



Comparison between cubital and carpal tunnel syndrome with patients' reported outcomes measures preoperatively : pilot study

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The aim of this study was to compare preoperative scores of Patients' Reported Outcomes Measures of two of the most common upper extremity compression neuropathies : Cubital Tunnel Syndrome (CuTS) or Carpal Tunnel Syndrome (CTS) in a single center. In total, 89 patients at the clinic were examined (CuTS :n=34 ; CTS :n=55). In the study, both the Michigan Hand Outcomes Questionnaire (MHQ) and the Disabilities of the Arm, Shoulder and Hand (DASH) Outcome Measure were used to compare the two analyzed hand disorders. The Mann-Whitney test was used and the results were presented as a median with an interquartile range. These final scores were significantly worse in cases of CTS in comparison to CuTS (MHQ $p=0.037$; DASH $p=0.004$). Analysis of each of the 6 MHQ subscales have shown that work and pain domain scores are significantly worse in the CTS group (both $p=0.017$). The remaining domains of hand function, activities of daily living, appearance, and satisfaction subscales did not show significantly statistical differences. The CTS group has lower outcomes in comparison with CuTS, when assessed by standardized general hand function questionnaires in an outpatient clinic. This study provides information which can be useful in allocation of resources for the two conditions.

Keywords : Cubital tunnel syndrome ; carpal tunnel syndrome ; ulnar nerve entrapment ; DASH ; Michigan hand outcomes questionnaire ; quality of life.

INTRODUCTION

Nerve compression syndromes involve chronic irritation and pressure lesions where nerves pass through anatomical narrow structures or fibro-osseous canals. Symptoms of neuropathies commonly include pain, tingling, numbness, and muscle weakness which occur in particular areas of the body, depending on the affected nerves (4,19). Two of the most common upper extremity compression syndromes are Carpal Tunnel Syndrome (CTS) and Cubital Tunnel Syndrome (CuTS) (4). CTS is due to compression of the median nerve in the carpal canal by any condition that increase the volume of the structures within it (19). CuTS, also known as ulnar neuropathy at the elbow, occurs when the compression at the cubital tunnel, mainly under Osborne's ligament, significantly affects the ulnar nerve (6,18).

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Table 1. — Demographic data of study groups: Cubital Tunnel Syndrome (CuTS) and Carpal Tunnel Syndrome (CTS)

	CuTS (n = 34)		CTS (n = 55)		Total (n = 89)	
	Mean / Median / n	SD / Q ₁ ,Q ₃ / %	Mean / Median / n	SD / Q ₁ ,Q ₃ / %	Mean / Median / n	SD / Q ₁ ,Q ₃ / %
Age [years]	62.1*	12.2	52.6	13.7	58.9	13.4
Men	18	52.9%	5	9.1%	23	25.8%
Women	16	47.1%	50	90.9%	66	74.2%
Affected Hand						
Right	17	50.0%	35	63.6%	52	58.4%
Left	17	50.0%	20	36.4%	37	41.6%
Duration of symptoms [months]	18	9, 36	24	16, 60	24	12, 36
Hand dexterity (right/left)	32/2	94.1%/ 5.9%	50/5	90.9%/ 9.1%	82/7	92.1%/ 7.9%
Clinical classification	McGowan modified by Goldberg (Goldberg 1989)		Mackinnon's classification (Mackinnon and Dellon 1988)			
	I	3 8.8%	Mild	7 12.7%		
	IIA	7 20.6%	Moderate	18 32.7%		
	IIB	15 44.1%	Severe	30 54.5%		
	III	9 26.5%				

Q1-Q3 – quartiles ; SD – standard deviation. * $p < .05$ for age. McGowan modified by Goldberg (Goldberg 1989). I - Subjective symptoms and without objective findings ; IIA – Motor weakness with good intrinsic strength, no atrophy ; IIB - Presenting atrophy of intrinsic muscles with fair strength ; III – Intense sensory and motor disturbance with marked intrinsic atrophy. Mackinnon's classification (Mackinnon and Dellon 1988). Mild - Presence of only sensory symptoms (pain, paresthasias and/or numbness). Moderate - Presence of motor symptoms (weakness). Severe - Presence of muscle wasting.

