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Association between pain catastrophizing, physical function and pain at first visit in the outpatient knee clinic

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ABSTRACT

Background: Pain catastrophizing has been associated with pain severity and disability in patients with knee osteoarthritis (OA). However, the literature is not consistent and other studies have failed to find this association. We examined the preoperative association between pain catastrophizing and physical function and pain, as well as the correlation between radiographic OA and physical symptoms and knee arthroplasty (KA).

Methods: This study was a cross-sectional study of all patients referred to the orthopaedic outpatient Knee Clinic from March to October 2013 with clinical symptoms of knee OA. Prior to clinical examination, the patients completed EuroQol-5D (EQ-5D), The Short Form-36 (SF-36 (PF)), The Oxford Knee Score (OKS) and The Pain Catastrophizing Scale (PCS). The severity of radiographic OA was graded with the Kellgren–Lawrence Scale (KLS).

Results: Of the 325 patients, 158 (48.6%) patients received a knee arthroplasty, 130 (40%) were treated conservatively, and 37 (11.4%) were scheduled for a knee arthroscopy. Mean age was 64.3 (SD 11.1) years and 53.9% were females. We found a strong correlation between PCS and OKS ($r = -0.60$, $P = 0.000$). Furthermore, the regression analysis showed statistically significant associations between PCS and both physical function and pain. We found no correlation between radiographic OA and physical function or pain.

Conclusions: Our results reveal that PCS is an important psychological factor when dealing with patients with OA. Furthermore, our results confirm the importance of a combined evaluation of symptoms, clinical examination, and radiographs when deciding on the right treatment for individual knee patients.

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1. Introduction

Osteoarthritis (OA) is a common debilitating degenerative joint disease, causing functional disability and pain. Clinical symptoms include joint pain, decreased range of motion, and joint stiffness in particular after exercise resulting in disability and reduction in performance of activities of daily living [1]. Knee OA is one of the most common forms of OA and end-stage knee OA often results in knee-replacement surgery. Knee arthroplasty (KA) is an effective surgery and most patients achieve pain relief and higher quality of life [2]. However, up to 20% of patients report knee pain and disability six months after a total knee arthroplasty (TKA) [3,4]. One of the psychological predictors of persistent pain following TKA is pain catastrophizing and a recent systematic review concluded that there is a moderate-level evidence for pain catastrophizing as an independent predictor of persistent pain after a TKA [5]. Pain catastrophizing is a widely researched measure of cognitive–affective responses to real or anticipated pain [6]. Pain catastrophizing has been associated with pain severity and disability in patients with knee OA [7–10]. However, other studies have failed to find this association [11] and we are not aware of any other studies examining this in a representative sample of patients referred to the outpatient knee clinic with symptoms of knee OA before operation with KA.

A review of the literature shows that there may be discordance between clinical symptoms and radiographic changes with some patients experiencing symptoms but having no or only minor osteoarthritic changes on the radiographs and vice versa [1]. If catastrophic thoughts about pain are associated with disability and pain, but the associations between symptoms and radiographic changes are weak, then the clinicians need to consider this in the decision of treatment.

The aims of this study were: (1) to describe a representative sample of patients referred to the outpatient knee clinic with clinical symptoms of knee OA; (2) to test whether there is a preoperative association between pain catastrophizing and physical function and pain; (3) to investigate whether the severity of radiographic OA is correlated with the severity of physical symptoms, and whether the severity of radiographic OA is associated with being operated with a knee arthroplasty.

2. Material and methods

The study was conducted in accordance with the declaration of Helsinki and registered in the Danish Data Protection Agency (j.nr. 1-16-02-245-15). The Regional Scientific Ethics Committee of Central Denmark waived the need for ethical approval as the study only involved questionnaire data.

2.1. Patients

This study is a first-visit cross-sectional study of all patients referred to the outpatient orthopaedic Knee Clinic at Holstebro Regional Hospital from March to October 2013 with clinical symptoms of knee OA. Prior to clinical examination, the patients were asked to complete the following four questionnaires: EuroQol-5D (EQ-5D), The Physical Function domain of Short Form-36 (SF-36 (PF)), Oxford Knee Score (OKS) and Pain Catastrophizing Scale (PCS).

