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Surgical Utility of the Lanz Classification of Median Nerve Ramification

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Rezumat

Utilitatea chirurgicală a clasificării lui Lanz a ramificațiilor nervului median

Autorii comentează clasificarea lui Lanz privitoare la ramificarea nervului median la nivelul încheieturii pumnului. Autorii subliniază importanța cunoașterii acestei clasificări de către chirurgii plastici, ortopezi, neurochirurgi și chirurgii de chirurgia mâinii, pentru a preîntâmpina leziunile iatrogene ale ramurilor nervului median la încheietura pumnului. Anatomia regională este esențială pentru chirurgia sindromului de canal carpal, mai ales tehnicile mini-invasive și endoscopice.

Cuvinte cheie: nervul median, ramurile nervului median, clasificarea lui Lanz, leziuni iatrogene, chirurgia canalului carpal

Abstract

The authors comment on the Lanz classification of the median nerve ramification at wrist level. The authors outline the importance of having very good knowledge of this classification for hand surgeons, plastic surgeons and neurosurgeons, in order to prevent iatrogenic lesions of the median nerve branches at wrist level. The regional anatomy is of utmost importance for carpal tunnel syndrome surgery, especially the mini-invasive and endoscopic techniques.

Key words: median nerve, median nerve branches, Lanz classification, iatrogenic lesions, carpal tunnel surgery

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Introduction

Lanz published in 1977 an anatomical classification of the median nerve branching at wrist level (1). This classification was elaborated after surgically exploring the carpal tunnels in 246 hands. Lanz found 29 anatomical variations of the course of the median nerve, 18 situations in which the median nerve had accessory branches in the terminal portion of the carpal tunnel, 4 situations in which the accessory branches had emerged in the initial portion of the carpal tunnel and 7 hands with high division of the median nerve (1). Apart from Lanz classification, another group of anatomical variations is known under the name of Martin-Gruber anastomoses and have different clinical and surgical implications (2).

Carpal tunnel syndrome is the most common entrapment neuropathy (3,4). Detailed knowledge of the anatomical variations of the median nerve at wrist level, is mandatory in order to perform safe and efficient carpal tunnel syndrome surgery.

The median nerve travels together with 9 tendons (wrapped in synovial sheath. Through the carpal tunnel (3,4,5), which is the only "pathway between the flexor compartment of the forearm and the midpalmar space" (6). In this tunnel, the median nerve gets constricted due to various causes. The

surgical treatment of carpal tunnel syndrome has 3 objectives (3,4):

- decompression of the median nerve;
- microsurgical neurolysis (if necessary);
- elimination of the cause of nerve constriction, when possible (synovial hypertrophy, osteophyte, lunate volar luxation, scaphoid fragment volarly displaced, amyloid, etc).

Decompression of the median nerve consists in complete section of the flexor retinaculum with mechanical protection of the median nerve and its branches (3,4,5). It is during this surgical decompression that the median nerve or one of its branches may be severed. The risk is higher with the use of mini-invasive or endoscopic procedures and lower when using the "classic" open approach (7,8). And, of course, this risk is different for each type of median nerve ramification.

Surgical risk in the Ist group by Lanz and Poisel

This group includes all the trajectory variations of the thenar ramus of the median nerve (1,9).

The most common anatomical situation is the extra-ligamentous one, in which the thenar branch emerges from the median nerve distal to the distal margin of the flexor retinaculum, then has a recurrent trajectory towards the thenar eminence (10,11). This is the safest situation if the decompression is made by cutting the flexor retinaculum "adjacent to the hook of hamate" (6). In this situation, it is practically impossible to intercept the thenar ramus if the surgical technique is accurate.

The second anatomical situation as frequency is the sub-ligamentous one, in which the thenar ramus originates from the median nerve in the carpal tunnel. It leaves the carpal tunnel together with the median nerve, then curves towards the thenar eminence (1,9,10). The thenar ramus may be harmed during the surgical decompression of the median nerve, especially in the mini-invasive technique.

The third anatomical situation in the Ist group is the transligamentous one, in which the thenar branch emerges from the median nerve in the carpal tunnel, then perforates the flexor retinaculum and enters into the thenar eminence (1,9,10). Two considerations must be made in connection to this anatomical variation. First, the thenar ramus might be compressed within its transretinacular course (12,13), so the median nerve decompression will not alleviate the motor symptomatology but only the sensitive one. Secondly, the thenar ramus is at high risk to be surgically damaged, especially if the surgical cut of the flexor retinaculum is not close to the hamate.

There are two other anatomical variants that might be included in the first group by Lanz.

The situation in which the thenar ramus arises from the ulnar side of the median nerve trunk (1,4,13). It crosses volarly the median nerve trunk, then emerges from the carpal tunnel and curves itself towards the thenar eminence. It may be considered as a particular case of the second anatomical situation. The motor branch of the median nerve is at high risk to be cut during the decompression of the carpal tunnel.

