

DISTAL PALMAR INCISION FOR CARPAL TUNNEL RELEASE

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ABSTRACT

BACKGROUND

Carpal tunnel syndrome is the most common entrapment neuropathy of the upper extremity. Surgical decompression is indicated in whom conservative treatment fails. Open carpal tunnel release has been replaced by endoscopic techniques and limited incision techniques, to avoid the complications of open method. Smaller incisions lead to rapid postoperative recovery. Midpalmar incision is a type of limited incision used for release of carpal tunnel.

MATERIALS AND METHODS

From February 2016 through January 2017, 84 patients had undergone 90 midpalmar carpal tunnel releases with accurate skin incisions under axillary block anaesthesia. Postoperative evaluations were performed via subjective assessment with a standardized telephonic interview over an average follow-up period of 12 months.

RESULTS

The average operation time was 20 minutes (range, 5 to 40 minutes). A total of 72 hands (80%) had excellent recovery, nine (10 %) had good relief of symptoms, four (4.44%) had fair relief of symptoms and five (5.55%) had minimal improvement. The incidence of postoperative sensory morbidity, i.e., pillar pain or scar tenderness, was 7.77% (7 hands). Motor functional morbidity in the form of a persistent subjective decrease in grip strength was noted in 8.88% (8 hands), and the mean period for returning to work was 4.5 weeks. In addition, no operation-induced neurovascular or tendinous injury occurred in any patient.

CONCLUSION

The outcomes were similar to those of endoscopic carpal tunnel release. Based on these results, midpalmar carpal tunnel release with accurate location of skin incision is as effective as any other surgical procedures for carpal tunnel release. It is a safe, effective and economical procedure.

KEYWORDS

Carpal Tunnel Syndrome, Carpal Tunnel Release, Midpalmar Skin Incision.

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BACKGROUND

OCTR is the gold standard for CTR and has the advantages of direct visualisation of the ligament, completeness of release, lower risk of injuring blood vessels, and allowing the performance of parallel treatments on other pathologies in the carpal tunnel. However, complications were found to be common. Typical complications include pillar pain, subcutaneous tumor, scar tenderness, carpal arch broadening, and flexor tendon entrapment, adherence of tendons, reflex sympathetic dystrophy. Scar tenderness was found to occur in 19% to 61% of patients. Among all the problems scar tenderness and pillar pain are found to be main problem.^{1,2,3,4} Delayed post-operative recovery is also one of the disadvantages of OCTR. The incision of the fascial convergence between the thenar and hypothenar is

responsible for slower postoperative recovery. The challenge to perform carpal tunnel release without incising the fascial convergence and wrist crease has stimulated the development of several different endoscopic and microsurgical minimally invasive techniques.⁵ The first of these, endoscopic carpal tunnel release (ECTR) procedures, were reported by Chow and Okutsu in and by Agee in. The second approach, limited incision techniques (LIT), a modification of the standard open CTR, was developed in response to apprehension about the early ECTR procedures.

Both ECTR and LIT uses smaller incision(s) which result in reduced operative exposure of relevant anatomy. Consequently, accurate knowledge of topographical landmarks helps to define the location of important surgical structures at risk for injury. Structures at risk of injury are located near the distal edge of the transverse carpal ligament (TCL) and may vary considerably from patient to patient.

The Recurrent Motor Branch of the Median Nerve

Recurrent branch of median nerve has three variants extraligamentous, subligamentous and transligamentous.

