One portal simultaneous bilateral endoscopic carpal tunnel release under local anaesthesia. Do the results justify the effort?

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Abstract

Purpose The purpose of this study was to evaluate whether simultaneous bilateral endoscopic carpal tunnel release could be effectively and safely performed under local anaesthesia.

Methods We prospectively evaluated 85 consecutive patients (62 females) who underwent simultaneous one portal endoscopic bilateral carpal tunnel release with subcutaneous injection of 2 mL 2 % lidocaine. In case of pain after discharge, all patients were advised to take paracetamol (i.e., acetaminophen) and to record the dose of drug taken. Patients were reviewed at regular intervals until one year postoperatively.

Results The mean operative time was 31.2 min. Postoperatively, only nine patients (10.6 %) received on average 611 mg of paracetamol. Significant improvement was noticed in the parameters of numbness, pain, positive Phalen and Tinel tests, pinch strength, grip strength, tip pinch strength and Quick DASH Score. Patients returned fully to work after surgery in average 2.2 weeks. Conversion to open release took place in four wrists (2.4 %). Discomfort and pain from tourniquet pressure was reported from two patients (2.4 %). Two wrists (1.2 %) required revision surgery. One patient (1.2 %) reported temporary thenar numbness and another (1.2 %) had slight scar hypersensitivity.

Conclusions Simultaneous bilateral endoscopic carpal tunnel release under local anaesthesia is well tolerated by patients. The technique may be of benefit in young, active, high-demand patients who require fast recovery, early return to work and less disability time.

Introduction

Carpal tunnel syndrome (CTS) is the most common peripheral compression neuropathy [1, 2]. The incidence is estimated to be 0.1–3 % in the general population and 10–40 % in some high-risk occupations [2]. With a life expectancy of 70 years, 3.5 % of men and 11 % of women are expected to develop CTS [1].

Currently, several different approaches are used to surgically release the transverse carpal ligament [3]. Open or mini-open procedures remain the standard treatment choice for the majority of surgeons. Although they have provided excellent long-term results, they are often associated with pillar pain, slow return of pinch strength and slow return to work. Single or dual portal endoscopic surgery has been associated with a lower incidence of pillar pain, infection and scar hypersensitivity [4]. However, it requires special training, adequate learning curve and familiarity with endoscopic techniques and instruments. Furthermore, it carries the theoretical disadvantage of increased risk of median nerve injury while its overall efficacy compared to open techniques is still questionable [4, 5].

Carpal tunnel syndrome occurs bilaterally in 22 to 87 % of cases and may severely affect hand function and work performance [6]. In this case, simultaneous or staged bilateral carpal tunnel release is required when non-operative treatment does not provide satisfactory relief from symptoms. Simultaneous endoscopic release of transverse carpal ligament may minimise the total disability time and the overall cost in terms of time off work as well as treatment and rehabilitation expenses [6]. On the other hand, opponents of the one-stage bilateral approach have expressed concerns about patients' ability to perform the postoperative activities of daily living and personal hygiene effectively [2, 7]. The type of anaesthesia is another issue for consideration as local anaesthesia could be inadequate for safe completion of the procedure and regional or general

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anaesthesia may be required. In this case, anaesthesia-related side effects, prolonged hospital stay and delay in patient recovery may be encountered.

The objective of this study was to prospectively investigate the outcome of patients with bilateral CTS undergoing endoscopic simultaneous bilateral carpal tunnel release. Our hypothesis was that the technique could be safely and effectively performed under local anaesthesia.

Materials and methods

Institutional Review Board approval was obtained for this study, and all participants signed informed consent.

We prospectively evaluated 85 consecutive patients who underwent simultaneous endoscopic bilateral carpal tunnel release during a given period (November 2006 to March 2010). All operations were performed by a single surgeon, who had more than ten years experience in endoscopic carpal tunnel release surgery. Patients had symptoms for a mean period of 43.3 months (range, three to 120 months) in both hands and electrophysiological confirmation of the nature of compression neuropathy. According to nerve conduction and electromyography findings the syndrome was classified as mild, moderate or severe [8].

Patients with previous wrist injury or surgery, pregnancy, current renal dialysis, severe medical comorbidities, terminal medical condition or unwillingness to return for postoperative visits were excluded from participation in the study. All patients were reviewed by an independent surgeon at two weeks, three months and one year postoperatively. No patients were lost to follow-up.