Many authors have studied the impact of these conditions on different aspects of life with general and disease-related questionnaires (9,13,15,17,24). Due to motor and sensory functions of the hand provided by the median and ulnar nerves, our team decided to compare these two conditions, based on data collected from general hand/ wrist related questionnaires.

MATERIAL AND METHODS

The study was conducted in the Second Department of General Surgery, Jagiellonian University Medical College in Poland from January 2015 to April 2016. The study was approved by the Bioethical Committee of the Jagiellonian University Medical College (#122.6120.107.2015). The methods and protocols were carried out in accordance with the approved guidelines and written informed consent was obtained from all the enrolled participants. Subsequent patients with clinical symptoms and

an electrophysiological confirmation of cubital or carpal tunnel syndrome, who were admitted to outpatient clinics and qualified for surgery, were included. The inclusion criteria also involved : patients older than 18 years-old, no prior hand/wrist surgery, and no history of neurologic and mental disease. Severity grading was classified using McGowan, modified by Goldberg's classification for CuTS, and Mackinnon's classification for CTS (Table 1 footnotes) (10,16).

Participants of both clinical groups were asked to complete the Polish version of the Michigan Hand Outcomes Questionnaire (MHQ) and the Disabilities of the Arm, Shoulder and Hand (DASH) Outcome Measure, which are the most popular tools in the subjective assessment of hand disorders (21,22). In the next phase, our analyzed hand disorders were compared.

The MHQ is a hand-specific outcome questionnaire that measures conditions of hand or wrist disabilities/injuries (2,7,14). Using 37 core ques-

tions, it assesses the subjective feeling of how patients' lives are affected by the disease, as well as quantifying it on different scales. The questions address the functionality of the left and right hands independently. The MHQ contains six distinct scales: overall hand function, activities of daily living (ADLs), work performance, pain, aesthetics, and patient satisfaction with hand ability.

Each question is answered from 1 to 5, while each of the 6 scales are scored and then converted to a scale of 0-100, in accordance with the scoring system. Higher numerical scores reflect better results, except for the pain scale, in which a higher score is associated with more intense pain. The final score is calculated for the left and right hands. The MHQ was analyzed between groups in every domain, including the final score of the affected hand. The official license was obtained from Regents of the University of Michigan (Academic License #3372).

The second measuring instrument was DASH (30 questions), which is a patient-report questionnaire designed to measure both physical function and symptoms in patients with any musculoskeletal disorders of the upper limbs (1,12). Questions are answered on a scale of 1 to 5. The final outcome is converted as a number from 0-100. The numerical score achieved in this questionnaire is inversely correlated with better function and patient condition, with 0 indicating no disability (good function) and 100 reflecting severe disability.

Normal distribution was assessed with a Shapiro-Wilk test, which was non-preserved except for age. Thus, the data was analyzed using non-parametric tests, with a parametric test for age. A p -value of <0.05 was considered to be statistically significant. To compare questionnaire scores between the analyzed groups, the U Mann-Whitney test was used. A T-test was used to assess differences in age between study groups, presented as means with standard deviations. The data was presented as a median with an interquartile range of Q_1 - Q_3 , with corresponding graphs for the MHQ and DASH outcomes. The statistical analyses were performed with STATISTICA v12 (StatSoft Inc., Tulsa, OK, USA) with Medical Bundle for Windows.

RESULTS

In total, 89 patients were included in the study, with 34 cases with CuTS and 55 cases with CTS (Table 1). The CuTS group was significantly older than the CTS group (62.1 ± 12.2 and 52.6 ± 13.7 , respectively; $p = 0.002$). Demographic data revealed that the majority of patients in the CTS group were women (90.9%), whereas the CuTS group had an almost equal gender ratio (~50%). The right hand was affected more often in the CTS group, in contrast to the CuTS group, in which the right and left hand were affected in approximately 50% of cases. Most of the participants were right-handed and all patients were Caucasian.

