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Case Report

Unusual variations in Gantzer muscle and neurovascular structures of forearm

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ABSTRACT

Background: Gantzer muscles are variants in forearm. They may cause compressive neuropathy affecting median or anterior interroseous nerve (Kiloh Nevin syndrome). Dual origin of Gantzer muscle forms tunnel which includes median nerve, this report reveals unique anatomical scenario where Gantzer muscle may compress and entrap median nerve.
Case Description: Present study reported dual origin of gantzer muscles in right forearm. It was pierced by median nerve and brachial artery. Two anterior interroseous artery emerged from common interroseous artery. Later, both anterior interroseous artery anastomosed with posterior interroseous artery.
Discussion: This variation is clinically significant since symptoms of median nerve compression caused by comparable changes are sometimes mistaken with symptoms caused by more prevalent causes like radiculopathy, carpal tunnel syndrome.
Conclusion: Noticed variation is particularly beneficial to hand surgeons since this unusual muscle serves as anatomical reference for procedures in this region. The safety and effectiveness of surgery are improved by knowledge of nerve variations. To the best of our knowledge, this variant has not been mentioned in current medical literature.

1. Introduction

Variant muscles seen in the front of the forearm that arise from the flexor pollicis longus (FPL) or flexor digitorum profundus (FDP) are known as Gantzer muscles (GM).[1] Albinus originally reported this muscle in the 18th century, and Gantzer, a German anatomist, described it in 1813.[2] This muscle is thought to be an anatomical variant, and the authors have reported it with varied degrees of prevalence.[3] The GM is prevalent, present in almost 65% of people.[4] However, the incidence of accessory FPL (aFPL) is found to be 48% and accessory FDP (aFDP) is 17%.[2] According to reports, 3.17% of forearms have coexisting variations of aFPL and aFDP.[5] Bergman et al. found that the occurrence of the aFPL varied from 33.3% in European Caucasians to 89.3% in Blacks[6] and aFDP from 2% to 35%.[7,8] Studies conducted in Africa have shown that the highest incidence is 73% in aFPL while in mongoloids, north Americans and south Americans, the incidence is 56%, 51% and 44%, respectively. Lowest incidence is seen in Caucasian population (Asian 41% and European 39%). Incidence of aFDP is 24% in mongoloid population while in in African, Caucasian of Asian and European origin were 9%, 17% and 11% respectively. Incidence of aFDP in north and south American population is 3%.[4] The incidence of aFPL in males and females is 38% and 13%,[4] respectively. According to some studies, these accessory muscles can originate from the medial epicondyle via fibres of the flexor digitorum superficialis (FDS) or coronoid process or a combination of the two.[9,10]

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Upper extremity muscle variations are characterised phylogenetically and ontogenetically as atavistic causes of peripheral nerve disorders.[5] The existence of GM might result in compressive neuropathy of the anterior interosseous nerve (Kiloh–Nevin syndrome).[1] In order to treat acute compartment syndrome, anterior forearm fasciotomies require evaluation of these muscles as well.[1] This report describes an unusual anatomical situation where GM might compress and entrap a portion of the median nerve.

2. Case Report

During regular dissection of the 78-year-old man's right forearm, it was discovered that the anterior part of the forearm had two separate origins of GM. The first head (GM1) took origin from the medial aspect of medial epicondyle of humerus, ran obliquely downwards, and from a fibrous cord which was attached near the insertion of distal part of the tendon of brachialis muscle. The second head (GM2) arose from the middle of the belly of FPL (Figure 1). Both GM1 and GM2 inserted in the tendon of FPL at the junction of middle and distal third of forearm (Figure 1 A). In lower one third of arm, median nerve was medial to brachial artery and both pierced GM1 medial to biceps tendon. In the middle of forearm, some fibres of GM1 merged with the belly of FDS. After emerging out, median nerve pierced GM2 and belly of both the GM1 and GM2 merged with the belly of FPL in its distal half. GM1 belly was triangular in shape and 9 mm wide at the mid part while GM2 belly was fusiform in shape, both were innervated by median nerve. Two anterior interosseous arteries emerged from the common interosseous artery, a branch of ulnar artery (Figure 1 B). Distally, both anterior interroseous arteries anastomosed with posterior interosseous artery.

