

ENDOSCOPIC CARPAL TUNNEL RELEASE: PRACTICE IN EVOLUTION

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Abstract. This study reports on 565 consecutive endoscopic carpal tunnel releases using the Agee one-portal technique of which 25 (4.4%) were converted to the open technique. The follow-up period was from 4 to 52 months. Immediate symptomatic relief was reported in 562 wrists (99.5%). There were 25 complications (4.4%) including pillar pain (8 wrists), digital neuropraxia ($n = 6$), median nerve contusion ($n = 3$), incomplete division of the flexor retinaculum ($n = 3$), superficial infection ($n = 3$), reflex sympathetic dystrophy ($n = 1$), and tenderness of the scar ($n = 1$). We describe the evolution of our selection of patients and surgical technique. We recommend caution in performing ECTR in short patients who are liable to have small wrists because of the risk of contusion of the median nerve. We present some technical modifications that may make the technique safer.

Key words: carpal tunnel syndrome, surgical procedures, endoscopy, postoperative complications.

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Endoscopic carpal tunnel release (ECTR) was introduced by Chow as a two-portal technique (7). Agee et al. developed it into a single portal approach with no palmar incision (1, 2). Previous studies have shown that patients who have had the endoscopic operation have less discomfort in the scar, a more rapid return of pinch and grip strength and an earlier return to normal activities and work (1, 13, 18). Despite concerns about its safety, several reports have shown ECTR to be associated with few complications (2, 14).

We have previously reported contusion of the median nerve in two patients (8). In each instance, the patients were short with small wrists, and access to the carpal tunnel was tight. This prompted us to examine the relationship between stature and the ease of access to the carpal tunnel (15), and we found that access was influenced by the wrist circumference and height. The aims of this study were to present the complications of one-portal ECTR and to describe the evolution of our selection criteria for patients and our surgical technique in the light of our experience.

PATIENTS AND METHODS

We reviewed the notes of 383 consecutive patients who had 565 ECTR performed between February 1996 and

January 2000, which gives a follow-up period of 4 to 52 months.

The diagnosis of carpal tunnel syndrome was made on the basis of characteristic symptoms and signs. Semmes-Weinstein monofilaments were routinely used as part of the preoperative assessment. Nerve conduction studies were done only if there was clinical uncertainty (91 wrists, 16%). Generally, conservative treatments with splinting and steroid injections were offered before surgical release was considered unless sensory loss, muscle wasting, or weakness were evident.

The patients were offered endoscopic release unless they had either previously undergone carpal tunnel release (endoscopic or open) on the same hand or had surgical scars on the wrist. Patients were also excluded if they required other procedures such as synovectomy, opponensplasty or decompression of Guyon's canal. When intervention was decided upon, all patients were given an information sheet describing carpal tunnel syndrome, endoscopic surgical technique, postoperative instructions, and potential complications.

We studied 383 consecutive patients (565 wrists), who underwent ECTR over a 48-month period. These hands were the first 565 of a series by a single surgeon. There were 265 women and 118 men, and their mean age was 54 years (range 13–88). Bilateral releases were

done for 182 patients and 201 patients had unilateral releases.

Twenty-five hands (4.4%) were converted to a standard open release. The reasons for conversion were unsatisfactory vision ($n = 7$), the tunnel was too tight ($n = 9$), inadequate vision because of synovial folds ($n = 6$), tourniquet failure ($n = 1$), and aberrant anatomy ($n = 2$). In one of the latter patients, there was a bifid median nerve. A longitudinal structure was noted on the ulnar side of visual field of the endoscope. This tended towards the radial side close to the distal end of the retinaculum, which made incision of the retinaculum unsafe. In the other wrist, we found an accessory muscle running through the carpal tunnel, which caused the surgeon to be uncertain of his landmarks, and necessitated conversion.

