

Quality of life and health of people undergoing median nerve decompression surgery

Qualidade de vida e saúde de pessoas submetidas a cirurgia de descompressão do nervo mediano
Calidad de vida y salud de personas sometidas a descompresión quirúrgica del nervio mediano

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Abstract

Theoretical framework: Carpal Tunnel Syndrome (CTS) is a musculoskeletal disorder affecting the functionality of the upper limbs.

Objective: To assess symptom severity and functional status, using the Boston Carpal Tunnel Questionnaire (BCTQ), and quality of life, using the SF-36 v2, in the preoperative period and two months after surgery.

Methodology: Prospective study of 50 patients (60.7 ± 11.7 years) who underwent decompression surgery. Participants were mostly women (52%), with 62% of them being post-menopausal women. Diabetes (8%), overweight (48%), and class I (26%) and class II obesity (4%) were found to be risk factors for CTS.

Results: In the preoperative period, the affected hand had significantly less grip and pinch strength than the contralateral hand. The follow-up results suggest a decrease in symptom severity and an increase in functional status.

Conclusion: Significant changes towards improving health-related quality of life were observed in the SF-36 v2 subscales: physical functioning, bodily pain, mental health, role-emotional, social functioning and vitality.

Keywords: carpal tunnel syndrome; quality of life; outcome assessment (health care); hand strength.

Resumo

Enquadramento: A Síndrome do Túnel Cárpio (STC) é uma doença musculoesquelética que afeta a funcionalidade superior.

Objetivo: Avaliar, no pré-operatório e aos dois meses pós-cirurgia, a gravidade dos sintomas e o estado funcional, através do Questionário de Boston (QB) e a qualidade de vida através do SF-36 v2.

Metodologia: Estudo prospectivo, realizado em 50 pacientes ($60,7 \pm 11,7$ anos) submetidos a cirurgia de descompressão. Os participantes eram maioritariamente mulheres (52%) e, destas, 62% eram pós-menopáusicas. Como fatores de risco para a STC encontramos ainda diabetes (8%), sobrepeso (48%), obesidade de grau I (26%) e grau II (4%).

Resultados: No pré-operatório, a mão afetada apresentava valores significativamente inferiores de força de preensão e pinça digital quando comparada com a mão contralateral. Os resultados do *follow-up* sugerem diminuição da severidade dos sintomas e incremento do estado funcional.

Conclusão: Mudanças significativas na direção da melhoria da qualidade de vida relacionada com a saúde, observadas nas subescalas do SF-36 v2: função física, dor corporal, saúde mental, desempenho emocional, função social e vitalidade.

Palavras-chave: síndrome do túnel carpal; qualidade de vida; avaliação de resultados (cuidados de saúde); força da mão.

Resumen

Marco contextual: El Síndrome del Túnel Carpiano (STC) es una enfermedad musculoesquelética que afecta a la funcionalidad superior.

Objetivo: Evaluar en el preoperatorio y a los dos meses después de la cirugía la gravedad de los síntomas y el estado funcional a través del Questionario de Boston (QB) y la calidad de vida a través del SF-36 v2.

Metodología: Estudio prospectivo realizado en 50 pacientes ($60,7 \pm 11,7$ años) sometidos a descompresión quirúrgica. La mayoría de los participantes eran mujeres (52 %) y, de estas, el 62 % eran posmenopáusicas. Como factores de riesgo para el STC se encontraron además diabetes (8 %), sobrepeso (48 %), obesidad de grado I (26 %) y grado II (4 %).

Resultados: En el preoperatorio, la mano afectada presentaba valores significativamente inferiores para la fuerza prensil y la pinza digital en comparación con la mano opuesta. Los resultados del seguimiento sugieren una disminución de la gravedad de los síntomas y un incremento del estado funcional.

Conclusión: Se observaron cambios significativos en la mejora de la calidad de vida relacionada con la salud en las subescalas del SF-36 v2: función física, dolor corporal, salud mental, desempeño emocional, función social y vitalidad.

