

Incidence of Martin-Gruber Anastomosis in Turkey: A Cross-Sectional Study

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Abstract: Martin-Gruber anastomosis (MGA) is a well described anastomosis between the median and ulnar nerves in various levels. MGA involves axons leaving either the main trunk of median nerve or the anterior interosseous nerve, crossing through the forearm to join the ulnar nerve and its incidence was reported as %10-40. The incidence of this anastomosis is important so that it can cause confusion in the assessment of nerve injuries, compressive neuropathies and it can show different percentages between different population groups. Our objective is to find out an idea about the incidence of MGA in Turkish population. 100 healthy volunteers were included to our study between an age of 17–73 years. Compound muscle action potentials (CMAPs) and motor conduction velocities of median and ulnar nerves were recorded. MGA was made by following criteria: amplitude of CMAP increased after median nerve stimulation at ante-cubital fossa as compared to stimulation at wrist. The corresponding decrease in CMAP amplitude was found after below elbow stimulation as compared with the wrist stimulation in ulnar nerve conduction studies. Martin-Gruber anastomosis was encountered in 29(6 male, 23 female) patients with a percentage of 29% in our present study. The incidence of MGA in Turkish population is high. Understanding the existence of this anatomic variation, its location and its possible presentation is important for the patient's quality of life. More studies with increased study groups are needed to make us better understand this condition and its incidence in our population.

Keywords: Median Nerve, Ulnar Nerve, Anastomosis, Quality of Life

1. Introduction

Median and ulnar communication was first described by the Swedish anatomist Martin (in 1763) and later by Gruber (in 1870) and thus referred to as the Martin-Gruber Anastomosis (MGA). In Martin's cadaver dissections, various forms and connections were described. [1-3] This anastomosis involves axons leaving either the main trunk of 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 muscles. [1-4]

Median-ulnar anastomosis (Martin-Gruber anastomosis) is a common anatomic variant. The crossover often occurs in mid-forearm. Median fibers that have crossed then run with distal ulnar nerve to innervate any of following ulnar muscle: Abductor digiti minimi (ADM), first dorsal interosseous (FDI), adductor pollicis, deep head of flexor pollicis brevis, or combination of these. The FDI is the most common termination (34%), followed by hypothenar (15.5%) and then

thenar (12%) musculature. This anomaly is generally asymptomatic.

In anatomical studies MGA is found in 10%-30.6% while in physiological studies the range becomes wider to 5%-40% [5].

Our objective is to find out the incidence of Martin-Gruber anastomosis in Turkish population.

2. Materials and Methods

36 male, 64 female (total 100) healthy volunteers were included to our cross sectional study and the subjects were between an age of 17–73 years with a median age of 42 years. Individuals having or reported a history of neuropathy, limb injury or ulcer, neuromuscular transmission disorder, myopathy, and alcohol abuse were excluded from the study. The patients were examined to exclude history of systemic or neuromuscular disorder. Relevant clinical history was taken and neurological examination was carried out. The study was carried out at a fixed room temperature of 30°C. Surface

recording electrodes were used in nerve conduction studies. At each subject, electrodes were placed on the hand abductor pollicis brevis, abductor digiti minimi, and the first dorsal interossei. We stimulated the median and ulnar nerves supramaximally at the wrist and the elbow and compound muscle action potentials (CMAPs) and motor conduction velocities of median and ulnar nerves were recorded.

MGA was made by following criteria: amplitude of compound muscle action potential (CMAP) increased after median nerve stimulation at ante-cubital fossa as compared to stimulation at wrist. The corresponding decrease in CMAP amplitude was found after below elbow stimulation as compared with the wrist stimulation in ulnar nerve conduction studies.

Analysis was done using statistical package for social sciences (SPSS) 16.0 version. P value was taken as significant if found to be less than 0.05.

3. Results

100 patients were evaluated by one specialist and by the same ENMG (electroneuromyography) device electrophysiologically. The patients had no clinical complaints before starting the study. Communication between the median and ulnar nerves (Martin-Gruber anastomosis) were observed in 29 patients.

All the patients have MGA bilaterally. The percentage of Martin-Gruber anastomosis is 29% in our present study. 6% (6) were male and %23(23) were female.

Table 1. Age, gender and MGA ratio's.

AGE(17-73)	MALE	FEMALE
MGA	6	23
TOTAL	36	64

4. Conclusion

Nerve communication between the median and ulnar nerves in the forearm, which is known as Martin-Gruber anastomosis, causes transfer of nerve fascicles from the median nerve to the ulnar nerve. This gives rise to alteration of the normal anatomical pattern of the motor and sensory innervation of the hand. It was first described by Martin, who considered the possibility of communication between these nerves in the forearm. 100 years later, in 1870, Gruber dissected 250 forearms and found communication between these two nerves in 38 of them [6].