Four hundred and seventy-five hands were operated on under general anaesthesia, 52 under regional anaesthesia using an axillary block technique, and 38 under local anaesthetic. The operations under local anaesthetic were later in the series as we gained confidence in the technique. A tourniquet was used in all cases. It was inflated just after marking the skin and deflated before closure. The mean tourniquet time for the 523 patients who underwent ECTR was 7.6 minutes.

Patients in the series were given an additional information sheet postoperatively with specific hand exercises to do. They were usually discharged from hospital on the day of operation as long as they had recovered full movement of the hand and if medical and social factors allowed. The patients were instructed to remove the dressing after three days. Sutures were removed after one week and the patients were discharged from follow-up after one or two weeks postoperatively. They were asked to come back to clinic if any problem arose.

Surgical technique

The senior author (HJCRB) did the operation using a modified Agee single-portal technique. During the series, the technique has evolved and here we describe our present practice.

First, the palmaris longus tendon is marked on the forearm. The ring-finger ray is marked on the palm (Fig. 1). A radially based "V" shaped incision is made just ulnar to the palmaris longus tendon at the distal wrist crease. In most patients, the incision lies in the interval between this line and the ulnar side of the palmaris longus tendon.

The forearm fascia is exposed and a transverse window made by gently opening a pair of fine scissors or haemostats. The fascia is incised longitudinally and released proximally. No fascial flap is raised.

The track is prepared with synovial elevators. In

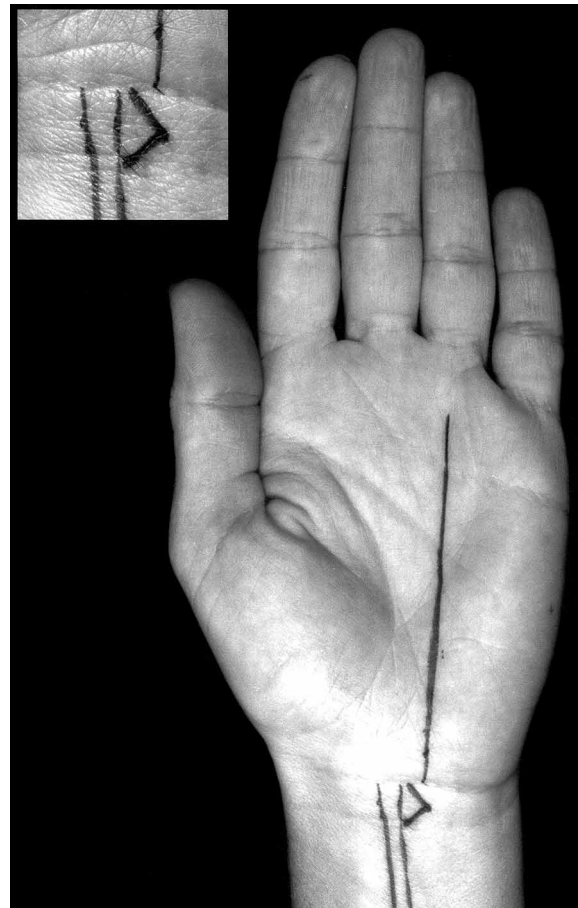


Fig. 1. Surgical landmarks and incision. The incision is marked in the interval between the ulnar side of the palmaris longus tendon and the line of the ring-finger ray.

most cases, this can be achieved using only the broader elevator. In some patients in whom the synovium is thicker, the smaller, sharper elevator is required. This must be done reasonably firmly. It is useful for the surgeon to palpate the palm around the distal end of the retinaculum, both to steady the hand and to appreciate the limit of the retinaculum. It is likely that over-enthusiastic and inaccurate use of the elevator has the potential for harm.

The track is now dilated with urethral dilators ranging from 16 to 20F in size. Introduction of the endoscope is usually easily achieved after passage of a 20F dilator. If an 18F dilator is not accepted easily, we immediately convert to the open technique to avoid contusion of the median nerve.

