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Entrapment of the Martin-Gruber branch of median nerve in the forearm

Anu Vinod Ranade[1], Bukkambudhi Virupakshamurthy Murlimanju[2], Rajalakshmi Rai[2], and Mohamed Ahmed Eladl[1]

1. Department of Basic Sciences, College of Medicine, University of Sharjah, Sharjah, PO Box 27272, UAE
2. Department of Anatomy, Kasturba Medical College, Mangalore-575004, Manipal University, Manipal, Karnataka, India

CASE STUDY

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Corresponding Author:
BV Murlimanju
Associate Professor
Department of Anatomy, Kasturba Medical College
Manipal University, Mangalore – 575004, India
Email: flutemist@gmail.com

ABSTRACT

We report a rare case of a dual neuro-vascular variation, which was observed in the right extremity of male cadaver. About an inch inferior to the elbow joint, three branches arose from the median nerve. These were the anterior interosseous branch, a Martin-Gruber branch (MGB) and a muscular branch. The MGB coursed infero-medially to join with the ulnar nerve by running posterior to the ulnar artery. It was surprising to observe that the MGB passed between the ulnar artery and its venae comitantes. There was an acute angulation of the MGB here, suggesting entrapment at this site.

Key Words
Martin-Gruber anastomosis, median nerve, neuropathies, ulnar nerve

Implications for Practice:

1. What is known about this subject?
Awareness of the MGB anastomosis is important in understanding traumatic and entrapment neuropathies involving the median and ulnar nerves.

2. What new information is offered in this case study?
This case exhibits a dual variation which potentially doubles the difficulty in making a clinical diagnosis and managing an associated problem.

3. What are the implications for research, policy, or practice?
Anatomical variants, particularly communications (such as the MGB) between major nerves may alter the clinical signs and symptoms of injury to these nerves. It is also important for the clinician to be aware of the possibility of entrapment or injury to a variant.

Background

The variant course and communications between the brachial plexus nerves, median nerve (MN) and ulnar nerve (UN) are reported to cause compression neuropathies and anomalous innervations.[1] The literature suggests two types of communications between MN and UN in the forearm. Martin-Gruber anastomosis (MGB) is the communication which starts at MN and goes to UN.[2] Axons in MGB leave the MN by passing either through the main trunk or through the branches of MN which supplies the deep flexor muscles or traverses its anterior interosseous branch (AIB). They enter the main branch of the UN and MGB supplies intrinsic muscles of the hand.[2] In the second type called Marinacci communication or a reversed MGB, a branch from the UN communicates with the MN.[2] It is believed that the MGB transmits motor; others describe the chances of transmission of sensation.[3] It is believed that the communicating branches between MN and UN can have clinical implications in traumatic and entrapment neuropathies. Sometimes the muscles supplied by the MN escape from paralysis even if there is a complete lesion of the MN, with altered clinical signs and symptoms leading to misdiagnosis of nerve related injury.[4] Our report highlights the clinical significance of MGB in diagnosis and planning an appropriate treatment.

Case details

During the practical teaching of second year medical students at our dissection hall, an unusual neuro-anatomical variation was observed in the right upper extremity of a male cadaver. The MN gave three branches in the upper part of the forearm (Figure 1). The ulnar artery, ulnar nerve and radial nerve were each normal in course and branching. The three branches of MN were identified as muscular branch (MB) to the flexor digitorum profundus, anterior interosseous branch (AIB) and Martin-Gruber branch (MGB). The MGB was unusual as it initially coursed infero-medially to the ulnar artery then became, lateral. At this site, the MGB acutely changed direction between the ulnar artery (UA) and its venae comitantes (VC). It subsequently ran posterior to the UA (Figure 1) to join with the ulnar nerve (UN).

Discussion

Although the literature suggests many anatomical, electro-diagnostic and genetic studies on MGB emphasizing its clinical importance, the nature of MGB still remains imprecise. Developmentally, these variant communications are said to be due to variant signalling among the mesenchyme and the neuronal growth factors.[5] According to Iwata, during the development of the upper limb bud, a single radicular cone, divides into a ventral and a dorsal segment with the roots of median and the ulnar nerve emerging from the former segment.[6] He indicated that failure to differentiate is a factor for the unusual course of the nerves in the brachial plexus leading to a communicating branch. Miller in his studies on the inter-cordal communication and its phylogenetic significance stated that, due to the diminutive forearm and hand in birds, they comprise of only ventral and dorsal cords with a single undifferentiated ulnar and a median nerve supplying their wings. However, due to the gradual development of the shoulder, forearm and hand muscles for finer muscle co-ordination, progressive changes were observed in monkeys and some apes with three cords.[7] Therefore, it is thought that MGB might be a remnant of the anterior trunk.[8]

Srinivasan and Rhodes[9] documented an incidence of 15 per cent MGB in a study conducted on human foetuses. Moreover, they also reported the bilateral occurrence of MGB in foetuses with trisomy 2. Uchida and Sugioka[10] reported an incidence of 16 per cent of cases and also documented the same in 17 per cent of patients with cubital tunnel syndrome. The prevalence rate of MGB documented among the patients with carpal tunnel syndrome was estimated to be up to 26 per cent.[11] In addition to this, some authors have documented the course of MGB, its relationship to the ulnar vessels and its communications. Niedenfuhr et al.[12] reported the occurrence of an intramuscular course of MGB and indicated this could be a possible compression site. The most frequent type of anastomosis is documented to be running obliquely rather than being arched, where the MGB passed posterior to the UA and terminated as a single or two, branches.[13]

The variation documented in the present study may have an additional clinical implication due to the close relationship of the MGB to the VC and the UA, since it acutely changed direction between the two. This may be the site of entrapment leading to nerve compression especially during certain postural manoeuvres of the elbow joint. Patients with nerve entrapment syndromes exhibit characteristic findings and clinical presentations on physical examination, which should be confirmed by radiological imaging.[14] However, some authors claim these communications are difficult to detect through radiological imaging as some of the muscular branches do not cross over the UN. They innervate the muscle directly or the communicating branch is too thin and arises proximal to the elbow joint.[15] These connections have clinical significance, particularly if damaged during surgical procedures.[4]

Conclusion

Although uncommon, communicating nerve variations of the arm and forearm should always be kept in the mind before coming to a diagnosis. This is also essential for a correct clinical assessment of radiological images. Surgeons should be aware of variations to rule out entrapment syndromes as well as unexplained complications related to surgery, or regional anaesthetic block procedures. We believe that the present case is of significance, particularly to orthopaedic surgeons and radiologists.

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CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

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PATIENT CONSENT

The authors, *Ranade AV, Murlimanju BV, Rai R, Eladl MA*, declare that:

1. They have obtained written, informed consent for the publication of the details relating to the patient(s) in this report.
2. All possible steps have been taken to safeguard the identity of the patient(s).
3. This submission is compliant with the requirements of local research ethics committees.

Figure 1: Right forearm of the male cadaver showing the double neurovascular variations (1-median nerve; 2-muscular branch; 3-Martin Gruber branch; 4-anterior interosseous branch; 5-ulnar artery; 6-venae comitantes; 7- ulnar nerve; 8-flexor digitorum profundus muscle)