Palabras clave: síndrome del túnel carpiano; calidad de vida; evaluación de resultados (atención sanitaria); fuerza de la mano.

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Received for publication: 11.06.14

Accepted for publication: 16.10.14

Introduction

Carpal Tunnel Syndrome (CTS) is a common entrapment neuropathy, with a prevalence of up to 10 cases per 1000 subjects per year (Spahn, Wollny, Hartmann, Schiele, & Hofmann, 2012). The syndrome results from the compression of the median nerve within the carpal tunnel. Typical symptoms usually include wrist and hand pain, and paresthesias of the thumb, index, middle and half of the ring finger. In advanced cases, it may lead to decreased hand strength and muscle atrophy, which is relatively common due to the period between the onset of symptoms and the final diagnosis (Ibrahim, Khan, Goddard, & Smitham, 2012).

The CTS affects the complex hand-wrist biomechanical system, limiting the ability to perform key strength and precision movements for most activities of daily living. From a kinesiological perspective, hand and wrist represent the extension and the specialised and executive extremity of the upper limb. The hand, however, is not only an organ of labor; it is also an extremely sensitive and precise receptor with sensory functions of pain, touch, pressure, temperature, and proprioception.

The CTS symptoms are usually worse at night, thereby affecting the duration and quality of sleep. The literature on this topic highlights that people with CTS wake up frequently during the night, experience fragmented sleep and daytime sleepiness, and are at a greater risk for comorbidities as they sleep on average 2.5 hours less than recommended (Patel et al., 2014). Consequently, this syndrome may affect work productivity and Quality of Life (QOL). However, Health-Related Quality of Life (HRQOL) in this specific disorder has been underinvestigated. Based on this assumption, a prospective study was carried out with the main purpose of assessing symptom severity and functional status, using the Boston Carpal Tunnel Questionnaire (BCTQ), and quality of life, using the (SF-36 v2), in the preoperative period and two months after surgery. Additionally, the secondary objectives were to study the participants' socio-demographic and clinical characteristics. Regarding the clinical variables, the anthropometric variables (weight, height and body mass index) and the assessment of grip and pinch strength should be highlighted.

Background

In general, musculoskeletal disorders and peripheral neuropathies affect the patients' QOL and may lead to premature disability or absence from work due to sickness. Pain and loss of muscle strength are common symptoms in this type of disorder which change the work or leisure routines, and interfere with the performance of activities of daily living to a greater or lesser degree. CTS is the most common upper limb neuropathy. When the median nerve is entrapped in the carpal tunnel due to increased pressure or adjacent structures, it impairs the innervation of the forearm pronators, deep flexors of the fingers and the thumb adductor and opponens muscles, thus interfering with the performance of activities that require precision and strength, such as feeding, dressing and undressing, hygiene and comfort, writing, work or leisure activities (Rizzo, Garret, Guigal, & Gazarian, 2009).

Despite its range, complexity and abstraction, the concept of QOL is a key issue in political, environmental and psychosocial sciences, representing a concern for society in general. Over the last decades, and based on the existing evidence, a consensus has been achieved that health is an important domain of QOL (Bowling, 2001). HRQOL emerged as a construct used to assess health-related variables, valuing the personal perspective and mental representation in this area.

From the very start, HRQOL was taken into account by the healthcare professionals in the decision-making processes and used as a tool to analyse the longitudinal changes in health outcomes. Several instruments have emerged throughout the years to assess HRQOL based on models which naturally reflect the concept's dynamic, subjective and multidimensional nature (Bakas et al., 2012). The following generic scales should be highlighted: the 36-Item Short Form Health Survey (MOS SF-36), the Nottingham Health Profile (NHP) and the QOL assessment instruments developed by the World Health Organization (WHO) - WHOQOL-100 and its short version, WHOQOL-BREF.

