Complications of surgical release for carpal tunnel syndrome

Review of a series of 186 operative cases of carpal tunnel release revealed 34 complications in 22 patients, for an incidence of 12%. Complications were grouped into seven categories: (1) inadequate section of the transverse carpal ligament (associated with both transverse and curved incisions), (2) symptoms related to damage to the palmar cutaneous branch of the median nerve, (3) reflex sympathetic dystrophy, (4) unsightly hypertrophic scar due to inappropriate incision, (5) damage to the superficial palmar arch following blind sectioning of the transverse carpal ligament, (6) bowstringing of the flexor tendons after excision of the transverse carpal ligament, and (7) adherence of the flexor tendons following excision of the mesotenon. Except for four of the complications, two each of bowstringing and reflex sympathetic dystrophy which occurred in our own practice, all of the complications were seen in patients referred for care. Most complications can be prevented by proper operative technique.


The carpal tunnel syndrome is a well known entity and has been documented extensively by Brain, Wright, and Wilkinson1 and Phalen.2, 3

The surgical treatment of this condition evolved from observations made by Marie and Foix4 in 1913. At autopsy of a patient with bilateral thenar atrophy, they noted an enlargement (psuedoneuroma) of the median nerve proximal to the transverse carpal ligament and postulated compression of the nerve by the ligament as the cause and recommended sectioning the ligament to decompress the nerve. It was not until 1933, however, that the procedure was performed clinically by Learmonth,5 who believed that the “median neuritis” was due to a proliferative tenosynovitis causing crowding and compression of the median nerve within the carpal tunnel.

Most articles dealing with carpal tunnel syndrome now advocate operative treatment for relief of symptoms if conservative therapy fails. All authors stress the immediate and lasting relief of symptoms following operation but seldom mention any complications.

Materials and findings

In reviewing our records of 186 patients who had had operations for carpal tunnel syndrome, we noted 34

<table>
<thead>
<tr>
<th>Table I. Complications</th>
<th>No. of complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomplete division of transverse carpal ligament</td>
<td>12</td>
</tr>
<tr>
<td>Damage of palmar cutaneous branch median nerve</td>
<td>4</td>
</tr>
<tr>
<td>Sympathetic dystrophy</td>
<td>2</td>
</tr>
<tr>
<td>Hypertrophic scar</td>
<td>2</td>
</tr>
<tr>
<td>Palmar hematoma</td>
<td>2</td>
</tr>
<tr>
<td>Bowstringing of the flexor tendons</td>
<td>2</td>
</tr>
<tr>
<td>Adherence of flexor tendons</td>
<td>1</td>
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<tr>
<td>Total</td>
<td>34</td>
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</table>

Example: Table II. Patients

<table>
<thead>
<tr>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

Legend: TCL, transverse carpal ligament; TML, transverse median ligament; MPN, median nerve; PAL, palmar cutaneous branch of the median nerve; R/P, reflex sympathetic dystrophy.

10 patients with transverse carpal ligament injury were grouped:

Ten patients (Table II). Five patients had transverse carpal ligament injuries. Of these patients, 4 had hematoma associated with incomplete sectioning; 2 had hematoma, with incomplete sectioning subsequent to transverse carpal ligament sectioning. One patient had transverse carpal ligament sectioning. Four had reflex sympathetic dystrophy of the median nerve; 3 had the Naval Hospital, and 7 had these seen elsewhere. The remaining 2 patients were treated all.

Complications

Incomplete sectioning (12) of the transverse carpal ligament: 2 patients were treated elsewhere, 7 had probable complete sectioning, and 3 had incomplete sectioning. The 2 patients receiving complete sectioning had their injuries at the Naval Hospital.

