Original Article

Comparison of postoperative pain after open and endoscopic carpal tunnel release
A randomized controlled study

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Abstract

Background: Results of open and endoscopic carpal tunnel surgery were compared with many studies done previously. To the best of our knowledge, difference in pain after endoscopic carpal tunnel release (ECTR) and open carpal tunnel release (OCTR) has not been objectively documented in literature. The aim of the study was to compare the pain intensity in the early postoperative period in patients undergoing OCTR versus those undergoing ECTR.

Materials and Methods: Fifty patients diagnosed with carpal tunnel syndrome were randomized into two groups using "random number generator" software (Research Randomizer, version 3.0); endoscopic surgery group [(21 female, 1 male; mean age 49 years (range 31–64 years)] and open surgery group [(25 female, 3 male; mean age 45.1 years (range 29–68 years)] and received carpal tunnel release. Surgery was performed under regional intravenous anesthesia. The patients' pain level was assessed at the 1st, 2nd, 4th, and 24th postoperative hours using a visual analog scale (VAS) score.

Results: Mean age, gender and duration of symptoms were found similar for both groups. Boston functional scores were improved for both groups ($P < 0.001$, $P < 0.001$). Pain assessment at the postoperative 1st, 2nd, 4th and 24th hours revealed significantly low VAS scores in the endoscopic surgery group ($P = 0.003$, $P < 0.001$, $P < 0.001$, $P < 0.001$). Need for analgesic medication was significantly lower in the endoscopic surgery group ($P < 0.001$).

Conclusion: Endoscopic carpal tunnel surgery is an effective treatment method in carpal tunnel release vis-a-vis postoperative pain relief.

Key words: Carpal tunnel syndrome, endoscopic surgery, open surgery, wrist, postoperative pain
MeSH terms: Carpal tunnel syndrome, carpus, endoscopy, wrist joint, postoperative care, surgical procedures, endoscopic

Introduction

Postoperative pain is a critical concern affecting the choice between open and endoscopic surgical techniques and it is the main outcome parameter in both techniques. Thus, postoperative pain is frequently assessed in studies comparing the results of open and endoscopic release in carpal tunnel syndrome (CTS), a common peripheral nerve entrapment. While several parameters such as functional outcome, recovery time, scar sensitivity and complication rates are also addressed in these studies, none of them focused on a scheduled and periodical followup of pain intensity in the early postoperative period.[1-4]

The aim of this prospective, randomized, controlled study was to compare the course of pain intensity in the early

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postoperative period in patients undergoing open carpal tunnel release (OCTR) versus those undergoing endoscopic carpal tunnel release (ECTR).

Materials and Methods

Eighty two patients, clinically and electrophysiologically diagnosed with CTS, were included in this study. The study protocol was explained to patients who met the inclusion criteria. Fifty patients gave consent for participation. Informed consent was given by all participants. Approval of the Ethical Committee of the hospital was obtained. The type of surgery to be performed was decided using a "random number generator" software (Research Randomizer©, version 3.0. Urbaniak GC, Plous S: [Computer software]. Retrieved on April 22, 2010, from http://www.randomizer.org). Patients were randomized into two groups; endoscopic surgery group [(21 female, 1 male; mean age 49 years (range 31–64 years)] and open surgery group [(25 female, 3 male; mean age 45.1 years (range 29–68 years)] and received carpal tunnel release [Table 1].

Inclusion criteria were complaints of CTS for at least 3 months which did not respond to conservative treatment, electrophysiological findings of intermediate to advanced level of isolated median nerve involvement in the carpal tunnel, lack of motor deficit, absence of cervical disc pathology, absence of metabolic problem resulting in peripheral neuropathy, lack of previous upper extremity injury or surgery and lack of movement restriction in the wrist and hand.

Preoperative physical examination and Boston CTS scale of patients was performed by the same surgeon.[5] The preoperative electrophysiological assessment was repeated in accordance with the study protocol by the same neurologist.

The electrophysiological evaluation was conducted using a Nihon-Kohden MEB 5504 K device in the electromyography laboratory at the Department of Neurology in our hospital. Sensory and motor median nerve conduction was tested in the symptomatic hand. Distal latency, conduction velocity and amplitude were evaluated.

Table 1: Demographics of study population

Patient demographics	Open surgery (*n*=28)*	Endoscopic surgery (*n*=22)	*P*
Age	49±8.21	45.1±8.54	0.114[a]
Duration of symptoms (months) (3-180)	47.96±50.43	59.55±57.18	0.438[b]
Gender (female/male)	25/3	21/1	1.000[d]
Operated dominant side	20/28	17/22	0.640[c] (test)

*Number of patients, [a]Independent samples *t*-test, [b]Mann–Whitney U-test, [c]Pearson Chi-square test, [d]Fisher's exact test

All patients received preoperative regional intravenous anesthesia (RIVA) with the same pharmacological agents (prilocaine hydrochloride 3 mg/kg citanest; AstraZeneca; complemented with 0.9% NaCl for a 40 cc solution).