The severity of radiographic OA was graded using the Kellgren–Lawrence Scale (KLS) [12]. The grading was made on a standing posterior/anterior or anterior/posterior image of the tibio-femoral joint. KLS is a five-point scale ranging from 0 to 4, with 0 presenting a normal knee and 4 severe osteoarthritis. All radiographs were graded by the same observer.

2.2. Outcome measures

The PCS is a 13-item self-report scale dealing with thoughts and feelings related to the experience of pain. The PCS covers three dimensions of catastrophizing: rumination, magnification and helplessness [13]. The scale was validated and translated into Danish by Kjogx et al. [14]. The total score ranged from 0 to 52 and each question was answered on a five-point Likert scale with 0 being 'not at all' and 4 being 'all the time'. The higher the score, the more catastrophizing thoughts were present.

Primary outcome measure was OKS. The OKS is a patient reported outcome measure (PROM) containing 12 questions on activities of daily living. The OKS assesses function and pain associated with the knee. Each item is scored from 0 to 4 and the total score ranges from 0 to 48 with 48 being the best outcome [15].

Secondary outcome measures were pain, SF-36 (PF) and EQ-5D. Pain was measured from the first question in OKS; "How would you describe the pain you usually have in your knee?" The question is rated on a five-point Likert scale ranging from 0 indicating 'no pain' to 4 indicating 'severe pain' [15].

The SF-36 is a widely used generic PROM consisting of 36 questions in eight different domains. We used only one domain; physical function (PF). The PF domain consists of 10 questions and is directly transformed into a 0–100 scale. The lower the score, the more the disability [16].

The EQ-5D is a generic PROM of general health. It consists of five items covering mobility, self-care, usual activities, pain/discomfort and anxiety/depression [17].

2.3. Statistical analysis

To evaluate pain, we dichotomized the answer into 'no pain' (none/very mild/mild) and 'pain' (moderate/severe). Furthermore, in the regression analysis we merged the highest (3–4) and lowest categories (0–1) in the KLS together because only a

few patients had the scores 0 and 4. Missing values were filled in with mean values, as described in the manuals, if fewer than half of the answers were missing in the SF-36 (PF) [16] and if two or fewer of the answers were missing in the OKS and the PCS [13,18].

Statistical analysis was performed using STATA 15. We used visual QQ-plots to determine whether data were normally distributed or not and descriptive statistics to summarize patient characteristics and baseline data. Categorical data are presented as number and percentage, and continuous data are presented as mean and standard deviation (SD), if normally distributed, and median and interquartile range (IQR), if not normally distributed. To determine whether PCS and KLS were associated with physical function and pain, we used Spearman correlation analyses. We used scatterplots to determine the relationship between the variables. The following cut-off values were used to interpret the Spearman correlation (r): 0 ≥ 0.20 = weak correlation; 0.20 ≥ 0.50 = moderate correlation; 0.50 ≥ 0.80 = strong correlation; and 0.80 ≥ 1.0 = perfect correlation [19].

We used linear regression to determine the association between PCS and physical function, and logistic regression to determine the association between PCS and pain. Furthermore, logistic regression analysis was used to assess the association between preoperative variables and treatment (knee arthroplasty vs. conservative treatment). All regression analyses were adjusted for gender and age. A P-value of <0.05 was considered significant for all statistical tests.

3. Results

The flow of patients is shown in Figure 1. From March to October 2013, 430 patients visited the outpatient orthopaedic knee clinic with clinical symptoms of knee OA and were available for recruitment. We excluded 105 patients; 25 due to missing radiographs, 15 due to arthritis other than primary OA and 65 due to incomplete PROMs (PCS or OKS). However, statistical tests showed no differences between the patients excluded and the patients included regarding age and gender. The final study population consisted of 325 patients, of whom 146 were scheduled for KA directly after the consultation, and additionally 12 were scheduled for KA within 12 months after the consultation. In total 158 (48.6%) patients received a KA, 130 (40%) were treated conservatively, and 37 (11.4%) were scheduled for a knee arthroscopy.

