UNIVERSITATEA DE MEDICINĂ ȘI FARMACIE
"CAROL DAVILA" din BUCUREȘTI

THE UNIVERSITY OF MEDICINE AND PHARMACY
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PHD THESIS SUMMARY

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Carpal tunnel syndrome: pathogenesis, clinic and endoscopic treatment

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INTRODUCTION

Carpal tunnel syndrome (CTS) is a common condition that affects the hand and wrist and occurs when the median nerve, which passes through the carpal tunnel at the wrist, becomes compressed. Symptoms of carpal tunnel syndrome can include numbness, tingling, weakness, and pain in the affected hand and wrist, which can have a significant impact on a person's quality of life and ability to perform everyday tasks.

The motivation for choosing the theme is that carpal tunnel syndrome is an area of active research and clinical interest, with a number of ongoing studies seeking to improve our understanding of the condition, its pathogenesis (underlying causes and mechanisms) and the more effective treatments.

The novelty and practical importance of the study lies in the endoscopic technical implementation.

On the topicality of the topic, carpal tunnel syndrome is a common condition that affects a large number of individuals, especially those who perform repetitive hand movements or work with vibrating tools. The prevalence of carpal tunnel syndrome is expected to continue to rise due to rising rates of obesity and diabetes, which are risk factors for the condition.

International, national and regional research groups have a strong interest in carpal tunnel syndrome due to its prevalence and impact on people's lives (Sano, 2008; Themes, 2016; Wolfe et al., 2021; Lupescu, 2006). The pathogenesis of carpal tunnel syndrome is not yet fully understood, and ongoing research aims to elucidate the underlying mechanisms. Understanding the pathogenesis of carpal tunnel syndrome can help identify risk factors and develop new treatments to alleviate symptoms and prevent the condition from developing.

The general objective of the research:

Choosing the moment of the surgical intervention and the endoscopic surgical technique that relieves the symptoms, reduces the recovery period, complications and recurrences.

Specific objectives:

O1. Realization of a preoperative evaluation methodology.

O2. Creation of a diagnostic guide and endoscopic treatment of carpal tunnel syndrome.

O3. Analysis of complications and recurrences in the endoscopic method,

O4. Analysis of the association of obesity, smoking, diseases as a risk factor.

O5. Analysis of the peculiarities and variations of the carpal tunnel and the median nerve.

O6. Analysis of patients with recurrences after classic surgical treatment after the endoscopic technique.

The study was carried out prospectively in the period 2017-2020 in which it was enrolled in a group of patients diagnosed with carpal tunnel syndrome hospitalized at the Arca Life Clinic in Bucharest and who requested endoscopic technique.

For the patients admitted to the Arca Life Clinic with the diagnosis of carpal tunnel syndrome and enrolled in the study, a methodology was established that consists of: anamnesis, clinical examination, electrophysiology, blood samples and imaging.

The statistical analysis of the data was performed using the IBM SPSS version 26 program.

In order to perform the analysis, descriptive statistics, mean and standard deviation were performed, the Wilcoxon test and the CHI square association test were applied.

Regarding the research results obtained from the analysis of the personal and clinical characteristics of the patients, we found the following:

The study involved 62 hands in 53 patients, 19 men (36%) and 34 women (64%), aged between 30 and 80 years (M=59.6 years, SD=3.12). Before the operation, the patients had numbness in the palms and fingers (25 patients), decreased muscle strength (25

patients), paresthesias (20 patients), nocturnal wrist pain and weakness (8 patients), thenar atrophy (10 patients).

Clinical signs disappeared after 6 months in 95% of patients. 18 patients had general anesthesia and 35 local anesthesia.

Before surgery, Phalen, Durken and Tinel's test were positive for 95% of the hands, after 6 months no patient has a positive test.

Postoperative median nerve: electroneuromyography complete recovery after 6 months for 94% of patients. Before surgery, 15 women and 12 men had the right hand affected, 11 women and 6 men had the left hand affected; and 8 women and one man had bilateral lesions.

Regarding the differences between men and women regarding the occurrence of this condition, we randomly selected from the number of women an equal number of men in the sample. Thus, we identified statistically significant differences.

Between men and women regarding the occurrence of carpal syndrome, women recorded significantly lower results than men in the Phalen, Durken and Tinel tests.

We also observed that there are statistically significant differences between Phalen, Durken, and Tinel's results

The average delay for returning to normal activity was appreciably less in the group subjected to endoscopic carpal syndrome. In our study, 94% of the participants had a rapid recovery, as shown by the results of the Phalen, Durken, and Tinel tests.