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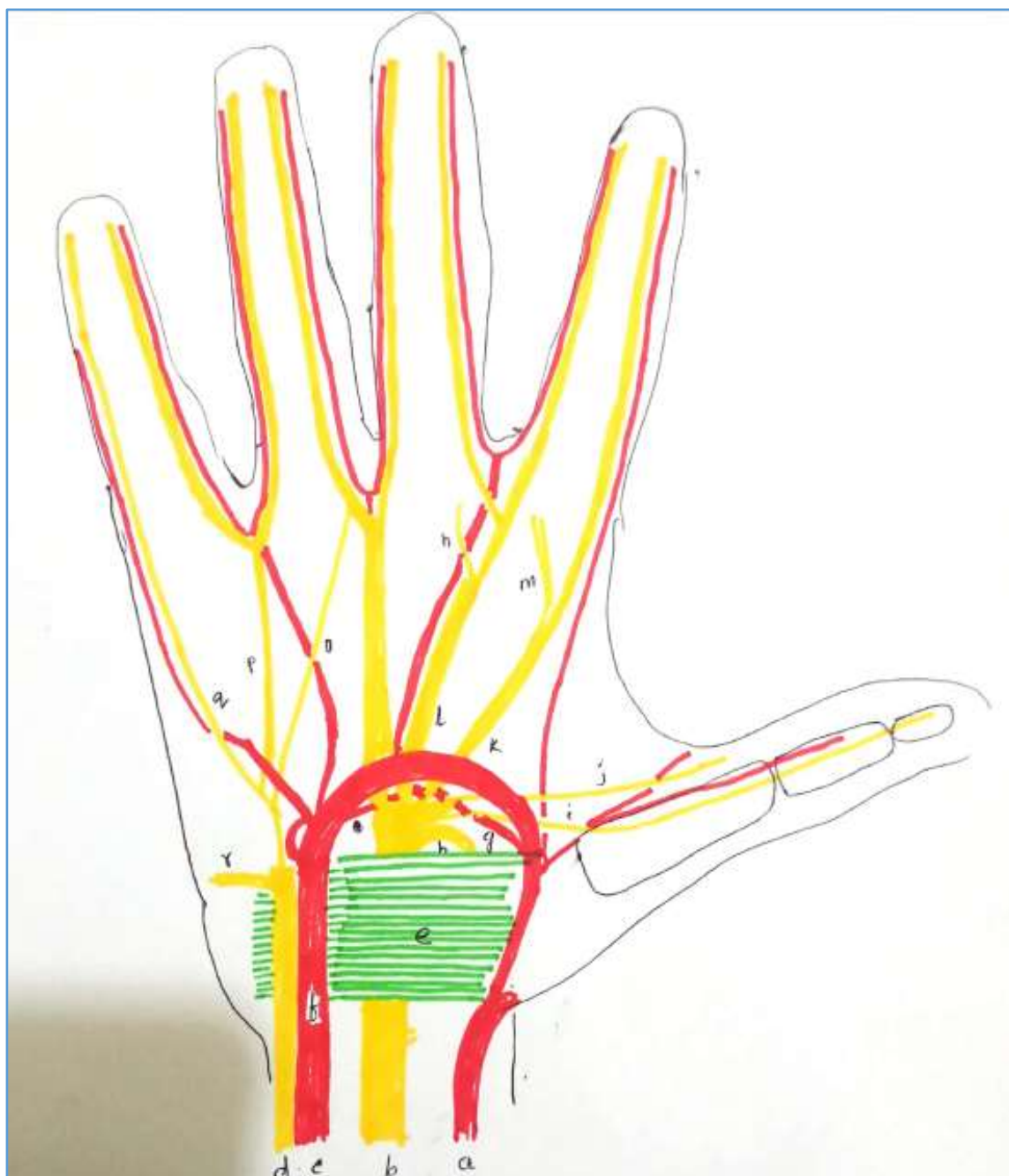


Figure 1. Anatomy of Carpal Tunnel and Relation to Neurovascular Structures

a) Radial artery. **b)** Median nerve. **c)** Ulnar artery. **d)** Ulnar nerve. **e)** Flexor retinaculum. **f)** Superficial palmar arch. **g)** Deep palmar arch. **h)** Recurrent branch of median N. **i and j)** Branch to thumb. **k and l)** Median N branch to index and middle finger. **m)** Branch to 1st lumbrical. **n)** Branch to 2nd lumbrical. **o)** Communicating branch from ulnar N to Median N. **p, q and r)** Branches of ulnar nerve.

The Superficial Palmar Arch

The superficial palmar arch (SPA) is located from 2 to 26 mm from the distal edge of the TCL (Figure 1). It is contained within and often hidden by the fat pad. Consequently, there is very little room for error.

