

# Outcome of Using Local Anesthesia and Arm Tourniquet During Open Surgical Treatment of Carpal Tunnel Syndrome

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## Abstract

**Objective:** This study aimed to evaluate the results and complications of open surgical treatment of carpal tunnel syndrome using local anesthesia technique and by applying arm tourniquet. In addition, the study also assessed the hand function at two different time intervals after operation. **Methods:** In this cohort study, 280 patients were evaluated who underwent open surgery to treat carpal tunnel syndrome with the use of local anesthesia. Moreover, the disabilities of the arm, shoulder and hand (DASH) score was calculated before operation and three and six months after the operation. Likewise, the numerical rating scale (NRS) was used to evaluate pain during the surgical procedure, at the time of local injection and at the postoperative days. **Results:** The DASH score was found to be improved from 61.49 before surgery to 22.94 at third month and 13.87 six months postoperatively. Most of the patients got improved after three months of surgery. However, the full hand function was regained only after six months. Regarding the pain of local anesthetic injection, 93.6% of patients considered it as a simple pain. With respect to the use of tourniquet, 268 patients (95.7%) felt it to be a real discomfort. **Conclusion:** The use of plain lidocaine as local anesthesia and applying arm tourniquet for open surgical treatment of carpal tunnel syndrome is found to be effective in performing the procedure and for the final results. Most of the patients were satisfied with their hand function three months after surgery. However, the full hand function was regained only after six months of the surgery.

Keywords: carpal tunnel syndrome, local anesthesia, hand function.

## INTRODUCTION

Carpal tunnel syndrome (CTS) is one of the most common peripheral compressive neuropathy, with a remarkably higher preponderance in females, accounting for about 80% of the cases according to some studies.<sup>[1]</sup> Worldwide, it is one of the main reasons of absence from work. It not only costs the society in aspects of productivity, but also causes a significant financial cost for treatment.<sup>[2]</sup> Mostly, surgical treatment is considered the best option after failure of conservative measures which include non-steroids anti-inflammatory drugs, steroids and orthotics.<sup>[2,3]</sup>

The aim of the treatment is to achieve the best result for the patient in terms of functional status, least

complications, lowest financial cost and finally returning back to daily activities and work as soon as possible.<sup>[4-7]</sup> In a study, researchers preferred surgical decompression under local anesthesia without using the tourniquet, in order to avoid arm pain.<sup>[8]</sup> On the contrary, a study reported significant pain on performing carpal tunnel decompression under local anesthesia to their patients.<sup>[9]</sup>

This was a prospective cohort study which was conducted

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from February 2008 to July 2017. After the approval from the Research Ethical Committee of the surgery department in the college of medicine, total 260 CTS patients whom underwent surgery under local anesthesia were recruited in this study. All the patients were interviewed and written informed consent was taken from them as part of the hospital policy.

All cases of CTS who were diagnosed clinically and electromyographically by nerve conductive study (NCS) and who had been receiving conservative treatment for more than three months without any benefit were included in this study. Whereas, those patients were excluded who were operated before and were presented with recurrence. In addition, those patients who were satisfied with the results of conservative treatment were not included in the study.

The CTS was diagnosed on the basis of clinical examination using positive Durkan and Phalen tests.<sup>[10]</sup> Finger pressure on the nerve was applied with the wrist flexed 20 degrees for 30 seconds, to see if this action elicited the symptoms of CTS. Moreover, the patients were informed about the intervention with local anesthesia, the DASH (disability of arm, shoulder and hand) scoring questioner and pain scoring chart. Plain lidocaine without adrenaline and pneumatic arm tourniquet was used in all cases. All the surgeries were done as a day case by three different surgeons and the patients were discharged few hours after surgical procedure.

After preparing the patients, pneumatic tourniquet was applied to the arm of the affected side, the operative field was sterilised and 5 ml of plain lidocaine was prepared. About 2 ml of lidocaine was infiltrated along the incision site and the remaining 3 ml was injected slowly deeper to the flexor retinaculum while monitoring the patient. If the patient felt pain, the needle was withdrawn and its direction was changed. After 5-7 minutes of the local injection, the tourniquet inflated to 250-300 mmHg.

In all the cases, the classical open technique by volar longitudinal incisions was used followed by the same technique of decompression, wound closure and dressing. At the time of lidocaine injection and throughout the infiltration time until withdrawal of the needle, the patient's response for any pain was monitored. A nurse was assigned to the patient to record the grade of the pain as per the pain scoring chart. The numerical rating scale (NRS) was used for this purpose. After removing the tourniquet, the patients were asked if they were satisfied with this technique or not. Moreover, no sedative or analgesic medication was given to any patient before and during the surgery. However, eight hours post-operation, some patients received NSAID as needed.

Statistical analysis was carried out using the SPSS version 21. Categorical variables were presented as frequencies and percentages whereas, continuous

variables were presented as mean±SD. Paired t-test was used to compare the means. A *p*-value of ≤ 0.05 was considered as statistically significant.

## Results

Out of total 280 CTS patients whom underwent surgery under local anesthesia, most of the patients were female (92.9 %). The age of the patients ranged from 22–75 years with 34 years as the mean age.

As part of the conservative management, all of the patients under study received local injection of cortisone 3-5 months before surgery decision.<sup>[11]</sup> Eighteen patients were presented with severe thenar muscles atrophy and tingling sensation at the median nerve area in the hand.

