

Research Article

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Grip Strength and Carpal Tunnel: What Interest in Management

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ABSTRACT

Introduction: Carpal tunnel syndrome (CTS) is one of the most common musculoskeletal disorders of the upper extremity. Strong evidence supports operative treatment, in motor forms, regardless of technique, as superior to nonoperative treatment. Severity of motor forms of CTS depend of clinicals, and Electroneuromyography aspects. According to ENMG aspects, therapeutics decisions are difficults. Hook grip strength could early diagnosed decrease strenght, and classified patients.

Objectives: Our study aim to determine strenght grip characteristics in differents class of severity in CTS.

Patients and Methods: We conducted a multicenter study including patients with unilateral CTS, on two phases. Weren't included, patients with bilateral CTS and pre-existing functional limitations of upper limb. We classed patients in 3 groups of severity according to motor ENMG results. Hook grip strength measured in all patients by a dynamometer with a maximum strenght of 90 kg on both sides and Functional capacity evaluated by Functional dimension of Boston Crapal Tunel Questionary (FBCTQ). We classes strenght grip on three groups of severity according to differences of both sides.

Results: We collected 33 patients. Median age was $48,33 \pm 11,67$ years. Sex-ratio was 0,27. CTS was severe in 54. 5% of patients. Grip strenght decreased in 81.8% of patients. Minor reduced grip strenght interested 45.5% of patients. FBCTQ score is less than 2/5 in 64% of patients. Functional prognosis factor in CTS were FBCTQS ($P= 0.035$), trans-carpal Tunel Velocity ($p=0,025$). Conclusion: Therapeutics decisions in CTS must include evaluation of Hook Grip strenght and FBCTQS.

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Introduction

Carpal tunnel syndrome (CTS) is one of the most common musculoskeletal disorders of the upper extremity [1]. CTS represented 90% of all neuropathy [2]. Annual incidence estimated at 3.8 per 1000 in general population, 1 to 2/1000 in men, 4 to 5/1000 in women [3]. It is most often linked for compression of median nerve at the wrist [4]. Idiopathic CTS is most frequent [5]. Clinically, syndrome characterized by hand pain, numbness and tingling in median nerve distribution. Classically, Carpal tunnel syndrome is first sensory, then sensorimotor. Motor assessment of CTS can be done using MRC scale or a dynamometer, which measures grip strength. Studies suggest that subjects with CTS lose grip strength, and Higher severity levels of CTS result in greater reduction in grip strength [6]. Initial treatment, indicated

in sensitive forms, is generally nonoperative, with the strongest evidence supporting bracing/splinting. Strong evidence supports operative treatment, in motor forms, regardless of technique, as superior to nonoperative treatment. Severity of motor forms of CTS depend of clinicals (MRC score, amyotrophy) and ENMG aspects (motor latency, potential amplitudes and reduced trans-carpal motor velocities). In those forms, therapeutics decisions are difficult according to ENMG aspects and clinics symptoms come late. Some authors retained that an anormal ENMG is an indication of surgical treatment [7, 8]. In others, surgical treatment depends of distal motor latency (MDL). Our hypothesis is, decreasey hook grip strength could diagnose severity of CTS and contributed of therapeutics decisions.

Objectives

Our study aims to determine strenght grip characteristics in diffents class of severity in CTS.

Patients and Methods

We conducted a transversal, descriptive and analytic study at two phases (15th August -15 november 2022; 01 January - 3 August 23; at the Departments of Neurophysiology and Physical Medicine, Fann teaching hospital, Malt Orthopedia Department, Dakar, Senegal. Study included patients followed at those centers, for treatment of unilateral CTS. Diagnosis of CTS were clinical and or ENMG. Clinicals symptoms retained were Pain and paresthesia in three first fingers, associated of tinel and or Phalen signs. ENMG aspects were reduced trans-carpal velocity more than 10m/seconde, in comparaison of velocity at forarm and high motor distal lantency in median nerve (superior of 4ms). Patients with bilateral CTS and those with pre-existing functional limitations of upper limb were excluded. We establish a questionnaire for noted sociodemographics aspects, clinical and results of ENMG aspects. We class patients in 3 groups of severity according to trans-carpal tunel velocity (table 1). We used Functional domains of Boston Carpal Tunnel Questionary (FBCTQ) for evaluation of functional limitations of CTS. This questionnaire evaluated 8 domains of activities of hand. Domains of BCTQ are write (Wr), buttoning clothes (BC), taking a book (TB), taking a telephone (TT), cleaning (CI), opening a bottle lid (OBL), taking shopping bags (TSB), washing (Wa) and dressing (Dr). Patients who cannot write or do not use affected side to write are evaluated on the remaining items. Items are answered on a 5-point scale ranging from 1 (no difficulty) to 5 (cannot perform activity at all). A single score is calculated as the average of the FCTQ in 69 by adding scores of different items of questionnaire divided by 8 (or 7 in patients who cannot write). The averages were represented by classes: [1; 2/[2; 3/[3; 5]. Assessment of pain was done by Neuropathic Pain Scale. Hook grip strength was measured in all patients by a dynamometer with a maximum strenght of 90 kg (figure 1), twice in pathologic side, one in normal side. Our choice for evaluation of hook grip strenght supported by necessary contraction of supperficial flexor carpi digitis and muscles of thenard eminency, innerved by median nerve. We retained best strenght on pathologic side. Grip strenght of pathologic side, compared to normal side and we retained difference of strenght and classed patients in three groups of severity (table 2). Data collection and analysis were carried out with strict respect of identity and informed consent.

