



Case series

Effectiveness of mini-transverse incision versus traditional reduced technique in the treatment of carpal tunnel syndrome. A prospective cohort study[☆]

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ABSTRACT

Background: Carpal tunnel syndrome has attracted attention as an occupational disease due to the dramatic increase on its magnitude, and its prevalence in the general population, who's has been reported from a 0.6 to 3.4%. Currently, there are various techniques for its approach. However, there is great controversy when it comes to establishing which of the methods is the most beneficial. The objective of this study was to compare the efficacy of the mini-transverse incision against the traditional longitudinal technique in treatment of carpal tunnel syndrome.

Materials and methods: A series of cases is presented, prospectively included, of patients with a diagnosis of carpal tunnel syndrome, who are beneficiaries of a government hospital. We present a series of cases with a diagnosis of carpal tunnel syndrome, which were performed with two different techniques. Both techniques were evaluated by comparing the recovery and work reintegration times, as well as the decrease in pain and the absence of complications.

Results: A total of 8 patients operated with a minimal incision and 9 with a traditional reduced incision were studied. Significant differences were shown in the days taken to return to work, with a median of 17.5 (q25-q75 14–21) days for mini-transverse incision group and of 28 (q25-q75 21–28) days for the longitudinal traditional incision group ($p = 0.002$). Likewise, differences were obtained in the visual analogue pain scale during the first week of evaluation 4 vs 7 ($p = 0.000$), in contrast to complications where there were no differences at all.

Conclusion: The results obtained corroborate a greater efficacy of the mini-transverse incision technique, in reducing disability times. This favors the health institution to reduce the costs of rehabilitation and for the patient to have a prompt work reintegration. It is suggested to strengthen the scientific evidence that supports the use of this technique by exploring other areas such as functional status or long-term benefits.

1. Introduction

Carpal tunnel syndrome (CTS) is the most common entrapment neuropathy of the upper limb, affecting 0.6 to 3.4% of general population and up to 5% of the working people, who frequently use their hands and wrists on daily activities. The incidence of CTS is of 105 cases per 100,000 people per year [1,2]. The surgical procedure is indicated in those cases in which there has been no improvement with common

treatment. The surgery is based on a decompression of the median nerve at the level of the carpal tunnel. To achieve this, three types of procedures have been designed: open or standard, endoscopic and minimally invasive. A very high success rate has been reported with any of these mentioned procedures, with minimum complications' frequency [3]. Nevertheless, most of the reported studies only describe the benefits of the technique under study. On rare occasions, they equate different techniques based on clear indicators, which allows to highlight the

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superiority of one procedure over another. With the foregoing, elements could be provided to objectively select the surgical method to be performed. Thereupon, an indicator that can be evaluated is based on the time that the patient requires to recover their functionality, and that is usually reflected in the total days taken to return to work. Both, the mini-transverse incision (MTI) and the traditional reduced incision (TRI), have proven their effectiveness over time in correcting the symptoms of carpal tunnel syndrome. The exercise of challenging both techniques can provide data with a positive impact, both in the patient's economy and in the improvement of their quality of life, as well as for the institution in which they work. The objective of this study is to compare the efficacy of the mini-transverse incision against the traditional longitudinal technique in treatment of carpal tunnel syndrome.

2. Material and methods

This study was reviewed and approved by the Ethics and Research Committee of the ISSSTE Regional Hospital "Dr. Valentín Gómez Farías" with registration number CEI/420/2020. This is a tertiary level hospital that has the characteristic of only paying attention to state workers and their families. In addition to serving as a teaching hospital, training high-level subspecialists. An observational, prospective, analytical cohort study with parallel groups was performed. The person in charge of the execution of the surgical interventions was a doctor specializing in plastic, aesthetic and reconstructive surgery. Patients of legal age (over 18), who underwent surgery with a diagnosis of carpal tunnel syndrome with more than 3 months of evolution and expressed their consent to participate in the study, were included for follow-up. All the patients were beneficiaries of the "Dr. Valentín Gómez Farías Hospital" (ISSSTE regional hospital).

