Variations in incisions and postoperative management in carpal tunnel surgery

Carolyn M Levis MD¹, Thomas H Tung MD², Susan E Mackinnon MD²

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This study examines the variations in incisions and postoperative protocol of open carpal tunnel release. A questionnaire was distributed to 65 hand surgeons. Respondents were asked to draw their preferred incision on original photocopies of the same palm. The results were measured against standard anatomical landmarks (thenar crease, vertical axis of the third web space, proximal palmar crease and the distal wrist crease). The participants were also asked to answer questions concerning their postoperative protocols. Demographics of the cohort, as well as the variations in incisions and postoperative management, were analyzed. Significant variations existed in the length and location of the incision in the palm. The differences in postoperative care in this cohort of surgeons were less significant.

Key Words: *Carpal tunnel syndrome; Median nerve; Surgical incisions*

Les variations dans le type d'incisions et la prise en charge postopératoire de l'opération du canal carpien

RÉSUMÉ : La présente étude porte sur les variations dans le type d'incisions et le protocole postopératoire de la libération ouverte du canal carpien. Un questionnaire a été distribué à 65 chirurgiens de la main. Les répondants étaient invités à dessiner l'incision qu'ils préféraient sur des photocopies originales de la même paume. Les résultats ont été mesurés d'après des repères anatomiques standards (pli thénarien, axe vertical du troisième espace interdigital, pli palmaire proximal et pli distal du poignet). Les participants étaient également invités à répondre à des questions axées sur leurs protocoles postopératoires. La démographie de la cohorte ainsi que la variation du type d'incisions et de la prise en charge postopératoire ont été analysées. Il existait d'importantes variations dans la longueur et l'emplacement de l'incision de la paume, mais les différences en matière de soins postopératoires étaient moins marquées.

¹McMaster School of Medicine, Hamilton, Ontario; ²Division of Plastic Surgery, Washington University School of Medicine, St Louis, Missouri, USA

Correspondence: Dr TH Tung, Division of Plastic and Reconstructive Surgery, Washington University School of Medicine, 17424 East Pavilion, Barnes-Jewish Hospital, One Barnes-Jewish Hospital Plaza, St Louis, Missouri 63110, USA. Telephone 314-362-4588, fax 314-367-0225, e-mail tungt@msnotes.wustl.edu

Since the first known surgical release of the carpal tunnel in 1924 (1), numerous reports in the literature have described various surgical approaches for decompression of the median nerve at the wrist. With the development of 'minimal access surgery', limited incisions to decompress the carpal tunnel have received renewed interest. Since the middle of the past decade, the endoscopic procedure has gained notable popularity (2,3). Some surgeons consider this to be the technique of choice, reserving the standard open technique for certain circumstances, such as patients with rheumatoid arthritis, previous wrist trauma or revision carpal tunnel surgery. The endoscopic approach has been criticized, however, because of a reported increased incidence of injuries to the median and ulnar nerves (4-6). 'Limited incision' techniques that claim the advantages of early return to work with less incidence of major neurovascular injuries continue to be published (7). Regarding efficacy, multicentre, randomized trials have demonstrated that the endoscopic release was found to be equivalent to open release of the carpal tunnel (3,8). The same trials demonstrated an early improvement in grip and pinch strength, but not an earlier return to work compared with open release in the worker's compensation population. Despite this, open release of the transverse carpal ligament is still considered to be the 'gold standard' technique for releasing the median nerve at the wrist. For those surgeons who use the open procedure, great variability regarding the incision and the postoperative protocol exists. The purpose of this study was to conduct a survey of these parameters among practising hand surgeons.

METHODS

Surgeons attending the three-day "In-Depth Carpal Tunnel Symposium" of 1997 in Bar Harbour, Florida (sponsored by the American Society for Surgery of the Hand, the American Academy of Orthopaedic Surgeons, and the American Association of Hand Surgery) completed an anonymous questionnaire that included surgeon and practice demographics as well as each surgeon's postoperative protocol for open carpal tunnel release. Surgeons were questioned about postoperative splinting, mobilization of the fingers and wrist, and suture removal. They were also asked to estimate postoperative incisional pain at three months and the long term incidence of pillar pain. The data were analyzed for trends. In addition, the surgeons were asked to draw their incisions for release on original photocopies of the author's hand. The relationships to standard anatomic landmarks were measured on two separate occasions by the same observer, and the average was taken. To obtain the measurements, a computer-assisted graphics pad, Summa Sketch Plus (Summagraphics, USA) was used. The landmarks used were the thenar crease, the vertical axis of the third web space corresponding to 5 mm ulnar to the interthenar depression (9), the proximal palmar crease corresponding to the approximate level of the superficial palmar arch, and the distal wrist crease (Figure 1). The length of the incision and distances from the landmarks were measured.