Results of the questionnaires are presented in Table 2. Both the MHQ and DASH final scores of the affected hand were significantly different for CTS and CuTS. The CuTS score was higher using the MHQ ($p = 0.037$; Figure 1A) survey and lower using DASH ($p = 0.004$; Figure 1B), such that a worse score was seen with CTS. Analysis of each of the 6 MHQ subscales showed that work and pain domain scores were significantly worse in the CTS

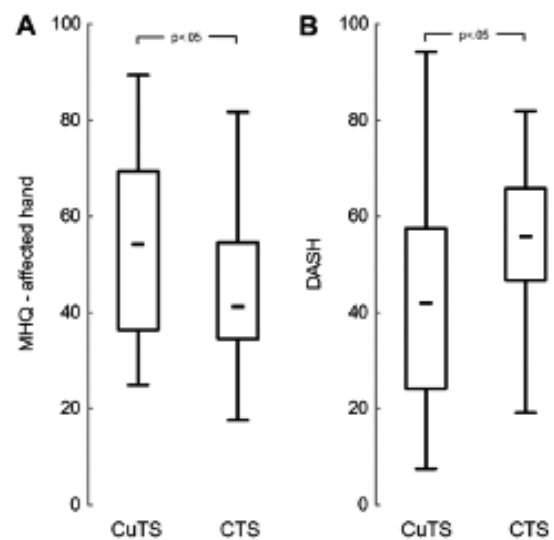


Figure 1. — Box and whisker graphs (median with interquartile ranges) illustrating the final outcomes of (A) the Michigan Hand Outcomes Questionnaire (MHQ) and (B) the Disabilities of the Arm, Shoulder and Hand (DASH) Outcome Measure between Cubital Tunnel Syndrome (CuTS) and Carpal Tunnel Syndrome (CTS). Higher MHQ and lower DASH scores reflect better overall hand function.

Table 2. — Comparison between Cubital Tunnel Syndrome (CuTS) and Carpal Tunnel Syndrome (CTS) of the Michigan Hand Outcomes Questionnaire (MHQ) and the Disabilities of the Arm, Shoulder and Hand (DASH) Outcome Measure

		CuTS (<i>n</i> = 34)		CTS (<i>n</i> = 55)		<i>p</i>
		Median	Q ₁ , Q ₃	Median	Q ₁ , Q ₃	
MHQ	Hand Function	40.0	35.0, 65.0	40.0	25.0, 50.0	0.389
	ADL	48.9	26.4, 68.9	33.6	22.5, 65.4	0.171
	Work	70.0	35.0, 75.0	50.0	30.0, 60.0	<u>0.017</u>
	Pain	52.5	35.0, 75.0	65.0	55.0, 75.0	<u>0.017</u>
	Appearance	75.0	43.8, 87.5	62.5	43.8, 75.0	0.253
	Satisfaction	29.2	25.0, 37.5	25.0	16.7, 41.7	0.205
	Total score	54.0	36.4, 69.4	41.2	34.4, 54.6	<u>0.037</u>
DASH	Function/symptom	41.9	24.2, 57.5	55.8	46.7, 65.8	<u>0.004</u>

Q1-Q3 – quartiles.

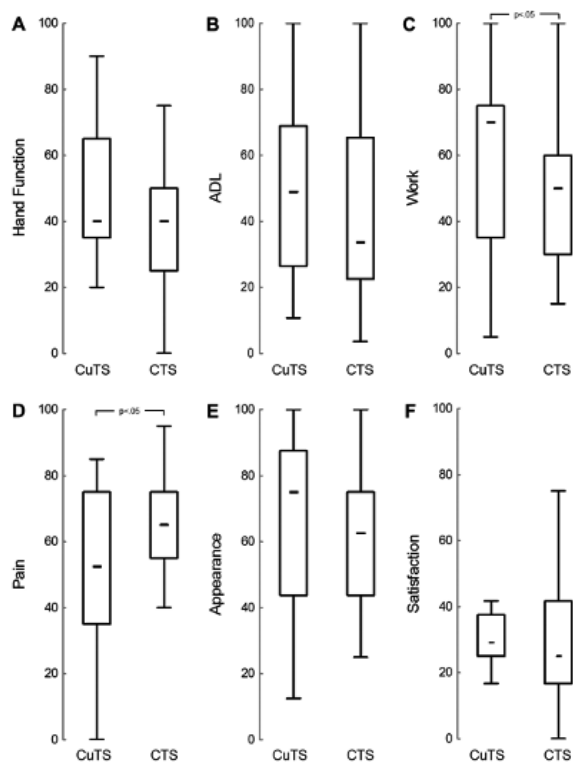


Figure 2. — Box and whisker graphs (median with interquartile ranges) illustrate differences between Cubital Tunnel Syndrome (CuTS) and Carpal Tunnel Syndrome (CTS) in 6 distinctive Michigan Hand Outcomes Questionnaire subscales: (A) hand function, (B) activities of daily living (ADL), (C) work, (D) pain, (E) appearance, and (F) satisfaction. Higher numerical scores reflect better results, except for the pain scale, for which a higher score is correlated with more intense pain.

group ($p = 0.017$; Figures 2C, 2D). The remaining hand function, ADL, appearance, and satisfaction

subscales did not show statistical differences ($p > 0.05$; Figures 2A, 2B, 2E, 2F).