Patients with radiographic evidence of osteoarthritis, a record of previous surgery or trauma of less than one year in the affected hand, and psychiatric or neurological conditions that could hinder pain assessment, were excluded from follow-up. The sample was calculated considering an estimated average of the days it took to work reintegration. The mean equivalence formula was used, with a confidence level of 95%, a power of 80%, a one-tailed hypothesis, a Kappa value of 6.2, a standard deviation of ± 4 and a margin of 5 days between groups to obtain equivalence. This gave us a minimum of 8 patients per group.

Once authorization was obtained for the execution of the study, a presurgical evaluation was performed on every patient scheduled for carpal tunnel syndrome surgical treatment with ASA I and II physical status, and who met the inclusion criteria. Afterwards, they were asked to sign the informed consent form. The pain intensity and the clinical results of the surgical wound were taken at first and fourth week after the surgical procedure. The intervention group was assigned by consecutive cases at the time of scheduling surgery in the outpatient clinic, 1) Mini-transversal Incision, where their turn was an even number, 2) Traditional Reduced Incision, where their turn corresponds to an odd number. Patients assigned to the control group underwent surgery with the traditional reduced technique for carpal tunnel pathology. All patients were asked to present fasting, avoiding alcohol consumption during the last 48 h.

All the data obtained were registered into a Case Report Format (CRF) where the results were: 1) Pain, measured by the visual analog scale, 2) Presence of complications and 3) Days of disability granted by the health institution (days reintegration).

2.1. Mini-transverse incision surgical technique

With the patient in supine position, sedation was performed. With prior asepsis and antisepsis, the median nerve was blocked at the radial border of the fourth toe, in the Kaplan line, and ischemia was performed in the forearm. A 1 to 1.5 cm incision was made across the wrist crease and dissected by planes (skin, subcutaneous cellular tissue, separation of the palmar greater tendon) until reaching the transverse carpal

ligament. A small longitudinal incision was made in the area and a slotted probe was placed to protect the median nerve up to the Kaplan line. Subsequently, the transverse carpal ligament was sectioned, its opening was checked with a Kelly forceps (curve) and the median nerve was visualized up to the interior of the tunnel. Finally, the ischemia was eliminated by carefully performing hemostasis, the skin was sutured, and a posterior splint was placed in extension, protecting the area with a dressing (20 degrees for 10 days).

2.2. Traditional reduced surgical incision technique

Sedation was performed to subsequently infiltrate the median nerve, and the incision was marked to begin. The reference points were assessed by drawing a safety line with indelible material. Uncontrolled ischemia was performed with an Esmarch bandage and the incision was made following the curvature of the thenar region, dissecting until delimiting the palmar fascia. Next, the flexor retinaculum itself was noted, which was released by direct vision and the complete release was corroborated to later assess the integrity of the median nerve. Finally, the ischemia was removed by carefully performing hemostasis, suturing the skin, and placing the posterior splint in extension, thus protecting the area with a dressing (20 degrees for 10 days).

3. Results

In total, 17 people joined the study for follow-up. 8 of them belonged to the group operated with a mini-transverse incision (MTI), and the rest were operated with a traditional reduced incision (TRI). Both groups were balanced in age and gender (Table 1). A pain assessment was performed at 1st and 4th week after carpal tunnel release surgery, using the validated VAS instrument (Visual Analogue Scale). A higher score could be observed in the underwent surgery group with the traditional longitudinal incision (7 IQR 7–8) vs 4 (IQR 2–5) in the mini-transverse incision (Graph No. 1) ($p = 0.000$). Regarding the assessment at the fourth week in the VAS, the behavior remains constant according to observed in first week (Graph No. 2), being those operated by mini-transverse incision, the first group to reach the lowest point on the VAS scale. ($p = 0.004$). Regarding the development of complications in both studied groups, the most frequent case was the presence of paresthesia in 45% of the cases in the group undergoing TRI and in 25% of the MTI group. There were no statistically significant differences between the two groups (Table 2). Finally, analyzing the information obtained due to disabilities, we identified that the group intervened with the MTI technique had evident shorter work reintegration times (Graph No. 3), with a median of 17.5 days. On the other hand, the group that underwent surgery with a traditional longitudinal incision took 28 days for the same reintegration. This was considered statistically significant ($p = 0.002$). The work has been reported in line with the PROCESS 2020 [4].