The patient characteristics are presented in Table 1. The study population had a mean age of 64.3 (SD 11.1) years and 53.9% were females. The median PCS score was 18 (IQR 18) for the total study population, and higher for patients referred for KA (21, IQR 16) than for patients treated conservatively (14, IQR 16).

We found a strong correlation between PCS and OKS, which was statistically significant ($r = -0.60$, $P = 0.000$) and a strong statistically significant correlation between PCS and SF-36 (PF) ($r = -0.51$, $P = 0.00$) (Table 2). Furthermore, the regression analysis showed statistically significant associations between PCS and both OKS, SF-36 and pain. A difference in one PCS score corresponds to an expected mean difference in OKS of −0.40 (95% confidence interval (CI) −0.46 to −0.34) (Table 3). We found no correlation between KLS and physical function or pain except for a weak correlation between KLS and SF-36 (PF) ($r = -0.12$, $P = 0.02$) (Table 2).

Table 4 shows the association between preoperative variables and treatment. The odds ratio (OR) indicates that one score higher in PCS increases the risk of having a TKA with three percent (OR 1.03; 95% CI: 1.01–1.05). Furthermore, the odds of having a low OKS, SF-36 (PF) or EQ-5D score is higher for patients referred for a KA compared to patients referred for conservative treatment. Further patients with a KLS 3/4 are 8.5 times (95% CI 4.5–16.4) more likely to have a KA compared with patients with a grade 0/1.

4. Discussion

The results of the present study support the growing evidence indicating that PCS is statistically significantly correlated with both physical function and pain. We found no correlations between radiographic OA and physical symptoms except for a weak

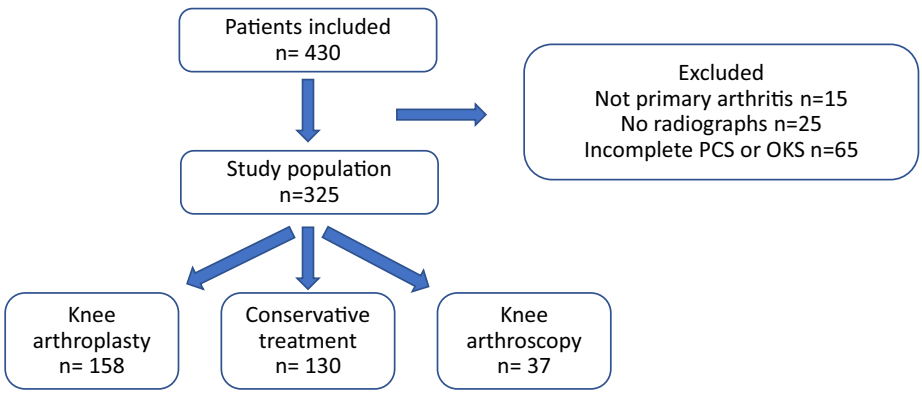

Figure 1. Flow chart. OKS, Oxford Knee Score; PCS, Pain Catastrophizing Scale.

Table 1
Patient demographics and characteristics.

	Study population n = 325	Knee arthroplasty n = 158	Conservative n = 130	Arthroscopy n = 37
Gender				
Male (%)	150 (46.1)	72 (45.5)	54 (41.5)	24 (64.9)
Female (%)	175 (53.9)	86 (54.5)	76 (58.5)	13 (35.1)
Age (SD)	64.3 (11.1)	67.4 (10.1)	62.1 (11.2)	58.9 (11.4)
BMI (SD)	–	29.2 (4.6)	–	28.2 (4.2)
Kellgren–Lawrence				
KL 0/1	144 (44.3)	32 (20.3)	82 (63.1)	30 (80.3)
KL 2	92 (28.3)	57 (36.1)	29 (22.3)	6 (16.2)
KL 3	69 (21.2)	51 (32.3)	17 (13.1)	1 (2.7)
KL 4	20 (6.2)	18 (11.4)	2 (1.5)	–
PCS (IQR)	18 (18)	21 (16)	14 (16)	17 (17)
OKS (SD)	25.4 (8.3)	23.3 (6.7)	27.8 (9.4)	25.7 (8.2)
SF-36 (PF) (SD)	44.9 (23.7)	40.0 (20.1)	50.4 (26.4)	46.9 (23.9)
EQ5D (IQR)[a]	0.72 (0.20)	0.72 (0.33)	0.72 (0.13)	0.71 (0.12)
Pain				
None/very mild/mild	82 (25.2)	25 (15.8)	47 (36.2)	10 (27.0)
Moderate/severe	243 (74.8)	133 (84.2)	83 (63.9)	27 (73.0)

