Limited-Incision Carpal Tunnel Release

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HISTORICAL PERSPECTIVE

Carpal tunnel release is one of the most commonly performed operative procedures. For many years since the diagnosis was developed and the surgical treatment described, the simplicity of the technique and the rewarding return of median nerve function was sufficient to satisfy the doctor and patient. In recent years, however, the procedure, the performer, the recipient and the payer of the bill have swung the microscope of scrutiny on this "little operation." The anatomy has been described and re-described. The carpal contents have been analyzed with regard to percentage of lumbrical incursion, tendon thickness, tenosynovial thickness, amyloid content, and so forth. The pressures have been measured within and without, in flexion and extension, in sickness and in health. The dimensions of the canal and its surroundings have been measured by computed tomography, magnetic resonance imaging, and volume techniques. Patients undergoing the procedure have been categorized into healthy and unhealthy, into white collar, light industrial, and heavy industry workers. The movements of the hands and arms and the associated postures of these workers have been ergonomically assessed. The surgeons themselves have been analyzed by health maintenance organizations, the American Association of Retired Persons, worker compensation panels, employers, consumer groups, and attorneys.

The operation of releasing the carpal tunnel, of sectioning the transverse carpal ligament, has somehow become the focal point of a billion-dollar cacophony. The conventional open carpal tunnel release, viewed under this intense scrutiny, was found lacking in some respects. Papers reporting long-term follow-up of this procedure lumped many varieties of release together (for instance, release with and without internal neurolysis) and failed to report the results rigorously in ways that can be compared with other reports. When these papers are reviewed as a group, one has the impression that carpal tunnel procedures are not so simple and direct. The complication rate is higher than we thought. The rate of recidivism is quite high. Morbidity is more than we would like. Job and career changes occur all too frequently in postoperative patients. In fairness, the open procedure itself is probably unfairly criticized. (It is the only surgical procedure that has been reported for the treatment of this condition since the condition was described.) In the last 5 years or so, there has been a revolution of sorts in the surgical treatment of this disease.

Surgeons familiar with using the arthroscope to deal with intra-articular problems have, with the willing help of medical instrument makers, adapted the technique to such diverse conditions as the hernia, the gallbladder, subcutaneous fat, and the carpal tunnel. Many who have used the newer endoscopic methods consider the outcome superior to the older standard procedures. Patients are said to have less surgical pain, less pain postoperatively, get back to work and play much sooner, and prefer the endoscopic procedure when they are able to compare (in the case of bilateral procedures). These benefits, viewed collectively, are presumed also to save money. The endoscopic techniques, however, come with a cost. The tools cost and the costs multiply as the charges move through the system from supplier to hospital to patient to payer. Probably no one knows just how much. Less obvious is the cost associated with the significant complications that do occur and have been reported (2,3). For the surgeon, the newer procedures are, for the most part, fun. This is avant garde surgery, almost equal to the laser in glamour. The early reports are encouraging. The method will not go away even with the significant criticism leveled at its problems. The leaders in the field are, for the
most part, responsible investigators who have learned from the reporting errors of the past. In time we will have good long-term comparable studies of a significant number of patients, and we will be able to know just how well we do with this variation of technique.

Some surgeons, eager to address the morbidity problems of the old open method but unwilling to promote the newer endoscopic methods and their specific subset of costs and complications, have developed “limited” incisions and approaches to release of the transverse carpal ligament (1, 5). These limited incision techniques may offer the advantages of the endoscopic methods without the increased technology costs and perhaps with an acceptable complication rate. In this context, the senior author has explored a limited incision technique in his private practice.

■ INDICATIONS AND CONTRAINDICATIONS

For the purpose of comparing the “limited” incision technique with that of the gold standard “open” technique, the patients in both groups were from the practice of one surgeon. Follow-up and data collection were performed by another surgeon. The diagnostic criteria for carpal tunnel syndrome (CTS) were the same for both groups. All patients had classic symptoms of median nerve compression at the wrist as characterized by nocturnal acroparesthesia, dysesthesia in the median distribution with repetitive activity and driving, decrease in dexterity and, in many cases, pain at the wrist. All had one or more of the following clinical tests characterized as positive for CTS: Tinel’s sign, Phalen’s test, median nerve compression test, two-point discrimination test, and/or standardized monofilament pressure examination. In the vast majority of cases, steroid injection provided significant temporary relief from symptoms with recurrence in the 2- to 3-month range. Nerve conduction velocity (NCV) and electromyographic (EMG) studies were done frequently and were positive in most cases. For the purpose of the study, patients undergoing concomitant surgery for an associated condition were excluded. Because of the “newness” of the procedure and the possibility that intracanal pathology might be overlooked, if these conditions were suspected, the patient was not included in the “limited” incision or comparison open group.