Communicating Branch between the Ulnar and Median Nerves

The communicating branch between the ulnar and median nerve is present in 80 to 90% of cases and may lie in close proximity to the distal "edge" of the flexor retinaculum. It

typically originates proximally from the fourth common digital nerve and enters the third common digital nerve more distally (Figure 1), but several variations have been reported. Injuries can result in postoperative paraesthesia to the long or ring fingers.

Fat Pad

The fat pad is located in the mid-palm. It may extend proximal and dorsal to the TCL for a distance of 2 to 3.5 mm. This prevents visualization of structures which could lead to an incomplete release of the TCL. Lack of

visualization also may result in injury to the SPA, the communicating branch of the ulnar nerve, or the motor branch of the ulnar nerve.

The anatomy surrounding the distal edge of the TCL is further complicated by the changing orientation of the flexor tendons and median nerve as they approach it. The median nerve starts to branch and the communicating branch of the ulnar nerve in some cases traverses horizontally close to this distal edge. These anatomic complexities highlight the importance of adequate visualization at the distal edge of the TCL. Procedures that do not permit this direct exposure prior to the introduction of cutting devices pose a greater risk of injuring these structures. The safest way for a surgeon to proceed is by exploring the distal edge of the transverse carpal ligament and identifying all pertinent structures and potential anomalies before introducing any instrumentation. One way to accomplish this is by enlarging distal incision. Because it permits identification of the key anatomy at the distal edge of the TCL, this modification should improve the safety of this technique. Additionally, the distal incision not only allows for the identification of key anatomic structures but also for safe insertion of the instrumentation. The TCL, median nerve, and flexor tendons can be visualised directly and before the division of the TCL. If a conversion to an open CTR is necessary, the small longitudinal incision in the palm is extended proximally, as done with the conventional CTR incision. This procedure also provides another possible anatomic benefit i.e. the option of preserving the interthenar fascia.

The purpose of this study was to evaluate a minimal nonendoscopic method that is the midpalmar carpal tunnel release (MPCTR) with particular emphasis on the location of the skin incision used in this technique.

MATERIALS AND METHODS

From February 2016 through January 2017, the author conducted 90 procedures in 84 patients, 7 underwent bilateral operations. The patients included 58 women (70%) and 26 men (30%) aged 25 to 75 years (average, 50 years). In 51 patients (60%), the affected or worse hand was on the dominant side. All patients had intermittent or continuous and disabling symptoms with or without evidence of muscle weakness and atrophy. The mean duration of symptoms was 33 months (range, 1 to 100 months). In all patients, the diagnosis was based on a clinical presentation involving median nerve compression and on electrophysiologic evidence of median nerve compression below the elbow. Twenty-nine hands (32%) had positive Tinel signs. Thenar muscle atrophy was noted in 15 hands (16%). In 54 hands (60%), the symptom of numbness with or without pain was prominent at night and interrupted the patient's sleep. Before the operations were undertaken, all patients but one (who had intolerable numbness and pain lasting 1 month) had received unsuccessful conservative treatments, such as anti-inflammatory drugs, wrist splints, and local steroid injections. Patients who had experienced previous hand

trauma or undergone surgery to the hands and those receiving haemodialysis were excluded from this study.

All patients were operated on in an outpatient setting. All procedures are performed under axillary block anaesthesia. Skin preparation and sterilization was performed as usual. A longitudinal skin incision of about 2.0 to 2.5 cm was created in the palm with its distal end about 0.5 to 1.0 cm proximal to the junction of the transverse line drawn from the proximal edge of the first web space and the axis of the middle finger/ring finger (Figure 2).