Fluid may be present in the carpal tunnel, particularly in cases done under local anaesthetic. This can cause problems with vision because of its possible entry into the blade assembly. Withdrawing the endoscope and passing cotton-tipped microbiological swabs into the canal to soak up the fluid can solve the problem.

Table I. Number (%) of complications observed in 565 consecutive ECTR

Pillar pain	8	(1.1)
Digital neuropraxia	6	(1.1)
Median nerve contusion	3	(0.5)
Incomplete release	3	(0.5)
Wound infection	3	(0.5)
Tender scar	1	(0.2)
Reflex sympathetic dystrophy	1	(0.2)
Total	25	(4.4)

The distal end of the retinaculum is often not immediately obvious. However, it can be identified easily if the palm is briefly pressed with a finger. The distal end is seen as the interface between mobile and fixed structures. Release is best achieved by first dividing the distal third. This can be checked before division of the remainder of the retinaculum. Division of the entire retinaculum in a single pass is followed by prolapse of soft tissues into the canal. This can make good visualisation of the important distal end difficult.

It is important that the surgeon maintains good alignment with the line drawn on the palm to minimise risk of division of nerves or tendons. Attention should be paid to preparation and positioning of both patient and surgeon before starting the operation. This prevents changes in rotatory or angulatory alignment of the endoscope within the canal. An over-tight lead or a cramped operating position can cause the surgeon to stray inadvertently from the desired track.

It is usually obvious that the release is satisfactory by observation of the separation of the two cut edges of the retinaculum. Nevertheless, it is worth a further check before closing the skin. This can be achieved by passing the broad synovial elevator into the canal and external manual palpation.

The wound is then closed with 5/0 nylon sutures and bandaged with a bulky dressing that leaves the fingers and thumb free for mobilisation. No splint is used.

RESULTS

Immediate symptomatic relief was reported for 562 wrists after the surgery (99.5%). There were 25 complications in the series (4.4%) (Table I). The flexor retinaculum was incompletely divided in three patients. These subsequently all underwent standard open release.

One female patient developed reflex sympathetic dystrophy. This was recognised early and successfully treated with guanethidine blockade and intensive physiotherapy. Eight patients returned after discharge with persistent pain at the base of the palm. These symptoms settled after six months. Three patients had

superficial wound infections. There were no deep infections. One patient complained of a tender scar, which settled after 12 months.

Three female patients developed sensory alteration due to median nerve contusion. All three patients were short with heights of 150, 142, and 146 cm, respectively, and with small wrists. Endoscopic access to their tunnels had been tight. All three had appreciable sensory loss. Their carpal tunnels were re-explored soon after the ECTR through a standard open carpal tunnel release incision. On each occasion, the contusion was on the ulnar side of the nerve but all branches were intact. At 12 months follow-up, sensation was normal or close to normal in two patients. One has been left with permanent sensory loss.

Three patients complained of numbness or dysaesthesia in the area of the third web space that was not present preoperatively. A further two patients complained of sensory alteration on the radial side of the ring finger. One patient had transient hyperaesthesia in the area of the second web space. In each instance, the objective degree of sensory loss was minor. Testing with monofilament hairs obtained values in the range of 3.22–3.84. It was our opinion that this was consistent with contusion rather than division of the nerve and observation was preferred to exploration. The symptoms settled completely within three months in three patients. In the other three, symptoms had substantially settled by six months.

There were no major complications such as transection of the superficial palmar arch or flexor tendons, damage to the ulnar neurovascular bundle, or laceration of the median nerve.

DISCUSSION

This series constitutes the first 565 ECTR done by a single surgeon. During this time, our indications and surgical technique have evolved.

A transverse incision has been almost universally recommended. In our view, this risks division of cutaneous nerve branches, particularly that from the median nerve. It does not lend itself well to extension should conversion to open release be necessary. A "V" shaped incision provides excellent access to the operative field as well as permitting a more elegant scar should conversion to an open operation be required. We have found that the creation of a distal fascial flap adds nothing to the ease of access to the carpal canal, so we abandoned it early in the series.

