attach to the ulnar border of the FPL [11,12]. The nerve supply was from and a branch of the AIN.

The relationship between the AIN and the AHFPL was variously reported. By one account, the muscle was between the median nerve and the AIN, with the median nerve lying anteriorly and the AIN posteriorly to the muscle [10,13]. Another report stated that the AHFPL was anterior to the AIN [12], whereas others stated it was posterior to the median nerve and AIN [10,11].

The objective of this study was to analyze the incidence, origin, insertion, and innervation of the Gantzer muscle. And to find the relationship regarding the anterior interosseous nerve and the median nerve, verifying the possibility of Gantzer muscle being the cause of the anterior interosseous nerve syndrome.

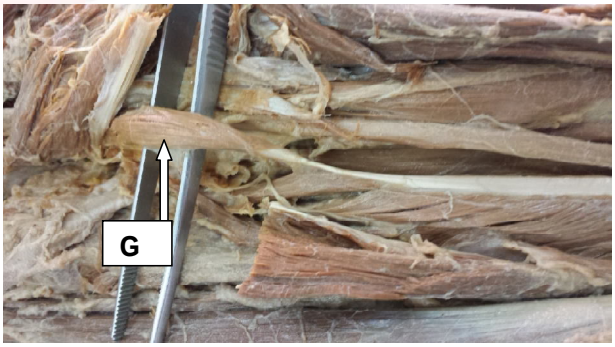
MATERIALS AND METHODS

The present study was conducted in the Department of Anatomy, faculty of medicine at umm Elqura university – Mecca- Saudi Arabia. Ethical clearance was obtained from Umm Elqura university Ethical Committee. This study was done from June 2016 to august 2016, and it consisted of 20 upper limbs which were used for the routine undergraduate teaching program. All the limbs belonged to the adult category and they were without any obvious pathological deformities. The limbs were belonged to cadavers which were preserved by the injection of formalin based preservative (10% formalin) and they were stored in tanks. Both the sexes were included in our study. There were 17 male and 3 female limbs.

The dissections were carried out in all the limbs on the right and left sides. The skin was reflected to expose the superficial fascia, and it was examined for its contents: cutaneous nerves and vessels and if any abnormality was noted, it was recorded in detail. Then the superficial fascia was incised and it was reflected to expose the deep fascia. Then the deep fascia was incised and it was reflected to expose the muscles of the superficial compartment of the fore arm. All the muscles were examined for their presence, position, and their attachments, and then the superficial compartment was cut to expose the deep compartment muscles; again, the routine investigation was carried out. If any abnormality was found in the muscular pattern, it was recorded in detail and photographed.

RESULTS

Fig 1: Showing the Gantzer muscle (G).



The incidence of the Gantzer muscle was detected in 9 (45%) of the 20 dissected forearms (fig1), three of these cases presented duplicated muscle bellies (Figure 2).

The Gantzer muscle originated from the medial epicondyle of the humeru in 8(88.9%) of forearms, and from the coronoid process of ulna in 1(11.1%) of cases.

The Gantzer muscle was inserted in the flexor pollicis lungus in 9(75%) forearms and in the flexor digitorum profundus in 3 (25%).

In this study the Gantzer muscle was innervated by the anterior interosseous nerve which crosses posterior to the muscle in all cases (Figure 3).

The muscle was 11.022 cm in length and 0.55 cm in width.

Fig. 2: Showing two Gantzer's muscles (G1, G2), the accessory muscle bellies, inserting separately into the flexor digitorum profundus (FDP) and flexor pollicis longus (FPL).

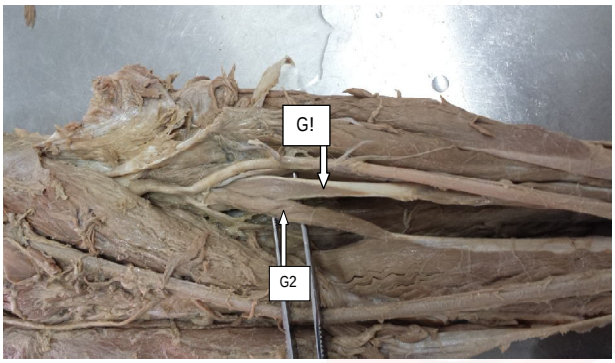
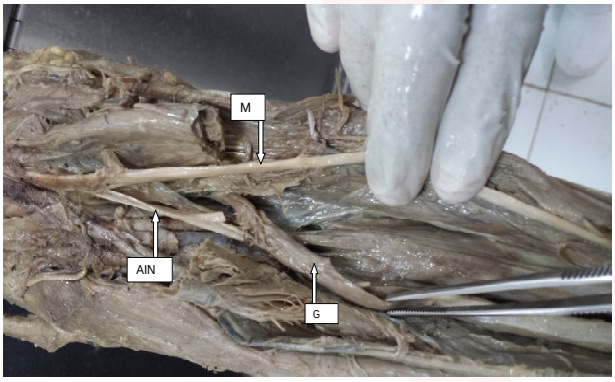