■ STUDY GROUPS

The study included 100 patients undergoing 116 carpal tunnel releases (CTR) between April 17, 1989, and June 20, 1992.

Group I

In Group I, the standard open technique was performed. This group included 15 patients with 16 CTRs (one bilateral). Patients included 14 women and one man (average age, 53.4 years). The technique was performed on 10 right and six left wrists. Eleven patients (73.33%) reported repetitive vocational hand use, and an additional four patients (26.66%) were receiving workers’ compensation benefits. One patient had diabetes. Nine of 10 patients having EMG/NCV had a nerve conduction positive for CTS. One had mild conduction delay, and eight had moderate to severe delays.

Group II

The new, “limited” incision group comprised 85 patients undergoing 100 CTRs. Patients included 68 women and 17 men (average age, 50.7 years). Sixty right and 40 left wrists were operated on (15 patients had bilateral releases). Forty-five patients (52.94%) reported repetitive vocational hand use, and 40 patients (47.06%) were receiving workers’ compensation benefits. Nerve-conduction studies were positive for CTS in 60 of the 65 cases studied (six had mild, 28 moderate, and 26 severe conduction delays). One patient had hypothyroidism controlled with medication. The surgical techniques are described in detail in the section entitled “Operative Techniques.”

■ FOLLOW-UP

All patients in both groups were seen for initial evaluation within 1 to 2 weeks after surgery. Subsequent follow-up was at 6 weeks, 3 months, 6 months, and 1 year after surgery. All patients in Group II had follow-up for at least 1 year, and most continue to be seen yearly. Formal follow-up for Group I averaged 16 months (11–34 months), Group II averaged 36 months (12–70 months). All patients were examined by the operating surgeon preoperatively, and all the surgeries were performed by the same surgeon. The results were evaluated by a different surgeon for the first 6-month period after surgery. Continued follow-up was by the operating surgeon. The data on which the study report is based was obtained by physical examination, in person and by telephone interview, operative record and clinical chart review. Pillar pain was rated by a method developed for this study (see Table 1).

■ OPERATIVE TECHNIQUES

Group I: Standard Open CTR Technique

An interthenar incision allows inspection of the median nerve both proximal and distal to the transverse carpal ligament (TCL) before its division. The median nerve is inspected and, in most cases, an external neurolysis performed. The canal is digitally and visually explored. The distal forearm retinaculum is divided from the wrist prox-
TABLE I. Scar and pillar pain rating method with results in control (Group I) and limited incision

| Rating | Description                                                                 |
|--------|-----------------------------------------------------------------------------|
| 0      | No subjective or objective findings                                         |
| 1      | No subjective complaints but mild tenderness to direct pressure over transverse carpal ligament |
| 2      | Mild subjective complaints and moderate tenderness                          |
| 3      | Moderate subjective complaints and moderate tenderness                       |
| 4      | Severe subjective complaints and/or severe tenderness                        |

Group I: In the control open CTR, 87.5% of patients complained of some pain. Rated on the above scale, the pain averaged 2.5 at the 6-week examination, 2.0 at 12 weeks, and 0 at 6 months. Group II: In the limited-incision CTR, 24% of patients complained of some pain. Rated on the above scale, the pain averaged 1.5 at the 6-week examination, 0.7 at 12 weeks, and 0 at 6 months.

Initially for 3 cm. This step is done without extending the incision proximal to the wrist flexion crease. Only the skin is closed. Average tourniquet time is 25 min. A bulky dressing with incorporated plaster splint is applied and removed in 7 to 10 days, at which time a commercial splint is employed as rehabilitation begins.

Group II: Limited-incision CTR Technique

The anesthesia of choice is axillary block. An alternative is a field block of the median nerve well proximal to the area of the carpal tunnel. Infiltration of local anesthetic into the operative site is not favored because of distortion of the tissue. For the procedure to be consistently successful, one’s visual cues regarding anatomy must not be obscured. There must be no confusion about what must be seen and what should be cut.

