Endoscopic Carpal Tunnel Release:

Report of 146 Cases

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Abstract

Objective: The purpose of this study is to describe one type of surgical treatment of carpal tunnel syndrome, namely endoscopic carpal tunnel release.
Materials and Methods: One hundred forty-six (146) cases of median nerve compression underwent the same-day procedure.
Results: Eighty-six percent (86%) were favorable, and 14% unfavorable. There was no damage caused to nerves, vascular structures, or tendons.
Conclusions: Although overall long-term results of endoscopic carpal tunnel release appear similar to those of open release, patients who undergo endoscopic carpal tunnel release demonstrate a quicker functional recovery, less postoperative pain, and less scarring than open carpal tunnel release patients.

Key Words: Carpal tunnel syndrome, transverse carpal, ligament, endoscopic carpal tunnel release, open carpal tunnel release.

Introduction

CARPAL TUNNEL SYNDROME (CTS) is perhaps the most commonly studied of all entrapment neuropathies. Sir James Paget (l) is credited with the first report (in 1854) of its clinical manifestations following the healing of a distal radius fracture in a patient. Subsequently, in 1880, James Putnam described patients who complained of "numbness, reoccurring periodically, coming on especially at night or very early in the morning and affecting one or both hands" (2, 3). Although similar clinical reports appeared later in the literature, the entity was largely ignored until 1950, when Phalen (4) described the syndrome as due to "compression of the median nerve beneath the transverse carpal ligament" (TCL). He also made note of the significance of Tinel's sign, a percussion of the median nerve at the wrist, producing tingling in the hand. A second test, which has become known as Phalen's test, reported hand tingling caused by prolonged wrist flexion.

Methods

This study involved a total of 128 patients with electrodiagnostically proven CTS. One hundred ten (110) patients had unilateral disease and 18 patients had involvement of both hands. The disease in this group of patients was more prevalent in females (63%). The age range was 22–86, with an average age of 51. Eighty-five (85) cases (58%) were of the right hand, 61 were of the left (42%). One hundred two (102) cases (70%) included sleep disturbances. Sixty-six (66) (45%) were compensation cases, of which 25 (17%) involved computer keyboard operators.

Between June 1993 and September 1998, 146 procedures of endoscopic carpal tunnel release (ECTR) were performed upon the 128 patients, utilizing the Brown technique (5), a modification of the two-portal Chow technique (Figure). The procedure was performed with local anesthesia, using approximately 3 cc of lidocaine with epinephrine injected into the two portals. A tourniquet was used in all cases, with an average tourniquet time of 11 minutes.

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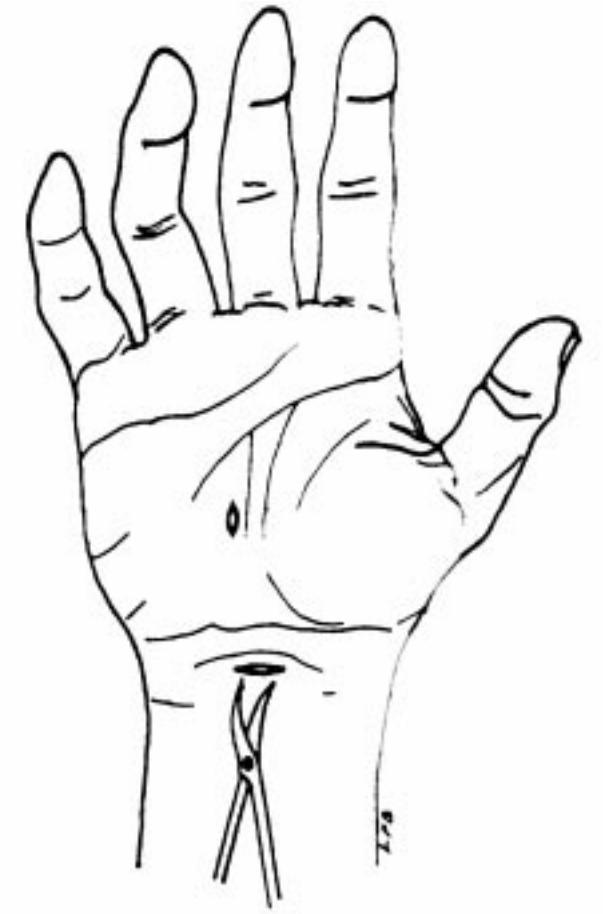


Figure. Two-portal technique with one small incision just proximal to wrist crease, second incision mid-palm.

