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# IMPACT OF CARPAL TUNNEL SYNDROME ON SYMPTOMS AND STRUCTURAL SEVERITY OF HAND OSTEOARTHRITIS: RESULTS FROM THE DIGICOD COHORT

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**IMPACT OF CARPAL TUNNEL SYNDROME ON SYMPTOMS AND STRUCTURAL SEVERITY OF HAND  
OSTEOARTHRITIS: RESULTS FROM THE DIGICOD COHORT.**

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Carpal tunnel syndrome (CTS) and hand osteoarthritis (HOA) are two common diseases that can coexist in the same patient [1]. Symptomatic HOA involves 8-16% of the general population over 50 years old [2]. Symptoms of HOA include pain, stiffness as well as functional and aesthetic discomfort [3]. The lifetime prevalence of CTS is estimated to be 3.1%, with an annual incidence rate of 1.73/1000 [4]. According to Bacle et al., only wrist osteoarthritis, but not thumb base OA, could be a causal factor for CTS [5]. However, beyond causality, combination of both disease (HOA and CTS) could aggravate hand symptoms in HOA population. One recent study showed that CTS was associated with a significant decrease in strength and performance of the OA-affected hand [6]. This observation suggested that CTS-induced neuropathic disorders may have effects on the surrounding joints symptomatically supporting the role of nerve-joint axis in OA pain. To confirm this hypothesis, we aimed to study the impact of CTS on the clinical signs and structural severity of HOA in the DIGICOD (DIGital COhort Design) cohort.

DIGICOD is a single-center prospective hospital cohort, which has included 426 patients over 35 years of age with symptomatic HOA [7]. The patients in our study were those from the DIGICOD cohort at inclusion for whom the dominant hand and laterality in case of CTS involvement were known. The diagnosis of CTS was declarative and therefore based on the patient's medical and surgical file. Considering the difference of strength between dominant and non-dominant hand and since only one patient had a CTS on non-dominant hand exclusively, the analysis was based on the study of the dominant hand. So, 417 patients including 39 with CTS were studied. Table 1 summarizes the comparison of demographic and clinical data of patients, and structural severity characteristics of HOA between patients without CTS and those with CTS. The difference in means, medians or proportions between groups is presented with its 95% confidence interval estimated by the Exact method, normal approximation or Mood method, respectively. Obesity ( $\text{BMI} \geq 30 \text{ kg/m}^2$ ) and metabolic syndrome (ATPIII criteria) were more frequent in patients with CTS than in those without CTS (obesity: 29.7% vs 10.2%,  $p < 0.01$  (Fisher exact test); metabolic syndrome: 51.4% vs 35.1%,  $p < 0.05$  (Chi-square test)). Same observation was made for dysthyroidism (38.5% vs 18.5%,

p<0.01 (Chi-square test)) and thyroid hormone replacement therapy prescribed for hypothyroidism (30.8% vs 15.4%, p<0.05 (Chi-square test)). The other general characteristics were similar between both groups.

At the level of the dominant hand, clinical signs of HOA (painful, swollen, or nodal joints), sum of Kellgren Lawrence (KL) score, number of joints with a KL score  $\geq 2$ , and the presence of erosive HOA (defined by the presence of at least 1 erosive joint defined as phase “E” or “R” in the Verbruggen scoring) were comparable between HOA patients with and without CTS.

Association between CTS and grips strength (measured using Jamar dynamometer), pinch strength (thumb index finger pinch) and KL score was investigated using linear regression model and with number of painful joints to pressure using negative-binomial model. Models were adjusted on age and sex. Age was associated with grip strength ( $\beta$  regression coefficient: -0.27, 95% CI: -0.39 to -0.14, p <0.001), pinch strength ( $\beta$ : -0.04, 95% CI: -0.06 to -0.01, p = 0.0024), KL score ( $\beta$ : 0.54, 95% CI: 0.43 to 0.65, p <0.001), but not associated with the number of painful joints at pressure. Compared with female, male gender was associated with higher grip strength ( $\beta$ : 13.2, 95% CI: 11.2 to 15.2, p <0.001), higher pinch strength ( $\beta$ : 2.49, 95% CI: 2.08 to 2.90, p <0.001), but not with KL score or number of painful joints. The presence of CTS in the dominant hand was not associated with grip strength disturbances, pinch strength, number of joints painful to pressure, and KL score (Table 2).