BMI, body mass index; IQR, interquartile range; PCS, Pain Catastrophizing Scale; PF, physical function; SD, standard deviation.
[a] 65 missing answers.

correlation between KLS and SF-36. Furthermore, we found that increasing radiographic OA was associated with higher probability of having a KA.

The mean PCS score reported in similar studies outside Scandinavia is lower than in the present study (median PCS 18 for all). Sullivan et al. reported a mean PCS of 13.9 (SD 12.6) and Riddle et al. a mean PCS of 13.9 (SD 12.2) in knee OA patients scheduled for a TKA [20,21]. However, if we compare our study to another study published in Scandinavia on patients referred for TKA, our PCS scores are only slightly higher [22]. This may suggest that cultural differences play a role in the perception of pain. Furthermore, the patients in our study had not been seen by the orthopaedic surgeon at the time where they filled out the questionnaire. This may have influenced their answers.

A total of 142 patients (43%) were not offered surgery and were returned to the general practitioner. Only 12 of these patients were referred back to the orthopaedic outpatient knee clinic again and operated with a KA within one year from the first visit to the knee clinic. This suggests that almost half of the patients referred to the knee clinic were not candidates for surgery. Similar results were reported by Gwynne-Jones et al. They found that up to 40% of the patients referred for a first specialist knee assessment were not qualified for surgery and were returned to the general practitioner [23]. In a recent study Gwynne–Jones et al. reported results from 189 patients with knee OA seen in a joint clinic over a two-year period. The patients were assessed by either a physiotherapist, a nurse, or a surgeon, based on the severity of their symptoms. The knee patients in this study reported a mean OKS score of 19.4 (SD 7.8) compared to 25.4 (8.3) in our study. However, their study population were on average four years older and they did not report degree of OA [24].

Surgery is indicated when the patient does not respond to conservative treatment and there is agreement between both the radiological and physical findings and the patient's symptoms. With an ageing population and a greater demand on the surgeons' time, it is important to pre-select the appropriate patients for evaluation by the knee surgeon, and to select the right patients for surgery in terms of disease severity and potential to benefit from the operation. Gwynne-Jones et al. found the joint clinic effective as a triage tool with 93% of those referred for a specialist being recommended surgery.

We found a strong and statistically significant association between PCS and physical function measured with both OKS and SF-36 and a statistically significant association between PCS and pain. These results are in line with previous studies suggesting that pain catastrophizing is an important factor in understanding pain and disability among OA patients [7,9,10]. In a cohort of 106 obese patients with knee OA, Somers et al. found pain catastrophizing to be an independent predictor of both pain severity and physical disability [10]. Similar results were found by Sinikallio et al. in a cohort of community-dwelling knee OA patients. They found that both pain self-efficacy, pain catastrophizing, fear of movement, and anxiety levels were associated with pain and disability [9].

Table 2
Association between Pain Catastrophizing Scale (PCS), Kellgren–Lawrence Scale (KLS) and physical function and pain in the study population (n = 325).

	PCS Spearman correlation (*P*)	KLS grade Spearman correlation (*P*)
OKS	−0.60 (0.000)	−0.06 (0.25)
SF-36 (PF)	−0.51 (0.000)	−0.11 (0.05)
EQ-5D	−0.48 (0.000)	0.08 (0.22)
Pain	0.37 (0.000)	−0.05 (0.36)

OKS, Oxford Knee Score; PF, physical function.

Table 3
Analysis of the association between pain catastrophizing and pain and physical function.