Electrodiagnostic Evaluation

Positive nerve conduction findings included slowing of the median sensory nerve action potentials, the most sensitive sign of abnormality (6). In addition, a decrease in amplitude or, in severe cases, the absence of the sensory nerve action potential was found. Prolonged latencies of the median-nerve compound muscle action potentials and reduction in amplitude or conduction velocities were also found. Needle electromyography (EMG) is less useful for CTS diagnosis and is rarely positive. When EMG abnormalities are noted, they may indicate advanced and chronic axonal denervation, or they may lead to consideration of alternate diagnoses (7).

Results

There were two categories of results, as described by the patients: (a) complete or significant relief of symptoms, 126 (86%), and (b) partial or no relief of symptoms, 20 (14%). No patient claimed to have been worsened by the surgery. There were no cases of wound infection, nerve damage, vascular damage, tendon laceration or reflex sympathetic dystrophy. No patients complained of recurrence of symptoms after having obtained relief. One interesting finding was that all 102 cases (70%) in which patients complained of sleep disturbances fell into category "a". This would suggest that sleep disturbance may be a good prognostic sign for ECTR. Return to work varied from 4–32 days, averaging 16 days. Office workers averaged 12 days, manual laborers 25 days. In 212 cases of open carpal tunnel release (OCTR) seen by one of the coauthors prior to 1993, the patients returned to work on the average within 37 days. Postoperative pain and scarring were less of a problem than in OCTR patients, probably due to this being a less invasive procedure. The principal complication encountered in this series was failure to improve after surgery, which occurred in 14% of the cases.

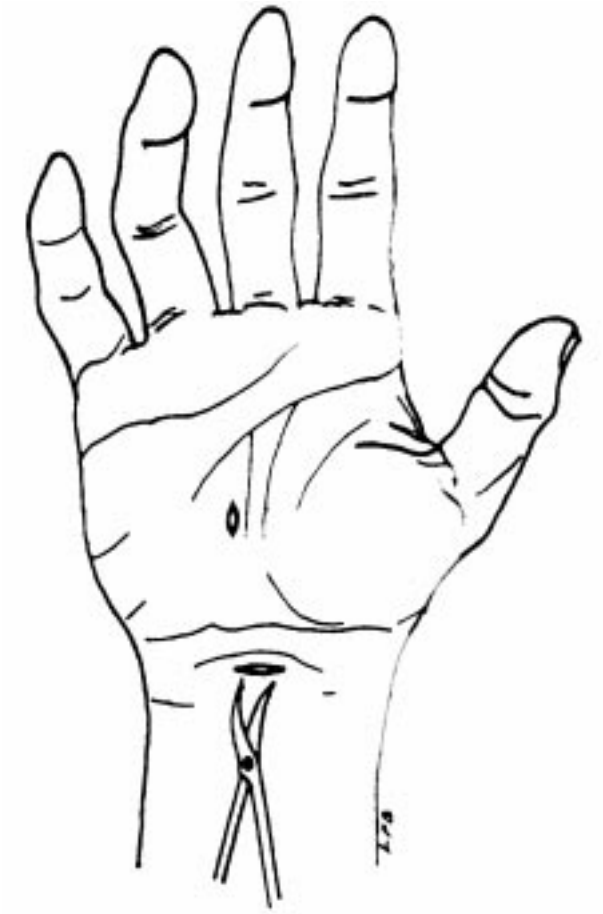
Discussion

Signs and Symptoms

Most patients with CTS present with complaints of numbness and tingling in the thumb, index, middle, and radial half of the ring fingers. It is quite common, however, that the entire hand may show sensory disturbances due to a defective vasomotor reflex (8) or autonomic nerve dysfunction (9). Paresthesias may radiate to the elbow, or even the arm or shoulder. Numbness and tingling frequently waken the patient from sleep at night. Wrist pain, also common, occurs after repetitive motions or prolonged wrist flexion or extension. In advanced cases, weakness of the hands and wrists may be reported, and patients frequently complain of dropping objects or having difficulty opening jars or turning doorknobs. Thenar atrophy may be seen in chronic cases.

Epidemiology and Associated Conditions

CTS is most frequently seen in women, with the majority of cases between the ages of forty and sixty (10). Although occupations requiring repetitive use of the wrists or involving heavy manual work have been associated with CTS (11), some find job-related activities controversial as a causative factor (12). Trauma, such as distal radius fracture, lunate dislocations, blunt injury to the wrist and post-traumatic arthritis, may produce structural changes leading to carpal tunnel symptoms (13, 14).