Case report: A 50-year-old woman with carpal tunnel syndrome had two elevators struck her hand, resulting in her injuries. She was referred to this institution confirmed by electromyography and Sunderland test; she had median nerve compression, with symptoms responsive to treatment. She returned for follow-up with the median nerve division of the carpal tunnel in March 1977.
**Table II.** Patients with more than one complication

<table>
<thead>
<tr>
<th>No. of patients</th>
<th>Incomplete division of TCL</th>
<th>Damage of PCB</th>
<th>Sympathetic dystrophy</th>
<th>Scar</th>
<th>Hematoma</th>
<th>Bow-stringing</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
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<tr>
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<tr>
<td>1</td>
<td>+</td>
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</tr>
</tbody>
</table>

Legend: TCL, transverse carpal ligament. PCB, palmar cutaneous branch.

Complications in 22 patients. The 34 complications were grouped into seven major categories (Table I). Ten patients had more than one complication (Table II). Five patients who had incomplete division of the transverse carpal ligament also had damage to the palmar cutaneous branch of the median nerve, and one of these patients also developed, in addition, a palmar hematoma and a sympathetic dystrophy. Two patients with incomplete division of the transverse carpal ligament subsequently developed bowstringing of the flexor tendons following a second operative procedure. One patient had bilateral incomplete division of the transverse carpal ligament which required another operation. Four complications, consisting of two cases of sympathetic dystrophy and two instances of bowstringing of the flexor tendons, occurred in patients seen at the Naval Regional Medical Center, San Diego, and in those seen in the private practice of one of us (J.N.W.). The remaining complications were referrals. We treated all complications.

**Complications**

**Incomplete division of the transverse carpal ligament (12 complications).** If symptoms and signs of the carpal tunnel syndrome persist after operation, the probable cause is incomplete division of the transverse carpal ligament. Eight of 11 patients with this problem had their operation performed through a transverse incision. The other three patients had a linear incision in the wrist and palm. The following case report illustrates incomplete division of the transverse carpal ligament.

**Case report.** A 36-year-old secretary sustained a crushing injury to her dominant right wrist when it was caught between two elevator doors. She noted immediate pain and numbness in her hand. The diagnosis of carpal tunnel syndrome was confirmed by electromyography. An operation to decompress the median nerve in the carpal tunnel failed to relieve her symptoms. She then was referred for evaluation. Upon examination there was a transverse scar, hypesthesia in the median nerve distribution, and a positive wrist flexion test, and paresthesias were elicited with percussion over the median nerve in the carpal tunnel. The diagnosis of residual compression of the median nerve in the carpal tunnel was made. At the time of the second operation, no evidence of previous division of the ligament was noted (Fig. 1). The ligament was divided. After operation her symptoms resolved, and she returned to work.

A thenar crease incision in contrast to a transverse incision permits complete division of the transverse carpal ligament under direct vision (Fig. 2).8

**Damage to the palmar cutaneous branch of the median nerve (11 complications).** Taleisnik has carefully studied and documented the anatomy of the palmar cutaneous branch of the median nerve. The large radial branch of the nerve is likely to be injured when a transverse incision is made to release the transverse carpal ligament. A thenar crease incision with extension to the radial side of the wrist, as illustrated by Milford,8 also will jeopardize the nerve.

The terminal ulnarmost branches of the nerve which pass through the radial two thirds of the transverse carpal ligament on the way to the skin also may be injured when the ligament is divided on the radial side or if a segment of the ligament is removed. The resultant morbidity is not due to loss of sensation in a small area at the base of the thenar eminence but is due to a painful neuroma entrapped in scar.

**Case report.** A 54-year-old housewife had a carpal tunnel release performed by a neurosurgeon through a transverse incision. Following this she complained of a painful scar associated with an intermittent "pins-and-needles" sensation when she dorsiflexed or bumped her wrist. Upon examination dysesthesia was elicited by touching the base of the thenar eminence, and paresthesias were elicited when percussing the scar between the flexor carpi radialis and the palmaris longus. Lidocaine injected subcutaneously relieved her symptoms. The diagnosis of a neuroma of the palmar cutaneous branch of the median nerve was made, and at operation the nerve was excised.

A longitudinal or thenar crease incision which extends to the ulnar side of the axis of the ray of the ring
finger at the base of the hand and detaches the transverse carpal ligament at its insertion into the hook of the hamate should eliminate possible damage to the palmar cutaneous branch of the median nerve. Excision is the recommended treatment for a symptomatic neuroma of the palmar cutaneous branch.

