Midpalmar Accurate Incision for Carpal Tunnel Release

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Background: Carpal tunnel syndrome is the most common entrapment neuropathy in humans today. For patients in whom conservative treatment fails, surgical decompression is indicated. Among the various surgical techniques currently in use, endoscopic techniques are becoming increasingly popular. Due to the rapid postoperative recovery shown after endoscopic operations, midpalmar accurate incision for carpal tunnel release is a comparative alternative.

Methods: From February 1998 through January 2003, 84 patients had undergone 96 midpalmar carpal tunnel releases with accurate skin incisions under regional block or general mask anesthesia. The postoperative evaluations were performed via subjective assessment with a standardized telephone interview over an average follow-up period of 22.4 months.

Results: The average operation time was 16 minutes (range, 5 to 40 minutes). A total of 87 hands (91%) had excellent or good recovery in terms of symptom relief (improvement of 70% or greater). The incidence of postoperative sensory morbidity, i.e., pillar pain or scar tenderness, was 7% (7 hands). The motor functional morbidity of a persistent subjective decrease in grip strength was noted in 8% (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.

Conclusions: 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. Furthermore, it is also a safe and simple procedure.

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Key words: carpal tunnel syndrome, carpal tunnel release, accurate midpalmar skin incision.

Carpal tunnel syndrome (CTS) is the most common peripheral entrapment neuropathy in humans today. The incidence continues to increase. This syndrome usually responds well to surgical decompression. Since the operative treatment of CTS was first described in 1924, the surgical methods have since been modified and varied. Currently, several surgical techniques are used to accomplish median nerve decompression in the carpal tunnel. These techniques are performed with the aid of different surgical instruments and through different skin incisions. The procedures can be classified into nonendoscopic or endoscopic methods. Nonendoscopic methods include (1) a standard open technique using a long palmar skin incision to transect the transverse carpal ligament (TCL) under full

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direct visualization, (2) a wrist-incision technique to blindly transect the TCL proximally to distally, and (3) a midpalmar-incision technique to transect the TCL distally to proximally.[1-5] The endoscopic methods are performed with endoscopic assistance and include single- or dual-portal techniques. The techniques have been reported worldwide and are becoming more popular.[6-18] Generally, the success rates of all these techniques are equally high. The current major concerns of these operations are the postoperative sensory and motor morbidity and the interval before the patient can return to work.

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.

METHODS

From February 1998 through January 2003, the author (W.C. Tzaan) conducted 107 procedures in 94 patients, 13 underwent bilateral operations. The patients included 69 women (73%) and 25 men (27%) aged 29 to 89 years (average, 50 years). In 49 patients (52%), 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 37 months (range, 1 to 240 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. Thirty-four hands (32%) had positive Tinel signs. Thenar muscle atrophy was noted in 17 hands (16%). In 64 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 hemodialysis were excluded from this study.

All patients were operated on in an outpatient setting. In the early practice of the operation, the procedures were conducted with a regional intravenous block; this was used in 34 hands (32%). Since February 2000, most procedures were conducted under general mask anesthesia with tourniquet control (73 hands, 68%).

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 (Fig. 1). The wound was then deepened. The TCL was longitudinally divided at its distal segment using a number 67 blade and small blunt-end scissors under direct visualization. The distal segment of the median nerve was then exposed. Exposure of the fatty tissue distal to the

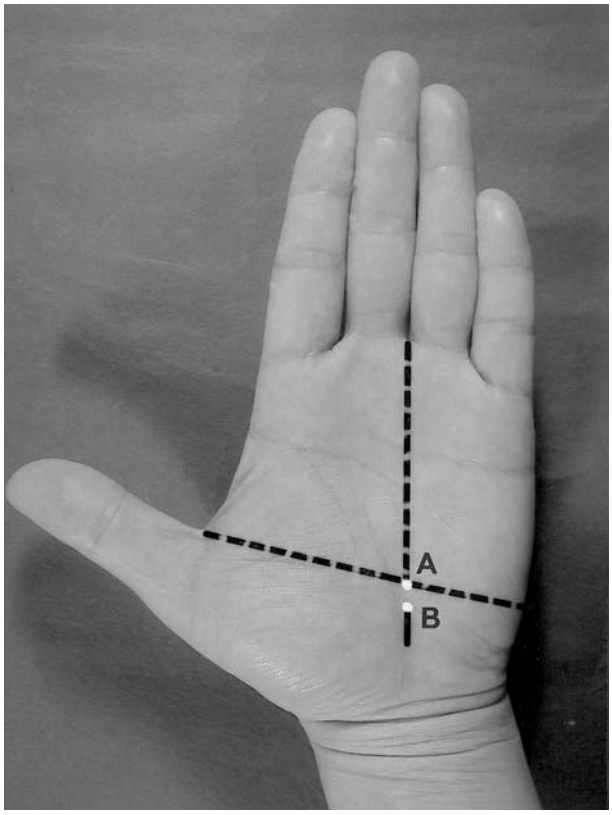

Fig. 1 Image shows the accurate location of the short palmar incision (2–2.5 cm). White dot A is the junction of the transverse line drawn from the proximal edge of the first web space (transverse broken line) and the middle/ring finger axis (longitudinal broken line). White dot B is the distal end of the incision. The distance between A and B is 0.5 to 1.0 cm.