The risk factors for CTS in HOA are those known in the general population: hypothyroidism, obesity and metabolic syndrome, the last 2 being shared by both diseases. However, our study did not find any impact of CTS on the clinical signs and structural severity of HOA and thus did not confirm the results of Kim et al. [6]. These two pathologies could thus evolve independently.

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### **Authors' contributions**

HJD: study design, design of statistical analysis, interpretation of the results, redaction of the 1<sup>st</sup> draft of the article.

ST and AR design of the statistical analysis, statistical analysis and data interpretation.

AL, JDL: reviewing the project, data interpretation and revising the manuscript

FB: main investigator of the DIGICOD cohort, reviewing the project, data interpretation and revising the manuscript

JS: scientific director of the DIGICOD cohort, study design, design of statistical analysis, interpretation of the results, revising the 1<sup>st</sup> draft of the article.

All authors approved the final version.

**Ethics approval protocol number, date and name of the approving institution:** DIGICOD fulfills the current Good Clinical Practices guidelines and has been approved by the appropriate ethics committee (Paris Ile de France IV) December 20, 2012. It has been registered on [www.clinicaltrials.gov](http://www.clinicaltrials.gov) as n°NCT01831570.

**Statement on data availability:** upon request of the corresponding author

**Conflict of Interest**

The authors declare that they have no conflict of interest.

**Table 1:** Comparison of demographic, clinical, and structural severity characteristics of hand osteoarthritis (HOA) between patients without carpal tunnel syndrome (CTS) and patients with CTS

Variables	Patients without CTS n=378		Patients with CTS n=39		Difference (95% CI)
	n*		n*		
Age at inclusion (years)	378	66.6 ± 7.4	39	67.1 ± 5.5	0.6 (-1.4 ; 2.5)
Male sex	378	65 (17.2)	39	4 (10.3)	-6.9 (-15.3 ; 8.7)
Had never consumed alcohol	372	75 (20.2)	39	9 (23.1)	2.9 (-9.5 ; 20.1)
Had never smoked	372	203 (54.6)	39	25 (64.1)	9.5 (-8.7 ; 24.8)
Metabolic syndrome ‡	368	129 (35.1)	37	19 (51.4)	16.3 (-2.5 ; 33.4)
Diabetes	378	29 (7.7)	39	3 (7.7)	0.02 (-6.7 ; 14.5)
Obesity (BMI ≥ 30 kg/m2) €	373	38 (10.2)	37	11 (29.7)	19.5 (4.5 ; 37.2)
Dysthyroidism €	378	70 (18.5)	39	15 (38.5)	19.9 (-0.1 ; 37.3)
Thyroid hormone replacement ‡	377	58 (15.4)	39	12 (30.8)	15.4 (-0.2 ; 32.7)
Assessment of pain at rest (VAS)	375	16.0 [0.0 ; 35.0]	39	15.0 [0.0 ; 42.0]	-1.0 (-8.0 ; 7.9)
Assessment of pain during activity (VAS)	375	44.0 [22.0 ; 66.0]	39	52.0 [28.0 ; 78.0]	8.0 (-4.9 ; 25.9)
AUSCAN - Pain (0-100)	353	18.8 [7.6 ; 37.6]	36	23.1 [9.2 ; 39.7]	4.3 (-5.9 ; 17.3)
AUSCAN - Stiffness (0-100)	352	22.0 [7.0 ; 49.0]	36	32.0 [12.5 ; 62.0]	10.0 (-9.9 ; 34.0)
AUSCAN - Physical function (0-100)	356	33.7 [12.8 ; 54.1]	37	44.4 [19.8 ; 59.1]	10.7 (-11.8 ; 22.7)
Pinch strength of the dominant hand (kg)	364	5.6 ± 1.9	39	5.4 ± 1.6	-0.2 (-0.8 ; 0.4)
Grip strength of dominant hand (kg)	377	26.1 ± 12.1	39	27.3 ± 15.3	1.2 (-4.0 ; 6.3)
At least 2 joints (out of 15) with pressure pain in the dominant hand ‡	377	201 (53.3)	39	21 (53.8)	0.5 (-17.0 ; 17.3)
At least 1 joint (out of 15) with synovitis in the dominant hand ‡	376	134 (35.6)	39	11 (28.2)	-7.4 (-21.2 ; 10.6)
At least 4 joints (out of 15) with nodosities in the dominant hand ‡	376	219 (58.2)	39	21 (53.8)	-4.4 (-21.8 ; 12.6)
Sum of score KL in the dominant hand (0-64)	366	23.4 ± 9.2	35	22.8 ± 8.9	-0.6 (-3.8 ; 2.6)
Number of joints with KL ≥ 2 in the dominant hand (0-16)	366	7.6 ± 3.3	35	7.7 ± 3.0	0.1 (-1.0 ; 1.3)
At least 1 erosive joint (out of 14) in the dominant hand #	371	130 (35.0)	37	8 (21.6)	-13.4 (-25.8 ; 5.2)