Figure 2

The wound was then deepened. The TCL was longitudinally divided at its distal segment using a number 15 blade and small blunt-end scissors under direct visualization. (Figure 3)

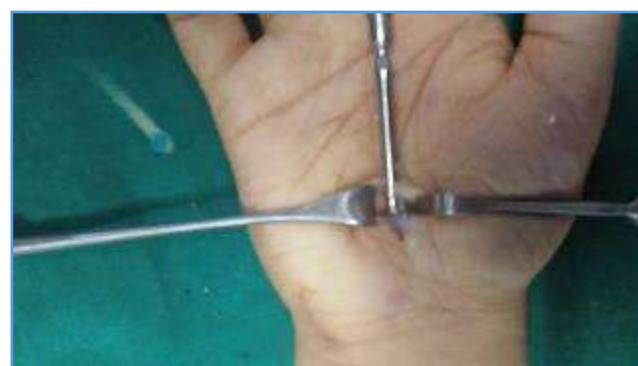


Figure 3

The distal segment of the median nerve was then exposed. Thus, the carpal tunnel was first released in its distal segment. The rest of the TCL was divided using a no 11 blade with its cutting edge facing upward. It was

guarded by freer elevator which was introduced into the carpal tunnel below the distal margin of TCL, with its protecting platform underneath the TCL and No-11 blade cutting the fibre of TCL. The wrist joint was slightly dorsally extended. The divided edge of the ligament and the contents of the tunnel were inspected. The released tunnel was explored using Metzenbaum scissors to ensure complete release. The wound was then closed with 5-0 PROLENE sutures. (Figure 4)



Figure 4

The tourniquet pressure was released, and the wrist and proximal palm were compressed for 5 minutes to achieve haemostasis. The wound was then dressed and bandaged. No splint was used. Nonsteroidal anti-inflammatory drugs were given for 2 days, and no antibiotics were prescribed. The patients were instructed to move their fingers after the operation.

RESULTS

At the end of this study, 17 hands (15 patients) were lost to follow-up. Therefore, we analysed the outcome of 73 hands. The average follow-up period for the 73 hands was 12 months (range, 4 to 53.5 months). An independent evaluator interviewed the patients by telephone using a standardized questionnaire. For this assessment, the evaluator inquired about the degree of relief of preoperative numbness and pain of the operated hand, any postoperative pillar and/or scar pain, and the patients' recovery in terms of their daily activities and return to their previous work. The mean operation time (from skin incision to the end of wound closure) was 20 minutes (range, 5 to 40 minutes). A total of 72 hands (80%) had excellent relief of symptoms (90%-to-complete improvement), nine (10%) had good relief of symptoms (70%- or-greater improvement), four (4.44%) had fair relief of symptoms (50%-or-greater improvement), and five (5.55%) had only minimal improvement or no change in their symptoms. Postoperative pain of the operated hand was noted in seven hands (7.77%). These included three hands with surgical-scar tenderness, three hands with pillar pain, and one hand with both. A subjective persistent decrease of grip strength was noted in eight hands (8.88%). Poorer performance in lifting heavy objects, as compared with the preoperative state, was noted in 5 hands (5.55%). Towel squeezing was worse in 4 hands (4.44%), and buttoning

ability was worse in 3 hands (3.33%). The return-to-work period was 1 to 16 weeks (mean, 4.5 weeks). No major neurovascular injuries occurred.

DISCUSSION

The goal of surgical treatment for CTS is to decompress the median nerve by transecting the TCL. To reach this goal, various surgical techniques are currently used; most of these have equal rates of success. In regard to the efficacy of symptom relief, the distal carpal tunnel release in the present study had results (80%) comparable with those of other reported techniques.