Table 1

Severity class of CTS	Differentiel velocity (Carpal tunel -Foream (m/s)
Minor	[1-5]
Moderate	[5-10]
Severe	>10



Figure 1: Dynamometer, used at Physical Medicine, Fann Teaching Hospital

Table 2

Strenght Differential (Kg)	Severity groups
0-5	Minor
5-10	Moderate
>10	Severe

Data Analysis: We used Excel database to perform data entry. Statistical analysis was carried out using statistical software SPSS version 20.0. A quantitative analysis is carried out based on averages and frequencies. The qualitative analysis made it possible to correlate grip strength with degrees of clinical severity, electroneuromyographic, types of treatment and the FBCTQ. Significance threshold was set at 0.05.

Results

Sociodemographic Aspects

Thirty-three (33) patients included in our study with an overage age of 48.33 ± 11.67 years. Sex-ratio was 0.27. Class of 40-60 years were largely predominant (62%). Patients aged more than 60 years represented 9% and those less than 40 years 29%. Married patients represented 85%. Women domestic activities (26.2%) and sellers' activities (36.4%) were most represented. Dominant side was right in 84.8% of patients.

Clinics and ENMG Aspects

Numbness (66.7%), electric shoks pain (51.5%) and burning pain (30.3%) were predominant symptoms. Intensity juged minimal in 31.3% and moderate (53.1%). Mechanism of pain was neuropathic in 51.5% of cases. Symptoms worse at night in 84.4% of patients. Others symptoms of CTS found were paresthesia (21.3%), Tinel (67%), Phalen (33%), hypoesthesia of median territory (48.5%) and thenar amyotrophy (18.2%). Trans-carpal tunel velocity reduced in 54.5% of patients. Reduced velocity Trans-carpal Tunel was minimal (24.2%), moderate (12.2%) and severe (54.5%). CTS was idiopathic in 75.8%, traumatic (9.1%). It's occured in pregnancy (9.1% and Renal failure (3%). Operator treatment curried in 9.1% of patients. Conservator treatment used pregabaline (66,3%), local corticosteroids (24,2%), physical rehabilitation (27.3%), association paracetamol+opioides (69%).

Functional Abilities

Strenght grip reduced in 81.8% of patients with CTS. Reduced strenght was minimal (45.5%), moderate (24.2%), severe (12.1%). According to FBCTQ, limitations were minimal, score (1 -2) in 64%. Moderate limitations represented by score 2-3 noted in 24% of patients and severe limitations in 12%. Overage score ofF BCTQ was 2/5. Most difficult activity for patients with CTS was open a covercle (score BCTQ: 2. 52) (figure 2). Correlations between strenght grip and clinicals, ENMG and functional abilities noted in table 3.

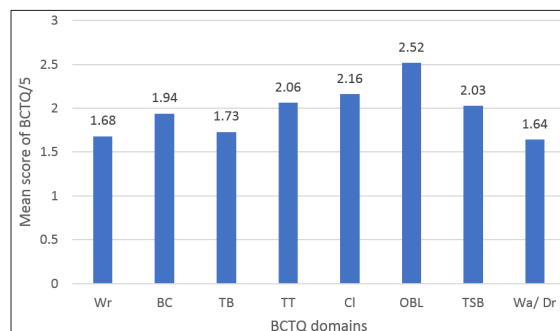


Figure 2: Mean Score of FBCTQ Domains

Table 3: Correlation between Strenght Grip and ENMG; Therapeutics Aspects, Functional Limitations