TCL indicated adequate distal release of the tunnel. Thus, the carpal tunnel was first released in its distal segment. No headlamp for bright illumination or loupe magnification was used. The rest of the TCL was divided using a Paine carpal tunnel retinaculotome (Ruggles Instruments, Elekta Instruments, Inc., Atlanta, Ga) (Fig. 2). The retinaculotome was introduced into the tunnel through the opening created, with its protecting platform underneath the TCL and its vertical cutting blade confronting the distal undivided edge of the ligament. The wrist joint was slightly dorsally extended. The carpal tunnel retinaculotome was then steadily advanced in a proximal direction to divide the remaining TCL and the distal antebrachial fascia. 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 4-0 vicryl subcuticular suture without knots. Wound approximation was enhanced using sterile tape. The tourniquet pressure was released, and the wrist and proximal palm were compressed for 5 minutes to achieve hemostasis. 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, 11 hands (10 patients) were lost to follow-up. Therefore, we analyzed the outcome of 96 hands. The average follow-up period for the 96 hands was 22.4 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.

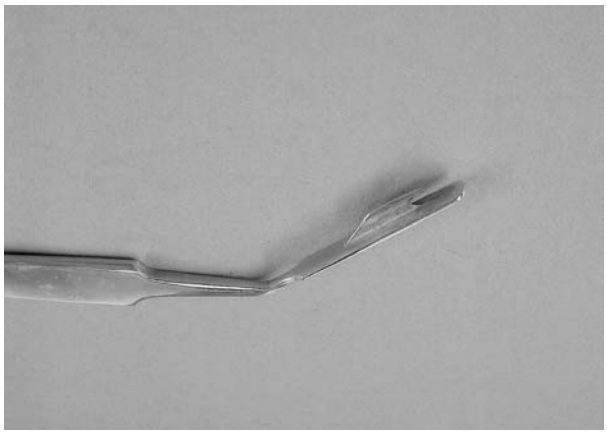

Fig. 2 Paine carpal tunnel retinaculotome with a platform to protect the median nerve and vertical cutting blade to transect the TCL.

The mean operation time (from skin incision to the end of wound closure) was 16 minutes (range, 5 to 40 minutes). A total of 78 hands (81%) had excellent relief of symptoms (90%-to-complete improvement), nine (9%) had good relief of symptoms (70%-or-greater improvement), four (4%) had fair relief of symptoms (50%-or-greater improvement), and five (5%) had only minimal improvement or no change in their symptoms.

Postoperative pain of the operated hand was noted in seven hands (7%). These included four 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%). Poorer performance in lifting heavy objects, as compared with the preoperative state, was noted in 5 hands (5%). Towel squeezing was worse in 4 hands (4%), and buttoning ability was worse in 3 hands (3%). The return-to-work period was 1 to 16 weeks (mean, 4.5 weeks). Stitch abscess was noted in 3 hands (3%). 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 regards to the efficacy of symptom relief, the MPCTR in the present study had results (90.2%) comparable with those of other reported techniques.[6-29]

Some researchers have claimed that the endoscopic carpal tunnel release (ECTR) decreased the postoperative morbidity of standard open carpal tunnel release.[6,8,19-25] 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%, which was close to that of the endoscopic techniques and other minimal palmar incision techniques.[1,4,6,8,22,23] Motor morbidity (8%) 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.[1,4,22] 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.[4,20]

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.[12,26-31] 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.[14] 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.[32]

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.

During the early stage of this series, MPCTR was undertaken with intravenous regional-block anesthesia. This anesthetic procedure took time, and many patients felt intolerable pressure and pain from the tourniquet. One patient had cellulitis on the dorsal surface of the treated hand. The infection was attributed to contamination at the venous puncture site for anesthesia. Since February 2000, with the exception of patients with short stiff necks or with other potential risks of airway obstruction, general mask anesthesia has been used in the majority of patients. No intraoperative discomfort or any other anesthetic complications occurred. No intraoperative endotracheal intubation during the operation became necessary. The overall operation time, including anesthetic preparation, was greatly reduced. Almost all of the patients receiving the general mask anesthesia were satisfied with this alternate anesthetic procedure.

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 regards 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.[33] 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 arboriza-

tions 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.[34] The macroscopic branches from either the median nerve or the ulnar nerve cross the proximal palm.[35] Skin incision and subcutaneous dissection superficial to the palmar fascia in the proximal palm should be avoided.[33]

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 favorable 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.

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掌中部精確傷口腕隧道神經減壓術

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背 景：腕隧道症候群爲一常見疾病，對保守療法失敗患者必須採手術治療，現行有多手術療法，但何者最理想且爲最多數外科醫師所採用，至今仍無定論。

方 法：作者採用掌中部精確小傷口，進行腕隧道神經減壓手術，最後對96隻手（84人）術後以電話問卷作總結評估，平均追蹤22.4個月。

結 果：平均手術時間爲16分鐘，有87隻手(91%)症狀改善極佳或良好（改善七成或超過）；術後感覺異常，包括掌根部疼痛傷口疤痕壓痛，發生率爲7%；運動功能障礙發生率爲8%; 術後平均4.5週復工作；手術引起之神經血管或肌腱損傷發生率爲0。

結 論：此手術法以精確掌中部小傷口進行腕隧道神經減壓，不僅可避免傳統手術過長之傷口疤痕，及內視鏡手術對設備之依賴，又保有良好之改善症狀療效，其操作也更爲簡單而安全。

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關鍵字：腕隧道症候群，腕隧道神經減壓術，掌中部精確傷口。

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