DISCUSSION

We have not been able to find other studies that compare the degree of discomfort and decrease in hand function between CuTS and CTS, using questionnaires to assess hand/wrist or upper-extremity conditions. Both DASH and MHQ are validated and commonly-used tools in research for CTS and CuTS, plus other disorders of the hands and upper limbs (22,23,25).

This is a pilot study, showing that patients diagnosed with CTS and qualifying for surgery in our clinic, typically had worse questionnaire results than those with CuTS, especially surrounding the work and pain domains of the MHQ. Study groups also had varying severity of symptoms, which directly influenced the general scores. Some patients were referred from other health centers, so these numbers cannot be extrapolated to the two nerve compression syndromes within the general population. The prevalence of CuTS and CTS was assessed by Ann et al. in a U.S. Metropolitan Cohort with a survey - using a more sensitive case definition (lax criteria). However, using a more specific case definition (strict criteria) was equal to 1.8% and 2.7%, respectively (3). Loge de Guyon syndrome (distal ulnar nerve compression) is rarer than CuTS, given that there were no patients with this syndrome in the study (4).

Considerations involving our results must refer to functional anatomy. The median nerve supplies muscles concerned with performing precision grip between the pad of the thumb and the pads of the fingertips. The ulnar nerve supplies muscles engaged when using heavy objects that need little precision. For this reason, the median nerve is referred to as the “nerve of precision” while the ulnar nerve is the “nerve of power” (8). In our study, patients had decreased functionality related to both of these components, and it naturally appears that a loss of precision affects patient quality of life more than a loss in strength.

This study included patients who came to our clinic over a one-year period. This means that the presented symptoms of the study population were severe enough to seek medical attention. Despite the availability of a short version of the questionnaires, we decided to use the full version to better analyze our subjects. Moreover, we purposefully omitted the use of typical quality of life surveys (ex. SF-36 and objective hand assessment instruments, such as the grip test or two-point discrimination test) in order to focus on subjective hand function.

The results show that 4 out of 6 subscales of MHQ are not statistically different between CTS and CuTS, despite that different areas of hand impairment, hand function, ADL, appearance, and satisfaction domains are similarly undermined. Song et al. noted that every MHQ and DASH subscale score improved after simple decompression of CuTS (24). This is similar to Kotsis, who reported improvement in analyzed surveys after open carpal tunnel release (13). Further research is needed to compare recovery trends between CuTS and CTS.

Although most patients were right-handed (>90%), the ratio of the affected hand was unequal. The right hand was influenced more often in the CTS group, which carries significance, as it had an impact on the scores.

Risk factors of these conditions have been investigated in the literature, but were not compared in this study. Age, gender, body mass index (BMI), and anthropometric characteristics of the hand are major risk factors for CTS (11,20). On the other hand, Bartels and Verbeek have reported that gender, previous elbow fractures, and BMI are not

predictive for ulnar entrapment neuropathy in CuTS (5). However, working experience and education level are closely associated with CuTS occurrence.

The strengths of this study are that all participants were Caucasian and that the MHQ as well as DASH are reliable measurement tools for each disease. Our sample was a convenience sample, so that selection bias cannot be excluded. Patients who responded to the questionnaire might not be an actual representation of those affected by these diseases. Disease severity and time of presentation to the clinic might influence data gathered by the questionnaires.

Although either of these two conditions obliges a clinician to provide care and appropriate treatment, our study was designed to show how each mononeuropathy affects patients' lives with different severities. This allows the physician to better understand their patients' conditions and subsequently provide them with proper care towards reducing specific symptoms, thereby providing better overall treatment. Moreover, in some centers, it may also be useful in the allocation of resources for these two conditions.

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Conflict of Interest

The other authors have no conflicts of interest to disclose.

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