Metacarpophalangeal impairment in hand osteoarthritis is not rare and is associated with mechanical factors: Results from the DIGICOD hand osteoarthritis cohort

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Running head: **Metacarpophalangeal joints in hand osteoarthritis**

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Abstract

Objective: To determine the prevalence, distribution and characteristics associated with radiographic metacarpophalangeal (MCP) osteoarthritis (OA).

Methods: This is a cross-sectional study of baseline data from the DIGItal Cohort Osteoarthritis Design, a French monocentric cohort including patients with symptomatic hand OA (HOA). We evaluated the prevalence of radiographic MCP OA defined as ≥2 MCP joints with a Kellgren and Lawrence score ≥2. We compared the prevalence of MCP OA in the dominant and non-dominant hands. Associations between radiographic MCP OA and patient characteristics were studied using univariable and multivariable logistic regression.

Results: Radiographic MCP OA was present in 138 of the 425 patients (32.5%) but was not severe. Patients with MCP OA had a mean age of 69.2±6.9 years, a BMI of 25±4.2 kg/m^2, and 86.2% were women. MCP OA was more frequent in the dominant hand and predominated at the 1st and 2nd MCP joints. In the multivariable analysis, MCP OA was associated with older age (OR 1.05, 95%CI [1.01,1.10] for each year), manual occupation (OR 3.74, 95%CI [1.21,11.54]), scaphotrapezial OA (OR 2.18, 95%CI [1.27,3.72]), and a high number of proximal interphalangeal joints with radiographic OA. MCP OA was not associated with metabolic syndrome or HOA symptoms.

Conclusion: In this cross-sectional study using a hospital-based HOA cohort, radiographic MCP OA was frequent and associated with structural HOA features rather than with symptom severity. Our results suggest that the involvement of MCP joints in HOA is predominantly related to mechanical rather than systemic factors in this population.

Significance and innovation

- Radiographic MCP OA was found in one-third of the present cases but was not clinically and radiographically severe.
- Radiographic MCP OA is associated with radiographic severity of the proximal interphalangeal OA and with the presence of scaphotrapezial OA.
- Involvement of MCP in HOA is associated more with mechanical factors than with systemic factors in this cohort of patients with symptomatic hand OA.
- The presence of MCP OA without proximal interphalangeal OA involvement should lead us to reconsider the diagnosis of HOA.

Introduction

Hand osteoarthritis (HOA) affects a large part of the population. The prevalence of radiographic HOA is estimated to be between 27% and 50% in the general population (1,2). Moreover, symptomatic HOA affects approximately 13% of men and 26% of women over 70 years of age (3). The burden of HOA is important for individual-level pain and disability as well as public health (4). Among HOA risk factors, some are well established (older age, female, family history), while others such as obesity or metabolic syndrome remain controversial (5,6) .

The commonly used clinical definition of HOA proposed by the American College of Rheumatology (ACR) has a good radiographic correlation (94% sensitivity and 87% specificity, with 78% agreement) demonstrated in secondary care population. The definition takes into account the distal and proximal interphalangeal (DIP/PIP) joint involvement but excludes metacarpophalangeal (MCP) swellings (7). The consensus among rheumatologists is that MCP joints are not affected by OA but by inflammatory rheumatic diseases, such as rheumatoid arthritis, psoriatic arthritis, or crystal arthropathies.

However, previous evidence suggests that MCP joints can also be affected in OA. In the Framingham cohort (n=2301), radiographic MCP OA, defined by one or more MCP joints with a Kellgren and Lawrence score (KL) ≥2, was observed in 11.9% of men and 6.8% of women (2). In the Rotterdam study (n=3906), 8.2% of people aged over 55 years and 14.8%

of people aged over 85 years were affected (8). In contrast, symptomatic MCP OA is less common and affects about 2% of people aged over 60 years (9).

Very few studies have addressed the prevalence of MCP OA in individuals with OA and its determinants. The role of mechanical stress may be critical because high manual strain at work and high grip strength are associated with radiographic and symptomatic MCP OA (i.e. farmers, dockers, pneumatic drillers, or jackhammer operators) (10–12). However, its association with systemic factors has never been studied. Finally, MCP OA might be associated with a more severe HOA impairment since it has been associated with hand disability (2,8,13) and accelerated OA (14). The aim of this study was to determine the prevalence, distribution, and features associated with radiographic MCP OA in a large hospital-based HOA cohort.