Limits of research

The studies were applied to a small number of patients, so the data cannot be generalized.

Future research directions

In the following study we aim to determine the causal pathway between sex and Carpal Tunnel Syndrome that could include several determinants, such as hormonal factors, anthropometric and non-occupational characteristics, exposure to biomechanical overload (eg household tasks).

I. GENERAL PART

CHAPTER 1. THE CARPIAN CANAL SYNDROME

Carpal tunnel syndrome (CTS) is currently the most common neuropathy of peripheral nerve compression affecting approximately 1% of the population.

The incidence of SCC appears to be increasing.

Carpal tunnel syndrome (CTS) represents the compression of the median nerve at the level of the wrist and the most common neuropathy at the level of the upper limb.

Paresthesias, especially nocturnal pains, numbness and weakness of the hand, tingling, atrophy of the tendon muscles are the most common clinical signs of SCC in addition to the Tinel sign, the Phalen and Durkan test.

The causes of SCC include: idiopathic, hereditary, infectious, endocrinological, metabolic, hematological, renal, rheumatic, traumatic and tumoral.

The diagnosis is basically based on the clinical signs, then it goes to the paraclinical analyses: electromyography (EMG), nerve conduction velocity, radiology, ultrasound, MRI and laboratory tests.

Treatment: a number of treatment methods have been tried over time.

The carpal tunnel is formed by the carpal bones and the transverse carpal ligament that forms the roof of the canal and extends from the hamate bone (hook bone) and

triquetrium (pyramidal bone) on the ulnar side to the scaphoid and trapezium on the radial side.

Through this channel pass the median nerve which is accompanied by the artery of the median nerve wrapped in a "perinerve" sheath and the flexor tendons which are wrapped by the synovial sheath, through which they help the proper functionality of the flexor apparatus under normal conditions (flexor pollicis longus, four superficial flexors of the fingers and four deep flexors of the fingers).

Also at the level of the wrist there is a channel through which the ulnar vascular-nerve bundle passes called Guyon's channel, which may or may not be affected at the same time as the carpal tunnel syndrome.

The direct cause of carpal tunnel syndrome remains uncertain, but there are general and local causes associated with carpal tunnel syndrome that can alter the normal pressure in the carpal tunnel and lead to the appearance of the syndrome either by narrowing the carpal tunnel or increasing the volume of the contents in the carpal tunnel.

CHAPTER 2. CARPAL CANAL SYNDROME CLINIC

Carpal tunnel syndrome presents itself in two clinical forms: chronic and acute. At the beginning of the chronic form, the symptomatology appears with certain provocative movements and maneuvers, for example, prolonged application of pressure on the median nerve, prolonged flexion of the fist, especially in a raised position (Padua et al. 2016). The first symptoms that appear and worry the patients are the sensitive ones: nocturnal paresthesias (hypoaesthesia) appearing at the level of the ÎI finger +\- the III finger, which are relieved by moving the fingers or massaging the fist and fingers. Then pains in the fist begin to appear in the morning (morning pains). These sensitive symptoms begin to disturb patients and wake them up from sleep, especially when they are repeated several times during the night.

In the acute form, the symptoms are very pronounced, the pain is severe and is not limited to the territory of the median nerve, any movement at the level of the fist of the fingers is very painful.

Acute forms are caused by acute tenosynovitis, hemorrhage (hematoma) in the carpal tunnel, dislocations and fractures of the carpal bones, posttraumatic edema and acute infections.

Characteristic anamnestic data and careful clinical examination are sufficient to establish the diagnosis.

Challenging clinical tests (Phalen, Tinel and Durken) are simple to perform and do not impose additional costs.

Paraclinical investigations provide additional data (electromyography (EMG), nerve conduction velocity, radiology, ultrasound, MRI and laboratory tests).

Electrodiagnosis is a test or a paraclinical study of the analysis of the muscular and nervous system, which evaluates the transmission of the motor, respectively sensitive nerve impulse, which helps the specialist to obtain a diagnosis or prognosis, after the anamnesis and the clinical examination have been carried out.

Over time, the following have been tried as treatment methods:

- conservative by rest and embolization, treatment with topical anti-inflammatories or infiltrates at the level of the carpal tunnel (in rare cases)

- surgical treatment through the classical or endoscopic technique, which are more effective than conservative treatment, which is considered a kind of postponing the moment of surgical interventions.

CHAPTER 3. ENDOSCOPIC SURGICAL TREATMENT

Since Phalen introduced and popularized carpal tunnel decompression in the 1950s, open transection of the LTC has become the gold standard in the surgical treatment of this condition.