3. Discussion

In the present report, GM1 was from the medial epicondyle of humerus similar to the attachment of GM in the studies conducted by Magini[7] and Hemmady et al.[11] In contrast, in a study conducted by Shirali et al.[12] it took origin from the flexion pronator muscle group, and from the coronoid process and medial epicondyle of humerus according to Malhotra et al.[13] Insertion of GM in majority of the cases is reported in the tendon of FPL[3,14] which is similar to the present report. GM was unilateral in the present report, however, few studies have revealed that it is more often bilateral than unilateral.[3,11]

The interpretation of dissected limbs aids in clarifying disagreements on the origin of GM.[3] The FDS muscle has two parts: one in the humerus' medial epicondyle and the other in the ulna's coronoid process. These two portions join together to form an arch.[3] According to Hollinshead, the Gantzer muscle usually joins to the deep portion of the FDS and inserts in the medial epicondyle of the humerus or the coronoid process of the ulna.[15] Other reports suggest that the insertion took place in the medial epicondyle or coronoid process, in conjunction with the FDS.[9,10]

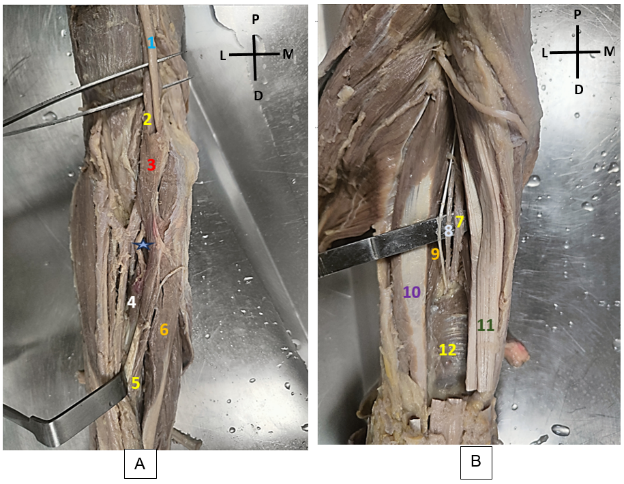

Figure 1: Showing variation in upper limb. 1-median nerve; 2-brachial artery; 3- Gantzer muscle (GM1); 4- Gantzer muscle (GM2); 5- Flexor pollicis longus; 6- Flexor digitorum superficialis; 7- anterior interroseous arteryI, 8- anterior interroseous artery II; 9- anterior interosseous nerve; 10- Flexor pollicis longus; 11- Flexor digitorum profundus; 12- pronator quadratus; Blue star-tunnel formation

During the seventh week of gestation, the flexor muscle group develops from the arm buds. It eventually divides into superficial and deep muscular layers.[1,14] It has been speculated that the existence of this auxiliary muscle may be due to incomplete delamination during embryonic development.[14]

A report by Kaplan and Spinner describes two cases where the GM can compress the median nerve. First is when the GM inserts into the superficial flexor around the arcade. Second, when the median nerve perforates the muscle.[16] In our study, GM was pierced by both median nerve and brachial artery. Such variation has not been mentioned in the literature before. According to reports, the median nerve innervates the GM in 2.7% of specimens and the AIN in 97.3% of specimens.[5] Since the GM is supplied via the median nerve, this scenario should be regarded as extremely rare similar to the studies conducted by Magini and Kida.[7,8]

Moreover, it is essential to assess muscle architecture as morphological anomalies might impact a muscle's ability to contract and its range of motion. Fusiform and papillary forms of morphology impose the highest risk of impingement.[9] In 72% of occurrences, the GM is fusiform, slender in 10.6% and triangular in 5% cases.[17] The present report identified that the main belly of the GM1 was triangular while GM2 was fusiform in shape.

The FPL, FDP and pronator quadratus (PQ) become weak or paralysed as a result of interosseous nerve compression, while the thenar region's muscles become paralysed and vital hand discriminating areas become less sensitive as a result of median nerve compression. The functional deficit—which causes prehension and digital pinch disability—is significant in both circumstances.[3] The typical presentation of anterior interosseous nerve syndrome is intense pain that gradually goes away over several hours or days, followed by paresis or paralysis of PQ, FPL, FDP. A patient may go months or even years without a diagnosis due to the notoriously difficult diagnosis process for proximal forearm compression neuropathies, which cause ambiguous symptoms.[18] Surgeons should be cautious of these variations since the accessory heads have a risk to end up in nerve compression syndromes and persistent inflammation in addition to tenosynovitis.[19]

4. Conclusion

Gantzer muscle may compress nerves related to the muscle and result in neuropathies such as anterior interosseous nerve syndrome. Thorough understanding of the variation of hand muscles is necessary for anatomists as well as surgeons to correct deformities of hand and to perform tendon transfer.