Figure 1 Photocopy of the palm used for the questionnaire with the addition of the standard landmarks for measurements: **A** proximal palmar crease, **B** distal wrist crease, **C** thenar crease, and **D** vertical axis of the third webspace

TABLE 1
Demographic information of the cohort of surgeons who participated in the questionnaire

Specialty (% of total participants)	Mean number of years in practice
Orthopedic surgeons (62)	19.3 (range 3–33)
Plastic surgeons (31)	14.0 (range 3–30)
General surgeons (7)	13.2 (range 6–26)

RESULTS

Questionnaires were returned from 65 hand surgeons. Orthopedic surgeons represented 62% (40 respondents) of the group, while 31% (20 respondents) were plastic surgeons. The remaining 7% (five respondents) were general surgeons who were trained in hand surgery or who restricted their practice to hand surgery. The average number of years in practice for the cohort was 16.7, with a range of three to 30 years, and 86% of the respondents had more than 10 years of practice experience (Table 1).

Postoperative protocol

The majority of hand surgeons (69%) immobilized the wrist postoperatively, while 31% of surgeons did not use any immobilization. All but four respondents encouraged immediate finger mobilization, but there was greater variability in the length of time that the wrist was immobilized.

This generally paralleled the duration that patients were instructed to wear a day splint. On average, patients were instructed to wear a night splint for 13 days after the operation (range zero to 60 days). Among those who immobilized the wrist for a period of time and who advocated day and/or night splinting, 47% were orthopedic surgeons, 42% were plastic surgeons and 11% were general surgeons. This group was in practice for a mean of 16.1 ± 7.2 years. Among those who did not immobilize the wrist postoperatively and who did not use day or night splints, 72% were orthopedic surgeons, 22% were plastic surgeons, and 6% were general surgeons. This group had practised for a mean of 16.7 ± 7.4 years. For all respondents, sutures were removed between 10 and 14 days after the operation. Patients were allowed to wash their incisions in an average of 8.9 days (range zero to 60 days). The surgeons were asked to estimate the incidence of scar tenderness that existed at three months and persistent pillar pain in their practices following carpal tunnel release. The group average was 14% for scar tenderness and 21% for pillar pain (Table 2).

Incision analysis

The survey indicated clearly that the questions referred to open carpal tunnel release. Two respondents (3%) used two short, transverse incisions, one in the palm and the other proximal to the wrist crease. These two respondents were not included in the analysis. The average length of the longitudinal incision used by the respondents was 3.72 cm, with a range of 0.78 to 9.64 cm. When analyzed by the type of surgical training, the mean incision length was 3.9 ± 1.9 cm for orthopedic surgeons, 3.4 ± 2.0 cm for plastic surgeons, and 3.2 ± 0.6 cm for general surgeons. Eighty per cent of surgeons did not take the incision proximal to the distal wrist crease. The location of the incision in the palm varied considerably. Regarding the landmark of third web space axis, 95% of incisions were placed radial and 4.7% were at or ulnar to this landmark. Eight per cent of incisions were placed radial to or

TABLE 2
Summary of postoperative protocols and estimates of scar tenderness and pillar pain

Postoperative protocol	Estimates of incidence (range)
Postoperative immobilization	69%
Dressing removal	8.3 ± 8.7 days (1–21)
Finger movement	0.3 ± 1.0 days (0–7)
Wrist extension	6.6 ± 6.1 days (0–21)
Wrist flexion	8.2 ± 6.7 days (0–28)
Wash incision	8.9 ± 4.1 days (1–21)
Suture removal	11.5 ± 2.7 days (6–21)
Day splint	8.3 ± 8.7 days (0–31)
Night splint	12.4 ± 13.9 days (0–60)
Scar tenderness (estimated)	$14.9\% \pm 18.7\%$ (0%–100%)
Pillar pain (estimated)	$21.8\% \pm 25.2\%$ (0%–100%)

crossing the thenar crease (Figure 2). Two surgeons continued the incision distal to the proximal palmar crease.

DISCUSSION

Carpal tunnel syndrome is the most common and most understood peripheral compression neuropathy, and simple release of the transverse carpal ligament relieves symptoms in the majority of patients. However, surgical failure rates of 7% to 20% have been reported (10) and may be related to patient selection, surgical approach and postoperative management. Twenty-five years ago, Taleisnik (11) noted that there was great disagreement about the incision that should be used for decompressing the median nerve at the wrist. Despite the prevalence of this syndrome and the vast number of publications on the topic, there is still great variability regarding the surgical approach and the postoperative care. In 1987, a report by Duncan et al (12) indicated that most hand surgeons were using a variation of a vertical incision in the palm to release the carpal tunnel. In the MEDLINE database, there are more than 990 publications in

Figure 2) Variability of incisions used by the cohort. The surgical incisions marked by the hand surgeons varied from extremely long (left) to very short distal incisions (middle). The authors' preferred incision (right)

English that concern carpal tunnel syndrome between 1995 and 1999. Many of these reports deal with the surgical management of carpal tunnel syndrome.

