

# Recurrent Carpal Tunnel Syndrome—Analysis of the Impact of Patient Personality in Altering Functional Outcome Following a Vascularised Hypothenar Fat Pad Flap Surgery

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**Abstract** We retrospectively analysed 25 patients (27 hands) who had both clinical and electrophysiological confirmation of true recurrent carpal tunnel syndrome from January 2004 to December 2009. In all the patients, after releasing the nerve a vascularised fat pad flap was mobilised from the hypothenar region and sutured to the lateral cut end of flexor retinaculum. The patient characteristics, co-morbidities, duration of symptom, interval between first release and revision surgery and intra-operative findings were assessed against post-operative relief of pain, recovery of sensory and motor dysfunction. The average age of the patients was 58 years (43–81) and the dominant hand was involved in 22 patients. Intra-operatively the nerve was compressed by scar tissue connecting the previously divided ends of the retinaculum in 18 and nine had scar tissue and fibrosis around the nerve. Following surgery 16 patients had complete recovery (asymptomatic at the first follow-up), eight had delayed recovery (partial recovery of symptoms at final follow-up) and three had a poorer outcome (persistence of preoperative symptoms at the final follow-up). The patients with delayed recovery/

poorer outcome had a) Early recurrence; b) Diabetes mellitus; c) Obesity; d) Cervical spine problems; e) Involvement of non-dominant hand; and f) Intraoperative scar tissue and fibrosis. The hypothenar fat pad transposition flap provides a reliable source of vascularised local tissue that can be used in patients with recurrent carpal tunnel syndrome. The factors that were associated with poorer/delayed recovery were involvement of non-dominant hand, recurrence within a year from the previous surgery, intra-operatively scar tissue in the carpal tunnel and associated co-morbidities, like obesity diabetes mellitus and cervical spine problems.

**Keywords** Hypothenar fat pad flap · Patient factors · Prediction of outcome · Recurrent carpal tunnel syndrome

## Introduction

Recurrence of carpal tunnel syndrome following surgical release is not uncommon [1, 2]. The recurrence rate in the literature ranges from 3% to 25% [3–6]. The outcome after the second surgery is variable with authors reporting persistent symptoms in up to 95% of the patients [7]. A recent study showed that 20% of these patients get no relief after second surgery [8]. The drawback with most of these studies is that they deal with a heterogeneous population of both recurrent and persistent carpal tunnel syndrome, the findings of which cannot be generalised to a patient population with recurrence.

Various methods of treatment have been described for the treatment of these patients. Recent studies have favoured the use of a hypothenar fat pad flap (HTFPF) as it has consistently produced better results [9–13]. From its first description in 1985 [14] many modifications have been suggested in the

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technique of HTFPF to further improve the functional outcome in these patients [9, 11, 12]. All the studies we can identify on HTFPF have looked at surgical factors and none of them have assessed patient characteristics against the surgical results [9–13]. Presently, there is insufficient evidence in the literature to predict the outcome after this technique in patients with true recurrent carpal tunnel syndrome. The aim of our study was to evaluate the patient factors and to predict the effect of these in altering functional outcome after HTFPF in patients with recurrent carpal tunnel syndrome.

## Materials and Methods

The study included 25 patients (27 hands) who underwent HTFPF for recurrent carpal tunnel syndrome from January 2004 to December 2009. Inclusion and exclusion criteria for the selection of cases are listed in Table 1. All the patients included in the study had a symptom free interval following the primary surgery and had recurrence of symptoms. The clinical diagnosis of recurrence was also confirmed by electrophysiological studies. Nerve conduction studies showed abnormal conduction velocity and prolonged latency in both motor and sensory values in all the patients. The patients having problems related to wrist and CMC joint were not taken up for the study. Four patients who had second surgery following incomplete primary release were excluded from the study.

Tinel's sign was positive over the carpal tunnel region in 23 hands and Phalen's test (the provocation of median paraesthesias by flexion of the wrist to 90° for 60 s) was positive in all the patients. Numbness and tingling was present in all the patients with waking dysesthesias in 24 hands. All patients had a trial of conservative treatment with NSAIDs and wrist splints before surgical intervention. None of the patients had evidence of injury to the palmar cutaneous branch of the median nerve following.