Prognosis Factors		Forms of CTS /strenght grip (%)				p
BCTQS	[1-2]	83.3	66.7	62.5	25	0.035
	[2-3]	16.7	26.7	0	75	
	[3-5]	0	6.7	37.5	0	
rTCNV	No	0	62.7	0	33.3	0.025
	Minimal	50	25	25	0	
	Moderate	33	0	66.7	0	
	Severe	0	61.1	22.2	16.7	
dDML	No	0	6.7	0	25	0.312
	Minimal	83.3	33.3	62.5	25	
	Moderate	0	26.7	0	25	
	severe	16.7	33.3	37.5	25	
TTT	Conservator	66.7	33.3	0	0	0.134
	Surgery	13.3	46.7	26.7	13.3	

BCTQS= Boston Carpal Tunnel Questionary Score; rTCNV= Reduced Velocity Trans-Carpal Tune; dDML= Differential of Distal Motor Lantency of Median Nerve; TTT= Treatment

Discussion

CTS is the most common peripheral nerve entrapment syndrome. In our study, CTS is more frequent in adulte aged 40-60years and women. All most of study suggest that CTS occurs more commonly in women, with an annual incidence of 1.5 per 1000 compared to 0.5 per 1000 for men [9]. Variability of incidence with gender, can be explain by hormonal factors as pregnant and breast-feeding women have increased risk of CTS [10]. In our study, in accordance with literature, CTS localized in dominant side in 84.8% and noted, in patients with occupational and manual activities [11]. Most frequent professional activities found in our study were domestic activity (26.2%) and sellers' activity (36.4%). Married women, in Senegal, generally, with low level education, have rarely a renumered profession, and take care home activities like dressing, cleaning, cooking, laundry... Those activities constutued risk factors of CTS. Others risk factors found in our study were pregnancy, renal failure and traumatism. In 1992, Hagberg et al published a review of 21 studies including high quality information on occupational associations, and reported an increased risk of CTS in a number of jobs believed to involve repetitive and forceful gripping [12]. The typical presentation of CTS involves pain and/or dysaesthesia of the fingers (typically the radial 3½ digits but can be diffuse throughout the hand and can radiate proximal to the wrist). Symptoms are often worse at night or in the early morning. Examination in advanced cases may reveal wasting of the thenar eminence and/or weakness of thumb abduction. Provocation tests such as those of Tinel (tapping the flexor retinaculum) and Phalen (full passive flexion of the wrist for 1 minute) are widely used as confirmatory tests in clinical practice. However, the sensitivity and specificity of these tests seem to be much greater in patients with more advanced disease [11]. Place of ENMG in CTS is unclear. Some authors noted that in typical CTS, ENMG is unnecessary. ENMG can contributed for therapeutics decisions. In Department of Neurophysiology, Fann teaching hospital, we determine in all patients with suspicion of CTS, motor trans-carpal Tunel velocity after stimulation in palm, wrist et elbow. Sensory trans-carpal tunel velocity determined with classical methods. Reduced of trans-carpal tunel velocity in the palm confirm CTS and represented an early symptom of alteration of motor fibers. For therapeutic decisions, we refered to distal motor lantency of median nerve and existing of denervation in detection. Our patients benificed for therapeutics used CTS

but we noted a few parts of surgery which can be explain by socio-cultural consideration of surgery and financial statuf of our patients. Senegalease patients are fear for surgery. In our study, average FBCTQ was approximately 2/5 [13]. This result is lower than Kang et al who obtain an average score of 2.8 before surgery. After surgery, they score decreasey (1.7) [14]. However, our score remains higher than Ndedi et al and Alvin et al studies, which found averages of 1.50 and 1.20 respectively. Strenght grip reduced in 81.8% of patients with CTS [15, 16]. A study, which measuring the time course of three first finger's grip motion shown, in CTS group, grip time with the index, middle, and ring fingers was longer, and time which strength was lost after reaching the maximum was earlier [17]. Correlation between strenght grip and severity CTS is variable in littérature. A study using a conventional grip dynamometer noted no correlation [18]. Authors explain their results for a synergistic function of the intrinsic and extrinsic muscles of the hand at grip motion, so patients do not use the muscles affected by CTS [19]. Toru Sasaki and al found a correlation between strenght grip of the ring and little finger and subjectives symptoms of CTS and functional abilities [17]. Patients with severe subjective symptoms tended to not use the index and middle fingers during grip motion. In our study, a correlation found between grip strenght and trans-carpal tunel velocity and FBCTQ.

Conclusion

CTS most affected adults' women with manual activities, and symptoms are initially subjective, affected three first fingers, more frequent at night. Severity appreciated clinically, ENMG aspects, Functional limitaions. Measurement of Strenght grip, which decreasey at time in CTS, can diagnosis early alteration of motor fibers of median nerve in CTS and help for therapeutics decisions.

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