However, several disadvantages have been associated with the open technique (OCTR), including pillar pain, hand weakness, sensitivity to scarring, delayed return to work, and slower return of function.

In the history of carpal tunnel endoscopy, two main techniques for relaxing the carpal tunnel have been described; "one portal procedure" and "duel portal procedure".

For the first time, the endoscopic technique was introduced in the relaxation of the carpal tunnel "one portal procedure" in 1986-1987 by Okutsu, a Japanese orthopedic doctor.

Then, in 1989, the "duel portal procedure" technique was introduced by Chow, an orthopedic doctor.

The two techniques have been modified by other doctors.

II. THE SPECIAL PART

CHAPTER 4. RESEARCH METHODOLOGY

Carpal tunnel syndrome is a complex subject even though it seems simple. At the onset of symptoms, conservative treatment is attempted by immobilization and topical anti-inflammatory application, but these methods delay the moment of surgical treatment.

4.1 Inclusion criteria

- paresthesias and pain in the distal distribution territory of the median nerve (police, index, medius);

- positive Phalen maneuver (forced hyperflexion of the fist induces pain and paresthesias in the first 30-60 seconds);

- positive Tinel sign (percussion of the median nerve triggers symptomatology at the level of the first three fingers);

- decrease in muscle strength in the territory of the median nerve;

- atrophy of the thenar eminence; sensitivity disorders at the level of the thenar eminence and the first two fingers.

Exclusion criteria:

- patients with spasticity and the inability to extend the fist (who have the fist fixed in flexion);

- pregnant patients;

- if the patient has suffered trauma (fractures) of the carpal area (fist) in the last 6 months, cervical radiculoneuropathy.

The study was carried out prospectively in the period 2017-2020 in which it was enrolled in a group of patients diagnosed with carpal tunnel syndrome hospitalized at the Arca Life Clinic in Bucharest and who requested endoscopic technique.

For the patients hospitalized at the Arca Life Clinic with the diagnosis of carpal tunnel syndrome and enrolled in the study, a methodology was established that consists of: anamnesis, clinical examination and challenging clinical tests.

The patients were hospitalized for the day and were discharged approximately 30 minutes after the intervention.

20-30 minutes before the operation, the patients received an intravenous dose of antibiotic, anti-inflammatory.

In the operating room, the patients were monitored (blood pressure, pulse and O2 saturation)

The hemostatic band (tourniquet) was mounted on the arm of the hand to be operated on.

The patients were placed on the operating table with the arm extended at 90 degrees to the patient's body on a table, the radiocarpal joint in extension between 20-45 degrees.

4.2 Operating protocol

All patients in the study were given an anamnesis and a clinical examination, which includes the evaluation of the integuments, the muscle strength of the thenar eminence and challenging clinical tests, all data were entered into an evaluation questionnaire.

The patients were hospitalized for the day and were discharged approximately 30 minutes after the intervention.

20-30 minutes before surgery, patients received an intravenous dose of antibiotic and anti-inflammatory.

In the operating room, the patients were monitored (blood pressure, pulse and O2 saturation)

The hemostatic band (tourniquet) was mounted on the arm of the hand to be operated on.

The patients were placed on the operating table with the arm extended at 90 degrees to the patient's body on a table, the radiocarpal joint in extension between 20-45 degrees.

4.2.1 The type of anesthesia used

There were 2 groups of patients; 18 patients operated with IV general anesthesia (sedation) without orotracheal intubation and 35 patients with locoregional anesthesia (median block).

4.3 Operative technique

The endoscopic operative technique "one portal procedure" was applied to all patients.

The operative surgical toilet with antiseptic substances, preoperative markings (Fig. 4.2), locoregional anesthesia or i.v. sedation, hemostatic tape on the arm of the hand to be operated on is practiced.

Fig. 4.2 Preoperative marking lines

Source: Dr. Hazim Elayan

A 1-1.5 cm incision is made in one of the flexion folds of the wrist according to the marking. The long palmar tendon is retracted radially.

Longitudinal subcutaneous dissection exposes the fascia of the forearm. A U-shaped incision is made on the fascia of the forearm, creating a rectangular flap based distally on the TCL.

While the flap is elevated, a synovial elevator is placed below the TCL (Wongsiri et al., 2008). An instrument (a type of dilator) is inserted into the carpal tunnel to create a path for the blade assembly. The bladed endoscope assembly is then inserted into the carpal tunnel and passed distally to the distal edge of the TCL (Fig. 4.3).