After exsanguination and inflation of an upper arm tourniquet at 100 mm above systolic pressure, a transverse incision is made in the area just proximal to the distal wrist flexion crease (Fig. 1A). An incision more proximal to avoid the potential of a sensitive scar is possible but makes the procedure more difficult. The incision extends from the ulnar border of the palmaris longus to the radial margin of the ulnar neurovascular bundle, a distance of 1.5 cm. The skin is carefully spread and bleeders are cauterized. The subcutaneous fat in this area can be excised in a limited way for better visualization of the forearm fascial retinaculum as it transitions into the TCL. It is important to ensure that the ulnar neurovascular bundle remains ulnar and that further incisions will be directed to the entry into the forearm retinaculum. If one is dealing with an obese patient, it can be too easy to enter the area of Guyons’ canal, believing it to be the carpal tunnel.

An incision is made in the forearm retinaculum, and beneath it one encounters the tenosynovium of the flexors. The incision is enlarged into a distally based flap. The ulnar border of the median nerve may be encountered if the incision is too radial. The flap is retracted distally by using a clamp. A Freer elevator, selected for its sharp edges and curved blade, is then used to dissect away the tenosynovium from the underside of the retinaculum and carpal tunnel. Using this plane as a guide, the Freer is passed distally along the inside ulnar border of the carpal tunnel (Fig. 1B). The direction of passage is toward the base of the ring finger. The elevator will be felt to give a sensation of “falling off” as it passes the hook of the hamate and will become immediately palpable in the ulnar palm. An incision is made at this point (Figs. 1C and Fig. 2). The orientation of the incision is oblique and somewhat longitudinal. The exact selection depends on where the elevator is palpated and the skin lines of the patient. The incision is approximately 1.5 cm long. Appropriate retraction identifies the palmar aponeurosis, which is entered longitudinally and spread (Fig. 2). A portion of this fascia can be excised if necessary for visualization. One will find fat beneath with some blueness in it; this will be the ulnar arch. Careful spreading in this area will allow identification of the arch, and a right angle bladed retractor can be used to retract it distally out of harms way. The Freer elevator will now be seen exiting from beneath the TCL.

The surgeon and a good focused light should now be positioned to look proximally into the wound. Some
have recommended a headlight or lighted retractors. I have used both but continue to prefer the regular operating room lighting. It is important at this time to place a small rake retractor into the wound and essentially to suspend the hand from the retractor as shown in the illustration. The tissue planes will separate and the layers can be identified. The deepest layer will be the elevator protecting the canal contents. The next most superficial will be the distal margin of the TCL, then the deep layer of the midpalmar fascia, and most superficial the palmar aponeurosis. The subcutaneous fat and the skin complete the layer identification. With good lighting and the elevator as a guide, the TCL is divided from distal to proximal, remembering that the ulnar aspect of the canal is curved. The first part of the incision may be directed radially and proximally, but the direction changed quickly so as to exit the ulnar to the median nerve. Potential damage to the nerve is possible if this detail is ignored. For this reason, a stout curved scissor is recommended for the division. The curve of the scissor helps to make this step safe. A small-handled knife is a second choice. I do not choose to use any of the special instruments that have been designed for division of the TCL. These instruments are costly, especially those that are sold for single use, and it makes no sense to use special instruments when those easily available will do an excellent job. In some patients, the incision of the TCL, started in the palmar wound, can be carried all the way back to the proximal wound. In other instances, the division must be stopped before getting to the proximal wound because of diminished visualization. When this is the case, I place a small mosquito at the proximalmost extent of the cut in the TCL and then remove all retractors from the distal wound. Retraction through the proximal wound will allow visualization of the proximal margin of the TCL. Lifting the fat superficial and radial to the ulnar bundle, the clamp can be seen or felt with an elevator. A short incision will connect the two TCL cuts, and the ligament will be completely divided. If one chooses, all fascial layers superficial to the TCL may be divided. I make it a practice to do so. There is some evidence that more than the TCL must be divided to achieve a critical decrease in canal pressure (4). An elevator placed in the canal at this point can be palpated in the subcutaneous fat indicating complete division of all fascial structures.

The skin proximal to the wrist incision is now suspended from a skin hook. The subcutaneous area over the distal forearm retinacular fascia is spread and a wide bladed retractor placed under the skin. The retinaculum is divided proximally for a distance of 3 to 4 cm. Once the complete retinacular release has been done, it is a fairly easy task to explore the canal, do a limited tenosynovectomy, and inspect the median nerve; however, the main advantage of this type of limited approach is decreased tissue disturbance. Thus, this latter exposure is rarely used. The wounds are infiltrated with a long-acting local anesthetic agent and closed. Small Silastic “vessel loop” drains are inserted in the wounds, and a bulky dressing is applied. The tourniquet is released. Usual tourniquet time is 12 to 16 min.

