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Research article

A STUDY TO ANALYZE THE PREVALENCE OF MARTIN GRUBER ANASTOMOSES AMONG MEDICAL STUDENTS

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ABSTRACT

The most frequently occurring anomaly in the upper extremities has been the Martin Gruber Anastomoses (MGA) which occurs due to the crossover of nerve fibers from the median nerve to ulnar nerve. This study was performed to investigate the prevalence of MGA in 100 healthy medical students as it acts as an etiology to carpal tunnel syndrome and other hand injuries. A nerve conduction study for median and ulnar nerve was performed by placing the surface electrodes on the Thenar, Hypothenar and first dorsal interosseus muscle with their Compound Muscle Action Potential (CAMP) and their amplitudes being evaluated. MGA was found in 23 out of 100 volunteers. This relatively high incidence demonstrates the necessity for healthcare specialists to factor the MGA into their diagnosis.

Keywords: Martin Gruber Anastomoses, Nerve Conduction study, Compound Muscle Action Potential

INTRODUCTION

The Martin Gruber anastomoses is a communicating nerve branch between the median nerve and the ulnar nerve in the forearm. It is one of the most common anastomotic anomalies that occur between these two nerves. This connection carries motor nerve fibers. In case of nerve lesions of the median or the ulnar nerves, the Martin Gruber anastomoses can serve as a channel for alternative innervations of portions of the forearm and hand. This inconstant pattern of connection can serve as an explanation for challenging differential diagnosis¹.

Median-ulnar nerve anastomosis in the forearm is the most common form of anomalous

innervations which was first described by Swedish anatomist R. Martin in 1763 and later by Gruber in 1870 and thus referred to as Martin-Gruber anastomoses. These anastomoses involve axons leaving either the main trunk of the median nerve or the anterior interosseous nerve, crossing through the forearm to join the main trunk of the ulnar nerve and ultimately innervating the intrinsic hand muscles²⁻⁴. It is to be noted that not all the axons of the median nerve will be involved in this anomalous route. In the type I anastomosis the cross over fibers terminate in the Hypothenar muscles, in the type II anastomosis the cross over fibers terminate in the first dorsal interosseous, in the type III

anastomosis the cross over fibers terminate in the Thenar muscles⁵.

The main purpose of this study is to draw attention of clinicians or surgeons from neurophysiology field to this anastomosis and to avoid misinterpretations of different studies of needle electromyography and other nerve conduction studies. Therefore for the assessment of traumatic and entrapment lesions of median and ulnar nerve and for surgical landmarks the knowledge of this anastomosis is important.

MATERIALS AND METHODS

100 healthy medical student volunteers of age group 17-22 years were selected for this study. Among them 40 students were male and 60 students were females. An informed consent was taken from the students to whom the study was performed. Subjects with peripheral neuropathies and patients having diabetes mellitus, neuropathy was not included.

The procedure followed to test for MGA is outlined below:⁶

Surface electrodes were placed on the right hand Thenar, Hypothenar and on the First Dorsal Introsseous (FDI) muscles and were left in the same position during the whole of the electrophysiological testing. The median and the ulnar nerves were stimulated supramaxilly at the wrist and the elbow and the compound muscle action potential (CMAP) were recorded with their amplitudes being evaluated.

The electrodes were placed in standard recording, reference and stimulation points. Rectangular pulses of 0.2 m Sec duration were used and the stimulus strength was supramaximal.

The compound muscle action potentials (CMAP) were recorded and the amplitude of each CMAP was measured from the negative to the positive peak of the response (peak to peak amplitude). CMAP from the FDI, Thenar and Hypothenar

muscles larger (at least 1 mv) upon median nerve stimulation at the elbow then at the wrist and CMAP from one or more of these sites larger (at least 1mv) upon stimulation of ulnar nerve at the wrist than at the elbow were accepted as indicators of presence of MGA.

MGA criteria²

A person is said to have Martin Gruber Anastomoses based on the following:

If, on median nerve stimulation on the three muscles-first dorsal interossei, hypothenar and thenar, the amplitude at the wrist is greater than the amplitude at the elbow, or If, on ulnar nerve stimulation on the three muscles-first dorsal interossei, hypothenar and thenar, the amplitude at the elbow is greater than the amplitude at the wrist.

Classification of Martin Gruber Anastomoses

In Type I anastomoses the crossover nerve fibers terminate in Hypothenar muscles.

In Type II anastomoses the crossover nerve fibers terminate in first dorsal interossei muscles.

In Type III anastomoses the crossover nerve fibers terminate in thenar muscles⁵.