Taking into account the research problem *Does decompression of the carpal tunnel change patient health outcomes and perceived quality of life?*, the instrument chosen would have to, on the one hand, include the classical components of functioning, symptoms, social and environmental

characteristics, perception of general health and psychosocial characteristics, and, on the other hand, be well accepted and frequently used by the scientific community in follow-up studies to measure the impact of a disease and the effects of a treatment from the patients' perspective (Thoma et al., 2014). The SF-36 v2 met these criteria.

Research questions

Taking into account the theoretical framework and objectives of the study, the following research questions were formulated: Is there a difference between the means obtained in the dimensions of the Boston Questionnaire (symptom severity and functional status) before and two months after decompression of the median nerve?; Is there a difference between the means obtained in the various dimensions of the quality of life questionnaire SF-36 v2 before and two months after decompression of the median nerve?; Is there a difference in the mean values of grip and pinch strength between the CTS affected and the contralateral sides?

Methodology

The objectives of this research were: (i) to analyse the socio-demographic characteristics of the participants; (ii) to identify the patients' professional and clinical history; (iii) to analyse the grip and pinch strength of the affected and contralateral hands; (iv) to compare symptom severity and functional status before and after surgery; (v) to compare the scores obtained in the different dimensions of the quality of life questionnaire (SF-36 v2) before and after surgery.

To achieve these objectives, a prospective study with a two-month follow-up was conducted in a sample consisting of all patients successively admitted with CTS in the Outpatient Unit of the Operating Room of the Hospital Unit of Macedo de Cavaleiros (Local Health Unit of the Northeast), from 1 October 2013 to 30 March 2014 (n=50). The exclusion criteria were the presence of severe cognitive impairment or refusal to participate in the study, although neither of the situations happened. Likewise, no participant withdrew from the study or the follow-up. Data were

collected through an interview using a structured form with the socio-demographic and clinical variables under analysis.

The Boston Carpal Tunnel Questionnaire (BCTQ) was used to assess symptom severity and functional status. The BCTQ is a specific instrument to assess patients with CTS (Levine et al., 1993). This instrument is widely used in clinical practice and research. It is translated and validated in several languages, including Portuguese. It is composed of two sections. One of them assesses the symptoms presented (such as pain and paresthesia) and is known as symptom severity (BCTQ - SSS), while the other assesses the functional status (BCTQ - FSS) through eight activities of daily living rated on a scale from one (no difficulty with activity) to five points (cannot perform the activity at all).

The HRQOL was assessed using the MOS SF-36 v2, in a total of eight health-related concepts (PF- Physical functioning, RP - Role-physical, BP - Bodily pain, GH - General health, MH - Mental health, RE - Role-emotional, SF - Social functioning and VT- Vitality). The procedures, codifications and calculations were followed as recommended by Ferreira (2000) in his cultural and linguistic adaptation of the instrument for the Portuguese population.

The maximal isometric grip strength was assessed using a Jamar® dynamometer and following the protocol recommended by American Society of Hand Therapists (ASHT). The method used to assess pinch strength between index finger and thumb was the tip-to-tip prehension using a digital dynamometer with scale in kgf (kilogram-force).

As for the procedures, a study protocol was elaborated and then submitted to and approved by the Ethics Committee. Lists indicating the patients undergoing intervention on a weekly basis were requested for a better management of time and materials. All participants were assessed in a voluntarily and informed manner by the same researchers in two moments: preoperative period (M1) and two months after surgery (M2).

Concerning question order in the interview, the SF-36 v2 was applied first, which is in line with the recommendations for the instrument to be completed before other health-related questions (Ferreira, 2000). The SPSS (Statistical Package for the Social Sciences) software was used for data treatment. The classical procedures of descriptive and inferential statistics

were followed. The results were analysed and discussed using $p < 0.05$ as the significance level.

Results

Of the sampled patients ($N=50$), the study showed that most were women (52%) and that they were younger than men (56.6 ± 11.5 vs. 65.1 ± 10.5 years), which has a statistical significance ($p=0.009$). Regarding the professional variables, 16 different professions were found, namely agricultural workers ($n=15$), construction workers ($n=7$) and cooks ($n=5$). Seventy-two per cent of patients admitted

to performing repetitive hand and wrist movements in their professional tasks, while 80% admitted to performing very demanding hand and wrist activities. Only 14% of patients mentioned using vibrating tools at work. Forty-six per cent of participants worked more than eight hours a day.