The parameters that were assessed before surgery and one year postoperatively for each hand included: Phalen test, Tinel test, numbness, pain using a visual analogue scale (VAS) pain score ranging from 0 (no pain) to 10 (unbearable pain), pinch strength, grip strength and tip pinch strength. Thenar muscle wasting was determined by palpation. Limb function was further estimated with the validated self-assessment questionnaire Quick DASH (Disabilities of the Arm, Shoulder, and Hand) score. Patients were also asked about their type of employment, when and in what capacity they returned to work and if they would have the simultaneous endoscopic procedure again.

Surgical technique

All operations were performed as outpatient procedures following the one-portal Agee endoscopic carpal tunnel release technique [9] using the MicroAire Endoscopic Carpal Tunnel Release System (MicroAire Surgical Instruments LLC,

Charlottesville, VA). One set of instruments and blades was used for each patient.

The worst side in terms of the severity of symptoms was operated upon first. A tourniquet cuff was applied to the upper arm and inflated to 120–150 mmHg above the systolic blood pressure. All procedures were done under local anaesthesia. Namely, 2 mL of 2 % lidocaine was injected subcutaneously with a 23-gauge needle in an area located at the ulnar side of palmaris longus at the proximal carpal crease. The needle was not advanced too deeply to avoid accidental injury of the median nerve. No local anaesthetic was infiltrated into the carpal tunnel. The injection was done in the operating room before tourniquet inflation and approximately ten minutes before skin incision (Fig. 1).

No additional analgesics or medication were given at that time. In case of pain after discharge, however, all patients were advised to take paracetamol (i.e., acetaminophen) and to record the dose of drug taken. After completion of surgery the incision site was closed with absorbable interrupted monofilament sutures (Monocryl 4–0) and Band-Aid coverage was applied.

The postoperative management was identical for all patients. Hand exercises were commenced immediately, and self-care or hygiene activities were encouraged. Return to work without any restriction was suggested seven to ten days postoperatively after dressing removal. According to our treatment protocol in CTS surgery, this time period was similar after unilateral endoscopic carpal tunnel release but shorter compared to open carpal tunnel release (three weeks).

Fig. 1 Intraoperative photograph showing the area of local anaesthetic injection (3 ml of 2 % lidocaine) at the ulnar side of palmaris longus (PL) and proximal carpal crease (PCC). DCC Distal carpal crease, P Pisiform bone

Statistics

Statistical evaluation was carried out using the SPSS software package (SPSS 17, Chicago, Illinois). Categorical data are presented as number of patients or wrists with percentages in parentheses, and were analysed by using the chi-square test. Continuous numeric data are presented as mean with range in brackets, and were compared using the Student's *t* test. Statistical significance was assumed for $p < 0.05$.

Results

There were 62 women and 23 men with an average age of 57.3 years (range, 29–79 years). Forty-six patients had mild CTS, 72 moderate CTS and 52 patients severe CTS. Medical comorbidities included hypertension in 19 patients, diabetes mellitus in eight patients, coronary artery disease in four patients and thyroid disease in eight patients. Work status was defined as unemployed or retired in 23 patients (27 %), employed in an occupation involving sedentary work in 34 patients (40 %), and employed in an occupation involving manual labour in 28 patients (33 %).

The mean operative time was 31.2 min (range, 21–46 min). At the one-year follow up, significant improvement was noticed in all the evaluated parameters of numbness ($p < 0.001$), pain ($p < 0.001$), positive Phalen ($p < 0.001$) and Tinel ($p < 0.001$) tests. Hand and upper limb performance was also significantly improved according to the clinical parameters of pinch strength ($p = 0.026$), grip strength ($p = 0.004$), tip pinch strength ($p < 0.001$) and Quick DASH score ($p < 0.001$). Fewer patients demonstrated thenar muscle wasting postoperatively but this difference failed to reach statistical significance ($p = 0.106$) (Table 1).

Only nine patients (10.6 %) received on average 611 mg (range, 500–1000 mg) of paracetamol during the first 24 hours postoperatively. After that time, no patients required further analgesia.

Patients returned to work and unrestricted activity in an average of 2.2 weeks (range, 1–6 weeks). Sedentary workers reported that they were able to work earlier than manual labourers (1.7 weeks vs. 2.8 weeks). None changed profession or were involved in a worker's compensation claim. All patients were satisfied with the final result and reported that they would do it again.