### Surgical Technique

The revision surgery was performed as a day case procedure. Two percent lignocaine was used for local anaesthesia together with an arm tourniquet. An incision was made through the previous scar. This was deepened to reach the level of the retinaculum or its remnants that when

present were incised while protecting the median nerve (Fig. 1). Any overlying scar tissue or fibrosis around the nerve was also removed to release the nerve. Internal neurolysis was not performed in any of our patients. For closure the hypothenar fat pad was mobilised with an intact base and of sufficient length to cover the nerve after release (Fig. 2). The mobilised fat pad was sutured to the under-surface of the lateral edge of cut flexor retinaculum (whole length) with 3–0 vicryl (Fig. 3). After haemostasis the skin was closed with 4–0 nylon sutures.

The patients were allowed to move the wrist and perform activities as tolerated after the surgery. The sutures were removed at 2 weeks and the patients were assessed for pain and neurological recovery in 2 weeks, 6 weeks, 3 months and every 6 months until recovery. Complete recovery was defined as the complete absence of preoperative symptoms after the surgery at the first follow-up visit. Delayed recovery was defined as partial recovery of preoperative symptoms at final follow-up and poorer outcome was defined as the persistence of preoperative symptoms at the last follow-up.

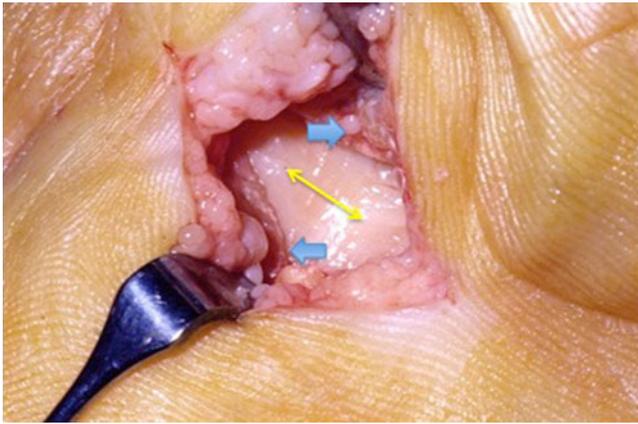
The patient characteristics, co-morbidities, duration of symptoms, interval between primary and second surgery and intra-operative findings were assessed against post-operative relief of pain, recovery of sensory and motor dysfunction. Details were collected retrospectively in the regular follow-up notes after surgery (till the final follow-up).

## Results

Of the 25 patients 15 were female and 10 were male. The dominant hand was affected in 22 patients. The average age was 58 years (range 43–81 years). The average follow-up was 22 months (range 10.5–62.5 months). The average duration of symptoms before the surgery was 5.8 months (range 3–21 months). The average time interval between the first and second surgery was 56 months (range 5–262 months). Intra-operatively 18 patients had a reformed retinaculum with scar tissues bridging the cut ends of previous surgery, nine had scar tissue and fibrosis around the nerve. 16 (60%) patients had complete recovery immediately after surgery and the remaining 11 (40%) patients had delayed/poorer recovery. No patient deteriorated after the surgery.

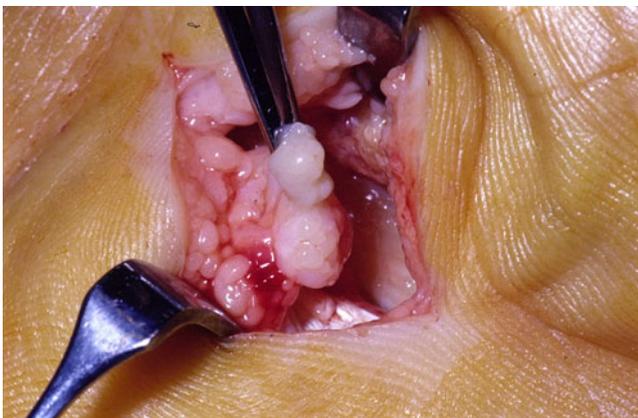
**Table 1** Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Presence of clinical symptoms	No symptom free interval
Symptom free interval between surgeries	Normal electrophysiological studies.
Electrophysiological confirmation	Secondary causes, eg Fracture, tumour
Failure of conservative treatment	Incomplete primary release

