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ORIGINAL STUDY

Outcomes of carpal tunnel surgery in patients with and without medical comorbidities with special attention to quality of life

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The objective of this study was to compare the outcomes of carpal tunnel surgery in patients with and without medical comorbidities typical in this age range, with particular attention to evaluation of their quality of life. The outcomes of carpal tunnel release at 6 months after operation in 128 patients, 70 (55%) with and 58 (45%) without comorbidities were compared. The measurements were performed preoperatively and at 6 months after the operation and included pain intensity, grip strength, sensation, hand dexterity with the Levine and quality of life with the RAND SF-36 questionnaires. Results. At baseline, the patients with comorbidities had significantly poorer hand function and reduced perception of light touch. Carpal tunnel release resulted in significant improvement for all patients, although outcomes at 6 months were less favorable for those with comorbidities in terms of quality of life and general health status. This however does not mean that the presence of the comorbidities is prejudicial to the outcome of CTS surgery.

Keywords: carpal tunnel syndrome ; comorbidities ; outcomes of surgery ; quality of life.

INTRODUCTION

It is believed that the presence of medical comorbidities may substantially negatively affect outcomes of carpal tunnel surgery. Therefore, in many studies patients with associated diseases are excluded from the analysis. Results of single works are available, comparing results of carpal tunnel release in CTS patients with and without diabetes, showing no significant effect of the systemic disease on the final outcome *(1,4,7,8)*. This is not the case in other common comorbidities, such as hypothyroidism, rheumatoid arthritis, polyneuropathy or cervical spine arthritis.

A second interesting issue is the effect of these comorbidities on the quality of life of patients with carpal tunnel syndrome. In the age range typical for CTS (40-60 years) the presence of other diseases such as spine arthritis (at different level), arterial hypertension, ischemic heart disease or diabetes is relatively common. These diseases may themselves decrease the general quality of life of patients. The question is to what extent the presence of comorbidities contributes to overall reduction in quality of life for persons with CTS. The objective of this study was to compare the outcomes of

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carpal tunnel surgery in patients with and without medical comorbidities typical in this age range, with particular attention to evaluation of their quality of life.

MATERIALS AND METHODS

A prospective study was conducted in two institutions (1 and 2) over a period of 12 months (April 2013 - March 2014). The approval of the Bioethical Council of the local Medical University was obtained and informed consent was obtained from all subjects before enrolment. Data were collected on all patients diagnosed with CTS who subsequently underwent operation. The diagnosis of CTS was made based on clinical symptoms and signs and, occasionally nerve conduction studies. Patients with bilateral involvement were included (any intervention in the other hand was postponed until completion of the study).

Initially, 166 patients were enrolled, of whom 128 completed a six-month follow-up. Thirty-eight patients (22%) did not attend the final assessment. At least one attempt has been made to contact these patients by telephone or mail, but with no response. Eventually the study included 128 patients, 103 women (80%) and 25 men (20%) with a mean age of 55 (range 26-86) years, with carpal tunnel syndrome lasting a mean of 33 (range 6-240) months. Seventy patients (55%) have at least one comorbidity listed in Table I (34 patients had only one and 36 had more than one) and 58 (45%) presented with "pure" carpal tunnel syndrome. The groups did not differ significantly with regard to age, sex distribution and duration of CTS. With regard to involvement of one or both hands, 37/70 (53%) of the patients with comorbidities had bilateral CTS comparing, to 27/58 (46%) in the group with "pure" CTS (the difference statistically not significant).