In four wrists (2.4 %) conversion to open release took place due to poor visualisation by herniation of ulnar bursa or median nerve into cannula. In addition, during division of carpal tunnel ligament, herniation of fatty tissue normally located between palmar fascia and transverse carpal ligament further obscured vision. Discomfort from tourniquet cuff and pain during surgery was reported by two patients (2.4 %) and mild sedation with midazolam and fentanyl was required to complete the procedure. Two wrists (1.2 %) required revision carpal tunnel release due to incomplete division of transverse carpal ligament. These cases were among the ten first cases that were operated upon with the described bilateral technique. One patient (1.2 %) reported numbness close to the thenar skin area that resolved after six months and another (1.2 %) had slight scar hypersensitivity.

Discussion

This study supports the option of performing simultaneous endoscopic carpal tunnel release under local anaesthesia, as supplementary sedation was required only in 2.4 % of cases. In the previously reported studies of endoscopic bilateral carpal tunnel release, the type of anaesthesia varied and mainly included local anaesthesia, local anaesthesia with sedation, regional blocks, and general anaesthesia [6, 10]. The concerns that endoscopic carpal tunnel surgery is more technically demanding, requires a longer learning curve and may be associated with prolonged tourniquet time and higher complication rate have increased surgeons'

Table 1 Evaluated parameters

Variables	Preoperatively	Postoperatively (one year)	<i>p</i> value
Numbness ^a	149 (87.6 %)	8 (4.7 %)	<0.001*
Pain (VAS score) ^b	7.3±3.45 (0–10)	0.7±1.4 (0–5)	<0.001*
Positive Phalen test ^a	158 (92.9 %)	12 (7 %)	<0.001*
Positive tinel test ^a	142 (83.5 %)	18 (10.6 %)	<0.001*
Thenar muscle wasting ^a	18 (10.6 %)	12 (7 %)	0.106
Grip strength ^b	23.2±4.1 (17–34)	27.1±6.45 (18–41)	0.004*
Pinch strength ^b	5.86±1.03 (4–7)	6.64±1.23 (4.8–10)	0.026*
Tip pinch strength ^b	3.6±0.75 (2–5)	4.66±1.15 (2–7)	<0.001*
Quick DASH score ^b	56.33±16.54 (25–89)	2.83±2.5 (0–9)	<0.001*
Quick DASH score ^b	56.33±16.54 (25–89)	2.83±2.5 (0–9)	<0.001*

^aData are given as number of cases and percentage in brackets

^bData are given as mean with SD and range (min and max) in brackets

* Statistically significant (95 % confidence interval)

uncertainty about the efficacy of local anaesthesia in simultaneous procedures. However, as the endoscopic approach minimises surgical trauma and avoids injury to the structures superficial to the transverse carpal ligament, the overall need for regional or general anaesthesia and the amount of local analgesia are much less compared to open procedures. It should be also pointed out that patients can tolerate tourniquets when inflation time does not exceed 20–25 minutes [11]. Taking into account that endoscopic carpal tunnel surgery rarely lasts more than 15–20 minutes, additional analgesia for alleviating tourniquet-induced pain is not generally required [12, 13].

Nabhan et al. [13] compared the efficacy of subcutaneous infiltration of a local anesthetic agent versus intravenous regional anaesthesia during endoscopic carpal tunnel release. The tourniquet time and operating room time were significantly lower in the local anesthetic group ($p=0.01$ for both). There were no complications related to the endoscopic surgery and the hand functional outcome was equal in both groups during follow up examination. In another prospective randomised trial, Sorensen et al. [14] compared intravenous regional anaesthesia with local anaesthesia in endoscopic carpal tunnel release using the Agee single-portal technique. There was no significant difference in reported pain during surgery. Immediately after surgery, patients in the local anaesthesia group reported significantly less pain in the hand and at the tourniquet. Two hours after surgery, patients in the local anaesthesia group reported considerably less hand pain. Moreover, significantly fewer patients in the local anaesthetic group required additional analgesics during the first two hours after operation. According to the above data, unilateral or even bilateral endoscopic release with subcutaneous infiltration of local anaesthetic appears to be a safe, cost-saving and well-tolerated procedure in the vast majority of cases.