Predictor variable PCS	Coefficient	95% CI	*P*
Mean difference in OKS[a]	−0.40	(−0.46 to −0.34)	0.000
Mean difference in SF-36 (PF)[a]	−0.93	(−1.18 to −0.73)	0.000
Odds of moderate/severe pain[b]	1.06	(1.03 to 1.08)	0.000

All analyses are adjusted for gender and age. CI, confidence interval. OKS, Oxford Knee Score; PCS, Pain Catastrophizing Scale; PF, physical function.
[a] Analysed with linear regression.
[b] Analysed with logistic regression.

In the statistical analysis we found that the KLS grade affected the association between PCS and OKS. The decrease in OKS when PCS increased was statistically significantly larger among patients with a low KLS grade (0–1) (−0.46 (95% CI; −0.55 to −0.37)) than among patients with a severe KLS grade (2–4) (−0.34 (95% CI; −0.42 to −0.27)). However, this difference was very small and not clinically relevant, and we chose to report the result for KLS grades 0–4 together. We were not able to find any association between the grade of OA and neither pain nor function, but we found that radiographic OA was associated with having a KA. These results confirm the importance of basing the treatment decision on both the patient's symptoms as well as clinical and radiographic findings.

Todays practice does not involve systematic psychological screening of the patients although we know that pain catastrophizing may be a predictor of persistent pain after a TKA. However, the PCS scores may be important for the surgeon, both in the process of choosing the right treatment and in guiding the patient about the results of KA surgery. In the present study, our focus was on pain catastrophizing. Recent research has suggested that patients with pain and elevated scores on more than one risk factor are more likely to develop prolonged pain and disability, and that multiple psychological factors need to be considered with respect to pain and physical disability in knee OA [9,25]. Further research in this area where pain catastrophizing is not the sole assessment is needed.

A strength in our study is the size and consecutive inclusion of the study population. We have assessed almost all patients referred to the outpatient knee clinic with symptoms of knee OA, which gives us a representative sample of the typical patients referred from the GP. Some points need to be mentioned in terms of limitations of our study. First, the cross-sectional nature of our study means that we cannot determine causality of the observed relationships. However, this study only aimed at examining associations, and not causality. Second, we were not able to adjust for BMI in the regression analysis because we only had those data on the patients who were operated. Yet, we are not aware of any study showing an association between BMI and PCS, thus we do not consider this to be an important problem. Third, in this study pain is measured from the first question in OKS. Our data would have been more detailed if we had measured pain on a continuous scale such as visual analogue scale (VAS). Furthermore, the first question from OKS deals with pain the past four weeks. Pain catastrophizing relates to both present and expected pain, and we might have found a stronger correlation between PCS and pain if this had been included in the question.

5. Conclusion

We found a preoperative association between PCS and physical function and pain and a higher PCS score among patients referred for KA than for patients referred for conservative treatment. This reveals that PCS is an important psychological factor when dealing with patients with OA. Furthermore, our results confirm the importance of a combined evaluation of symptoms, clinical examination, and radiographs when deciding on the right treatment for individual knee patients.

Table 4
Analysis of the association between preoperative variables and treatment.

Variable	Knee arthroplasty		
	Odds ratio	(95% CI)	*P*
PCS	1.03	1.01–1.05	0.004
OKS	0.93	0.90–0.96	0.000
SF-36 (PF)	0.98	0.97–0.99	0.002
EQ5D*	0.83	0.21–3.32	0.000
Pain§	1.76	1.33–2.32	0.000
Kellgren–Lawrence			
Grade 2	4.6	2.5–8.5	0.000
Grade 3/4	7.8	3.9–15.2	0.000

The table shows the odds ratio for knee arthroplasty (n = 158) vs. conservative treatment (n = 130). CI, confidence interval. OKS, Oxford Knee Score; PCS, Pain Catastrophizing Scale; PF, physical function.
*Adjusted for gender and age. §Moderate/severe vs. none/very mild/mild pain. *58 missing answers.

Author contributions

S.B., M.S., I.M. and T.B.H. participated in the conception and design of the study and helped to revise the manuscript. M.B.R. graded all the radiographs. All authors read and approved the final manuscript.

Ethics committee

The Regional Scientific Ethics Committee of Central Denmark waived the need of an ethic approval as the study only involved questionnaire data.

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Declaration of competing interest

The authors declare that they have no competing interests.

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