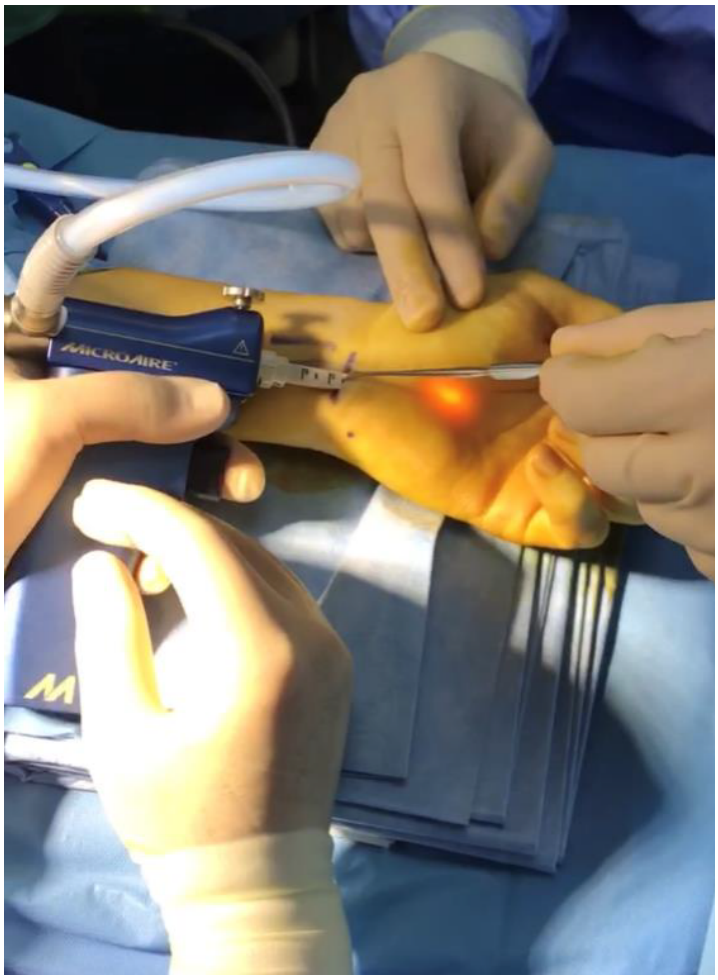

Fig. 4.3 Endoscope inserted into the carpal tunnel through an incision of approximately 1.5 cm

Source: Dr. Hazim Elayan

Several steps are usually required to obtain a proper definition of TCL. After defining the distal edge of the ligament, the tip of the instrument (together with the blade) is placed distal to the edge of the TCL (Fig. 4.4).

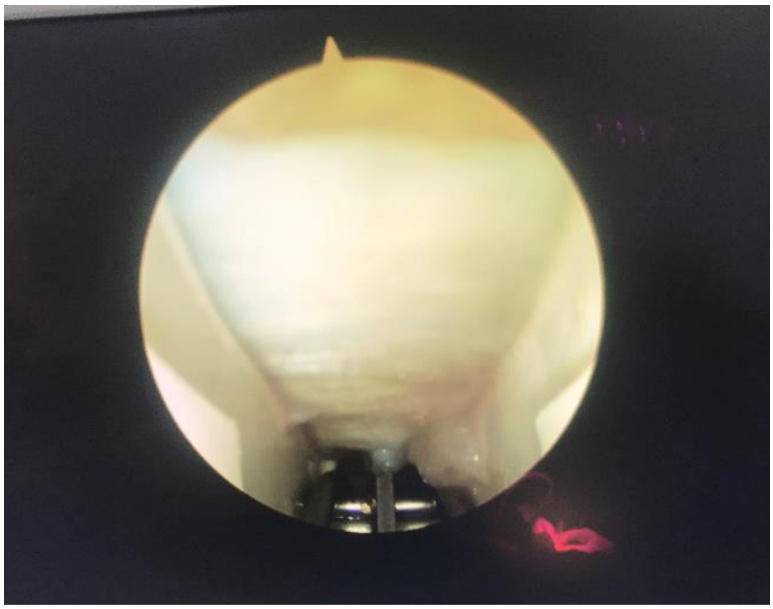

Fig. 4.4 The transverse carpal ligament visualized on the monitor through the endoscope

Source: Dr. Hazim Elayan

After verifying correct positioning, the trigger mechanism is activated and the blade is engaged and raised 3.5 mm above the assembly at an angle of 80° (Wongsiri and Keyhole, 2015). The instrument is withdrawn and under direct vision, the TCL is divided in a distal to proximal direction (Fig. 4.5).