As for the risk factors for CTS, and as shown in (Table 1), 8% of patients had diabetes, 18% had changes in the thyroid function, 8% suffered from gout, 10% reported some type of benign or malignant tumour, 6% mentioned having changes in kidney function, and 6% referred having an inflammatory disease. Most women were post-menopausal.

Table 1

Distribution of participants according to the presence of risk factors for carpal tunnel syndrome

	Participants (n=50)
<i>Presence of associated diabetes</i>	4 (8%)
<i>Menopause</i>	16 (62%*)
<i>Changes in thyroid function</i>	9 (18%)
<i>Changes in kidney function</i>	7 (14%)
<i>Presence of uric gout</i>	4 (8%)
<i>Benign or malignant tumours in any life stage</i>	5 (10%)
<i>Rheumatic or inflammatory diseases</i>	3 (6%)
<i>Other pathological diseases</i>	
Rheumatoid arthritis	1
Heart bypass	1
Depression	1
COPD	2
Gastritis	2
Spinal disc herniation	1
Right elbow tendonitis	1

*Percentage calculated based on the number of women ($n=26$); COPD - Chronic Obstructive Pulmonary Disease.

Regarding Body Mass Index (BMI), which is calculated by dividing the weight in kilograms by the square of height in meters, a mean sample of 28.1 kg/m^2 was obtained for an extreme maximum of 38.4 kg/m^2 and a minimum of 21.6. When classified in BMI categories and using the cut-off points recommended by the WHO, it was found that 22% of the subjects had a normal weight, 48% were overweight, 26% had class I obesity, and the remaining 4% had class II obesity.

Table 2 shows the results obtained in the preoperative assessment of the isometric grip strength and isometric pinch strength for both hands. The mean grip values observed were lower for the affected hand than its contralateral ($26.3 \pm 13.5 \text{ kgf}$ vs. $29.3 \pm 13.5 \text{ kgf}$), with a statistical significance. Patients also showed less strength between index finger and thumb in the affected segment ($5.72 \pm 2.89 \text{ kgf}$ vs. $6.33 \pm 2.33 \text{ kgf}$).

Table 2

Comparative statistics between the affected hand and the contralateral hand regarding grip and pinch strength

	Minimum	Maximum	Mean \pm (SD)	p value
<i>Grip strength¹</i>				
Affected hand	1	54	26.3 \pm 13.5	0.005
Contralateral hand	8	60	29.3 \pm 13.5	
<i>Pinch strength¹</i>				
Affected hand	1	12	5.72 \pm 2.89	0.005
Contralateral hand	2	10	6.33 \pm 2.33	

1- Measured in kgf (kilogram-force); SD - Standard deviation; p - significance of the independent-samples t-test.

The results showed a decrease in the means obtained in the different dimensions of the Boston Carpal Tunnel Questionnaire (BCTQ-SSS and BCTQ-FSS) between both moments of assessment (Table 3). The difference between means was significant for both the SS dimension (3.9 \pm 0.5 vs. 1.81 \pm 0.6; $p=0.000$) and the FS dimension (3.9 \pm 0.5 vs. 2.5 \pm 0.5; $p=0.000$). With the aim of assessing if the means obtained in the SF-36 v2 varied between the first and the second moment of assessment, those values were compared

using a paired samples t-test. Thus, the scores obtained (49.4 \pm 22.8 vs. 63.4 \pm 29.6) indicate an improvement in the PF dimension ($p=0.001$). The RP dimension showed an increase in the mean values in the second assessment, but without statistical significance ($p=0.528$). As for the BP dimension, the mean increased from 38.5 \pm 31.5 (in M1) to 69.3 \pm 21.5 (in M2), suggesting an improvement in this dimension. The changes were also significant for the MH, RE, SF, and VT dimensions (Table 3).

