“DANGEROUS” ANATOMIC VARIETIES OF RECURRENT MOTOR BRANCH OF MEDIAN NERVE

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Carpal tunnel release became one of the most common operations in the field of hand surgery. Many controversies has been made about frequency of the so-called dangerous variations of motor branch of the median nerve. Knowledge of all the anatomical variations motor branches is the duty of every surgeon dealing with the subject.

The aim of the study was to present the incidence of dangerous variants of median nerve motor branch in the carpal tunnel based on both clinical experience and anatomical studies performed on 20 cadaver wrists.

Material and methods. Between 2006-2012 during minimally open carpal tunnel release we made photographic documentation of all visible dangerous varieties of recurrent motor branches of the median nerve. We also studied 20 cadaver wrists in the Department of Anatomy Medical University in Wroclaw.

Results. Dangerous varieties of the motor branch of median nerve was found in three clinical cases and in one cadaver wrist. Also In one wrist we found one regular branche, which, however, has atypical two separate branches supplying the thenar muscles.

Conclusions. Dangerous varieties of the motor branch of median nerve occur very rare in the population, but does not release from the fact that in each case special attention must be given.We also conclude that, at the minimally open carpal tunnel release procedure, the transverse carpal ligament should be released rather from the line of radial border of the 4th finger to minimize the risk of injury to the recurrent motor branch of median nerve.

Key words: median nerve, recurrent motor branch, carpal tunnel, hand anatomy

Knowledge of the anatomy of the carpal tunnel allows to minimize the risk of inadvertent injury to the recurrent motor branch of the median nerve. Within the tunnel there are numerous variations of the recurrent motor branch of the median nerve. The most common anatomical variation of the recurrent motor branch (RMB) is the extraligamentous one. Less frequently the recurrent motor branch leaves the median nerve deep to the transverse carpal ligament, and passes around the distal edge of the transverse carpal ligament to enter the thenar musculature as a subligamentous branch. Least frequently the recurrent motor branch diverges from the median nerve within the limits of the carpal tunnel and perforates the ligament to the thenar muscles as a transligamentous branch (1). The highest risk of injury is associated with the transligamentous and ulnar variants of. There is no unique correlation between the presence of the distal tunnel and the motor branch orientation in the median nerve (2).

In the distal forearm, the median nerve lies superficially between the tendons of flexor digitorum superficialis (FDS) and flexor carpi
The palmar cutaneous branch of the median nerve then enters the deep antebrachial fascia, and passes superficially to the flexor retinaculum to give off one radial and one or multiple ulnar branches which provides sensory innervation to the palmar skin of the proximal hand. After exiting the carpal tunnel the median nerve divides into six terminal branches. The recurrent motor branch supplies the thenar muscles (flexor pollicis brevis – FPB, abductor pollicis brevis – APB, and opponens pollicis – OP). The first lumbrical muscle is innervated by motor branches that originate from the radial proper digital nerve to the index finger; the second lumbrical muscle is innervated by motor branches that originate from the second common digital nerve (3, 4).

In this paper we present our experience, both in minimally open carpal tunnel release surgery and cadaveric studies of the wrist.

**Lanz classification**

The most common anatomical variations of the median nerve have been described and classified by Lanz in 1975 into five groups (5):

Group 0 – regular branch of the median nerve.


Group II – accessory branches of the median nerve at the distal carpal tunnel.


Group IV – accessory branches proximal to the carpal tunnel: IV A – direct to the thenar muscles, IV B – joint to another branch.

**MATERIAL AND METHODS**

Between 2006-2012 during minimally open carpal tunnel release we made photographic documentation of all visible dangerous varieties of recurrent motor branches of the median nerve. Anatomical studies of 20 adult cadaver wrists fixed with ethanol were conducted at the Departament of Anatomy in Wroclaw Medical University. Permission to conduct research was obtained by the ethics committee at the University – KB- 7/2013.