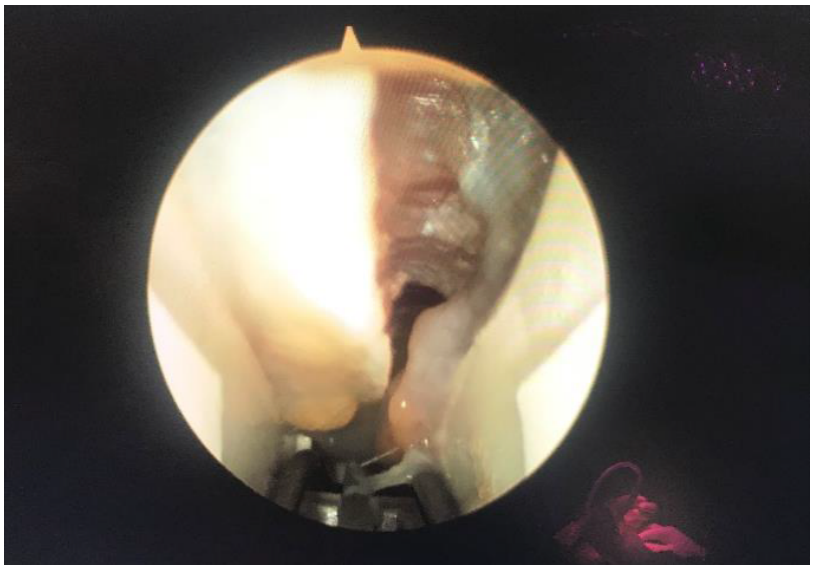

Fig. 4.5 Transverse carpal ligament sectioning, fiber remnants that are sectioned by repeating the endoscope blade 2-3 times until complete sectioning

Source: Dr. Hazim Elayan

With the blade retracted, several passes can be made to check the section of the ligaments. If necessary, the blade can be engaged and the remaining TCLs can be sectioned (the instrument should not be placed too deep in the tunnel, as this may cause damage to the superficial palmar arch). Next, a proximal volar antebrachial fasciotomy is performed, followed by standard wound closure (Agee et al., 1994) (Fig. 4.6).

Fig. 4.6 End of intervention, skin suture

Source: Dr. Hazim Elayan

The **compressive dressing** includes compresses and the elastic face.

Postoperative treatment includes:

- vitamin therapy po with vitamin b complex for 1 month.

- anti-inflammatory for 5 days

- gastric protector timo for 5 days.

The first postoperative control takes place at 5 days, then at 14 days for the suppression of sutures. The following checks take place at 3, 6 and 12 months, respectively.

Complications:

- Intraoperative: 1 patient with minimal damage to the ulnar artery (probably due to the small size of the hand). Arteriorrhaphy and suture verification were performed.

- Postoperative: 2 patients with small subcutaneous hematoma, performed at the 5-day control.

4.4 Statistical analysis

The statistical analysis of the data was performed using the IBM SPSS version 26 program.

In order to perform the analysis, descriptive statistics, mean and standard deviation were performed, the Wilcoxon test and the CHI square association test were applied (Table 4.2).

The Wilcoxon test helped us to evaluate the condition of patients before and after surgery. While the Chi-square test evaluates gender differences in the occurrence of the studied condition (Table 4.3).

Table 4.2 Chi square test

$X^2_{Phalen}(2) = 17.33$	$p<0.01$
$X^2_{Durken}(2) = 15.94$	0.021
$X^2_{Tinel}(2) = 10.76$	0.036

Tabel 4.3 Wilcoxon test

$W_{Phalen}=111.24$	0.041
$W_{Durken}=139.91$	0.035
$W_{Tinel}=102.46$	0.022

CHAPTER 5. APPLIED STUDIES REGARDING CARPAL TUNNEL SYNDROME

5.1 Study 1. Endoscopic treatment in carpal tunnel syndrome

Carpal tunnel syndrome is compression of the median nerve at the wrist (radiocarpal joint and palm) and the most common neuropathy in the upper limb. Paresthesias, especially nocturnal pain, numbness and weakness of the hand, tingling, atrophy of the thenar muscles are the most common clinical signs of CTS in addition to Tinel's sign, Phalen and Durkan's test, eventually leading to severe injuries of the hand and forearm (Durkan, 1991).

Diagnostic

It is basically based on the clinical signs, the Tinel sign, the Phalen and Durkan test, then it goes on to the paraclinical analyses: electromyography (EMG), nerve conduction velocity, radiology, ultrasound, MRI, laboratory blood tests.