Patients and Methods

Study population

The DIGItal Cohort Osteoarthritis Design (DIGICOD, NCT01831570) is a French monocentric prospective cohort, including patients with symptomatic HOA. A detailed description of the study design and data collection has been described elsewhere (15). For inclusion, people aged over 35 years with symptomatic HOA defined as symptomatic HOA (pain or nodes) on at least 2 joints among PIP or DIP joints or first IP joint with KL $\geq$ 2, and/or symptomatic OA (pain or deformation) at the thumb base with KL $\geq$ 2, were eligible to participate.

Patients with known polyarticular chondrocalcinosis or other inflammatory rheumatic diseases, such as psoriatic arthritis or rheumatoid arthritis, were excluded. At baseline, patients were clinically examined by a rheumatologist, completed self-reported questionnaires

(the Australian Canadian Osteoarthritis Hand Index [AUSCAN], Functional Index for Hand Osteoarthritis [FIHOA], and the Cochin Hand Function Scale), provided a blood sample, and underwent a radiograph of both hands. As previously described, this radiograph was performed in a postero-anterior view, with both hands in the same film (18x24 cassette), with the same device, and wrists, MCP, PIP and PID had to be well visualized. Both hands are pronated and hands and wrists had to be flat, the fingers well-extended, very little apart, and the second metacarpal had to be in the extension of the radius. The focal-film distance is 1 meter and technical parameters were 40 to 65 kV, 5-10 mAs (15).

Each hand joint of both hands (DIP, PIP, MCP, trapeziometacarpal [TMC], and scaphotrapezial [ST]) was radiographically scored by one trained musculoskeletal radiologist (MDC) blinded to the clinical data to obtain the KL (0–4 for each hand joint) and Verbruggen anatomical scores (16,17). The protocol for this cross-sectional analysis of the baseline visit assessments was approved by the local Ethics Board (Comité de Protection des Personnes Paris Ile de France IV). All participants provided written informed consent.

Clinical and biological data collection

At baseline, the following demographic and biological variables were collected: age, gender, occupation, body mass index (BMI), alcohol consumption, smoking, diabetes, hypertension (HTN), dyslipidemia, cardiovascular diseases, metabolic syndrome as defined by the National Cholesterol Education Program–Adult Treatment Panel III (NCEP ATP III) criteria (18), menopausal status, family history of OA, biological inflammation (C-reactive protein [CRP] $\geq$ 5 mg/L), hyperferritinemia (defined by ferritinemia $>$ 300 µg/L in men or $>$ 200 time of evolution of HOA, and use of analgesics or non-steroidal anti-inflammatory drugs (NSAIDs). All the definitions used for these characteristics are shown in **Supplementary Table 1**. Current or previous occupations were classified using the *Institut National de la Statistique et*

156 *des Etudes Economiques* classification and grouped into three categories: (1) manual
157 professions; (2) intermediate professions and employees; and, (3) intellectual professions. In
158 this study, we call "manual workers" farmers, craftsmen, traders and workers.
159
160 Radiographic metacarpophalangeal osteoarthritis
161 A MCP joint with OA was defined by a KL score ≥ 2 and radiographic MCP OA was defined
162 by at least two MCP joints with a KL score ≥ 2 among the MCP joints of both hands.
163
164 Radiographic and clinical severity
165 Radiographic severity excluded the MCP joints since they contributed to the outcome and was
166 defined as the sum of the KL score at the PIP, DIP, ST, and TMC joints (total score between 0
167 and 88); the number of PIP, DIP, ST, and TMC joints with KL ≥ 2, each and together; and the
168 number of erosive joints among the PIP and DIP joints defined by phase E or R of the
169 Verbruggen radiographic score.
170 Clinical severity was defined by an AUSCAN pain score ≥ 40/100, FIHOA score > 5/30,
171 Cochin Hand Function Scale score between 0 and 90, the visual analog scale (VAS) score for
172 hand pain ≥ 40/100, number of painful joints on applying pressure, swelling joints among the
173 PIP, DIP, MCP joints and thumb base, and grip and pinch strengths on the dominant hand.
174
175 Statistical analysis
176 The prevalence of radiographic MCP OA defined by at least two MCP joints with a KL score
177 ≥ 2 was evaluated as well as the prevalence of patients with at least two MCP joints with a
178 KL score ≥ 3 or 4. The prevalence of painful MCP joints spontaneously or under pressure was
179 assessed too. Proportions of patients with MCP OA were compared between the dominant and
180 non-dominant hand using a McNemar test for paired data.