Table I. — List of comorbidities diagnosed in 70 CTS patients in this study. Note, that an individual patient might have more than one associated condition and, therefore, number of patients assigned to diseases is greater than actual number of patients in the study

Associated disease	Number of patients
Spine arthritis	18
Arterial hypertension	17
Diabetes	15
Ischaemic hearth disease	15
Thyroid gland diseases	14
Big joints arthritis (hip, knee, shoulder)	12
Rheumatoid arthritis	7
Chronic obturatory lung disease	6

The following measurements were performed:

a. Pain intensity was measured on a numeric scale, range 0 (no pain) to 10 (extreme pain)

b. Digital sensibility with Semmes-Weinstein monofilament test. Measurements were carried out on the thumb, index and middle fingers and the results were expressed in ranks from 5 to 1. The Sensory Index was calculated by adding the measurements from each finger and then dividing by three. A Sensory Index score of 5 indicated normal sensation in all three digits; a score of 1 indicated no sensation in these digits.

c. Total grip strength was measured with a Jamar dynamometer from the set of DataLink (Biometrics and Co Ltd, Gwent, UK) and expressed in Kg.

d. All patients completed the Levine questionnaire *(3)*

e. Quality of life was assessed with the RAND SF-36 questionnaire

f. Patients were asked about the presence of all possible comorbidities they have, not only involving the hand. All the declared diseases were recorded.

All measurements were performed one day before the operation, and repeated at six months post-operatively. To minimalize possible effect of the involvement of the other hand on the Levine scores, at the follow-up assessment the patients with bilateral disease were asked whether their complaints or functional impairment had been related to the operated hand or the contralateral one, i.e. „Was awaking by nocturnal pain caused by already operated or non-operated hand?" In general the patients had no difficulties with distinguishing these problems in symptom part of the Levine questionnaire, but it was less obvious with the function part.

Presence of the comorbidity was ascertained by a direct asking each individual patient: "Do you have

any comorbidity, not only involving the hand?" Additionally, the patient was asked for permanent taking any medicine, and then, for the reason (a disease) of taking it.

Patients received mini-invasive carpal tunnel release under local anesthesia, with the use of tourniquet. The operative technique was identical in both institutions participating in the trial. The outcomes in patients with (n=70) and without comorbidities (n=55) were compared. The statistical significance of differences in outcomes in either group was examined with the U Mann-Whitney test for non-normal distribution of variables.

RAND SF-36 questionnaire

The SF-36 is a generic health-related quality of life questionnaire consisting of 36 items grouped in 8 scales (domains): PF - Physical Functioning, RP - Role Physical (role limitations because of physical health problems), BP - Bodily Pain, GH - General Health, VT - Vitality, SF - Social Functioning, RE - Role Emotional (role limitations because of emotional problems) and MH - Mental Health. The first four domains consist of physical, and the latter four domains of mental components. Raw scores from each item are next translated into a final score ranging from 0 (poor health) to 100 (optimal health). The questionnaire also comprises one separate question not related to any scale. It concerns the patient's feeling of his/her actual health status, compared to their status from one year before. This outcome was recorded using a three-grade scale: better, the same or worse than a year before.

RESULTS

The outcomes of carpal tunnel release at 6 months after operation in 128 patients, 70 (55%) with and 58 (45%) without comorbidities were compared.

a. Baseline assessment (Table II and III)

Pre-operative comparison showed statistically significant, but clinically not meaningful differences between the groups in pain intensity and perception of touch with the Semmes-Weinstein filaments (the minimal detectable difference of the Sensory Index is considered to be 1.0). Statistically significant differences were noted in function Levine scores, showing poorer hand function in patients with comorbidities (2.6 vs 3.1, p=0.004).

Quality of life (Table 3). The RAND SF-36 scores were overall lower in patients with comorbidities, suggesting poorer quality of life, although statistically significant differences were noted only in domains PF and VT. Answering the question concerning how their actual health status felt, statistically significantly more patients with comorbidities regarded their health to be poorer than from one year before (n=40; 57% vs n=14; 25% without comorbidities, p=0.004).

b. At 6 months assessment (Table 2 and 3)

An assessment at six months showed strong and statistically significant improvement in both groups in all considered parameters comparing to the baseline. Comparison of outcomes between the groups showed similar range of improvement, although statistically significant differences persisted in perception of touch with the Semmes-Weinstein filaments (4.8 vs 4.4) and in total grip strength (23.4 Kg vs 19.6 Kg), favoring patients without comorbidities. Likewise at baseline, the difference in Sensory Index was minimal and clinically not relevant. The difference in grip strength was significant - 3.8 Kg, but did not translate into the Levine function scores. Patients in both groups had similar final the Levine symptom and function severity scores.