Table 3

Mean values in the dimensions of the Boston Questionnaire and the SF-36 v2

	M1 Mean \pm (SD)	M2 Mean \pm (SD)	p value
<i>Dimensions of the Boston Questionnaire</i>			
Symptom severity (SS)	3.9 \pm 0.5	1.81 \pm 0.6	0.000
Functional status (FS)	3.9 \pm 0.5	2.5 \pm 0.5	0.000
<i>Dimensions of the SF-36 v2</i>			
Physical functioning (PF)	49.4 \pm 22.8	63.4 \pm 29.6	0.001
Role-physical (RP)	91.0 \pm 25.1	94.0 \pm 24.0	0.528
Bodily pain (BP)	38.5 \pm 31.5	69.3 \pm 21.5	0.000
General health (GH)	64.7 \pm 26.0	70.9 \pm 29.2	0.114
Mental health (MH)	42.1 \pm 32.0	70.7 \pm 26.3	0.000
Role-emotional (RE)	26.0 \pm 35.0	59.8 \pm 27.2	0.000
Social functioning (SF)	61.5 \pm 24.1	82.0 \pm 28.4	0.000
Vitality (VT)	44.0 \pm 35.2	59.1 \pm 26.7	0.006

M1- First assessment; M2- Second assessment; SD- Standard deviation; p- significance of the paired-samples t-test.

Discussion

The first aspect for discussion is the fact that the sample was mostly composed of women (52%). In this respect, epidemiological studies analysed reported a higher prevalence of CTS among women (Yazdanpanah et al., 2012). The literature considers

that women are more prone to this disorder than men in a ratio of between 3:1 and 10:1. Gender and age are considered as independent risk factors for this syndrome (Thurston, 2013). A possible explanation for the higher prevalence among women is the fact that women are more exposed to manual work such as cooking, laundry or housekeeping. Another

factor to take into account is the anatomy of the carpal tunnel, which is smaller in women. Pregnancy, anthropometric characteristics, changes in the thyroid function and female obesity may also explain this issue.

In this study, women were younger than men. The literature emphasises that the prevalence of CTS is correlated with increasing age, the most affected being the 40-60 years age group (Spahn et al., 2012). The disease is rare in childhood and adolescence. The patients' mean age was around 61 years, which is in line with the mean age found in other research studies.

As for professional factors, epidemiological studies suggest an association between CTS and repetitive and/or vibration-exposed work (Ibrahim et al., 2012). Thus, the mechanical compression of the median nerve seems to be a result of strain, repetitive or prolonged hyperextension of the wrist joint, excessive use of hand tools and overexposure to vibrations. A recent thematic review (CTS/ professional activity) based on 37 studies published in English concluded that occupational exposure to excess vibration, wrist posture, excessive hand force during tasks and movement repetition increase the risk of developing CTS. It also recommends the implementation of strategies in the workplace to avoid exposure to these factors (Barcenilla, March, Chen, & Sambrook, 2012). Our study revealed that more than 50% of patients worked on average more than eight hours a day. Thus, the results suggest that the prevalence of this syndrome may decrease by changing the working conditions, either by improving the tools' ergonomics or adaptation, using anti-vibration accessories, rotating the tasks or increasing rest periods.

In the clinical variables analysed, the fact that only 22% of the participants had a normal weight should be underlined. Weight increase has been referred to as an important risk factor. In an attempt to clarify this issue, Werner, Albers, Franzblau and Armstrong (1994) studied 946 patients using clinical and sensory methods, and diagnosed a wrist neuropathy in 261 of them. Individuals classified as obese were 2.5 times more likely to be diagnosed with CTS than lean individuals. More recently, new evidence has shown that the higher the BMI, the greater the risk of developing this condition. In this study, there was a 8% prevalence of diabetes, which is in line with others studies that found diabetes in 5% to 8% of

people with CTS (Papanas & Maltezos, 2010). In fact, due to microvascular reasons, diabetes is a frequent comorbidity in patients undergoing hand surgery.