Baseline characteristics were reported according to the presence or absence of radiographic MCP OA using frequencies and percentages for categorical variables and mean ± standard deviation (SD) or median and interquartile range (IQR) for continuous variables (according to the distribution). Differences in proportions between groups were reported with 95% confidence intervals (CIs), estimated by the exact method, and the difference of means between groups was reported with a 95% CI estimated by the pooled or Satterthwaite method depending on whether variances were equal or unequal between groups, respectively.

Associations between the presence of radiographic MCP OA and demographic characteristics and radiographic and clinical severity were analyzed using logistic regression. A multivariable model was built using covariates selected from the univariable analysis ($p < 0.20$) and was systematically adjusted for age, gender, BMI, and family history of OA. The final model was determined using a backward elimination method. Results were expressed as odds ratios (OR) with 95% CIs. All analyses were performed using SAS version 9·4 statistical software (SAS Institute Inc.). All tests were two-sided, and a p-value < 0.05 indicated statistical significance.

Results

In total, 436 patients were included in the DIGICOD cohort between April 2013 and June 2017 from the rheumatology department of Saint-Antoine Hospital (Assistance Publique-Hôpitaux de Paris). Eleven participants were excluded (one withdrew consent, 3 had unavailable radiographs, 6 did not meet the selection criteria, one with missing KL score). Finally, data from 425 patients were analyzed in the present study.

MCP OA is frequent, predominates on the dominant hand but is radiographically and clinically not severe.

Among the 425 patients, 49.4% had at least one MCP KL $\geq$ 2, 16.7% had at least one MCP joint KL $\geq$ 3, and only 3.3% KL $\geq$ 4. The median MCP KL total score (extremes 0–40) was 3.0 (IQR: 1.0 to 6.0). MCP OA was more frequent in the dominant hand (40.6% vs. 34.7%, $p<0.05$) and was predominant in the thumb and index finger (20.2% and 20.7%, respectively) (**Figure 1**). Spontaneous painful MCP joint was rare (n=29/424, 6.8%), while 139/424 (32.8%) patients had at least one painful MCP joint under pressure. Only 2 patients (0.5%) had one erosive MCP joint and none had more. In total, 138 patients (32.5%) had at least 2 MCP joints with a KL $\geq$ 2 and were considered as patients with radiographic MCP OA for subsequent analyses.

Patients with MCP OA are older, have a more manual job, and are radiographically more severe

Patients with or without radiographic MCP OA were similar in their BMI (25.0 ± 4.2 vs. 25.2 ± 4.4) and OA family history (66.9% vs. 70.5%). In addition, the percentages of patients with metabolic syndrome or its components were similar between the two groups. Patients with MCP OA were slightly older than those without MCP OA (69.2 ± 6.9 vs. 65.5 ± 7.3 years). Although there was a predominance of women in both groups, proportion of women appeared to be slightly more frequent among individuals with MCP OA (86.2% vs. 82.6%). There were twice as many patients with past or present work involving hands among the patients with MCP OA (10.4% vs. 4.6%) compared to patients without MCP OA. In contrast, intellectual professions were less frequent among patients with MCP OA. There were no

differences between the two groups in terms of iron parameters, CRP level, and calcemia (**Table 1**).

In the MCP OA group, the mean KL score excluding MCP joints (0–88) was 50.3 ± 11.9 compared to 37.9 ± 15.3 in the group without MCP OA. The presence of a high number of PIP joints with OA (9 or 10) was much more frequent in patients with radiographic MCP OA, while the presence of a low number of PIP joints with OA (0 to 4) was much more frequent in patients without MCP OA. In addition, 56.2% of the patients with MCP OA had erosive OA versus 39.2% of patients without MCP OA.

Concerning the clinical severity, 59.1% of patients with MCP OA had a VAS score $\geq 40/100$ compared to 57.2% of patients without MCP OA. There was no evident difference in the function scores on the FIHOA and Cochin scales (**Table 2**).