The DASH questionnaire was filled out three times as summarized in table I. The first DASH evaluation was done on 280 patients on admission day before operation. The score range obtained was 50.6–76.3 (mean: 61.49). The second evaluation was done after three months and only 260 patients were included. Twenty patients were dropped out as they did not attend the second evaluation. The DASH score range obtained was 14.6-40.1 with the mean of 22.94. The third evaluation was done six months after the surgery and 244 patients were included. Another 16 patients dropped as they didn't attend the clinic for further evaluation. The range of DASH score obtained was 6.20-29.2 (mean:13.87).

After three months, 6 out of 260 patients (2.14 %) were feeling moderate pain (DASH score: 39-40.1). Their NCS was repeated which showed a significant nerve compression. These patients were considered as recurrent cases which might be decompressed ineffectively at the first time. They were treated by revision surgery under local anesthesia as per their preference. The remaining patients were satisfied with their hand function after three months of surgery.

With respect to NRS, 85.7% patients (n=240) expressed mild pain (2-3 grade), 10.7 % patients (n=30) showed moderate pain (4-5 grade) and 3.6% patients (n=10) expressed severe pain (7-8 grade). The patients experienced this pain during the surgery due to the flaws in surgical techniques. Three cases felt pain due to manipulation of the median nerve, 4 cases due to over stretching of the self-retaining retractor and 3 cases felt pain when the wound was extended distally and proximally during the procedure. The mild and moderate pain was treated by temporarily stopping the procedure while for severe pain, the above-mentioned surgical flaws were rectified. Regarding the use of local anesthesia, all patients (n=262; 93.6%) considered it equal to or easier than the pain of the local injection which they received in the preoperative time. Similarly, 2.8% patients considered it less painful than the application of intravenous cannula. Whereas, 3.6% patients evaluated the local injection pain of the same grade as of

the pain of injection in the gum during dental procedure.

Regarding the use of tourniquet, most of the patients (n=268; 95.7%) did not feel any significant discomfort whereas only 4.3% patients mentioned mild (tolerable) discomfort from the tourniquet in the last 2-3 minutes. However, all of them preferred using this procedure if they needed it again. Overall, the mean time of surgery was 16 minutes and that of the tourniquet usage was 20 minutes.

Regarding the post-operative complications, 4 patients developed wound healing issues due to infection and were treated with systemic antibiotics for 5 days. While 10 patients developed tenderness at the wound scar which was resolved spontaneously after three weeks.

**Table 1: DASH score of study patients at three different periods of assessment**

Period of assessment	N	Mean DASH±SD	DASH Score
Preoperative	280	61.49±6.18	50.60-76.30
3 months postoperative	260	22.94±4.91	14.6-40.1
6 months postoperative	244	13.87±3.66	6.20-29.2

**Table 2: The DASH score difference between pre-operative and 3 months post-operative time.**

Period of assessment	N	Mean DASH	SD	Paired t-test	P-value
Preoperative	260	61.46	6.25	107.599	<0.001*
3 months postoperative	260	22.94	4.91		

Significant difference was found between the means of DASH score between the preoperative time and 3 months after the surgery.

**Table 2: The mean differences of DASH score among pre-operative, 3 months and 6 months post-operative period.**

Period of assessment	N	Mean DASH score	SD	Paired t-test	P-value
Preoperative	244	61.61	6.30	113.16	
3 months postoperative	244	22.92	4.98	29.149	<0.001*
6 months postoperative	244	13.87	3.66	113.16	

There were significant differences between means of DASH score between these two periods.

## Discussion

Some studies have reported that the treatment of CTS by local injection might be equal to the surgical treatment.<sup>[12]</sup> Conversely, in this study, all patients who received local injection previously were presented with the same complaint after 3-5 months. According to a study, although local corticosteroid injection and surgery are clinically effective in reducing symptoms, yet, only surgery results in an improvement of the neurophysiologic parameters at 12-months follow-up.<sup>[13]</sup>

Similar to other studies<sup>[14,15]</sup>, local anesthesia was chosen as a procedure of choice for CTS patients in this study. In contrast, some studies criticize the use of local anesthesia because of pain.<sup>[9]</sup> Similar to a study (16), in this study, only 3.6% of the patients felt severe pain which was due to technical reasons.

In Canada, CTS is usually treated under local anesthesia without sedation.<sup>[16]</sup> In the present study, tourniquet was used in all the cases to get bloodless surgical field and to save the time needed for hemostasis.<sup>[17]</sup> However, some studies do not advocate the use of tourniquet in surgical procedures.<sup>[8]</sup>

The time of tourniquet usage in current study ranged from 17- 24 and it was tolerable among all the patients. Some studies have reported the use of tourniquet for up to 30 minutes under local anesthesia. While others have mentioned 20-24 minutes as the accepted tolerable time.<sup>[18]</sup>

The recurrence rate in this study was found to be 2.14% which is in accordance with a study which reported recurrence rate as 1.7% after primary release.<sup>[17]</sup> In contrast, another study reported a high recurrence rate i.e. 10.4% to 12.4%.<sup>[11]</sup>

The present study found significant decline in the DASH score in patients i.e., from the mean of 61.49 preoperative to 22.94 after three months of surgery. This suggests that most of the patients regained their accepted but not full hand function three months postoperatively.

While after 6 months, significant improvement in the hand function was observed i.e. the mean of DASH score between the preoperative evaluation and that after 6 months declined from 61.61 to 13.87. These results of DASH score are similar to those reported by Marco Felipe Francisco et.al.<sup>[19]</sup>

## Conclusion

For the clinically confirmed cases of CTS, using arm tourniquet under local anesthesia is found quite effective. Most of the patients in this study achieved the best hand function after six months of operation.

## Conflicts of Interest

The authors declare no conflicts of interest.

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