All of the patients in this study referred to their right hand as the dominant one, and the percentage of cases of CTS in the right hand was of 82%. The literature points out that the dominant hand is usually the first to be affected, and, in these cases, the pain is more intense. In line with this, the results of this study suggest that intense activity in the dominant hand may have contributed to the development of CTS.

Hand and pinch strength have been used to assess the functional and motor recovery of the hand after surgery. Gellman, Kan, Gee, Kuschner and Botte, (1989) studied the levels of grip and pinch strength recovery in that phase. Their patients had recovered 28% of the hand force in three weeks and in six months their grip strength increased by 116% compared to the preoperative period. Their pinch strength had a more dramatic increase and at the three-month follow-up their levels were higher than those in the preoperative period. At the six-month follow-up, Zyluk and Puchalski (2013) also concluded that the patients showed significant resolution of symptoms and significant improvement of hand dexterity and strength. However, they also mentioned that the results were not as significant in patients older than 60 years.

In this study, the differences in the pinch strength between the affected hand and its contralateral may be explained by the presence of pain and difficulty opposing thumb, which are common symptoms in these patients.

A baseline mean score of 3.9 ± 0.5 points was obtained for both FS and SS, which, according to the literature, is consistent with the results found by other authors. Padua, Padua, Aprile, Caliandro and Tonali (2005) found means of 3.1 ± 0.9 for SS and 2.7 ± 1.1 for FS. Using the same instrument, Meirelles et al. (2006) found a score of 1.41 ± 0.57 for SS and 1.59 ± 0.93 for FS. The authors responsible for the development and validation of the Boston Questionnaire found, in the SS scale, a mean of 3.4 points in the preoperative period that fell to 1.9 points in the last follow-up assessment at the 14th month. In the same study, the mean of the FS increased from 3 to 2 points (Levine et al., 1993).

With regard to HRQOL assessment, the SF-36 is considered by many authors as the gold standard

generic measure. Different versions of the original instrument have been used to assess the construct after an orthopaedic surgery in general and after a CTS surgery in particular. For example, Gay, Amadio, and Johnson (2003) studied 34 subjects before and after surgery, using various instruments including the SF-36. The authors concluded that the Boston Questionnaire is more sensitive to clinical changes and that the SF-36 provides more general and consistent information concerning the perceived QOL.

In the Physical function (PF), the mean differences observed between assessments were significant, which indicates functional improvement. Bodily pain (BP) also improved significantly between assessments. The measurement of pain is an important component of the assessment of the impact of upper limb disorders, and the bodily pain scale of the SF-36 seems to fit that purpose (Atroshi, Gummesson, McCabe, & Ornstein, 2007). In this study, significant changes towards improved health status and QOL were also observed in the following sub-scales: MH - Mental health, RE - Role-emotional, SF - Social functioning, and VT- Vitality.

Conclusion

Bearing in mind the study objectives and research questions, the results show an improvement in patients' perception of their HRQOL in the preoperative period and two months after surgery for the following SF-36 dimensions: physical functioning, bodily pain, mental health, role-emotional performance, social functioning, and vitality. The results suggest that the symptoms and functional status assessed by the Boston Questionnaire have significantly improved.

Throughout the research process, few studies on the CTS were found to be conducted in Portugal, both epidemiologically and at the level of health outcomes and study of QOL after surgery. Therefore, it would be interesting to replicate this study using more representative samples. Studies focused on the profile of patients diagnosed with CTS would contribute to designing prevention interventions aimed at reducing the incidence of this occupational disease.

The most common occupation in this study was agriculture, thus more preventive actions are needed among agricultural workers. Agriculture is the main

economic activity in our region. Agricultural workers are exposed to weather conditions and heavy physical work, such as using physically demanding agricultural tools for the wrist region, which is typical of agriculture and livestock activities.

These results for grip and pinch strength may be used as comparative values in Nursing rehabilitation programmes for patients with this specific condition.

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