RESULTS

MGAs were found in 23 out of 100 subjects tested: Out of these, 5 students were found to be having type I (nerve fibers terminate in Hypothenar muscles), 17 students were found to be having type II (nerve fibers terminate in first dorsal interossei muscle), and 1 student was found to be having type III (nerve fibers terminate in thenar muscles). In the group of 60 women 11 (18.3%) were found to have MGA. In the group of 40 men, 12 (30%) were found to have MGA. There are no significant racial or gender differences in the prevalence of this communication.

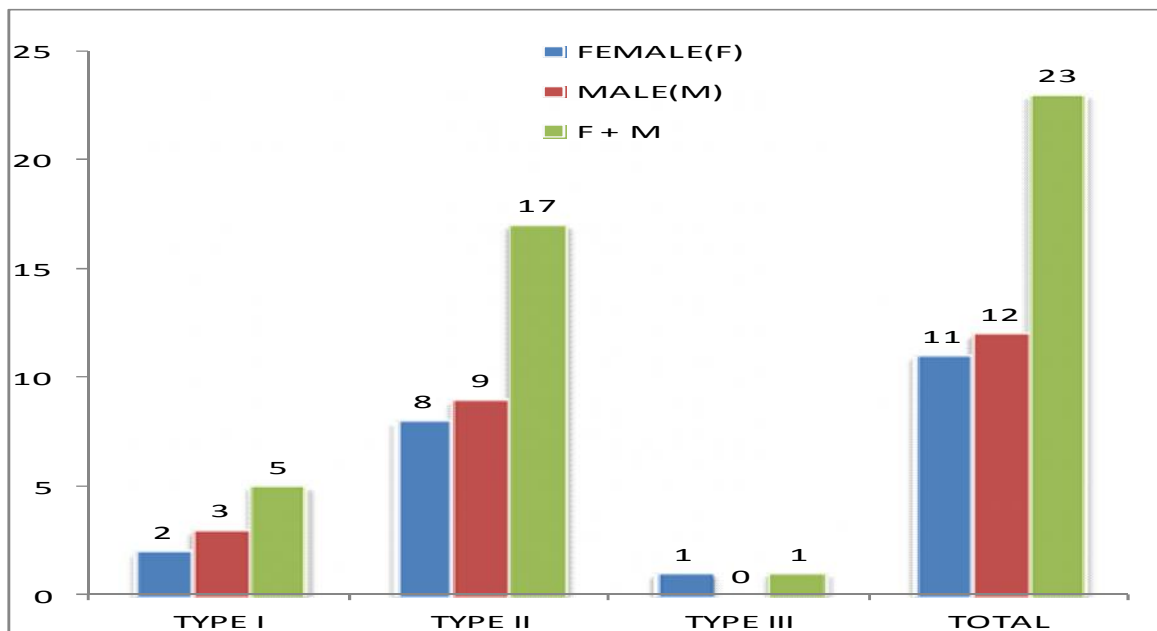


Fig 1: Prevalence of different types of MGA

DISCUSSION

MGA has been causing confusion in the assessment of nerve injuries, carpal tunnel syndrome and leprosy neuropathy. Because of its high prevalence and different electro diagnostic considerations, it can thus be concluded that MGA is frequently encountered and it should be kept in mind that abnormal innervations models might influence the electrophysiological findings and ultimately gives rise to faulty interpretations, particularly in case of median and ulnar nerve lesions. Mannerfelt was the first to use electro diagnostic techniques to detect MGA and reported a 15% incidence in a study of 41%⁷. Crutchfield and Gutmann found an incidence of 28% in the general population and 62% in 29 relatives of 5 subjects with MGA⁸. Gutmann studied 13 extremities with MGA and reported that anomalous innervations were present in all of Hypothenar and FDI muscles and in 6% of Thenar muscles⁹. Several other authors, using electro diagnostic techniques have reported incidences of MGA ranging from 8% to 26% in patients with carpal tunnel syndrome (CTS)^{10,11}.

CONCLUSION

Martin Gruber Anastomoses might lead to the misdiagnoses of many syndromes that affect the nerve supply of the upper limb especially the intrinsic muscles of hand. There were absolutely no noticeable racial or gender differences in the prevalence of this communication. It is important to understand the existence of this communication and its location for correct patient assistance. In our study the incidence of type II MGA was relatively high. Fortunately, this does not present any difficulty in routine ulnar nerve conduction studies because the recording electrodes are not placed on this muscle. A potential difficulty arises in cases of suspected lesions in the deep palmar branch of the ulnar nerve, because the recording electrodes should be placed on the dorsal interosseous muscle¹⁰.

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