The Adson and Wright costoclavicular tests are used to rule out chest compression syndrome that may mimic CTS.

Cervical examination, including the Spurling test, is essential to rule out cervical radiculopathy. Percussion of all primary peripheral nerves can lead us to an unexpected area of compression (Enrique et al., 2010).

A study of nerve conduction velocity and electromyography is performed. They help us confirm the diagnosis of CTS and exclude other pathologies (Chow, 1993). Basic radiographs of the wrist are useful in detecting unexpected pathology

Surgical treatment by the classical technique involves a curved longitudinal incision parallel to the tenerian fold for zigzag sometimes extended proximally to the forearm through the flexion folds of the wrist to relax the forearm fascia, external or internal neurolysis, synovectomy or removal of any formations that may compress the median. nerve, TCL sectioning from proximal to distal on the ulnar side to avoid damage to the thenar motor branch, hemostasis control, skin suture, dressing and immobilization.

Risks include pole pain, hand weakness, scar tenderness, delayed return to work and slower return to the office, relatively long recovery period, and risk of adhesions.

This technique has proven itself well over time, but as medicine evaluates and we continue to search for new techniques and procedures to minimize risk and recovery time, we will present endoscopic surgical treatment.

Indications are similar to those of the classical technique and include severity of symptoms, duration of symptoms, ineffective response to conservative treatment.

Contraindications: Include patients with severe CTS with evidence of muscle atrophy, rheumatoid arthritis, previous surgical treatment of recurrent CTS, significant loss of wrist extension, proliferative synovitis, and lesions invading the carpal tunnel (Enrique et al., 2010).

Endoscopic surgical technique

A portal procedure (modified Agee's technique):

Following the inflation of a tourniquet with the initial recommendation of general or regional anesthesia, then with the evolution of surgeons' experience, they began to use local anesthesia with or without sedation, a 2-3 cm incision is made in one of the flexures. folds of the wrist between the flexor carpi ulnar and the flexor carpi radialis.

Longitudinal subcutaneous dissection exposes the fascia of the forearm.

A U-shaped incision is made on the fascia of the forearm, creating a rectangular flap based distally on the TCL. While the flap is elevated, a synovial elevator is placed below the TCL (Agee et al., 1994). An instrument (a type of dilator) is inserted into the carpal tunnel to create a path for the blade assembly. The bladed endoscope assembly is then inserted into the carpal tunnel and passed distally to the distal edge of the TCL.

Several steps are usually required to obtain a proper definition of TCL. After defining the distal edge of the ligament, the tip of the instrument (together with the blade) is placed distal to the edge of the TCL.

After verifying correct positioning, the trigger mechanism is activated and the blade is engaged and raised 3.5 mm above the assembly at an angle of 80° Agee et al.,

1994). The instrument is withdrawn and under direct vision, the TCL is divided in a distal to proximal direction.

With the blade retracted, several passes can be made to check the section of the ligaments. If necessary, the blade can be engaged and the remaining TCLs can be sectioned. Next, a proximal volar antebrachial fasciotomy is performed, followed by standard wound closure.

Dual portal procedure (Chow technique and its modifications):

His original technique involved a transbursal approach to the carpal tunnel. The surgeon and nurse should sit facing each other at the hand table. A TV monitor is placed behind each surgeon so that both can have a full view of the procedure. A 1 cm transverse incision is made 0.25 cm proximal and 0.25 cm radial to the pisiform bone.

Chow later modified his technique by changing the landmarks of the proximal incision (Chow, 1993; Chow, 1994; Chow, 1990). He recommended that the proximal portal be made by drawing a transverse line 1 to 1.5 cm radially from the proximal pole of the pisiform bone. A second line is marked longitudinally 0.5 cm from the end of the first line. A third line is transverse 1 cm radially from the end of the second line to indicate the portal of entry.

A longitudinal incision is made on the fascia of the forearm, taking care to protect the ulnar artery and nerve. The flexor tendons are exposed (transbursal) and retracted towards the radial side, finding the space between the ulnar neurovascular bundle and the flexor tendons. A trocar is inserted and the wrist is placed and held in hyperextension by a special hand frame. Using the tip of the trocar, feel for the base of the harness hook, then lift and feel for it, if you feel the cannula it means it is above the TCL or in Guyon's canal and needs to be removed and reinserted into the subTCL canal. A second (palmar) incision is made distal to the distal edge of the transverse carpal ligament along the long axis of the ring finger. The endoscope is inserted proximally into the trocar, which has one end just below the TCL.

