Carpal tunnel syndrome and hand function

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GA Taylor. Carpal tunnel syndrome and hand function. Can J Plast Surg 1993;1(1):44-46. A prospective review of 78 hands in 58 patients with carpal tunnel syndrome is presented. The author's technique for carpal tunnel release under local anesthesia is described. Comparison of the patients in the series with age- and sex-matched controls revealed a high incidence of preoperative weakness of grip and pinch strength. Postoperatively, many patients experienced further loss of strength persisting six months or more. Some had not regained preoperative strength by six months. Explanations for diminished hand strength in patients with carpal tunnel syndrome both pre- and postoperatively are advanced and recommendations made for improved informed consent for patients undergoing carpal tunnel release.

Key words: *Carpal tunnel release, Carpal tunnel syndrome, Grip strength, Hand function, Pinch strength*

Syndrme du tunnel carpien et fonction de la main

RSUM: Une revue prospective de l'tat de 78 mains, chez 58 patients, atteints du syndrme du tunnel carpien est prsente ici. La technique de l'auteur pour la dcompression du tunnel carpien sous anesthsie locale est dcrite. La comparaison des patients avec une srie de tmoins assortis au plan de l'ge et du sexe a rvl une incidence leve de faiblesse de la force de prhension et de pincement en pr-opratoire. En post-opratoire, plusieurs patients ont vu leur affaiblissement s'aggraver de faon persistante durant 6 mois ou plus. Certains n'avaient pas retrouv la force qu'ils avaient avant l'opration 6 mois aprs. Des hypothses sont fournies pour expliquer la diminution de la force prhensile chez les patients atteints du syndrme du tunnel carpien, tant avant l'opration qu'aprs, et des recommandations sont formules pour une amlioration du processus de consentement clair chez les patients qui subissent une dcompression du tunnel carpien.

Carpal tunnel syndrome is the most common entrapment neuropathy (1). The diagnosis is usually straightforward and can often be made without confirmatory nerve conduction studies (2). Most patients present complaining of nocturnal paresthesias with or without pain. This history, particularly in a middle-aged female with a positive median nerve compression test and/or Phalen's sign permits the diagnosis of carpal tunnel syndrome with confidence.

I have often noticed that with careful questioning, these patients also complain of varying degrees of functional impairment of the affected hand(s). Their complaints include loss of hand strength, clumsiness performing fine tasks and a tendency to drop small objects. When questioned postoperatively to evaluate their response to surgery, surprisingly while many patients did notice improvement in hand strength, some did not. Some even complained that their hand was now weaker than preoperatively.

I felt that these complaints deserved a closer look and designed the present study with three objectives: to determine the incidence of disturbances in hand function preoperatively in patients with carpal tunnel syndrome, to develop and describe a safe, simple and cost effective technique for carpal

tunnel release; and to assess the effect of surgical release of the carpal tunnel by this technique on hand function.

SURGICAL TECHNIQUE

I was encouraged to develop a simple technique for the outpatient management of carpal tunnel syndrome by the fact that many patients referred to me had experienced lengthy waiting periods for treatment. The delay was usually due either to the long delay in obtaining nerve conduction studies (which in many instances were superfluous), or to limited availability of operating time.

By restricting conduction studies to patients with equivocal or atypical clinical findings (2), and by operating in my out-patient clinic, where the waiting period for bookings is less than two weeks, these delays were eliminated.

The surgery is performed in the out-patient department where we do a variety of minor surgical procedures without premedication. Patients remove their shirt or blouse, don a clean examination gown, and lie down on a comfortable operating table with their hand or hands supported on a hand table. No tourniquet is used since a dry field is achieved due to the combined effects of adrenaline and self-retaining retractor tension.

Ten millimetres of an equal parts mixture of 0.5% bupivacaine and 2% lidocaine with adrenaline 1:100,000 containing 1 mL of Wydase is used. Three millilitres are infiltrated

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subcutaneously across the front of the wrist just proximal to the flexion crease, 3 mL deep to the flexor retinaculum, and the remainder subcutaneously in the line of the incision.

Location of the incision is critical. It must be aligned with the slightly abducted ring finger as described by Engber (3), to avoid damage to the palmar cutaneous branches of the median or ulnar nerves. The incision is 4 cm long and straight with a slight curve ulnarward into the wrist flexion crease at its proximal end. Structures including the flexor retinaculum are divided under direct vision. Gradually increasing the tension on the tissues with the self retaining retractor improves visualization and ensures a dry field.

Following one layer skin closure with a continuous untied 0000 monofilament suture, the incision is reinforced with Hypafix Tape and a light dressing applied. A few layers of 3 inch plaster of Paris slab with a central strengthening rib is added to prevent wrist flexion and a 3 inch tensor bandage applied over all. The bandage is removed in a week to 10 days, and light hand function resumed. The sutures are removed in two weeks.

METHODS

Fifty-eight consecutive patients referred with carpal tunnel syndrome were evaluated preoperatively and at six weeks, three months and six months postoperatively by the same occupational therapist.

The assessment included measurements of grip strength (Jamar Dynamometer), three point pinch strength (Osco Pinch Meter), and light touch and pinprick sensation. The patients' preoperative grip and pinch strengths were compared to age- and sex-matched controls obtained from the study compiled by the Kenny Rehabilitation Institute based on 250 normal patients (4). The patients' preoperative values were used as controls for their own measurements taken at six weeks, three months and six months.