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Some systemic diseases may increase the risk of developing CTS symptoms. Diabetes is frequently associated with CTS (14). Acromegaly, however, is the most common associated endocrine disorder, producing CTS symptoms in 35% of acromegalics (15). Rheumatoid arthritis, producing tenosynovitis and a space-occupying lesion in the carpal tunnel, is also a risk factor (13). Pregnant women may develop CTS, mostly in the third trimester; their symptoms usually resolve within one month of delivery (17). Other medical conditions linked to CTS are hypothyroidism, alcoholism, amyloidosis, chronic renal failure with dialysis, and space-occupying lesions such as lipomas and ganglion cysts (13, 17).

Anatomy and Pathophysiology

The carpal tunnel is bounded by the thick TCL as the roof anteriorly, and the carpal bones as the floor dorsally. In its narrowest cross section, it is 2.0−2.5 cm in diameter. Through the tunnel pass nine finger flexors (four flexor digitorum superficialis tendons, four flexor digitorum profundus tendons, and the flexor pollicis longus tendon) along with the median nerve. The TCL is 3 cm long, extending from the level of the distal wrist crease into the palm, where it terminates in a sharp fibrous edge. Proximally, the TCL is continuous with and a thickening of the volar forearm fascia.

In flexion of the wrist, the median nerve is compressed against the TCL. During both flexion and extension, moreover, pressure within the carpal tunnel increases (18). As a result, it has been hypothesized (19, 20) that compression forces within the tunnel lead to mechanical deformation and eventual demyelination of the median nerve, as well as ischemic changes to the nerve.

Treatment

Treatment may be conservative or surgical. Conservative treatment consists of avoidance, job modification, splinting, anti-inflammatory agents, observation and other, less conventional forms of treatment. Avoidance involves abandoning or modifying tools which seem to cause or exacerbate symptoms, such as jackhammers, splicing tools and heavy wrenches. Station or job modification may be implemented by (for example) adjustment or padding of keyboards. Splinting is helpful mainly to relieve night symptoms, maintaining the wrist in a neutral position and making it easier for the patient to avoid unconscious wrist movements during sleep. However, splints eventually tend to lose their effectiveness as the symptoms of CTS worsen.

Nonsteroidal anti-inflammatory drugs (NSAIDs) may afford some relief, but they never fully relieve symptoms. The use of Vitamin B6 for CTS is not clearly beneficial. Steroid injections, popularized by Phalen (20), are now rarely used.

Observation and symptomatic treatment are helpful in cases associated with pregnancy, obesity, diabetes or rheumatoid arthritis, as the CTS may be relieved by the resolution or improvement of the associated conditions. Other forms of treatment, such as "stretching techniques," physical therapy and occupational therapy appear to be largely ineffective. Overall, conservative methods seem most helpful in mild cases, but have little, temporary, or no effect on cases of CTS in which the symptomatology is severe (21).

Surgical release may be performed by open or endoscopic techniques. OCTR, popularized by Phalen in the 1950s, is a conventional, well-established operation, of which there are two types. The first consists of open division of the TCL. The second type adds exploration, epineurectomy and neurolysis of the median nerve through the same incision (22). Results of open surgical release are time tested and well proven.

ECTR, introduced independently by Chow (23) and Okutsu (24) in 1989 has gained a great deal of popularity in the past decade; it is performed through one portal or two portals. The basic idea of ECTR is to introduce a fenestrated cannula deep into the TCL through a small skin incision at the wrist, and then divide the TCL under endoscopic visualization. This technique requires a good deal of endoscopic expertise, and because of the high learning curve involved, is fraught with more potential complications than OCTR. The controversy between proponents of OCTR and ECTR has been ongoing since the early 1990s.

Complications

Nationally, there have been reports of major complications after using ECTR including median nerve, ulnar nerve and digital sensory nerve lacerations, as well as tendon lacerations and vascular injuries to the superficial palmar arch. Incomplete division of the TCL, reflex sympathetic dystrophy, and infection have also been reported (5, 25). Most of these complications can be attributed to the relatively high learning curve involved in ECTR.

Conclusions

ECTR is a delicate and effective procedure. Although it remains controversial, mainly because of its steep learning curve for surgeons and early reports of complications, it has gained wide acceptance among orthopedic surgeons and hand surgeons who are skilled endoscopists. In a series of 146 consecutive cases, the authors found a favorable result rate of 86%, with no major complications. Patients with sleep disturbances appear to have a more favorable prognosis for a good surgical outcome. As compared to OCTR, ECTR seems to offer a quicker functional recovery and earlier return to work, as well as less postoperative pain and scar formation. Long-term outcomes, however, appear to be similar with both techniques. We believe that ECTR should be performed only by experienced endoscopists, arthroscopists and hand surgery specialists familiar with endoscopy.

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