Following surgery, the patient may use the hand with a single limitation; the lifting or manipulation of significant weight in the palm down position is prohibited for 1 month. Lifting with the palm up is allowed. In my view, this reduces the tendency for flexor displacement postoperatively and allows the TCL time to heal, perhaps contributing to the more rapid recovery of grip strength. Sutures are removed in 5 to 10 days, and the patient is allowed full use with this single restriction.
RESULTS

Group I
Axillary block was used in 14 cases, general anesthesia and local in one each. The average time to suture removal was 9 days. The average time to return to most activities of daily living (ADL) was 22.3 days. Average time to return to the workplace (either light or regular duties) was 48.37 days (range, 20–120 days). Subjectively, most (14 of 16) had improvement of paraesthesia by the initial postoperative examination. Two patients reported no improvement, and two reported a worsening of paraesthesia. Eventually, all reported improvement. Fourteen of 16 had scar or pillar pain (Table 1), rated as an average in relation to time as 2.5 at 6 weeks, 2 at 12 weeks, and 0 at 6 months. Grip strength was tested at 6 months. Patients who underwent bilateral procedures were excluded. Of the 14 tested, the average grip strength of the operated to the unoperated side was 97.8%. There were three complications. One patient had a weeping wound, which eventually closed; one patient developed scar hypersensitivity, which has not limited activity; and one patient had an extensive unrevealing workup for persistent postoperative hand swelling.

Group II
Axillary block was used in 90 cases, general anesthesia in 10 cases. The average time to suture removal was 9 days. The average time to return to ADL was 11.9 days, and the time of return to the workplace was 28 days (range, 14–56 days). Subjectively, at the first postoperative visit, 90% (90 hands) had improvement in paraesthesia, six had no change, and four were worse. Eventually, all except one had improvement, and that one exception eventually had improvement after a cervical disc excision. Most patients had no pillar pain. Of the 24 cases reporting pain of this nature, the average rating was 1.5 at 6 weeks and 0.7 at 12 weeks and 0 at 6 months (Table 1). Grip strength was tested in 44 patients at 6 months. The average was 99% of the unoperated side. Three complications included a wound hematoma, a superficial wound infection requiring antibiotics to resolve, and the patient with persistent hand numbness. This last patient clearly had CTS by NCV and symptoms but required cervical disc surgery for eventual improvement.

Patients with Both Types of CTR
There was a separate subset of four patients who underwent both types of CTR. These patients all had a standard open procedure before the study began and returned later to have the limited incision release. When comparing the two, all these patients believed both procedures were equivalent with regard to the relief of paraesthesia. According to the record, they returned to ADL 8 days after the limited release and 10 days after the open method. Return to the workplace was 4 weeks after the limited method and 6 weeks after the standard method. There was a lower incidence of pillar pain (0 vs. 1). All four patients preferred the two-incision method.

DISCUSSION
The two groups of patients are similar with regard to demographics, clinical course, type of conservative therapy, nerve conduction study results, surgeon, surgical time, and rehabilitation. The limited incision group had a higher percentage of patients receiving workers’ compensation benefits (47 compared with 26%).

Patients undergoing the newer limited-incision CTR (Group II) appeared to fare better than the control group (Group I). They returned to ADL an average of 10.4 days earlier and to the workplace an average of 20.37 days before controls, even though the percentage of workers’ compensation in Group II was nearly twice that in Group I. The percentage of cases in Group II who developed pillar pain (24%) was considerably less than in Group I (87.5%). The degree of pain reported was also more severe in Group I. The differences in the two groups tended to diminish with time. Grip strength was equal at 6 months, pillar pain was absent, and symptom relief was similar.

The benefits of the limited incision appear to be early, distinct, and worthwhile, particularly for the workers’ compensation patient. It is safe and cost effective. On the basis of this study, the procedure can be recommended to other surgeons. The limitation of the procedure is also its strength. Exposure is limited, and the canal and the median nerve cannot be seen as widely as in the open method. Consequently, when intracanal pathology is suspected or when the median motor branch must be exposed, the open technique remains the best, until perhaps the physician gains wide experience with this technique. In the authors’ experience, with more than 400 additional limited-incision CTRs, the canal and nerve can be adequately examined without major variations in the technique. Although not a part of this report, procedures such as palmaris longus opponensplasty can easily be added to the technique. In the authors’ experience, limited-incision CTR is ideal for the CTR that must be done with other procedures, such as CMC arthroplasty, release of trigger digits, or DeQuervain’s disorder.

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