Six patients were excluded from the study because of difficulties encountered obtaining accurate measurements. One of these had a severe congenital hand deformity and one had sustained four digital amputations. Four patients, none of whom posed long term problems, developed mild sympathetic dystrophy which precluded accurate testing at six weeks. This incidence is similar to that reported in other published series (5,6).

RESULTS

Fifty-eight patients with 78 affected hands were assessed. Thirty-eight patients had unilateral involvement and 20 had bilateral. There were 51 females and seven males ranging in age from 25 to 86 years (median 58).

Preoperative hand strength comparison with age- and sex-matched controls in The Kenny Rehabilitation Institute study (4) showed that 62 of the 78 hands (79%) fell below the 50th percentile for grip strength, while 64 hands (82%) fell below the 50th percentile for pinch strength (Table 1).

Postoperatively, grip and pinch strengths were measured at six weeks, three months and six months and compared to the preoperative values.

TABLE 1: Preoperative hand strengths measuring below the 50th percentile compared to age- and sex-matched controls

	Number < 50th percentile	Percentage < 50th percentile
Grip strength	62/78	79%
Pinch strength	64/78	82%

TABLE 2: Patients failing to regain their preoperative hand strength by six months

	Number	Percentage
Grip strength	27/78	35%
Pinch strength	24/78	31%
Grip or pinch strength	38/78	49%
Grip and pinch strength	13/78	17%

At six months patients were divided into three groups.

- Those with reduced grip strength.
- Those with reduced pinch strength.
- Those with reduction of both grip and pinch strength.

Very few patients had achieved their preoperative values before three months and many took considerably longer. Six months postoperatively, 27 of 78 hands (35%) had not returned to preoperative grip strength, and 24 of 78 (31%) had not returned to preoperative pinch strength.

When these data were combined, by six months 38 of 78 hands tested (49%) had not regained either preoperative grip or pinch strength. Thirteen of 78 hands (17%) had not regained preoperative levels in both pinch and grip strength measurements (Table 2).

We attempted to determine whether certain risk factors might be associated with failure to regain preoperative strength by comparing patients with persistent weakness at six months with the rest of the series. Age, sex and the existence of unilateral as opposed to bilateral disease were the factors examined.

While the numbers are not large enough to assure statistical validity, it appears that groups with persistent weakness are younger, and have a higher ratio of females and bilateral hand involvement than those who returned to preoperative levels.

Because of the major role which sensation plays in determining hand function, we felt that we should attempt to detect sensory changes which could have occurred as a result of carpal tunnel decompression. The subjectivity of sensory testing makes interpretation difficult; however, our primary aim was to be certain that altered sensation was not contributing to the reduction in grip and pinch strengths persisting beyond six months.

Sensation was tested separately with pin and cotton wisp and graded as normal, altered or absent. Sensation was considered to be absent if the patient consistently failed to identify the stimulus on repeated testing, and altered if they were inconsistent in their response. By these criteria sensation

either improved or remained unchanged six months following surgery in 75 of the 78 hands tested.

Finally, to determine whether the patients had benefited from their surgery, we asked them to respond to the following question: "Do you feel that your hand function is better, worse or unchanged following your surgery?" In 58 of the 78 operated hands (74%) the patients felt that their hand was better, 15 hands (19%) were unchanged or worse, and no response was recorded in five hands.

DISCUSSION

The study has confirmed our clinical impression that many patients who present with carpal tunnel syndrome have diminished hand strength. Patients may not complain of this weakness, since their sensory symptoms are more conspicuous and interfere more with their daily lives.

We were surprised at the failure of many patients to regain their preoperative hand strength and sought an explanation. The median nerve innervated thenar muscles probably contribute very little to hand strength. In view of the results of our sensory tests and the response to our questionnaire, it seems unlikely that their weakness is due to delay in sensory recovery following nerve decompression.

We assume, therefore, that the weakness is related to loss of the flexor retinaculum leading to altered mechanics of the long flexor tendons as they approach the proximal (A2) pulley. Volarward migration of the long flexor tendons due to loss of the flexor retinaculum pulley will occur with wrist in neutral or flexed positions. This will result in an increased angle of approach to the proximal (A2) pulley. This phenomenon has already been incriminated as the cause of digital triggering following carpal tunnel release (7).

CONCLUSIONS

Many patients with carpal tunnel syndrome have weakness of their affected hand(s) which is overshadowed by their sensory symptoms and may therefore be overlooked. Weakness can be suspected prior to surgery by a careful history and confirmed by measurements of grip and pinch strength compared to age- and sex-matched normal controls.

In our study, 79% of the hands had below average grip strength and 82% below average pinch strength compared to control values. The cause of this weakness is not clear, but may be due to compression of the long flexor tendons in the tight carpal canal. Following carpal tunnel release, some patients experience a further reduction in hand strength. In our series 50% of the hands tested had not regained either their preoperative grip or pinch strength by six months. This weakness following surgery is probably related to alteration in the mechanics of action of the long flexors and not to persistent motor or sensory impairment.

Since patients may complain of loss of hand strength for many months following carpal tunnel release, they should be advised accordingly prior to surgery. Persistent loss of hand strength may be the price they will pay for relief from their sensory symptoms. In 74% of operated hands the patient felt that their hand function had improved following surgery.

Carpal tunnel release is a minor hand procedure which lends itself to performance under local anesthesia in a simple outpatient operating setting.

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