<u>Age, socio-professional category, number of PIP and ST with OA are independently associated with MCP OA</u>

Duration of HOA, number of erosive joints, DIP or TMC joints with OA, painful joints on applying pressure, number of joints with synovitis, and the prehension strength on the dominant hand were significantly associated with MCP OA in the univariable analysis ($p < 0.20$) but the association did not remain did not remain in multivariable analysis. No biological factors were associated with MCP OA (calcemia, CRP, hyperferritinemia, or high TSC). Neither BMI nor metabolic syndrome was associated with MCP OA (**Table 3**).

In the multivariable analysis, radiographic MCP OA was associated with higher age (OR=1.05; 95% CI [1.01, 1.10]), manual works (OR=3.74, 95% CI [1.21, 11.54] for manual workers versus intellectual professionals), and higher radiographic severity of HOA (**Table**

3). Patients with 5 to 8 PIP joints with OA, representing 34.1 % of the entire population, were 7.83 (95% CI [3.58, 17.16]) times more at risk for MCP OA than patients with 0 to 4 PIP joints with OA. In addition, those with 9 to 10 PIP joints with OA (30% of the population) were 14.29 (95% CI [6.46, 31.64]) times more at risk for MCP OA compared to patients with 0 to 4 PIP joints with OA. Lastly, ST impairment was also associated with radiographic MCP OA with an OR of 2.18 (95% CI [1.27, 3.72]).

Discussion

Using a large hospital-based cohort of patients with symptomatic IP and/or thumb base HOA, we found that radiographic MCP OA is frequent (32.5%) and predominates in the thumb and the index finger of the dominant hand. Radiographic MCP OA was independently associated with older age, manual work, PIP OA radiographic severity, and presence of ST OA, but not with systemic or metabolic factors.

Here, we found that the prevalence of radiographic MCP OA is higher than that reported in previous studies, such as the Framingham study (11.9% of men and 6.8% of women in Framingham) (2). One explanation is that we studied MCP OA in a symptomatic HOA population (defined by PIP/DIP or thumb OA) (i.e., hospital-based cohort), while the Framingham cohort is a general population sample (i.e., a population-based cohort). Indeed, in a recent study, MCP impairment was studied using magnetic resonance imaging (MRI) in HOA patients compared to controls showing that 21/81 MCP joints had a loss of cartilage, including 5 with areas of full-thickness loss (19). This prevalence is close to that observed in our study. MCP OA is more frequent than expected and probably underestimated, especially when it is studied with radiographs only. Although the prevalence of MCP OA was high, the

severity of the radiographic impairment was low (low prevalence of MCP joints at KL 3 or 4 and low median MCP KL sum) and so was the clinical burden (few spontaneously painful MCP joints).

We found that older age was associated with MCP OA (5% increase in risk per year) but not with gender. Conversely, in the Framingham cohort and the Zoetermeer study, MCP OA was slightly more frequent in men and at a younger age than other HOA localizations. For example, in the 40–44 year age group, 9.6% of men had MCP OA versus 8.2% of women (2,20). These discrepancies can also be explained by the differences in the sample populations (individuals with HOA vs. general population). The presence of confounding factors in the Framingham study from a random general population would likely include more manual workers among men, explaining this difference. Radiographic MCP OA did not seem to be independently associated with disease duration, as may have been expected, probably because disease duration is strongly associated with age.

In this population of symptomatic hand OA patients, MCP joints impairment was more frequent and independently associated with manual jobs, which is consistent with the literature (10–12). Indeed, some observations among samples up to 200 patients found an association between manual works (farmers, cotton workers, workers using vibrating-tools) and MCP OA in terms of frequency and of severity (10,21,22). Moreover, the distribution of MCP OA was consistent with previous publications, since MCP OA was more frequently described in the thumb, index and middle fingers probably because mechanical factors are stronger at these fingers (2,8). The higher frequency of MCP OA in the dominant hand and the association with manual occupations suggest that mechanical factors are strongly implicated in the development of MCP OA, which is in accordance with studies that showed

that higher grip strengths can be associated with the occurrence of MCP OA later (11,12). However, more specific mechanical factors such as quantitative data about the manual occupation (mechanical loading or repetitive tasks), length of time in the employment or manual hobbies were not available which limits the accuracy of manual activities assessment.