**RESULTS**

At our department during the minimally open carpal tunnel release procedure in the vast majority of patients the „dangerous” anatomic variations of the median nerve were not seen. We reported one case of transligamentous variation of RMB of the median nerve (fig. 1) and two cases of the ulnarward RMB (fig. 2). The results of dissection were also presented – only one case of transligamentous RMB (fig. 3) and one case with two thenar branches sup-
plying the thenar musculature – Lanz II (fig. 4), while a regular RMB of the median nerve were found in the remainder of cases (fig. 5).

DISCUSSION

Poisel (6) described three subtypes of RMB: 46% of cases were extraligamentous, 31% were subligamentous, and 23% were transligamentous. In comprehensive studies Tountas and coauthors (7), Olave et al. (8, 9), and Kozin (10) reported the same basic subtypes as Poisel; however, they observed different frequencies. In 80%–90% of cases an extraligamentous RMB was found. These discrepancies may be explained by the different dissection techniques and/or populational differences. The transligamentous course is of significant clinical importance due to the susceptibility to compression within the retinacular fibers (11, 12). Also, the transligamentous variant of the recurrent motor branch is at greater risk of sustaining injury during both endoscopic as well as open carpal tunnel releases. Perforations of the flexor retinaculum occurred at various levels, joining a branch or the median nerve distally (5, 13). A high division of the median nerve in which the radial part passes through a separate compartment of the carpal tunnel was described by Amadio is also at a similar risk (14). The majority of the branches leave the median nerve radially or on its palmar aspect. Therefore at surgery, the nerve is approached rather from the ulnar side to minimize the risk of injury to the typical branches; nonetheless, in rare cases the RMB may originate from the ulnar side of the median nerve, and thus sustain injury despite the ulnar approach of the surgery.

Mizia et al. (15) in their study of 60 wrists (30 adult cadavers) observed that 43 hands had Lanz type IA variant branching of the thenar branch of the median nerve (71.7%), and 17 hands had other variations (28.3%). Five out of the 17 hands had Lanz type II variations with an accessory branch at the distal carpal tunnel (8.3%). Both branches originated from the first common digital palmar nerve. High division of the median nerve (Lanz type III) was found in three hands (5%) in association with a persistent median artery. An accessory branch proximal to the carpal tunnel was observed in four hands (6.7%), a variation known as Lanz type IV.
After leaving the median nerve, the accessory motor branch ran within the carpal tunnel and perforated the transverse carpal ligament and gave off fibres to the muscles of the thenar eminence. There were two hands in which two motor branches were observed, but the accessory motor branch originated from the median nerve in the carpal tunnel. Senanayake also dissected 60 wrists from adult cadavers (16) Extraligamentous variant was found in 53 hands (88%) and the subligamentous variant found in 7 hands (12%). However, no case of transligamentous variant was observed. Vashishtha published a case report of an unusual motor branch of the median nerve (17). She found seven thenar branches supplying the thenar musculature. One branch was arising from the main trunk of median nerve, second from the lateral aspect of lateral division of median nerve, third from the medial aspect of lateral division of median nerve, fourth from the lateral aspect of lateral division of median nerve slightly distal to second branch. Fifth, sixth and seventh were arising from the proper palmar digital nerve to the lateral aspect of thumb. Also, out of 50 studied cadaver wrists there was only one transligamentous variant of RMB. The abovementioned data confirms the unpredictable course of the RMB. Furthermore, it makes a strong case that at minimally open carpal tunnel release procedures the operator should confirm that:

1) the transverse carpal ligament was dissected completely,
2) the RMB was not injured (18-21).

CONCLUSIONS

1. Dangerous varieties of the motor branch of median nerve occur very rare in the population, but does not release from the fact that in each case special attention must be given.
2. We also conclude that, at the minimally open carpal tunnel release procedure, the transverse carpal ligament should be released rather from the ulnar side of the carpal tunnel to minimize the risk of injury to the recurrent motor branch of median nerve.

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