The situation in which the thenar ramus originates from the median nerve trunk in the carpal tunnel. It emerges from the carpal tunnel, then bends across the flexor retinaculum and has a variable supra-ligamentous trajectory before entering the thenar eminence (4). The thenar ramus truly lies on the top of the flexor retinaculum, being called the supra-ligamentous variant (4,6,13). The thenar branch is exposed to iatrogenesis during the decompression of the carpal tunnel by cutting the flexor retinaculum.

Surgical risk in the IInd group by Lanz

The IInd group by Lanz comprises the duplication of the thenar ramus and thin additional sensory branches that leave the palmar or the ulnar aspect of the median nerve trunk (6). This situation was reported in 7,2% of cases (1,6). The surgical risk is rather low, if the flexor retinaculum is cut as close to the ulnar nerve as possible. Frequently, this anatomical variant is overlooked during the surgical treatment of carpal tunnel syndrome.

Surgical risk in the IIIrd group by Lanz

This group comprises all the situations with high division of the median nerve at the level of the forearm. It accounts for 2,8% of the cases (1,6). The division of the median nerve results in two parts: an ulnar part and a radial part. In most of the situations the thenar ramus emerges from the radial part. The IIIrd group has several subgroups.

The first subgroup includes high division of the median nerve without a median artery. Sometimes the ulnar part is thick, other times the radial part is thick. Rarely, the two divisions of the median nerve are equal in size. The surgical risk is low for the thenar ramus and common for the ulnar division of the median nerve.

The second subgroup consists in the persistence of the median artery between the two parts of the median nerve. In this situation, the surgical risk exists for the median artery, especially with mini-invasive techniques.

The third subgroup consists in high division of the median nerve and the presence of an accessory lumbrical muscle between the two parts of the median nerve (14). In this situation the radial part of the median nerve is at risk to be severed during the surgical decompression of the carpal tunnel.

The fourth subgroup consists in high division of the median nerve with the radial part of the nerve passing through its own separate compartment of the carpal tunnel (15). The radial division might not be decompressed if the flexor retinaculum is cut on its ulnar part. If the flexor retinaculum is cut on its radial side, the thenar branches, emerging from the radial division, might be intercepted and severed.

Surgical risk in the IVth group by Lanz

This group includes the situations in which accessory branches of the median nerve emerge from the main trunk, proximal to the carpal tunnel (1,6,17,18). This anatomical variant is found in 1,6% of cases (1,6). There are four subgroups in this category.

First subgroup, when the accessory branch originates from the main trunk proximal to the carpal tunnel, escorts the median nerve through the carpal tunnel, then emerges from the tunnel and joins the median nerve or the thenar branch (1,6,18). The surgical risk in this situation is low.

Second subgroup, when the accessory branch originates from the main trunk proximal to the carpal tunnel, escorts the median nerve through the carpal tunnel, then perforates the flexor retinaculum and joins the nerve trunk or a ramus of the median nerve (1,6,18). The surgical risk is high for the accessory branch that perforates the flexor retinaculum.

Third subgroup, when the accessory branch sprouts proximal to the carpal tunnel, from the ulnar border of the median nerve trunk (1,6,18). This branch crosses the main trunk, then escorts the median nerve for a variable distance, in the carpal tunnel. Further, the accessory branch perforates the flexor retinaculum and joins a branch of the main trunk. The surgical risk is double, because the branch emerges from the ulnar side of the main trunk and because it perforates the flexor retinaculum. Any place of those mentioned above, is a place where the accessory ramus may be intercepted by the surgeon. Although rare, as other anatomical variations in other surgical specialities (19,20), this anatomical variation must be very well known by the hand surgeon.

The fourth subgroup, when the accessory ramus emerges from the radial side of the main trunk proximal to the carpal tunnel, enters the carpal tunnel and then joins directly the thenar eminence muscles (1,16,18). There is a surgical risk for the accessory branch only if the decompression is performed on the radial side of the flexor retinaculum.

Discussion

Lanz classification offers an anatomical tool for the evaluation of the anatomical particularities and of the surgical risks in wrist surgery generally and in carpal tunnel surgery especially.

With modern imagistic investigations-peripheral nerve ultrasound, Magnetic Resonance Imaging (MRI) - the surgeon may discover, before the surgical operation, what type of ramification does the median nerve present at wrist level. These findings permit a choice for the best surgical technique: classic open surgery, mini-invasive surgery or endoscopic surgery.

For example, endoscopic surgery puts the thenar ramus at high risk in trans-ligamentous, sub-ligamentous and supra-ligamentous type I Lanz subgroups.

Both endoscopic and mini-invasive techniques have a high risk to inflict iatrogenic lesions of the thenar ramus in all the situations in which this branch originates from the ulnar border of the median trunk, be it in the carpal tunnel (type I Lanz) or proximal to the carpal tunnel (type IV Lanz).

Conclusions

Before surgery, it is advisable to determine, by ultrasound or MRI, the type of ramification of the median nerve at wrist level.

If during a mini-invasive or endoscopic surgical procedure the surgeon identifies one of the situations with high risk to produce lesions to the main trunk or to the thenar ramus, the operation should be converted to the classic open technique.

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