

Functional Outcome of Double Incision Open Carpal Tunnel Release: A Prospective Study

¹Dr. Jaswant Singh, Singh Orthopedic Hospital Research Center, Station Road, Kota, Rajasthan

²Dr Dhanraj Madhur, Principal Specialist MS (Ortho), General Hospital, Bundi

³Dr. Nitin Kumar Bairwa, Senior Resident, Department of Orthopaedics, Government Medical College, Kota

⁴Dr. Chetan Mehra, Senior Resident, Department of Orthopaedics, Sardar Patel Medical College, Bikaner

Corresponding Author: Dr. Chetan Mehra, Senior Resident, Department of Orthopaedics, Sardar Patel Medical College, Bikaner

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Abstract

Introduction: Carpal tunnel syndrome is one of the most frequently encountered conditions in the orthopedic practice, affecting 3.8% of the general population. In this study we assessed functional outcome of double incision open technique for carpal tunnel release that avoid incision in the critical pillar zone.

Method: This study had 160 patients of carpal tunnel syndrome who undergone the procedure from January 2005 to December 2020 and total follow-up time was 2 years. To obtain diagnosis accurate history, physical examination including sensory and motor examination was performed. Provocative test for alternative diagnosis, as well as positive nerve conduction studies were also conducted.

Results: All the patients returned to activities of daily routine in average period of 9.6 days post operative (range, 9 to 12 days) and they regained full range of movements by 2nd week post operative.

Conclusion: The present technique addresses the problem of prolonged pillar pain after traditional open

carpal tunnel release incision. The technique provides equally good results as that of endoscope technique, while inherent risks of complications and cost for the patients are lessened.

Keywords: Carpal tunnel syndrome, Double incision open technique, Pillar pain, Transverse carpal ligament (TCL).

Introduction

Carpal tunnel syndrome is one of the most frequently encountered conditions in the orthopedic practice, affecting 3.8% of the general population.(1) Surgical decompression results in satisfactory outcomes regardless of the technique used. Open median nerve release via a straight or curved longitudinal incision has been a reliable method for most surgeons (2). Open carpal tunnel release surgery have recognized complications Pillar pain (thenar and hypothenar pain) (3) and scar sensitivity (4). There are several minimally invasive approaches which may reduce scar-related complications (5, 6) like endoscopic release (7) double-incision technique (8), limited-open incision (9) and approach

through the flexor carpi radialis (10). In open carpal tunnel release long standing pillar pain is most common complication. The exact etiology of pillar pain is not known. The neurogenic theory suggests cutting of cutaneous nerve fibers, while performing traditional open release are the reason for long standing pillar pain. This could be improved using an endoscopic technique or a "mini open" technique that avoids making an incision in the critical pillar zone(7,11). Endoscopic release has steep learning curve and requires costly equipment and specific setup along with some times incomplete decompression. In this study we assessed functional outcome of double incision open technique for carpal tunnel release that avoid incision in the critical pillar zone.

Material and Methods

This study had 160 patients of carpal tunnel syndrome who undergone the procedure from January 2005 to December 2020 and total follow-up time was 2 years. All the patients had preoperative grip and pinch strength tested for index to thumb pulp. To obtain diagnosis accurate history, physical examination including sensory and motor examination was performed. Provocative test for alternative diagnosis, as well as positive nerve conduction studies were also conducted.

Operative technique

In all cases axillary nerve block was used and pneumatic tourniquet was applied. Below the tourniquet painting and draping was done. A 1.5 cm. transverse incision was made just proximal to the wrist flexion crease between the palmaris longus and flexor carpi ulnaris. The forearm fascia was incised longitudinally up to 2 cm proximal to the wrist flexion crease and under direct vision, the proximal 1 to 1.5 cm of Transverse carpal ligament (TCL) was cut. While cutting TCL care was taken as not to cut either thenar, hypothenar or palmaris brevis muscles.

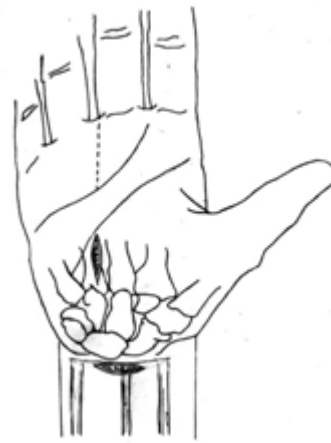


Figure 1: Critical pillar rectangle. The boundaries are wrist flexion crease proximally, to hook of the hamate distally, the ulnar border of the hamate ulnarly, and the scaphoid tubercle radially.