5. Source of Funding

None.

6. Conflicts of Interest

None.

References

1. Zdilla MJ, Pacurari P, Celuck TJ, Andrews RC, Lambert HW. A Gantzer muscle arising from the brachialis and flexor digitorum superficialis: embryological considerations and implications for median nerve entrapement. *Anat Sci Int*. 2018;94(1):150–3.
2. Gantzer KFL. Dissertatio anatomica musculorum varietates sistens Quam consensu gratiosi medicorum ordinis. 1813;.
3. Caetano EB, Neto JJS, Vieira L, Caetano MF, Moraes DV. Gantzer muscle. An anatomical study. *Acta Ortop Bras*. 2015;23(2):72–5.
4. Asghar A, Jha RK, Patra A, Chaudhary B, Singh B. The prevalence and distribution of the variants of Gantzer's muscle: a meta-analysis of cadaveric studies. *Anat Cell Biol*. 2022;55(1):3–13.
5. Pai MM, Nayak SR, Krishnamurthy A, Vadgaonkar R, Prabhu LV, Ranade AV. The accessory heads of flexor pollicis longus and flexor digitorum profundus. Incidence and morphology. *Clin Anat*. 2008;21(3):252–8.
6. Bergman RA, Afifi AK, Miyauchi R. Opus I: Muscular system. In: Illustrated Encyclopedia of Human Anatomic Variation. Anatomy Atlases; 2007.
7. Magini U. Flexor pollicis lungus muscle. Its morphology and clinical significance. *J Bone Joint Surg Am*. 1960;42:467–70.
8. Kida M. The morphology of Gantzer's muscle, with special reference to the morphogenesis of the flexor digitorum superficialis. *Kaibogaku Zasshi*. 1988;63(6):539–46.
9. Oh CS, Chung IH, Koh KS. Anatomical study of the accessory head of the flexor pollicis longus and the anterior interosseous nerve in Asians. *Clin Anat*. 2000;13(6):434–8.
10. Mahakkanukrauh P, Surin P, Ongkana N, Sethadavit M, Vaidhayakarn P. Prevalence of accessory head of flexor pollicis longus muscle and its relation to anterior interosseous nerve in Thai population. *Clin Anat*. 2004;17(8):631–5.
11. Hemmady MV, Subramanya AV, Mehta IM. Occasional head of flexor pollicis longus muscle: a study of its morphology and clinical significance. *J Postgrad Med*. 1993;39(1):14–6.
12. Shirali S, Hanson M, Branovacki G, Gonzalez M. The flexor pollicis longus and its relation to the anterior and posterior interosseous nerves. *J Hand Surg Br*. 1998;23(2):170–2.
13. Malhotra VK, Sing NP, Tewari SP. The accessory head of the flexor pollicis longus muscle and its nerve supply. *Anat Anz*. 1982;151(5):503–5.
14. Sudhakaran R, Mathew AJ. Gantzer of flexor pollicis longus - a culprit in Kiloh-Nevin syndrome. *Int J Anat Var*. 2014;7:100–102.
15. Hollinshead WH. Textbook of anatomy. 2nd ed. New York: Harper & Row; 1967. p. 205.
16. Kaplan EB, Spinner M. Important muscular variations of the hand and forearm. In: Kaplans functional and surgical anatomy of the hand and forearm. Philadelphia: JB Lippincott; 1984. p. 335–9.
17. Roy J, Henry BM, Pękala PA, Vikse J, Ramakrishnan PK, Walocha JA, et al. The prevalence and anatomical characteristics of the accessory head of the flexor pollicis longus muscle: a meta-analysis. *Peer J*. 2015;3:e1255.
18. Gunnal SA, Siddiqui AU, Daimi SR, Farooqui MS, Wabale RN. A study on the accessory head of the flexor pollicis longus muscle (Gantzer's Muscle). *J Clin Diagn Res*. 2013;7(3):418–21.
19. Raviprasann KH, Das AK, Kulkarni AL. Study of Morphology of Gantzer Muscle in Forearm and its Clinical Significance. *Int J Anat Physiol*. 2019;8(2):261–4.

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