Quality of life (Table III). In both groups, the RAND SF-36 scores were significantly higher in all domains, comparing to baseline, suggesting better quality of life following surgery. Statistically significant differences (final vs baseline) were noted in domains PF, RE and BP. Comparison of RAND SF-36 scores between the groups showed that patients with comorbidities, regardless of similar range of improvement, still experienced worse quality of life than patients without comorbidities. Statistically significant differences between the groups were noted in all "physical" domains, favoring patients without comorbidities: PF, RP, BP and GH. In three of the four "mental" domains the scores were statistically significantly higher in

Table II. — Baseline characteristics between the three groups

Variable	Without comorbidities n=58		With comorbidities n=70		Statistical significance
	Mean	SD	Mean	SD	p
Baseline assessment					
Pain in numeric scale (cm)	5.7	3.1	5.9	3.2	0.60
Totol grip strength (Kg)	17.6	10.3	15.1	8.8	0.24
Sensory Index	4.1	0.9	3.6	1.0	0.012
Symptom Levine score	3.1	0.8	3.2	0.7	0.2
Function Levine score	2.6	1.0	3.1	0.9	0.004
At 6 months assessment					
Pain in numeric scale (cm)	0.4	1.5	0.7	1.9	0.77
Totol grip strength (Kg)	23.4	8.3	19.6	6.9	0.008
Sensory Index	4.8	0.5	4.4	0.9	<0.001
Symptom Levine score	1.3	0.5	1.4	0.6	0.22
Function Levine score	1.5	0.7	1.7	0.9	0.31

Table III. — Comparison of baseline and at 6 months SF-36 scores the study groups

Variable	Without comorbidities n=58		With comorbidities n=70		Statistical significance
	Mean	SD	Mean	SD	p
RAND SF-36 domains, baseline assessment					
PF - Physical Functioning	77	19	55	25	0.003
RP - Role Physical	37	43	23	37	0.40
BP - Bodily Pain	38	24	29	23	0.76
GH - General Health	54	11	43	7	0.51
VT - Vitality	59	18	49	18	0.014
SF - Social Functioning	80	23	77	26	0.22
RE - Role Emotional	72	42	58	47	0.18
MH - Mental Health	68	17	58	19	0.26
RAND 36 domains, at 6 months assessment					
PF - Physical Functioning	90	13	74	25	< 0.0001
RP - Role Physical	79	34	59	45	0.04
BP - Bodily Pain	72	23	60	28	0.02
GH - General Health	59	11	48	11	< 0.0001
VT - Vitality	69	12	60	15	0.003
SF - Social Functioning	87	22	87	23	0.92
RE - Role Emotional	98	9	84	35	0.02
MH - Mental Health	74	14	67	15	0.04

patients without comorbidities: VT, RE and MH. Only in subscale SF were the scores an equal 87 in both groups. Compared to their status from one year before, statistically significantly more patients without comorbidities evaluated their overall health status better (n=31; 57% vs n=27; 39%, with associated diseases, p=0.02). This results show that the operation was more beneficial for patients with "pure" carpal tunnel syndrome than for those with associated diseases.

As the spectrum of comorbidities in our study was mixed, we compared RAND SF-36 scores in patients with conditions predisposing to, or mimicking CTS and with more "general" diseases. Of 70 patients with comorbidities, 21 had one or more of the following disorders predisposing to CTS: diabetes, thyroid gland disease, cervical spine arthritis or rheumatoid arthritis, and 34 had one or more "general" diseases (HA, ischemic heart disease, etc.). We failed to find statistically significant differences between the groups in any of the RAND SF-36 subscales at 6 months assessment. This suggests that the character of the associated disease did not influence the perception of quality of life in patients following CTR.