Figure 2: The proximal transverse incision is made proximal to the wrist flexion crease. The distal longitudinal incision is made between the proximal palmar crease and hook of the hamate in line with the radial border of the ring finger.

Another 1.5 to 2 cm. longitudinal incision was made in the palm beginning distal to the Kaplan's line in the axis of ring, long finger web space and ending just proximal to where the ring finger touched the distal palmar crease. The fascia was incised, exposing the superficial palmar arch and the distal edge of TCL. While the retractors elevate the skin and subcutaneous tissues, the TCL was divided under direct vision to meet the previous incision.

A gentle pop would confirm the complete release of the ligament.

The skin incision was closed with 4-0 nylon suture and below the elbow pop slab was applied for one week. Thereafter tendon gliding exercises were promoted.



Figure 3: Intraoperative photograph showing proximal end of the transverse carpal ligament through proximal wrist incision.



Figure 4: Intraoperative photograph showing dissected distal end of the transverse carpal ligament and underlying median nerve.

Results

In this study average age of patients was 52.2 years (range, 37- 65 years) with M: F ratios of 1:11. Post operatively, patients were evaluated at 1st, 4th and 10th week for pillar tenderness and pain were rated 0 to 4 by applying approximately 2 kgs of force on the region immediately proximal to Kaplan's cardinal line in the axis of long and ring finger web. The pillar pain was 0.5 at the end of 4th postoperative week; however, the pain subsided to zero in all the patients by 10th week.

At first week post operative, the grip strength was 10 to 24 % (average 16%) of the preoperative grip strength. It

increased to an average of 70% at 4th week post operative and the strength reached 90% at the 10th week post operative.

The thumb to index pulp strength was 50% to 70%, (average 65%) at the first post operative week, and it was 90% at the 4th week post operative. The pulp strength at the end of 10th week post operative was 100%.

Scar tenderness was also examined by palpation and it was absent in all the patients by 4th week post operative.

All the patients returned to activities of daily routine in average period of 9.6 days post operative (range, 9 to 12 days) and they regained full range of movements by 2nd week post operative.

Discussion

The pillar area consists of osseous and muscular attachments of the TCL three thenar muscles and three hypothenar muscles originate from the ligament. And the TCL serves the function of maintenance of the volar carpal arch(3). Although the exact etiology of the pillar pain is unknown, the proposed theory was alteration of the carpal arch. However regardless of the technique which has been adopted, the pillar pain should have occurred, whether open or endoscopic and whether the incision is large or small. Therefore, it has been suggested that sectioning of the TCL leads the thenar and hypothenar muscles to fall apart from each other. Alterations of the origin of these muscles, as well as the swollen raw edges of the cut TCL may result into pillar pain. Considering above theory, no incision was applied over these muscles and under direct vision TCL was identified and incised(11–13).

Wilson K.M. et al (1994)(11) postulated that transverse nerve fibers of ulnar and median nerve along with pacinian corpuscles present in the skin and subcutaneous tissues of the pillar rectangle can be disrupted while making incision in this area. Any technique that can

avoid cutting the skin through the critical pillar rectangle can minimize pillar pain. They operated 30 patients, and observed that one patient had persistent pillar pain. Keeping almost similar view, the double incision procedure was investigated in this study and observed that pillar pain was 0.5 at the end of 4th week and none of them experienced pain at 10th week. On the similar principle, Agee et al. (1994) (7) introduced endoscopic release of the transverse carpal ligament, and reported persistent tenderness level of 0.4 at 9th week and 0.3 at 13th week. The persistent neurogenic pain may be because some of the nerve fibers, which were present immediately anterior to the TCL, possibly cut by endoscope blade.

When other complication rates of endoscope and mini carpal tunnel release techniques are compared⁷, endoscopic release cite significant documented injuries of the median nerve, the deep motor branch of the median nerve, digital nerve, ulnar nerve, ulnar artery and the superficial palmar arch. Additional cadaveric studies (14) reported as great as a 50% incidence of incomplete release of TCL. This may account for apparently higher rate of recurrence of CTS symptoms after endoscopic release. On the contrary, in the present series, none of the major complications were observed and recurrence of symptoms was not observed in any of the case even after two years.

In the literature various mini open approaches and many specially designed tomes and cutting guides have shown promising results. The present double incision open technique relies on the sound principle of “if you cannot see it, don’t cut it”. Usually, this principle prevents intraoperative complications (11). An additional advantage of double incision is that no special instrument is required; thereby cost to the patient is significantly reduced.

Summary

The present technique addresses the problem of prolonged pillar pain after traditional open carpal tunnel release incision. The technique provides equally good results as that of endoscope technique, while inherent risks of complications and cost for the patients are lessened.

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