One of the most important anastomoses of nerves in the upper extremity is Martin-Gruber anastomosis (MGA). In this, there are crossovers of nerve fibers in the forearm between median and ulnar nerves. Communication between the median and ulnar nerves in the hand and in the forearm shows variations in the innervations of the intrinsic hand muscles, as proved by anatomical and nerve conduction studies. Most of the connections cross from the median nerve to the ulnar nerve and are bilateral in 10%–40% of the cases. This anomaly was first described by the Swedish anatomist

R. Martin in 1763 and later by Gruber in 1870 and is thus referred to as the Martin-Gruber anastomosis (MGA). The axons in this anastomosis may innervate any of the intrinsic hand muscles, most commonly the FDI. Various forms and connections were found in Martin's cadaver dissections. This anastomosis involves axons leaving either the main trunk of 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 muscles. MGA may lead to misdiagnosis of conditions affecting the nerve supply to the upper extremity, particularly intrinsic muscles of hand. So for the assessment of traumatic and entrapment lesions of median and ulnar nerves, it is important to have the knowledge of these anastomoses [7].

The incidence of nerve communication between the median and ulnar nerves in the forearm is variable and this becomes more marked when the results obtained through electroneuromyographic studies are compared with those from anatomical dissections [6]. Martin-Gruber anastomosis (MGA), or median-to-ulnar nerve communication in the forearm, is not uncommon. The mean incidence is 20%, but incidence has been reported to be as high as 54%. This communication may be bilateral in up to 73.6% of cases. The intrinsic muscles of the hand can be completely unaffected by median lesions. A lesion of the median nerve situated proximal to the departure of the communicating branch would affect the median thenar muscles, whereas a lesion below that level would not. In addition an ulnar nerve lesion at the elbow may produce an unusual pattern of intrinsic muscle paralysis. Although some research claims the cross over to be purely motor in nature, other studies lend to the possibility that sensory fibers may be involved as well. Thus abnormal symptoms of sensory radiation may be produced.

When we analyse the literature: in anatomical studies MGA was found in 10%-30.6% while in physiological studies the range becomes wider to 5%-40% [5].

Erdem HR et al reported an MGA incidence of 27% from 100 patients from Turkey, and their findings were similar to our report. [1]

Felipe MM et al reported an incidence of 10% and Prates LC et al reported an incidence of 7.8% [8], from Brazil [2] and Kaur N et al reported 11.6% from India [5] by an anatomical study. Pawar S et al reported an incidence of 12% from India [4], Hodzic R et al reported an incidence of 33% from Bosnia [10] and Khosrawi S et al reported an incidence of 14.4% from Iran [11] by an electrophysiologic study.

Our incidence is higher than most of the other population results, and that increases the importance of MGA in our country.

The presence of Martin-Gruber anastomosis in the forearm results in unusual innervation of hand muscles. MGA has been shown to cause confusion in the assessment of nerve injuries, cubital tunnel syndrome, compressive neuropathies and traumatic lesions of median and ulnar nerves. [5, 8-12]

This anastomosis can be diagnosed by detecting the difference in the compound muscle action potential (CMAP) recorded from the hand muscles when the median and ulnar

nerves are electrically stimulated at the wrist and the elbow.

The Martin-Gruber anastomosis suggested that unilateral MGA occurs more often in the right side than the left. But no differences were reported with respect to the frequencies of MGA or MGA types for the sexes.

Knowledge of the anatomical variations relating to innervation of the hand is important with regard to performing physical examinations, making diagnoses, determining the prognosis and implementing surgical treatment. If these variations are not given their proper value, errors and consequences will be inevitable.

At the time, when a patient is in a carpal tunnel surgery, attention to anatomical variations is of obvious importance, particularly with respect to the palmar cutaneous nerve and the recurrent branch of the median nerve. Interestingly, considering the incidence of such variations, not many related complications have been reported during endoscopic carpal tunnel release, where many of the variations cannot be seen intraoperatively. Regardless of the approach to carpal tunnel release, it is imperative that plastic surgeons be cognizant of these variations and be vigilant during carpal tunnel release.

We concluded that MGA has a relatively high incidence in the Turkish population. Because of its high incidence and different electrodiagnostic considerations, MGA should be considered to be of great clinical significance for correct diagnosis and for planning appropriate therapy in peripheral lesions of median and ulnar nerves.

Future studies (anatomical and electrophysiological) with increased study groups are needed to make us better understand this condition and its incidence in our population.

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