In previous studies, patients who underwent ECTR had less pillar pain, faster recovery of grip and pinch strength, and earlier return to daily activities and work than those who underwent nonendoscopic treatments. In the present study, our patients had postoperative incidence of scar and pillar pain of 7.77%, which was close to that of the endoscopic techniques and other minimal palmar incision techniques.^{5,6} Some researchers have claimed that the endoscopic carpal tunnel release (ECTR) decreased the postoperative morbidity of standard open carpal tunnel release. Motor morbidity (8.88%) in the current study was evaluated using the patients' subjective report of decreased grip strength. This rate was higher than the results of the endoscopic techniques and other minimal palmar incision techniques in which the objective grip and pinch strength were measured.^{5,6,7} This discrepancy could be attributed to the differences in the measuring method. The reduction in the destruction of skin, subcutaneous tissue, and palmar fascia and the preservation of the important fascia convergence between the thenar and hypothenar muscles is believed to have contributed to the lower morbidity observed with endoscopic and minimal palmar incision techniques.^{5,8} ECTR is a demanding procedure that is prone to technical errors, and some authors had questioned whether the benefits of ECTR outweighed the potential risks.⁹ ECTR is not without risk, and incomplete decompression is possible. The complications of injury to the superficial palmar arch or median or ulnar nerve and of incomplete release of the carpal tunnel have been well documented.^{10,11,12,13,14,15,16} Moreover, the advantages of ECTR compared with standard open carpal tunnel release seem to predominate only during the first few weeks after the operation and wane with time. The midpalmar-incision technique presented here is intended to decrease the size of not only the skin and palmar fascia opening but also tissue destruction. In addition, the direction in which the TCL is transected here is safe because it is oriented away from the superficial palmar arch. On the contrary, this critical vascular arch is exposed and endangered during the endoscopic and wrist-incision techniques. With accurate location of the skin incision, the risks of major neurovascular or tendon injuries in the midpalmar-incision technique can be further minimized. This is because the narrow tunnel is first opened under visualization in its distal and middle segments using a scalpel, and then the proximal segment is gently approached using a carpal

tunnel knife or other specially designed instruments. In other words, the tunnel is released in a semi-open method, that is, partially open (the middle and distal segments are released using a scalpel under visualization) and partially blind (the proximal segment is approached using a carpal tunnel knife). The structures inside the tunnel are better protected using this method than with the ECTR and wrist-incision technique. The duration of the operation from the skin incision to the end of skin closure varied and depended mainly on the thickness of the skin, subcutaneous tissue and TCL and the severity of tightness of the tunnel. In regard to the completeness of decompression, to neurovascular safety, and to the short operation time, the location of the skin incision is crucial in MPCTR. The distal end of the incision should be 0.5 to 1.0 cm proximal to the intersection of the axis of the middle finger/ring finger and the transverse line drawn from the proximal edge of the first web space, as depicted in the report by Atik et al.¹⁷ The distal edge of the TCL can be identified under visualization through this incision, and from here, the TCL is resected in a proximal direction. With this distal-to-proximal transection direction, the convergence of the superficial vascular arch and the third common digital nerve are not endangered. The palmar cutaneous branch of the median nerve, which is always radial to the axis of the middle finger/ring finger, can also be preserved in this skin incision. Watchmaker et al suggested that the transection of the palmar cutaneous branch and its small arborizations can be avoided with an incision placed 5 mm ulnar to the interthenar depression, extending distally in line with the third web space, a consistent landmark in the proximal palm.¹⁸ The macroscopic branches from either the median nerve or the ulnar nerve cross the proximal palm.¹⁹ Skin incision and subcutaneous dissection superficial to the palmar fascia in the proximal palm should be avoided.¹⁷ Among the 11 hands with the preoperative neurophysiologic study revealing the double crush phenomenon, 2 hands (18%) had poor recovery (one with minimal resolution and one with no change in symptoms). The patients were later proved to have significant cervical spinal lesions. This finding may indicate that the double crush phenomenon, as demonstrated with electrophysiologic study, is prognostic of poor procedural outcomes. Preoperative study of the cervical spine may be necessary in this circumstance. Significant nocturnal symptoms were documented in 64 hands. Among these, 60 hands (94%) had better-than-good relief of symptoms after the procedure. The favourable predictive value of this symptom was similar to that in the overall population (94% vs. 91%). In conclusion, with the accurate location of skin incision, MPCTR is an effective, safe, and simple technique. Its postoperative morbidity is less than that of other surgical techniques and similar to that of ECTR. Because of its safety and simplicity, MPCTR is believed to be a good alternative to ECTR.

CONCLUSION

The outcomes were similar to those of endoscopic carpal tunnel release. Based on these results, midpalmar carpal tunnel release with accurate location of skin incision is as effective as any other surgical procedure for carpal tunnel release. It is a safe, effective and economical procedure.

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