In contrast, systemic factors such as BMI, diabetes, metabolic syndrome, and elevated CRP were not associated with MCP OA among these hand OA patients. The absence of such associations reinforces the importance of mechanical factors in MCP OA and suggests that MCP joints are more responsive to mechanical stress than PIP or DIP (5,23). There was no association with hyperferritinemia, elevated TSC, or hypercalcemia, but it is expected because the study population was primary OA patient. Some other systemic features may have influenced MCP OA such as genetic factors but they were not investigated here..

Finally, MCP OA was associated with HOA radiographic severity, especially with PIP OA severity and with the presence of ST OA. Although the ST joint is known to be related to mechanical forces, it is independently associated with MCP OA, even when adjusted on manual works. This is consistent with data showing that HOA of other joints co-occurred in 86% of patients with MCP involvement (8). Thus, OA in the MCP joints could be part of a generalized and evolved form of HOA. Since only 2.7% and 9.5% of patients with MCP OA have less than 3 DIP with OA and less than 4 PIP with OA, MCP OA without PIP or DIP OA should lead us to reconsider the diagnosis of primary HOA.

While MCP OA was associated with symptoms in the univariable analysis, there was no association between MCP OA and HOA clinical symptoms (pain, loss of function or loss of grip strength) in the multivariable analysis. The reason may be because symptoms are closely

related to radiographic severity. This means that although radiographic MCP OA is common, its clinical impact is limited and is mediated by the severity of the PIP or thumb base OA.

The strengths of this study should be considered. First, DIGICOD is a large cohort of individuals with symptomatic HOA, defined by worldwide validated criteria. The radiographs were analyzed by a trained radiologist blinded to the patient characteristics. Second, the definition of MCP OA was stringent compared to other studies because we used the presence of at least 2 MCP joints with $KL \geq 2$ (and not at least 1 MCP joints with $KL \geq 2$) to be more specific in the association studied. Finally, patient characteristics were defined using composite criteria (patient interview, clinical examination, and biological samples) thereby strengthening the results.

However, our study had some limitations. First, it was cross-sectional, that limits the possibility to demonstrate a causality link between MCP OA and manual activity. Second, it was conducted in a symptomatic HOA population, that limits the generalizability of the findings to asymptomatic HOA patients. It is particularly true for the high prevalence, which is not what is observed in general population. Then, it would have been pertinent to conduct sensitivity analysis using more stringent criteria, but it was technically impossible because of the low number of patients with MCP joints KL 3 and 4. Moreover, because it is a symptomatic hand OA cohort, it was predominantly female population, which prevented us to describe MCP OA among men. Finally, because of missing data, the analyzed population was smaller than the included population, with a slight overrepresentation of diabetic and hypertensive individuals as well as those with metabolic syndrome. However, since these factors were not associated with MCP OA, their influence over the results would be unlikely.

In conclusion, radiographic MCP OA is frequent in patients with symptomatic PIP/DIP or thumb base OA but is clinically rarely severe. Among these patients, the presence of radiographic MCP OA is cross-sectionnally associated with mechanical factors rather than systemic factors such as metabolic factors and is especially associated with severe radiographic PIP OA. The presence of MCP OA without PIP OA involvement should lead us to reconsider the diagnosis of HOA, which is consistent with the literature. Further prospective studies are necessary to confirm longitudinally these cross-sectional results.

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436 **Tables and figures**

437 **Table 1.** Characteristics of patients according to the presence or absence of MCP OA