The need for administration of local anaesthetic into the carpal tunnel is still controversial. Moreover, installation of local anaesthetic into the carpal tunnel may impair visibility during endoscopic surgery. Altissimi and Mancini [15] recommended that the local anaesthetic should be infiltrated into the carpal tunnel despite the risk of median nerve injury. Gale [16] suggested that superficial infiltration of the local anaesthetic could provide adequate anaesthesia in most cases. In a randomised-controlled single blinded trial, Patil et al. [17] compared the efficacy of both techniques in 20 patients with bilateral CTS. Patients were randomised to receive anaesthesia by one technique on the first side and the other on the second. The postoperative pain was not significantly different between the two groups, although the patients anaesthetised by the Altissimi and Mancini technique required significantly fewer analgesic tablets. This difference has been mainly attributed to the additional volume of instruments under the intact flexor retinaculum that

might cause pressure on the nerve. Nabhan et al. [13] and Sorensen et al. [14] infiltrated the subcutaneous area of palmar proximal wrist as well as the distal wrist down to the palm before endoscopic surgery. In both studies, no significant problems with visibility during endoscopic division of the transverse carpal ligament were reported. Neither infiltration of carpal tunnel nor subcutaneous injection of the palm was performed in our study. We did not notice any significant discomfort or intolerance during the introduction of blade assembly and endoscopic division of ligament. We believe that subcutaneous injection of proximal carpal crease area only is adequate for the majority of patients undergoing endoscopic carpal tunnel decompression.

Bilateral simultaneous surgery is appealing as it could substantially decrease the cost to patients and their employers in terms of wages and productivity lost [6]. From the financial perspective, it was previously estimated that by performing the operations simultaneously instead of in stages, an amount of \$682 could be saved per patient [2]. Moreover, the one-stage release decreases time commitment for repeated preoperative evaluations and postoperative office visits as well as the additional time and paperwork involved in return-to-work issues and restrictions [10]. These benefits are more evident in patients that routinely use both hands in their job, such as heavy labourers, and have expectations for a shorter postoperative period of disability and an earlier return to work. Nesbitt et al. [6] compared outcomes of bilateral simultaneous endoscopic carpal tunnel release to staged release. Seventy-one patients were evaluated preoperatively and at six months postoperatively. One group underwent simultaneous releases, a second group underwent staged releases one to three weeks apart, and a third group underwent staged releases more than three weeks apart. Although the satisfaction rate and functional outcome were almost equal between groups, there was a statistically significant difference among the groups in number of weeks off work postoperatively ($p=0.002$). The simultaneous group required the least amount of time off work (average, 2.6 weeks). The group staged one to three weeks apart required an average of 8.5 weeks off work, and the group staged more than three weeks apart required an average of six weeks off work. In our study, full return to work was achieved in an average of 2.2 weeks but all patients were able to successfully use both hands immediately after surgery.

On the other hand, the main argument against simultaneous bilateral carpal tunnel release is patient's ability to perform effectively daily activities and personal hygiene. Wang et al. [7] reported the difficulty of performing activities of daily living after simultaneous open bilateral carpal tunnel release. Self-care and hygiene tasks (with the exception of using the bathroom) were rated as moderately difficult, including bathing, dressing, cooking, and writing. Easier tasks were light duty-type activities such as shopping,

holding a book, eating, using a computer, and holding a phone. Weber and Boyer [2] reviewed the charts of 108 patients who underwent simultaneous or consecutive open bilateral carpal tunnel release. For two-handed activities, patients who had one hand operated upon had essentially the same functional abilities in the immediate postoperative period as those having both. We encouraged our patients to perform personal hygiene tasks unassisted and all the regular activities of daily living as tolerated immediately after surgery since wound infection or dehiscence are rarely seen after endoscopic carpal tunnel release.

Our study has certain limitations. First, it was mainly based on subjective patient reported outcomes, which are susceptible to a high degree of variability. Second, this series represents a single surgeon experience and whether the results can be reproduced by different clinicians and in different patient populations remains to be determined.

Simultaneous bilateral endoscopic carpal tunnel release under local anaesthesia is well tolerated by patients, and virtually problem-free. The technique may be of benefit in young, active, high-demand patients who require fast recovery, early return to work and less disability time.

Conflict of interest The authors declare that they have no conflict of interest.

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