4. Discussion

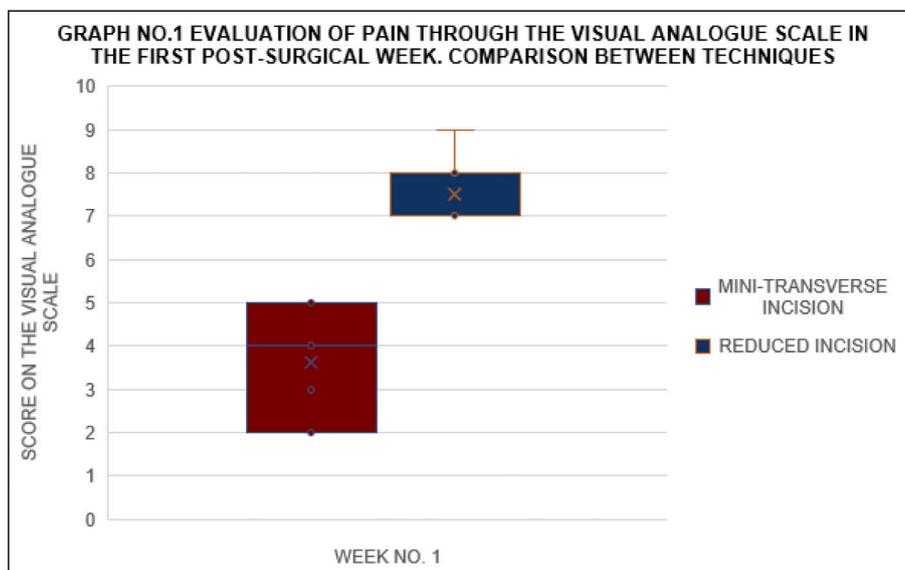
Carpal tunnel syndrome is the most common peripheral neuropathy involving median nerve entrapment at wrist level. It has been reported

Table 1
General characteristics of the studied population.

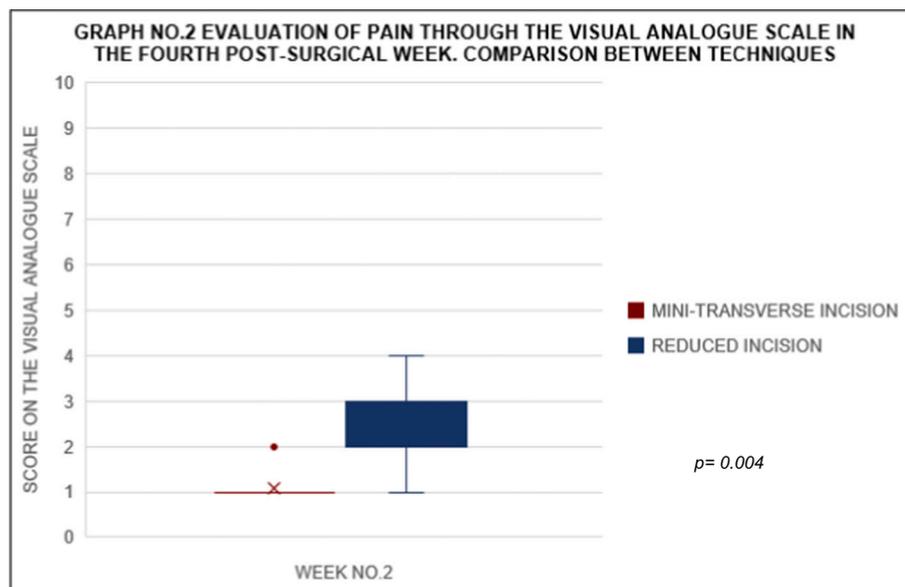
	Mini-transverse Incision		Reduced incision		p
	n = 8		n = 9		
Age ^a	46.3	± 9	48	± 8	0.653
Sex	Male	12.5%	Male	11.1%	0.600
	Female	87.5%	Female	88.9%	

The difference between means was calculated with the Student's *t*-test, the difference between percentages was calculated with the Chi-square test.