Variables	**No MCP osteoarthritis n=287**		**MCP osteoarthritis n=138**		**Difference (95% CI)**
	n*		**n***		
Age at inclusion (years), mean±SD	287	65.5±7.3	138	69.2±6.9	3.7 (2.2 to 5.1)
Women, No. (%)	287	237 (82.6)	138	119 (86.2)	3.7 (-3.6 to 10.9)
Body mass index (kg/m2), mean±SD	285	25.2±4.4	133	25.0±4.2	-0.1 (-1.0 to 0.8)
Family history of osteoarthritis, No. (%)	278	196 (70.5)	133	89 (66.9)	-3.6 (-13.2 to 6.0)
Socio-professional category, No. (%)	282		135		
Manual works		13 (4.6)		14 (10.4)	5.8 (0.06 to 11.5)
Intermediate professions and employees		107 (37.9)		63 (46.7)	8.7 (-1.4 to 18.9)
Intellectual professions		162 (57.4)		58 (43.0)	-14.5 (-24.6 to -4.3)
Time of evolution of hand osteoarthritis (years), No. (%)	285		136		
< 5 years		70 (24.6)		14 (10.3)	-14.3 (-21.4 to -7.1)
5-15 years		143 (50.2)		68 (50.0)	-0.2 (-10.4 to 10.0)
> 15 years		72 (25.3)		54 (39.7)	14.4 (4.8 to 24.1)
Current tobacco consumption, No. (%)	285	21 (7.4)	134	8 (6.0)	-1.4 (-6.4 to 3.6)
Current alcohol consumption, No. (%)	285	215 (75.4)	134	109 (81.3)	5.9 (-2.4 to 14.2)
Diabetes, No. (%)	287	24 (8.4)	138	9 (6.5)	-1.8 (-7.1 to 3.4)
Hypertension (HTN), No. (%)	287	155 (54.0)	138	82 (59.4)	5.4 (-4.6 to 15.4)
Cardiovascular disease except AHT, No. (%)	287	13 (4.5)	138	8 (5.8)	1.3 (-3.3 to 5.8)
LDL (g/L), mean±SD	277	1.4±0.4	134	1.4±0.4	0.009 (-0.07 to 0.09)
Metabolic syndrome, No. (%)	279	99 (35.5)	134	51 (38.1)	2.6 (-7.4 to 12.5)
CRP, No. (%)	237		112		
< 5 mg/L		213 (89.9)		101 (90.2)	0.3 (-6.4 to 7.0)
≥5 mg/L		24 (10.1)		11 (9.8)	-0.3 (-7.0 to 6.4)
Hyper-ferritinemia, No. (%)	253	28 (11.1)	121	12 (9.9)	-1.1 (-7.7 to 5.4)
TSC>45%, No. (%)	277	8 (2.9)	134	5 (3.7)	0.8 (-2.9 to 4.6)
Calcemia (mmol/L), mean±SD	279	2.4±0.1	135	2.4±0.1	0.003 (-0.02 to 0.02)
Current analgesics or NSAIDs consumption, No. (%)	287	149 (51.9)	138	80 (58.0)	6.1 (-4.0 to 16.1)

438 * number of patients with available data. MCP = metacarpophalangeal joints. HTN =
439 Hypertension. LDL = Low density lipid. CRP = C reactive protein. NSAID = non-steroidal
440 anti-inflammatory drugs. TSC = transferrin saturation coefficient
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Table 2. Clinical and radiographic severity of patients according to the presence or absence of MCP OA.

	No MCP osteoarthritis (n=287)		MCP osteoarthritis (n=138)		Differences (95% CI)
	n*		n*		
RADIOGRAPHIC SEVERITY					
Sum of KL score except MCP (0-88), mean±SD	276	37.9 ± 15.3	135	50.3 ± 11.9	12.4 (9.7 to 15.1)
Number of joints KL ≥ 2 excluding MCP (0-22), median (IQR)	276	13.0 (8.0 -17.0)	135	18.0 (14.0 -20.0)	
Number of erosive joints among PIP and DIP (0-18), No. (%)	281		137		
0		171 (60.9)		60 (43.8)	
1-3		82 (29.2)		47 (34.3)	
4 et +		28 (10.0)		30 (21.9)	
Number of DIP KL ≥ 2 (0-8), No. (%)	282		138		
0-3		48 (17.0)		4 (2.9)	
4-6		89 (31.6)		25 (18.1)	
7-8		145 (51.4)		109 (79.0)	
Number of PIP KL ≥ 2 (0-10), No. (%)	285		137		
0-4		138 (48.4)		13 (9.5)	
5-8		92 (32.3)		52 (38.0)	
9-10		55 (19.3)		72 (52.6)	
Number of ST KL ≥ 2 (0-2), No. (%)	284		137		
0		172 (60.6)		52 (38.0)	
1		49 (17.3)		32 (23.4)	
2		63 (22.2)		53 (38.7)	
Number of TMC KL ≥ 2 (0-2), No. (%)	284		135		
0		93 (32.7)		36 (26.7)	
1		56 (19.7)		17 (12.6)	
2		135 (47.5)		82 (60.7)	
Sum of KL score at TMC + ST (0-16), median (IQR)	283	5.0 (2.0 - 9.0)	135	8.0 (4.0 - 10.0)	
CLINICAL SEVERITY					
AUSCAN pain score ≥ 40/100, No. (%)	271	69 (25.5)	124	26 (21.0)	4.5 (-4.4 to 13.3)
FIHOA score > 5/30, No. (%)	272	129 (47.4)	132	73 (55.3)	-7.9 (-18.2 to 2.5)
Cochin function hand scale (0-90), median (IQR)	274	5.0 (1.0 - 13.0)	132	6.0 (2.0 - 15.0)	
Pain VAS (rest or activity) ≥ 40/100, No. (%)	285	163 (57.2)	137	81 (59.1)	-1.9 (-12.0 to 8.1)
Painful joints on pressure (0-30), median (IQR)	287	3.0 (2.0 - 6.0)	137	3.0 (1.0 - 7.0)	
Swelling joints (0-30), median (IQR)	287	0.0 (0.0 - 1.0)	136	1.0 (0.0 - 3.0)	
Grip strength on dominant hand (kg), median (IQR)	287	24.0 (20.0 - 31.0)	136	22.0 (18.0 - 28.0)	
Pinch strength on dominant hand (kg), median (IQR)	280	5.4 (4.3 - 6.7)	130	5.3 (4.4 - 6.5)	