**Reflex sympathetic dystrophy (four complications).** The cause of sympathetic dystrophy is thought to be a disturbance in the autonomic nervous system. It is seen more commonly in women and occurs at all ages. Precipitating factors include trauma, operation, infection, and myocardial infarction. Pak and Martin\(^a\) reviewed 140 cases of reflex sympathetic dystrophy seen at the Mayo Clinic during a span of 2 years and noted an incidence of 16.4% occurring after operation.

There are three clinical stages. The first is characterized by persistent pain aggravated by movement, swelling, hyperesthesia, and warmth, usually dry skin. In the second stage the edema and pain spread proximally. The skin becomes cool, pale or cyanotic, and shiny with atrophic changes. Joint stiffness also is noted. In the third stage there is progressive atrophy with joint contractures, osteoporosis, and intractable pain.

Four patients, two of whom we treated initially, developed sympathetic dystrophy following a carpal tunnel release. All of the patients when seen were in the first stage or in the early second stage. Three of them had had an external neurolysis of the median nerve performed by opening and stripping off the anterior epineurium near the “hourglass” constriction.

**Case report.** A 48-year-old woman had a carpal tunnel release and an external neurolysis of the median nerve in her dominant right hand. One week later she complained of increasing pain aggravated by movement of the fingers. Upon
examination her hand was noted to be swollen, dry and mottled, and very sensitive to touch. The diagnosis of early sympathetic dystrophy was made, and she was given Stelazine, 2 mg three times a day. Since she responded poorly to this medication, stellate ganglion blocks were instituted. Relief of pain was immediate but returned a few hours later with less severity. Repeat blocks were given, resulting in progressively longer periods of relief from pain. After 3 months her problem had resolved completely, and she regained full use of her hand.

Early recognition and prompt treatment are essential in the management of sympathetic dystrophy. We use Stelazine initially in conjunction with vigorous physical therapy. Stellate ganglion blocks are used if the response to Stelazine is poor.

Hypertrophic scar (two complications). A poor scar results when the skin incision is injudiciously placed and crosses the flexion crease of the wrist at a right angle (Fig. 3). A transverse incision heals with less scar but does not allow adequate exposure, and distal dissection must be performed blindly. The incision previously discussed should minimize this problem. Tenderness in the scar may persist for many months, regardless of the type of incision used.¹⁰

Damage to the superficial palmar arch (two complications). The superficial palmar arch lies at the distal edge of the transverse carpal ligament (Fig. 4). Blindly sectioning the ligament may result in injury to the artery with resultant hematoma, skin slough, infection, and circulatory embarrassment of the hand.

Case report. A 54-year-old man had a carpal tunnel release in his nondominant left hand through a transverse incision. After operation he had severe throbbing pain in his hand and palmar swelling associated with bloody drainage. He was seen in consultation, and it was elected to explore the wound. An incision was made in the palm, and a large hematoma was
evacuated. A significant tear in the superficial palmar arch was visualized, and the artery was ligated.

**Bowstringing of the flexor tendons following release of the transverse carpal ligament (two complications).** On the ulnar side of the hand, the transverse carpal ligament arises from the hook of the hamate and the pisiform bone. On the radial side it is inserted into the crest of the trapezium, the tubercle of the scaphoid, and sometimes into the styloid process of the radius. The ligament maintains the carpal arch and serves also as an important retinacular pulley for the flexor tendons of the fingers. Lack of restraint by the ligament on the flexor tendons may result in complaints and loss of function.

*Case report.* A 36-year-old woman developed throbbing pain in her dominant right wrist and paresthesias in the median nerve distribution associated with a snapping sensation in the wrist 10 months following a second operation on her hand for carpal tunnel syndrome. Examination revealed bowstringing of the flexor tendons elicited by active flexion of the wrist and fingers against resistance, producing a "shocklike" pain which radiated from the wrist into the fingers (Fig. 5). At operation it was noted that the transverse carpal ligament did not provide any restraint, and the flexor tendons were dislocated volarward. The ligament was reconstructed using a free palmaris longus tendon graft. When healing was complete, she no longer noted paresthesias when gripping or lifting heavy objects. Minor bowstringing still was present.