Operative procedure

Open surgery

An incision of 3–4 cm long, 2 mm ulnar to the thenar crease line and distal to the Kaplan oblique line was made. The superficial palmar fascia and the transverse carpal ligament was cut through the ulnar side while protecting the median nerve and its motor branch. The skin and subcutaneous tissue was released proximally and distally with a retractor, the opening of the tunnel was confirmed. The skin was closed with nonabsorbable sutures.

Endoscopic surgery

The surgery was performed under RIVA according to Chow's description. Two portals were needed to perform the surgery. A 1–1.5 cm line from the proximal tip of the pisiform was drawn radially. A second line was drawn proximally from the end of this first line 0.5 cm. After that, a third line was drawn from the proximal end of the second line radially 1 cm which determined the entry portal. For exit portal; the thumb was brought to full abduction. A transverse line from the distal end of the abducted thumb and a longitudinal line between the 3rd and 4th finger toward the proximally was drawn in the palm surface. This two line formed a right angle. A line bisecting this right angle was extended 1 cm from the vertex toward the ulna. It established the site of incision for the exit portal. The entry portal was opened and the fascia exposed with blunt dissection and cut. A gap was created between the transverse carpal ligament (TCL) and the ulnar bursa with the help of a curved dissector after the proximal border of the TCL was determined. Then, a slotted cannula was inserted through entry portal under TCL. Incision was made on exit portal and the cannula was extracted. TCL was visualized with an endoscope and divided with a retrograde knife (ECTRA 2; Smith and Nephew). The completion of the cut was checked with endoscope. The cannula was removed. Portals were closed with nonabsorbable sutures. A compression bandage was applied to control postoperative bleeding and released 30 min after surgery in all patients.

Patient's pain level was assessed on the 1st, 2nd, 4th and 24th postoperative hours using visual analog scale (VAS) scores. Time of the first analgesic intake was recorded. Pain relief was achieved with orally administered paracetamol 500 mg tablets (Parol tb, Atabay İlaç). The total dose of postoperative medication in the first 24 h was noted.

Discharged patients were examined at weekly followups for carpal tunnel complaints and wound healing. Treatment

efficacy was assessed using Boston and functional scorings on the 6th postoperative week.

Data were analyzed using the SPSS for Windows (version 15.0), Chicago, USA, SPSS Inc. For the assessment of the study data, beside descriptive statistical methods (average, standard deviation, median, frequency, ratio, minimum, maximum), independent samples *t*-test was used for comparing the normally distributed parameters between the groups and the Mann–Whitney U-test was used for comparing the nonnormally distributed parameters between the groups in the comparison of quantitative data. Categorical data were compared using the Chi-square and Fisher's exact test. Repeated measures test was used to analyze the change of the VAS score according to followup time. The significance of the difference between pre and postoperative mean values was analyzed with paired samples *t*-test. Significance level was set at $P < 0.05$ in all analyses.

Results

The mean age of the patients was 45.1 ± 8.54 (range 31–68 years) years in the open surgery and 49 ± 8.21 (range 31–64 years) years in the endoscopy group; both groups were similar ($P = 0.11$). There were three (10.7%) male and 25 (89.3%) females in the open surgery group. The endoscopic surgery group had one male (4.5%) and 21 females (95.5%) patients. The two groups were similar ($P = 0.673$).

Mean preoperative duration of complaint was 47.96 ± 50.43 (range 3–180 months) months in the open surgery and 59.55 ± 57.18 (range 4–180 months) months in the endoscopic surgery group. Two groups were similar ($P = 0.451$). Twenty one patients (75%) in the open surgery group and 17 (77.3%) in the endoscopic surgery group were operated on their right upper extremity. Seven patients (25%) in the open surgery group and 5 (22.7%) in the endoscopic surgery group were operated on their left upper extremity. The groups were statistically similar ($P = 0.852$).

The Boston questionnaire assesses the severity of the symptoms and functional capacity of the patients. There was no statistical difference between the groups in terms of both pre and postoperative Boston scores. A significant difference was observed between the pre and postoperative 6th week Boston scores of the two groups [Tables 2 and 3].