* number of patients with available data. VAS = Visual analogic scale, DIP = distal inter-phalangeal joints, PIP = proximal inter-phalangeal joints, ST = scaphotrapezial joints, TMC =

trapezometacarpal joint, KL = Kellgren and Lawrence, AUSCAN = Australian Canadian osteoarthritis hand index, FIHOA = Functional Index for Hand osteoarthritis, KL = Kellgren and Lawrence score.

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483 **Table 3.** Univariable and multivariable analysis of factors associated with MCP OA (n=356,

484 population with available values for all selected variables in univariable analysis)

	Univariable analysis		Multivariable analysis*	
	OR [IC à 95%]	**p-value**	**OR [IC à 95%]**	**p-value**
Age at inclusion (by year)	1.09 [1.05-1.13]	<.0001	1.05 [1.01-1.10]	0.0194
Gender		0.2947		0.2505
Men	1	.	1	.
Women	1.40 [0.74-2.65]	.	1.59 [0.72-3.48]	.
Body Mass Index (kg/m^2)	1.00 [0.95-1.05]	0.9912	0.99 [0.93-1.05]	0.7547
Family history of osteoarthritis		0.7893		0.8558
No	1	.	1	.
Yes	0.94 [0.58-1.51]	.	1.05 [0.59-1.87]	.
Socio-professional category		0.0114		0.0158
Intellectual professions	1	.	1	.
Manual works	3.16 [1.31-7.62]	0.0104	3.74 [1.21-11.54]	0.0218
Intermediate professions and employees	1.67 [1.05-2.68]	0.0320	1.85 [1.07-3.21]	0.0280
Time of evolution of hand osteoarthritis (years)		<.0001		
< 5 years	1	.		
5-15 years	4.64 [1.32-16.39]	0.0170		
> 15years	9.67 [2.91-32.14]	0.0002		
Number of erosive joints among PIP and DIP (0-18)		0.0027		
0	1	.		
1-3	1.58 [0.94-2.64]	0.0815		
4 and +	2.94 [1.57-5.52]	0.0008		
Number of DIP KL ≥ 2 (0-8)		<.0001		
0-3	1	.		
4-6	3.37 [1.11-10.25]	0.0323		
7-8	9.02 [3.16-25.77]	<.0001		
Number of PIP KL ≥ 2 (0-8)		<.0001		<.0001
0-4	1	.	1	.
5-8	6.78 [3.23-14.23]	<.0001	7.83 [3.58-17.16]	<.0001
9-10	15.34 [7.22-32.59]	<.0001	14.29 [6.46-31.64]	<.0001
Number of ST KL ≥ 2 (0-2)		<.0001		0.0045
0	1	.	1	.
1-2	2.60 [1.64-4.12]	.	2.18 [1.27-3.72]	.
Number of TMC KL ≥ 2 (0-2)		0.0430		
0-1	1	.		
2	1.59 [1.01-2.51]	.		
Painful joints at pressure (0-30)		0.0232		
0-1	1	.		
2-3	0.45 [0.24-0.82]	0.0097		
4-6	0.48 [0.25-0.93]	0.0289		
7 and +	0.86 [0.47-1.59]	0.6319		
Swelling joints (0-30)		0.0013		

0-2	1	.
3 and +	2.49 [1.43-4.35]	.
Grip strength on dominant hand		0.0143
> 30kg	1	
≤ 30kg	2.12 [1.16-3.87]	.