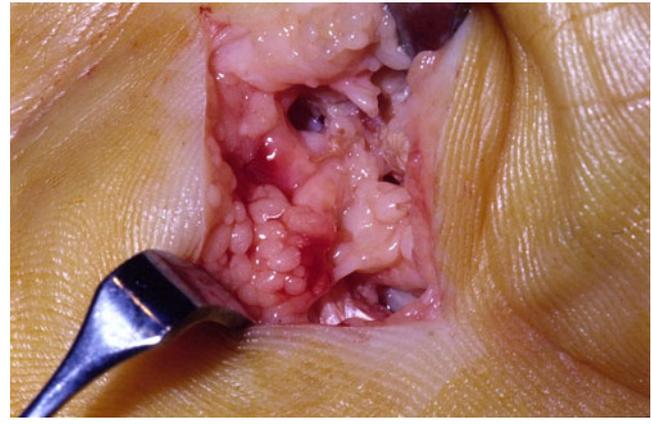


**Fig. 1** Through an incision over the previous scar the reformed retinaculum/scar tissue (blue arrows) was released and the nerve (yellow arrow) was freed

Analysis of the two sub groups (Complete recovery–16 patients; delayed/poorer recovery–11 patients) is shown in Table 2. There was no difference between the groups in relation to the age, sex or duration of symptoms before the second surgery. The average interval between the first and the second surgery was about 7 years in the group with complete recovery and it was less than one year in the group with delayed/poorer recovery, implying that a longer symptom free interval is good news. Four out of five patients in our series with involvement of the non-dominant hand had delayed/poorer recovery. Both the patients with bilateral involvement had delayed/poorer recovery on the non-dominant hand. The patients with diabetes mellitus (all were type II), obesity (BMI >30) and cervical spine problems (degenerative spondylosis with C5-6 radiculopathy in five and myelopathy in one) had a high possibility of delayed/poorer recovery. Intra-operatively scar tissue with fibrosis around the nerve was associated with a high probability for delayed/poorer recovery.



**Fig. 2** The hypothenar fat pad flap was mobilised with an intact base and of sufficient length to cover the nerve after release



**Fig. 3** The mobilised fat pad was sutured to the under-surface of the lateral edge of cut flexor retinaculum

Post surgically Tinel's sign was negative in 20 of the 23 patients and in the remaining 3 patients they had progressive Tinel's sign indicating some degree of nerve regeneration. Pain disappeared in all except 3 patients at the final follow-up of 22 months (range 10.5–62.5 months).

Of the 11 hands with delayed/poorer recovery, eight patients had complete relief of pain with varying degrees of neurological recovery at the final follow-up. In eight hands with delayed recovery, pain and wakening dysesthesia disappeared in all the patients, tingling disappeared in 6 patients and numbness disappeared in four hands at the final follow-up and all these 8 patients were happy with the final functional outcome. Three patients out of the 27 continued to have pain and neurological symptoms and were not keen on further investigations or any further intervention. At the final follow-up 89% (24/27) of the operated hands had achieved excellent to good results.

## Discussion

Since the time when Sir James Paget first described the clinical manifestations of carpal tunnel syndrome in 1854 [15], it has become the commonest surgically treated entrapment neuropathy with a prevalence of 3-7% in the general population [16, 17]. Though the results after primary surgery are excellent, the frequency of re-operation can be up to 12% [8]. The commonly cited causes for initial failure include incomplete release of the transverse carpal ligament, post-operative adhesions, tenosynovitis, and intraneural fascicular scarring [18]. The majority of the patients who undergo secondary surgery were due to incomplete release. Bagauter in a study on 26 patients identified that the secondary surgery was because of inadequate release in 23 and no release in 3 patients [19]. Thus the present publications on recurrent carpal tunnel syndrome are confounded by patients who do not have a true recurrence.

**Table 2** Complete recovery vs delayed/poorer recovery

	Complete recovery (16)	Delayed (8) or poorer (3) outcome
Age (Years)	59.4 (43–81)	56 (47–76)
Sex (Female: Male) <sup>a</sup>	9:7	7:4
Duration of symptoms (months)	5.5 (3–16)	6 (4–21)
Interval between 1st & 2nd surgery (months)	86.5 (23–262)	11.3 (5–26)
Non dominant hand	1/16 (6%)	4/11 (36.6%)
Diabetes	2/16 (12.5%)	6/11 (54.5%)
Obesity (BMI >30)	4/16 (25%)	7/11 (63.6%)
Cervical spine problems	1/16 (6%)	5/11 (45%)
Intra-operative findings	Scar tissue – 2 Reformed retinaculum - 14	Scar tissue and fibrosis around nerve – 2 Scar tissue - 5 Reformed retinaculum - 4