Nocturnal complaints of all patients receded in the early postoperative period. Pain assessment at the postoperative 1st, 2nd, 4th and 24th hours revealed significantly low VAS scores in the endoscopic surgery group [Table 4]. The changes of

Table 2: Pre and postoperative Boston scores of open surgery patients

Variables	*n***	Preoperative	Postoperative	*P*
Severity of the symptom	28	3.36±0.56	1.48±0.45	<0.001*
Functional capacity		2.41±0.47	1.37±0.59	<0.001*

*P<0.05 Wilcoxon test, **Number of patient

Table 3: Pre and postoperative Boston scores of endoscopic surgery patients

Variables	*n***	Preoperative	Postoperative	*P*
Severity of the symptom	22	3.35±0.63	1.34±0.51	<0.001*
Functional capacity		2.3±0.60	0.96±0.32	<0.001*

*P<0.05 Wilcoxon test, **Number of patient

Table 4: Postoperative pain assessment results with VAS

Postoperative time	Open surgery (*n*=28)*	Endoscopic surgery (*n*=22)	*P*[a]
Postoperative 1st h			
Mean±SD	5.61±2.36	3.68±1.91	0.003
Median (minimum-maximum)	5.5 (0-10)	3.0 (1-7)	
Postoperative 2nd h			
Mean±SD	5.25±2.14	2.91±1.41	<0.001
Median (minimum-maximum)	5.5 (0-9)	3.0 (0-5)	
Postoperative 4th h			
Mean±SD	5.29±1.99	2.73±1.86	<0.001
Median (minimum-maximum)	5.0 (1-10)	3.0 (0-7)	
Postoperative 24th h			
Mean±SD	4.64±2.20	2.18±2.17	<0.001
Median (minimum-maximum)	4.0 (1-8)	2.0 (0-7)	
P[b]	0.445	0.264	

*Number of patient, [a]Independent samples *t*-test, [b]Repeated measures test. VAS=Visual analog scale, SD=Standard deviation

VAS scores according to followup were found statistically insignificant for both groups ($P = 0.445$, $P = 0.264$; $P > 0.05$). The first analgesic intake requirement in the open surgery group was at 3.81 ± 2.67 h and 6.53 ± 3.96 h in the endoscopic surgery group. This difference was statistically significant ($P = 0.0027$). Cumulative dose of Paracetamol intake during the first 24 h postoperative period was 772.72 ± 428.93 mg in the endoscopic group and 1, 535.71 ± 428.79 mg in the open surgery group. The difference was statistically significant ($P < 0.001$).

One patient in the endoscopic surgery group experienced a flexor digitorum superficialis injury of the 5th finger. The injury was detected peroperatively and the tendon was primarily repaired by expanding the incision. Examination at the postoperative 6th week revealed scar pain in three patients in the open surgery group.

Discussion

This prospective, randomized and controlled study was undertaken to compare the course of pain intensity in the

early postoperative period in patients undergoing OCTR and ECTR. Both open and endoscopic techniques can be used for carpal tunnel release in refractory cases of carpal tunnel syndrome.[1] Skin problems are one of the drawbacks of open release and can be reduced with the endoscopic technique.[2,6-9]

In our study, one patient in the endoscopic surgery group experienced a flexor digitorum superficialis injury of the 5th finger, which was detected peroperatively and was repaired primarily by expanding the incision. Three patients in our open surgery group revealed scar pain. Vasiliadis *et al*. (2014) reported in his meta-analysis that ECTR appears to be associated with fewer minor complications compared to OCTR, but there was no difference in the rates of major complications.[10] In another current meta analysis, the risk of nerve injury was found to be higher in endoscopically treated patients, whereas the scar tenderness was less common.[11] The findings were supported by Keith's study.[12]

To the best of our knowledge, postoperative pain after endoscopic and OCTRs has not been compared. In their studies, Atroshi, Chow and Hantes and Agee *et al*. emphasized the low postoperative level of pain but reported subjectively.[13-15] Standard pain scoring was not performed in both studies.[13-15] In our study, postoperative pain was analyzed in detail using the VAS score. The pain level in the endoscopic surgery group during the first 24 h after surgery group was low.

Meta analysis did not showed any difference between OCTR and ECTR regarding to functional outcome.[10-12] However, less postoperative pain and faster recovery have been reported following endoscopic release when compared with open technique,[3] disadvantages of ECTR, including high surgical complication, inability to perform synovectomy, inability to detect space occupying lesions in the carpal tunnel and high cost have been reported in the literature.[16] Chow and Hantes (2002) demonstrated that patients required 0–2 tablets of analgesics after endoscopic carpal tunnel surgery. However, the type of analgesic or its dosage is not mentioned in their study.[15]

Functional capacity of the patients can also be improved.[4,17-21] In our study, carpal tunnel symptoms disappeared in both patient groups. Pre and postoperative functional scores of the patients also improved in a similar manner.

Kang *et al*. (2013) reported in his study that the pain relief immediately after surgery and after discharge from hospital was also similar for OCTR and ECTR.[22] Whereas, our results showed that postoperative pain intensity is significantly less after ECTR. It might be due to smaller skin incision for ECTR. This advantage has been reported as an outcome parameter in previous studies. However, the pain assessment was subjective, momentary and unscheduled. Also, the amount of analgesic medication was used to compare pain intensity, rather than standardizing the analgesic regimen between the groups.

Our study highlights the need for a more comprehensive investigation in which large patient groups are used to determine whether there is a statistically significant difference between two groups.

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Conflicts of interest
There are no conflicts of interest.

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