Care is taken to ensure that only the transverse fibers that make up the TCL are visible and not the tendons or nerves. The endoscope is inserted into the proximal incision

and advanced to the distal edge of the TCL. A knife inserted through the second incision (palmar incision) is used to cut the distal edge in a proximal direction to the midpoint of the ligament. To complete the release of the TCL, the endoscope is inserted into the distal opening.

The knife is used to cut the proximal edge of the TCL, and the retrograde knife is inserted into the midsection and advanced proximally to complete the release. The wounds are sutured, a simple dressing is applied, and the sutures are removed one week postoperatively. Because the transversive technique frequently produced ulnar neuropaxy, either due to withdrawal pressure or the cannula, the technique was modified by Resnick and Miller to a subligamentary or extracurricular approach (Resnick and Miller, 1991).

In this technique, the fascia of the forearm is incised proximal to the TCL, and the dissection is made below the fascia and in the carpal tunnel below the ligament, avoiding the flexor tendon bursa. The rest of the operation is performed in a similar way to the Chow method. In our clinic, we use the "one portal procedure" endoscopic technique

5.2 Study 2. Electrodiagnostic studies in carpal tunnel syndrome

The electrodiagnostic is a test or a paraclinical study of the analysis of the muscular and nervous system, which evaluates the transmission of the motor or sensory nerve impulse, which helps the specialist to obtain a diagnosis or a prognosis, after the anamnesis and the clinical examination have been carried out (Weiss et al., 2015).

In chronic nerve compression, the first changes that occur in nerve fibers are changes in demyelinated nerve fibers, which cannot be assessed with electrodiagnostic studies and tests (Mackinnon et al., 1986). Example: early symptoms of pain and paresthesia cannot be objectified with electrodiagnostic studies (Hand-Surgery et al., 2010).

Another limitation of the nerve conduction study is the location of the nerve injury in the extremity. Nerve problems occur very distally or very proximally and are difficult to assess (Hand-Surgery et al., 2010).

The median nerve is electrically stimulated at the wrist and the motor response is recorded from the abductor pollicis brevis muscle using surface electrodes; usually the motor response occurs 4 msec after stimulus application, an interval called distal motor latency (DL) (latency is the time required for the impulse to travel the distance from the stimulation site to the collection site); if a distal latency of more than 4.5 ms is observed, it means that we are dealing with carpal tunnel syndrome (Lupescu, 2006; Nathan et al., 1998 and Wilbourn, 2003).

Nerve conduction velocity (NCV = s/t = S/PL - DL)1 in motor nerve fibers is 45 - 65 m/s, in nerve fibers, depending on nerve thickness.

Electrodiagnostic studies are useful to rule out other associated problems, such as cervical disc disease, motor neuron problems, myopathy, or overlapping polyneuropathy.

5.3 Study 3. Endoscopic treatment in carpal tunnel syndrome: a case study in Bucharest – Romania

This is a prospective study carried out between 2017-2020, on 62 hands in 53 patients diagnosed with carpal tunnel syndrome hospitalized at the Arca Life Clinic in Bucharest and who requested the endoscopic technique.

Inclusion criteria: paresthesias and pain in the distal territory of the distribution of the median nerve (police, index, middle); positive Phalen maneuver (forced hyperflexion of the wrist induces pain and paresthesia in the first 30-60 sec); positive Tinel sign (percussion of the median nerve induces symptoms in the first three fingers); decrease in muscle strength in the territory of the median nerve; atrophy of the thenar eminence; sensory disturbances in the thenar eminence and the first two fingers (Chow, 1994; Chow, 1990; Pagnanelli and Barrer, 1991).

Exclusion criteria: patients with spasticity and the inability to extend the fist (who have the fist fixed in flexion); pregnant patients; if the patient has suffered trauma (fractures) to the carpal area (wrist) in the past 6 months, cervical radiculoneuropathy (Chow, 1994; Chow, 1990; Pagnanelli and Barrer, 1991).

Electrophysiological diagnosis Includes electromyography and electroneurography showing a decrease in sensory and motor nerve conduction velocity (Chow, 1994; Chow, 1990; Pagnanelli and Barrer, 1991).

Electrophysiological diagnostic criteria: (one or more of them): Distal motor latency greater than 4.5 msec.; Sensible latency greater than 3.7 msec.; Amplitude less than 20 mV.; Driving speed less than 40 m/sec. (Pagnanelli and Barrer, 1991).

In all cases, the following were taken into account: age, occupation, height, weight, calculation of body mass index, hereditary antecedents, personal pathological antecedents, personal medication, smoker, alcohol user, date of appearance of signs and symptoms and their severity, examination overall clinical compared to the healthy limb, assessment of appearance and muscle strength, Reverse Phalen Test, Tinel Sign, Durkan Test and assessment of the radiocarpal joint and its mobility.