^a The data presented correspond to the mean and standard deviation.



Graph No. 1. Evaluation of pain through the visual analogue scale in the first post-surgical week. Comparison between techniques.



Graph No. 2. Evaluation of pain through the visual analogue scale in the fourth post-surgical week. Comparison between techniques.

Table 2

Frequency of post-surgical complications in carpal tunnel pathology. Comparison between techniques.

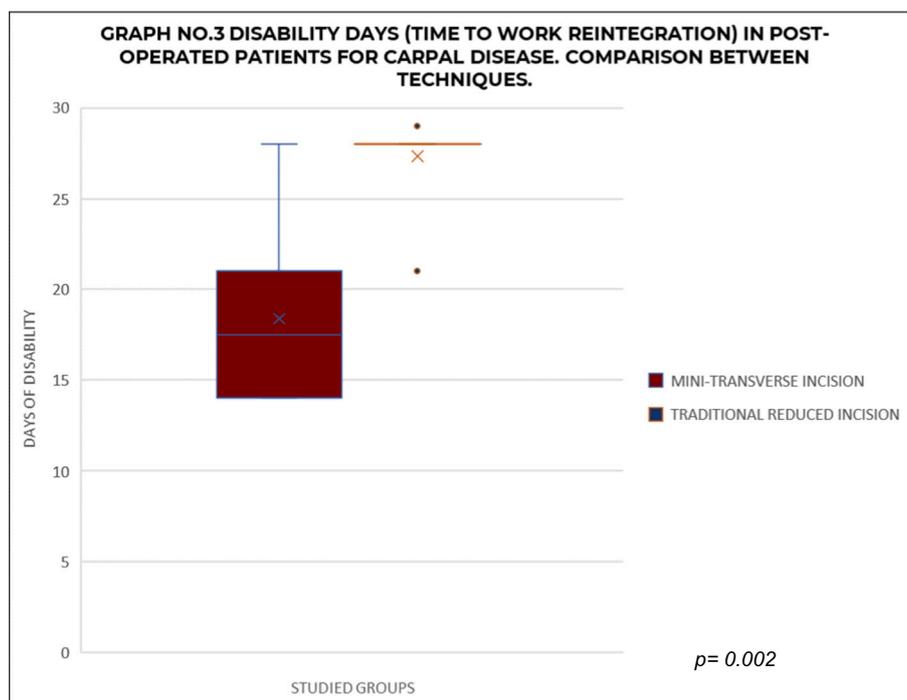
N = 17					
	Mini-transverse incision	Traditional reduced incision	p	RR	IC 95%
Complications	25.0%	50.0%	0.402	1.33	0.3-5.6
Scar hyperesthesia	25.0%	50.0%	0.042	1.33	1.3-5.6
Paresthesia	25.0%	62.5%	0.201	1.54	0.39-6.14

The comparison between percentages was made by means of the Chi-square test.

that its presence is indistinct for either of the two genders and its frequency in the economically active population stands out [5]. In this study we observed that the average age of the intervened population oscillates between 45 ± 8 years, with a female predominance of 87%.