Fig. 3: Showing the relations of Gantzer's muscle(G) to the median nerve (M), anterior interosseous nerve (AIN).



DISCUSSION

Developmentally, the occurrence of Gantzer muscle is due to incomplete differentiation. Initially, a common flexor mass is formed in the embryo, which further differentiates into a superficial layer and a deep layer. The deep layer further develops into the FDP, FPL and the PQ muscles. [14,15].

The incidence of the Gantzer muscle was recorded in 9(45%) of the 20 dissected forearms. This is close to the percentage observed by Dykes and Anson [16] (53.3%), 54.2% Malhotra et al. [17], Dellon and Mackinnon (10) (45%), Al Qattan(11) (52%), Jones et al.[2] (55%), Shirali et al. [12] (55%), Gunnal et al.[18] (51.1%) and Temang et al.[19] (43%).

Other authors have reported different results regarding the presence of this muscle: Mangini et al., [9] (71%) Hemmady et al., [13] (66.7%) and Oh et al. [21] (67%). Dykes and Anison [16] in their exhaustive study showed the distribution of the Gantzer's muscle to be 28% on the right, 25% on the left and 18% bilateral [16]. In the present report we found 6(20%) muscle in the right and 3(15%) in the left.

The result of our study is the same of that of the most authers who stated that the most frequent site of Gantzer muscle origin is the medial epicondyle of the humerus (Mangini [9] and Hemmady et al. [13]).

Dykes and Anson [16] and Malhotra et al. [17] suggest the medial epicondyle and coronoid process of the ulna to be the site of origin. , Oh et al. [21] in the coronoid process of the ulna.

In this study we recorded duplication in three (15%) cases of 20 dissected forearms. Shirali et al. [12] also recorded four duplications in 60 dissections, Jones et al. [2] found duplication of the Gantzer muscle in two limbs, Oh et al. [21] also reported duplication in one of the limbs of 72 dissected forearms.

Regarding the insertion, Al Qattan [11] reported that in all dissected forearms the Gantzer muscle was inserted into the flexor pollicis longus muscle, Mangini [9] agrees, since he considers the Gantzer muscle a continuation of the flexor pollicis lungus muscle.

We noticed that in 9 forearms (75 %) the Gantzer muscle was inserted into the flexor pollicis lungus and in 3 (25%) in the flexor digitorum profundus.

Regarding the relationship between the Gantzer muscle (G) and anterior interosseous nerve (AIN), we found the nerve running posterior to the belly. This follows the reports of Mangini; [9], Hemaddy et al. [13]; Jones & Abrahams [2]; Shirali et al. [12]; Oh et al. [21] where the nerve ran posterior to the belly. It also differed from the reports of Dellon & Mackinnon [10] and Al-Qattan [11]; stating that the nerve passed anteriorly in front of the muscle belly. In our study the average length of the Gantzer muscle belly was found to be 72 mm.

Other authors stated that the mean length of the muscle belly was found as 50 – 80 mm by Hemmady et al [13].68 mm by jones et al [2] and 71.25 mm.

The average width of the muscle belly was 7mm in the study of Oh et al [21], 6.7 mm in the study of Mahakkanukrauh et al [7], 10 – 25 mm in the study of Hemmady et al [13] and 5.5 mm in our study.

CONCLUSION

The anterior interosseous nerve (AIN) was seen to be posterior to the Gantzer muscle in the present study. Knowledge of such variations is very important for the orthopedic surgeons since this muscular variation can cause chronic inflammation, nerve compressions, tenosynovitis.

Conflicts of Interests: None

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