Data are presented in the form: number (%), mean ± standard deviation, median [1st quartile - 3rd quartile].

\* Number of available data

€ p < 0.01

‡ p < 0.05

VAS: Visual Analogue Scale

BMI: Body Mass Index

AUSCAN: AUStralian CANadian Osteoarthritis Hand Index

Kellgren Lawrence: KL

# Erosive HOA is defined by the presence of at least 1 erosive joint whereas erosive joint is defined as phase "E" or "R" in the Verbruggen scoring.

‡ These thresholds correspond to the median value of each variable.

**Table 2:** Study of the association between carpal tunnel syndrome (CTS) and clinical and radiographic signs of hand osteoarthritis (HOA) in the dominant hand.

Variables	Unadjusted model		Adjusted model	
	Beta (95% CI)	P-value	Beta (95% CI)	P-value
<b>Grip strength (n=387) <sup>€</sup></b>				
Age (years)	-0.27 (-0.39 ; -0.14)	<0.001	-0.27 (-0.37 ; -0.17)	<0.001
Gender (male vs female)	13.2 (11.2 ; 15.2)	<0.001	13.2 (11.3 ; 15.1)	<0.001
Carpal tunnel syndrome (yes vs no)	-1.73 (-4.88 ; 1.42)	0.28	-0.49 (-3.05 ; 2.06)	0.70
<b>Pinch strength (n=401) <sup>€</sup></b>				
Age (years)	-0.04 (-0.06 ; -0.01)	<0.01	-0.04 (-0.06 ; -0.02)	<0.001
Gender (male vs female)	2.49 (2.08 ; 2.90)	<0.001	2.49 (2.09 ; 2.90)	<0.001
Carpal tunnel syndrome (yes vs no)	-0.16 (-0.75 ; 0.43)	0.59	0.018 (-0.48 ; 0.52)	0.94
<b>Number of joints painful to pressure (n=416) <sup>¥</sup></b>				
Age (years)	0.00 (-0.01 ; 0.02)	0.75	0.00 (-0.01 ; 0.02)	0.74
Gender (male vs female)	-0.20 (-0.47 ; 0.07)	0.15	-0.19 (-0.47 ; 0.08)	0.17
Carpal tunnel syndrome (yes vs no)	0.12 (-0.21 ; 0.45)	0.47	0.10 (-0.23 ; 0.43)	0.55
<b>Kellgren-Lawrence score (n=401) <sup>€</sup></b>				
Age (years)	0.54 (0.43 ; 0.65)	<0.001	0.54 (0.43 ; 0.65)	<0.001
Gender (male vs female)	1.30 (-1.11 ; 3.71)	0.29	1.13 (-1.05 ; 3.31)	0.31
Carpal tunnel syndrome (yes vs no)	-0.57 (-3.77 ; 2.64)	0.73	-1.08 (-3.98 ; 1.82)	0.47

<sup>€</sup> Linear regression models adjusted for age and sex

<sup>¥</sup> Negative-binomial model adjusted for age and sex



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