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* Systematic adjustment on age, gender, BMI and family history of OA. DIP = distal inter-phalangeal joints, PIP = proximal inter-phalangeal joints, ST = scaphotrapezial joints, TMC = trapezometacarpal joint KL = Kellgren and Lawrence score

Socio-professional categories	- Manual workers : Farmers, craftsmen, traders and workers
	  o Farmers
	  o Craftsmen
	  o Merchants and equivalent
	  o Skilled workers
	  o Unskilled workers
	  o Agricultural workers
	- Intermediate professions and employees
	  o Intermediate professions in education, health, public service and similar
	  o Intermediate administrative and commercial professions of companies
	  o Technicians
	  o Foremen, supervisors
	  o Public service employees
	  o Commercial employees
	  o Personal of direct services to individuals
	- Intellectual professions
	  o Entrepreneurs with 10 or more employees
	  o Corporate administrative employees
	  o Liberal and assimilated professions
	  o Public service executives, intellectual and artistic professions
	  o Company executives

Diabetes	- declared diabetes, - anti-diabetic treatment, - fasting blood sugar > 1,26 g/L, or - HbA1c ≥ 6,5%.
Hypertension	- declared high blood pressure, - anti-hypertensive treatment, - systolic blood pressure ≥ 140 mmHg, or - diastolic blood pressure ≥ 90 mmHg.
Cardiovascular diseases	- declared heart failure, - declared history of myocardial infarction or ischemic heart disease, - declared history of ischemic stroke or transient ischemic attack, or - declared obliterating arteriopathy of the lower limbs.
Metabolic syndrome is defined by Adult Treatment Panel III criteria, i.e. three or more of these components:	- Increased waist circumference (≥102cm in men, >88cm in women) - Elevated triglycerides: ≥1,5 g/L or drug treatment for elevated triglycerides - Reduced HDL-cholesterol: < 0,4 g/L in men, < 0,5 g/L in women or drug treatment - Elevated blood pressure ≥ 130/85 or drug treatment for elevated blood pressure - Elevated fasting glucose ≥ 1g/L or drug treatment for elevated glucose
Dyslipidemia	LDL cholesterol in continuous variable.
Hyperferritinemia	- > 300 ug/L in men - > 200 ug/l in women.

Current consumption of analgesics or NSAID	Current consumption of acetaminophen, systemic or topic NSAIDs, and weak opioids.

Supplementary Table 1. Definitions

Figure l

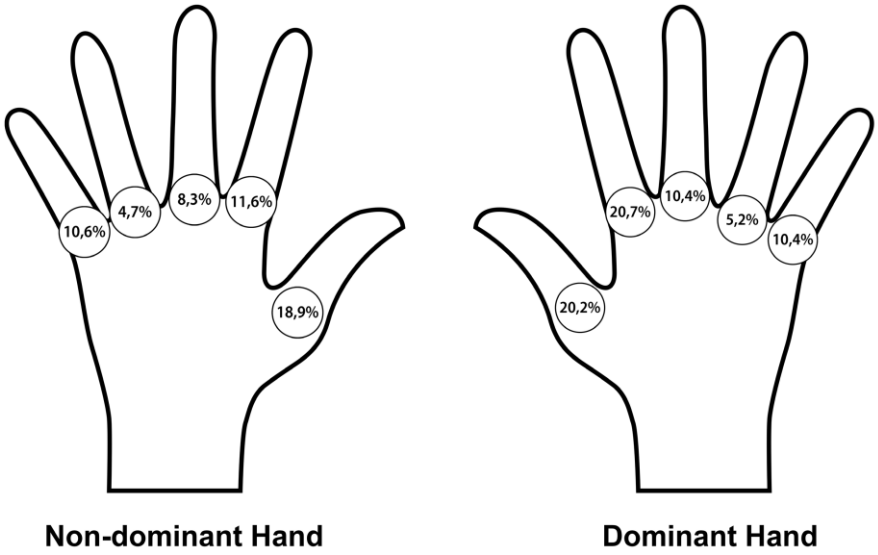

Figure 1: Distribution of MCP osteoarthritis (KL≥2) according to the fingers and the dominant hand.