A recent review of other publications has suggested that ECTR is associated with more transient neurological disturbances than open release (5). Rates of 4.3% and 0.9%, respectively, have been reported in prospective studies. The authors postulated that this is

caused by neuropraxia as a result of instrumentation. We have previously reported contusion of the median nerve in two patients and have had one further instance (8). It has become clear to us that surgeons should be aware that ECTR is likely to be more difficult in small patients with small wrists. They should have a higher threshold for conversion to the open technique to avoid neurological complications. We have certainly become increasingly selective in choosing ECTR in preference to the open technique and now rarely offer it to patients whose height is less than 163 cm (64 inches).

Initially, we used the recommended dilators for preparing the carpal canal. However, it was clear that these dilated the track unevenly and incompletely (16), so we now dilate the passage with urethral sounds. These permit a graded, controlled dilatation of the track. They also allow an objective assessment of the tightness of the tunnel. We suggest that if an 18F dilator is not readily admitted into the canal, the procedure be converted to open release immediately.

In the present series, five patients experienced sensory alterations after surgery around the third web space, and one in the second. It is likely that this complication is caused by blunt injury to the communicating branch between the median and ulnar nerves that was first described by Berrettini in 1741. More recent studies have confirmed that this communication is common (6, 10–12). Ferrari and Gilbert have shown that it is present in 90% of cases (9). Its distribution is variable but it usually joins the third common digital nerve. It invariably makes some contribution to the radial side of the ring finger. In 30% of cases, it also supplies the ulnar side of the middle finger. When present, its mean total contribution to sensation in these fingers is 46% and 30%, respectively. In each of our patients, it was noticeable that there was an apparent discrepancy between symptoms and objective findings. The patients experienced considerable paraesthesiae and sometimes dysaesthesiae. In contrast, the degree of sensory loss was often minor as assessed objectively by monofilament hairs. This amounted to a one to two incremental difference compared with the remainder of the median territory (3.22 or 3.61 compared with 2.83). Fortunately, these symptoms settled completely. Other authors have reported neuropraxia after ECTR in the same distribution that recovered (4). In contrast, Armstrong et al. reported that although four patients with neuropraxia recovered, two out of 208 ECTR resulted in permanent sensory loss in the third web space caused presumably by injury to the common digital nerve (3). It can be difficult to decide whether to re-explore the carpal tunnel in patients who have sensory loss after ECTR. We think that clinicians should note carefully the distribution of sensory loss and use objective criteria such as monofilament hairs or

two-point discrimination to judge the possible merits of further intervention. Clearly, dense anaesthesia in the distribution of a common digital nerve requires exploration. Our experience suggests that an expectant policy is reasonable when sensory loss is partial and the distribution not suggestive of an injury to a common digital nerve.

More recently, we have moved towards doing ECTR under local anaesthetic. We now prefer it for unilateral cases and in patients who are not fit for general anaesthesia. The procedure is well tolerated. However, it is our impression that the presence of local anaesthetic in the carpal tunnel makes the procedure a little more difficult. While we have not seen an increase in conversion rates, achieving good vision takes a little longer. These effects can be minimised by care when giving the local anaesthetic. Wood and Logan have alluded to the effects of anaesthetic infiltration on visibility during ECTR and have described a technique for giving it that may avoid this problem (17).

Few publications have dwelt on the aftercare of patients after carpal tunnel surgery. All hand surgeons are aware of the occasional patient whose recovery after this minor operation is complicated by appreciable stiffness. We have been fortunate in experiencing a low incidence of complications of this type. We think that providing patients with good information and clear postoperative instructions reduces their likelihood.

This large series provides further evidence that ECTR can achieve good results in carpal tunnel syndrome without compromising safety. We think that care is needed in the selection of patients, and we feel that there are some technical modifications that may make the technique safer. We suggest that clear information and instructions for patients can contribute to a smoother recovery.

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