DISCUSSION

In our study we took into consideration a wider spectrum of associated diseases than reported in other works, which mostly include comorbidities predisposing to CTS such as diabetes, hypothyroidism or rheumatoid arthritis *(1,2,6)*. We took into account all diseases typically occurring in middle/older age, such as cardiovascular, digestive tract, spine and joint disorders (Table I). All these conditions negatively affect quality of patients' life and occurrence of carpal tunnel syndrome constitutes an additional component further depreciating their feeling of health. An interesting question was, to what extent does the presence of comorbidities worsens patients' experience of symptoms of carpal tunnel syndrome, and, further, limits the beneficial effect of surgical treatment?

The results of our study show that patients with carpal tunnel syndrome burdened with comorbidities had significantly poorer hand function and considered their quality of life worse (in aspect of physical functioning and vitality) than patients suffering only from CTS. Surgical intervention resulted in significant improvement of all examined variables in both groups. However, the patients without comorbidities experienced greater improvement in their quality of life and in general health status following operation than those with comorbidities. This finding suggests a need for correction of outcomes of carpal tunnel surgery in patients with associated diseases, particularly in the quality of life aspect.

Thomsen et al. (2010) compared outcomes of CTR in patients with (n=35) and without (n=31) diabetes. A large clinical improvement was observed at final assessment in both groups and the Levine scores at one year did not differ significantly between the groups. The SF-36 physical component scores at baseline were significantly reduced for diabetic compared with non-diabetic patients, which was not the case with the mental component. The authors conclude that health-related quality of life is impaired in diabetic, compared with non-diabetic patients with CTS *(6)*.

Except of the abovementioned, there are no other similar studies in the literature. Cagle et al., 2014 reported results of carpal tunnel release at 3 months in patients with (n=351) and without (n=599) comorbidities. The disorders included diabetes, rheumatoid arthritis, radiculopathy, polyneuropathy, hypothyroidism and gout, thus predisposing to, or mimicking CTS. There were no significant differences at final assessment between the groups, as measured by Levine symptom and function scores. The authors conclude that patient medical comorbidities do not affect improvement after carpal tunnel surgery *(1)*.

Limited data are available about the effect of comorbidities predisposing or mimicking CTS, such as diabetes or cervical spine arthritis. Most studies showed that carpal tunnel release was similarly beneficial for diabetic and non-diabetic patients, but none included quality of life in post-operative outcome measurement *(4,7,8)*. Cervical spine diseases (arthritis or discopathy) with associated spinal root involvement might mimic CTS. There is conflicting evidence about the effect

of these disorders on outcomes of carpal tunnel surgery. Mondelli et al., (2001) reported cervical-spine diseases to be present in 81% of patients who were not satisfied with their carpal tunnel decompression, whereas another study showed no differences in long-term relief after surgery in 15 patients with associated cervical spine disease, compared to 139 with isolated CTS *(2,5)*.

There are several shortcomings of this study. First is a problem of a bilateral disease and its possible effect on the Levine and SF-36 scores at follow-up assessment. One may speculate that presence of CTS in the other hand should be also considered comorbidity. To resolve the problem we compared all variables measured (except SF-36 subscales) in groups with unilateral and bilateral CTS, regardless presence of comorbidities. Results of this comparison showed no significant differences between the groups, except of Sensory Index before surgery, but the difference was clinically not meaningful.

Next drawback is missing comorbidities involving hands, such as trigger digit, de Quervain disease or CMC arthritis. Actually, it seems impossible that in a population of 128 patients with CTS none of them had ever had one of these conditions. An explanation may be that the patients were literally asked: "Do you have any comorbidity, not only involving the hand?" Thus, the patient concentrated on the other (systemic) diseases, not related to the hand problems.

Summarizing, the results of our study show carpal tunnel release resulted in significant improvement for patients with and without comorbidities, although outcomes at 6 months were less favorable for those with comorbidities in terms of quality of life and general health status. This however does not mean that the presence of the comorbidities is prejudicial to the outcome of CTS surgery.

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