Despite the success of open decompression of the carpal tunnel, a variety of approaches has evolved for decompressing the median nerve in the carpal tunnel in an effort to avoid complications such as injury to the palmar cutaneous branch (PCB), prolonged scar tenderness and pillar pain. The advent of minimally invasive surgery techniques in the past decade has expanded the surgical management of carpal tunnel syndrome. The surgical approaches fall into three major categories – the classic open technique performed by Learmonth (13) in 1933; the endoscopic approach described by Chow (2) in 1989 and Agee (14) in 1992; and the limited incision technique that uses a variety of 'retinaculotomes' and scopes reported by several authors (12,15-17).

The location of the incision in the palm has been discussed extensively for open techniques of carpal tunnel release, in particular with respect to the location of the PCB (9,11,18,19). Carroll and Green (18) noted that, with the interthenar incision described by Milford (20), the nerve is not visualized and is not likely to be injured, provided that the incision is not carried proximal to the base of the thenar eminence. Taleisnik (11) and others (21,22) have long advised an incision just ulnar to the longitudinal axis of the ring finger ray that does not jeopardize the palmar branch of the median nerve. In the group of surgeons that was surveyed, none of the incisions were placed ulnar to this axis. Taleisnik (11) and, later, Hobbs et al (22) described the ulnar branches of the PCB as penetrating the skin at or radial to the axis of the ring finger after traversing the transverse carpal ligament. It was suggested by Engber and Gmeiner (23) that this ulnar incision could potentially injure the PCB of the ulnar nerve, which has a variable location. Furthermore, they described two cases of painful neuromas in the hypothenar skin with the ulnar incision, and therefore recommended an incision that was located directly over the axis of the ring finger metacarpal. In a detailed anatomical study, Watchmaker et al (9) described considerable variability in the location of the axis of the ring finger, depending on abduction or adduction of the digits and the palmar creases, and their relationships to the PCB. They recommended that both of these landmarks are unreliable for the planning of incisions in the palm. They concluded that an incision 5 mm ulnar to the depression, between the thenar and hypothenar eminences, and in line with the third web, is a constant landmark and avoids injury to the PCB. Three of the respondents in the cohort placed their incisions within 5 mm on the ulnar side of the third web axis. Forty-three per cent of the surgeons placed their incisions between 2 and 5 mm radial to this axis. In this group, the incidence of scar tenderness varied between 0% and 40%. In an anatomical study, Ruch et al (24) localized and quantified the cutaneous nerves of the palm. They found that the third web space had the lowest innervation density, while the second web and the ring finger axis had the greatest density. They recommended an incision in the third

web space, placed 2 cm proximal to Kaplan's cardinal line. A longitudinal incision was used by 97% of the present cohort, with an average length of 3.72 cm. Sixty-seven per cent of the surgeons indicated an incision that was less than 4 cm in length, compared with 32% of those in the American Society for Surgery of the Hand survey. No significant difference in incision length was noted when surgeons were grouped by type of training (orthopedic, plastic or general surgery). For each group, the mean incision length was between 3 and 4 cm. In this series, 69% of respondents splinted their patients postoperatively during the day for an average of eight days and during the night for an average of 13 nights. This percentage is similar to the 77% of those in the American Society for Surgery of the Hand group who use postoperative splints for a period of seven to 14 days in 42% of respondents (12). No correlation was noted between the number of years in practice and the use of postoperative immobilization; however, the group that advocated postoperative immobilization and splinting was equally represented by orthopedic surgeons (47%) and plastic surgeons (42%), whereas those who used no postoperative immobilization or splinting were more likely to be orthopedic surgeons (72%) than plastic surgeons (22%).

In the present series, the surgeons estimated their incidences on average of scar tenderness at three months to be 14%, and their incidences of significant pillar pain to be 21%. In the literature, scar tenderness is reported to be 6% to 37% in open carpal tunnel decompression, while the incidence of pillar pain is 12% to 21% in various series (25,26). A major concern in reporting these numbers is the lack of consensus as to the correct definition of pillar pain.

This study reports the results of a questionnaire of 65 hand surgeons. This cohort may be considered to be too small to draw definite conclusions; however, for this relatively small group of specialists, the variability in the placement of incisions was considerable. Eighty-six per cent of our respondents had been in practice for more than 10 years. All surgeons had an obvious, significant interest in carpal tunnel syndrome, demonstrated by their attendance at a comprehensive course on carpal tunnel syndrome. This suggests that these surgeons were experienced in carpal tunnel surgery and that the placement of the incision was not, in of itself, a predictor of outcome following carpal tunnel release.

The difference in the postoperative protocol in this group was not as remarkable as the variability in incision placement. Furthermore, the incidences of scar tenderness and pillar pain were estimations made by the surgeon and, therefore, were subject to bias and would likely be less than the incidences in patient self-report. As well, strict criteria for the diagnosis of 'scar tenderness' and 'pillar pain' were not provided with the questions and, therefore, inconsistencies may exist in the surgeons' definitions of these outcomes. Despite this, there is sufficient information in the present report to confirm that this extremely common surgical procedure continues to raise controversy among hand surgeons, and that there is no single accepted surgical approach that is advocated universally for the procedure of open carpal tunnel release.

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