Standard carpal tunnel release has been the optimal procedure for surgical decompression of the median nerve. Although this technique has the advantage of direct visualization of the structures, it can be

associated with certain complications such as painful scarring, neurosensory deficits and neuromas. In recent decades, open carpal tunnel release for the treatment of carpal tunnel syndrome has achieved excellent results. It has become the reference standard for the treatment of this pathology. However, some authors state that the failure rate ranges between 7% and 20% [6-11]. In this study, the obtained results behave in accordance with information reviewed in the literature,



Graph No. 3. Disability days (time to work reintegration) in post-operated patients for carpal disease. Comparison between techniques.

presenting complications in 30% of the underwent surgery population according to the technique, with paresthesia being the most frequent followed by scar hyperesthesia. In agreement, Isik et al. [12] mentioned that complications can decrease hand strength and quality of life. Although minimal incision carpal tunnel release has limited visualization, it has not yet been shown to have a higher complication rate.

Both methods, both the mini-transverse incision and traditional longitudinal incision, have proven to be highly effective for the remission of symptoms in carpal pathology. However, until today, there has been a few studies that seek to demonstrate the superiority of one technique over the other.

Although it is a fact, the presence of complications was not different between the two groups, the recovery measured by the decrease in pain (with the VAS) at the first and fourth postoperative week, do presents differences. In addition, superiority was shown in the group operated with a mini-transverse incision ($p < 0.05$).

Similarly, the differences in recovery times are evident with the decrease in the days of disability granted to the group of patients operated on with MTI versus those with TRI ($p = 0.002$). These differences establish an antecedent, which may be attractive to point MTI as the procedure of choice. The foregoing, especially in a hospital for care of eligible workers, since it impacts in favor of the economy, both for the institution and for the worker.

In a recent publication, Khoshnevis et al. [13], showed the benefits of the minimal incision compared to traditional open surgery, coinciding with our findings regarding recovery times. Khoshnevis describes a labor reintegration 9 ± 2 days after surgery versus 24 ± 4 days with the traditional method. In the same sense, they found differences in pain and the presence of paresthesia between the studied groups.

In a study by Keramettn et al. [14], it has been demonstrated superiority in MTI against open carpal tunnel release. The parameters that showed differences were the grip force, the gripper movement and the aesthetic results.

5. Limitations

The results obtained in this study are favorable, and provide

elements to the medical responsible for the surgical intervention, so he/she can objectively discern the type of technique to be used, considering the speedy recovery of the patient with CTS. One of the limitations of our study was the reduced sample size; however, despite this situation, the superiority of MTI in the main variables evaluated was clear. There is necessary to continue obtaining robust evidence with controlled clinical trials and a sufficient sample size to obtain meaningful and robust statistics. Alternatively, we can propose, a longitudinal multicenter analysis with randomization of participants for future research, which would produce more robust and clinically applicable results. In addition, future studies that take into account our suggestions, could contribute to changing the guidelines for surgical management of CTS, and consequently improving patient outcomes.

6. Conclusion

In conclusion, our findings accept the working hypothesis that the Mini-transverse Incision is more effective than the traditional reduced incision, due to the reduction of time in labor reincorporation on patients underwent surgery for carpal pathology.

Availability of data and materials

All databases as well as original sources are at the publisher's disposal. Our study is registered on the research registry platform under the code researchregistry7154.

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Ethical approval

This study was reviewed and approved by the Ethics and Research Committee of the ISSSTE Regional Hospital "Dr. Valentín Gómez Farías" with registration number CEI/420/2020.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Authors' contributions

ODC, RMJ, NHJ, VSJL and TSQL were involved in the patient's care. All authors have contributed substantially to collecting data, revising the article, and having given necessary intellectual inputs. All authors read and approved the final manuscript.

Registration of research studies

1. Name of the registry: Effectiveness of mini-transverse incision versus traditional reduced technique in the treatment of carpal tunnel syndrome. A case series.
2. Unique identifying number or registration ID: researchregistry7154.
3. Hyperlink to your specific registration (must be publicly accessible and will be checked): <https://www.researchregistry.com/browse-the-registry/#home/>.

Guarantor

Dra. Quitzia Libertad Torres Salazar.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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Provenance and peer review

Not commissioned, externally peer-reviewed.

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