Bowstringing of the flexor tendons is an uncommon complication of carpal tunnel release. When it occurs, it can be associated with significant morbidity.

The problem is best managed by reconstruction of the transverse carpal ligament using a free tendon graft. We believe that this problem can be avoided by dividing the ligament along its ulnar border, by maintaining proper postoperative immobilization, and by suturing the free margin of the ligament to the palmar fascia on the ulnar aspect of the palm (Fig. 6). Thus the pulley effect of the ligament is retained and an adequate decompression of carpal tunnel contents is achieved. A retractor handle or small finger can be passed easily into the tunnel beneath the sutured ligament (Fig. 7). An additional benefit derived from this procedure is that the raw margin of the ligament is satisfied and will not become adherent to the adjacent gliding structures.

**Adherence of flexor tendons following excision of the synovial sheath (one complication).** Thickening of the synovial sheath of the flexor tendons is a frequent finding in patients with carpal tunnel syndrome. Removal of the synovium at the time of carpal tunnel release is not recommended, except when it is invasive, as in rheumatoid arthritis wherein the integrity of the tendons is threatened, or when a biopsy is needed. Extensive removal of synovium will create raw bleeding surfaces which heal with excessive scar, and the flexor tendons may become adherent, resulting in limited excursion and loss of grip strength. This is particularly true in patients who are disinclined, for whatever reason, to move their fingers in the early postoperative period.

*Case report.* A 35-year-old woman had a tenosynovectomy performed on the flexor tendons at the time of a carpal tunnel release on her nondominant left hand. The surgeon described the synovium as gray, thickened, and noninvasive. The patient's hand was immobilized in a bulky dressing for 3
She then was noted to have a "stiff" hand which did not respond to therapy. When seen as a referral, she had developed limitation of active flexion of her fingers due to adhesion of the flexor tendons. Intensive physical therapy, including the use of dynamic splinting, was instituted. Her condition improved, but she still is unable to make a clenched fist.

Whether or not tenosynovectomy is performed, early motion of the fingers in a supportive bulky dressing should be encouraged to avoid this problem.

Summary

A review of 186 operative cases of carpal tunnel syndrome disclosed a total of 34 complications in 22 patients. The complications were grouped into seven different categories. Failure to release the transverse carpal ligament completely was the most frequent complication. Damage to the palmar cutaneous branch of the median nerve occurred almost as often. Less frequent complications included reflex sympathetic dystrophy, unsightly hypertrophic scar, damage to the superficial palmar arch, adherence of the flexor tendons, and bowstringing of the flexor tendons. The use of a proper skin incision and division of the transverse carpal ligament under direct vision should eliminate four of the seven complications. Reflex sympathetic dystrophy, when it occurs, is best treated early and vigorously. Bowstringing of the flexor tendons is a rare complication, possibly occurring as a result of removing a segment of the transverse carpal ligament or from inadequate immobilization following a carpal tunnel release. It can be prevented by suturing the ligament to the palmar fascia. Adherence of the flexor tendons can be minimized by limiting excision of the tenosynovium to those instances where it is invasive and by encouraging early motion of the fingers.

REFERENCES

2. Phalen S: The carpal tunnel syndrome. Seventeen years'
3. Phalen S: Reflections on 21 years' experience with the carpal tunnel syndrome. JAMA 212:1365-1367, 1970


Case 7.—David Franklyn, aged twenty-two. In October, 1820, was seen by Mr. Swan. Seven years before, he was holding a restive horse by a halter wound tightly around his hand and wrist, when the animal, running back, drew the halter tight, and bent the wrist, pulling on it violently. Great pain ensued in the hand and wrist, and continued ulceration of the dorsal skin of the hand followed. The thumb and three fingers were bent back towards the wrist, and so remained, there being loss of sensation and of touch-sense. Mr. S. amputated the hand, and found hypertrophy of the median beneath the annular ligament, and several gangliform enlargements of the digital nerves.