<sup>a</sup> Includes two bilateral patients

Non-operative treatment of recurrent symptoms may provide symptomatic relief for a small number of patients but fail to benefit most patients in the long term. In our series none of the patients benefitted. In 1963, Paine was the first to report on re-exploration for true recurrent carpal tunnel syndrome. Since then various surgical options have been described in the literature. Simple decompression with neurolysis is not favoured by many authors because of poor outcome [4, 20, 21]. The use of muscle flaps, fascial flaps, vein wrapping and omental transfer has been described in the literature with good results [22–28]. However these options were not followed universally because of various drawbacks associated with these techniques. These include, donor site morbidity, use of microscope, usually performed by surgeons working in specialist centres, technically demanding, increased theatre time and cost, poor cosmetic results, small patient group and finally the results were not superior to HTFPF. The use of HTFPF first described by Cramer and further modified by various authors has stood the test of time from 1985 [9–14]. The advantage in using the flap is that it is locally available, easily performed and the results are equivalent or better than the other techniques. HTFPF does not improve the results of primary surgery [29]. There seems to be conflicting evidence regarding routine internal neurolysis after carpal tunnel surgery [30, 31]. In this study none of the patients underwent internal neurolysis.

Results after a revision carpal tunnel surgery are variable [7, 8, 12, 32]. The reason for these differences in outcome has been attributed to the surgical factors and various authors have described different methods of treatment [22–28] or modifications of a technique [9–13]. However the results were variable, with authors reporting up to 40% poor results [32] and 95% persistent symptoms [7] after re-exploration.

As all the studies in the literature analysed the surgical factors, we analysed the patient characteristics against the

surgical outcome. The age, sex and duration of symptoms did not affect the functional outcome in our patients. However the decrease in time interval between the primary and revision surgery was a major risk factor for delayed/poorer recovery. These findings have not been previously reported and the authors believe that these patients with early recurrence are more prone for scar tissue formation. In keeping with this belief involvement of non-dominant hand was rare. However, when it occurred we noted delayed/poorer recovery (though the numbers are too small to draw any conclusions), but interestingly in 2 patients with bilateral recurrence, the non-dominant hand did not recover well after the revision surgery. It is well known that the result after carpal tunnel decompression is unpredictable if the patient has double crush syndrome [33, 34]. Forty five % (5/11) of the patients with cervical spine problems did poorly after the surgery. Recent evidence showed that outcome after primary carpal tunnel decompression in patients with diabetes is no different from other patients [35]. However, 54.5% (6/11) of our diabetic patients did not have prompt relief of symptoms with the second surgery. We accept the view of Al-Quattan et al. that diabetes is a risk factor for poor outcome [36]. Though obesity was considered as a risk factor for CTS [37], its role in influencing the outcome after surgical release is uncertain. In 63.6% (7/11) of our patients with poorer outcome, obesity was present.

In our study only 60% (16/27) had complete recovery immediately after the surgery, in the remaining 11 patients (40%) with delayed/poorer recovery, eight patients improved post surgically. We accept the view of Clarke et al. (1993) that if the improvement was not obtained by 24 hours, a good outcome was still possible but a poor outcome becomes more likely [38].

A limitation of this study is that the study is retrospective with a small number of patients and no control group. However our inclusion and exclusion criteria dictated that

we were treating a small subgroup of patients with true recurrent symptoms. A recent study from the Mayo clinic identified 28 consecutive patients with true recurrent carpal tunnel syndrome in a span of 9 years, which demonstrates the rarity of these patients [10]. In their study, though the results were good after treatment with HTFPF, they did not analyse the patient factors that are associated with the recovery. As HTFPF is a trust worthy procedure for recurrent carpal tunnel syndrome [9–14] and since the study concentrated more on patient variables the need for a control group is negated. As there is only limited evidence available in the treatment of recurrent carpal tunnel syndrome, the authors suggest that in future a randomized control trial should be performed to evaluate the various methods of treatment.

Although this study cannot provide statistically significant evidence, the results help the operating surgeon to explain to each patient about the anticipated results after the surgery by analysing the patient characteristics and intra-operative findings.

## Conclusion

We conclude that the hypothenar fat pad is a reliable source of vascularised local tissue that can be used favourably in patients with recurrent carpal tunnel syndrome. The factors associated with poorer/delayed recovery are early recurrence (<1 year), involvement of non-dominant hand, intra-operatively fibrosis and scar tissue around the nerve and associated co-morbidities of obesity, diabetes mellitus and cervical spine problems.

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