Surgical Methods – A Portal Procedure (Modified Agee's Technique)

After inflating a tourniquet with local anesthesia with or without sedation, a 1-1.5 cm incision is made in one of the flexion folds of the wrist. The long palmar tendon is retracted radially.

Longitudinal subcutaneous dissection exposes the fascia of the forearm. A U-shaped incision is made on the fascia of the forearm, creating a rectangular flap based distally on the TCL.

While the flap is elevated, a synovial elevator is placed below the TCL (Wongsiri et al., 2008). An instrument (a type of dilator) is inserted into the carpal tunnel to create a path for the blade assembly. The bladed endoscope assembly is then inserted into the carpal tunnel and passed distally to the distal edge of the TCL. Several steps are usually required to obtain a proper definition of TCL. After defining the distal edge of the ligament, the tip of the instrument (together with the blade) is placed distal to the edge of the TCL. After verifying correct positioning, the trigger mechanism is activated and the blade is engaged and raised 3.5 mm above the assembly at an angle of 80° (Wongsiri and Keyhole, 2015). The instrument is withdrawn and under direct vision, the TCL is divided in a distal to proximal direction.

With the blade retracted, several passes can be made to check the section of the ligaments. If necessary, the blade can be engaged and the remaining TCLs can be sectioned (the instrument should not be placed too deep in the tunnel, as this may cause damage to the superficial palmar arch). Next, a proximal volar antebrachial fasciotomy is performed, followed by standard wound closure (Agee et al., 1994).

The study involved 62 hands in 53 patients, 19 men (36 %) and 34 women (64 %), aged between 30 and 80 years (M=59.6 years, SD=3.12). Before surgery, patients had numbness in palms and fingers (25 patients), decreased muscle strength (25 patients), paresthesia (20 patients), nocturnal wrist pain and weakness (8 patients), thenar atrophy (10 patients).

Clinical signs disappeared after 6 months in 95% of patients. 18 patients had general anesthesia and 25 local anesthesia.

Before surgery, Phalen, Durken and Tinel's test was positive for 95% of hands, after 6 months no patient has a positive test. Postoperative electroneuromyography of the median nerve complete recovery after 6 months for 94% of patients.

Before surgery, 15 women and 12 men had the right hand affected, 11 women and 6 men had the left hand affected, and 8 women and one man had bilateral lesions.

In conclusion, the endoscopic technique is a modern technique that requires a special professional experience of the surgeon. It is a minimally invasive technique with the protection of the noble elements (vessels, nerves and tendons) at this level (from the radiocarpal and palmar joints). The recovery of the operated hand is much faster with the endoscopic technique (does not require immobilization, fast socio-professional reintegration). The duration of the surgical intervention in an experienced surgeon is much shorter than in the classical technique.

In this study we demonstrated the effectiveness of the endoscopic technique in terms of the treatment process of carpal syndrome, but also the more frequent occurrence of this condition in men than in women.

CONCLUSIONS AND PERSONAL CONTRIBUTIONS

Regarding the research results obtained from the analysis of the personal and clinical characteristics of the patients, we found the following:

The study involved 62 hands in 53 patients, 19 men (36%) and 34 women (64%), aged between 30 and 80 years (M=59.6 years, SD=3.12).

Before the operation, the patients had numbness in the palms and fingers (25 patients), decreased muscle strength (25 patients), paresthesias (20 patients), nocturnal wrist pain and weakness (8 patients), thenar atrophy (10 patients).

Clinical signs disappeared after 6 months in 95% of patients. 18 patients had general anesthesia and 35 local anesthesia. Before surgery, Phalen, Durken and Tinel's test were positive for 95% of the hands, after 6 months no patient has a positive test.

Postoperative median nerve: electroneuromyography complete recovery after 6 months for 94% of patients. Before surgery, 15 women and 12 men had their right hand affected, 11 women and 6 men had their left hand affected, and 8 women and one man had bilateral lesions.

The efficiency of the endoscopic technique and differences regarding the occurrence of carpal syndrome.

Regarding the differences between men and women regarding the occurrence of this condition, we randomly selected from the number of women an equal number of men in the sample. Thus, we identified statistically significant differences.

Between men and women regarding the occurrence of carpal syndrome, women having significantly lower results than men in the Phalen and Durken tests.

We also found that there were statistically significant differences between Phalen, Durken and Tinel's results

Thus, our results are closely related to those in the literature.

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