

Risk factors for knee osteoarthritis in Morocco. A case control study

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Received: 6 May 2007 / Revised: 3 July 2007 / Accepted: 16 July 2007 / Published online: 16 August 2007
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Abstract Osteoarthritis (OA) of the knee is the most common form of arthritis. A positive association between obesity and several occupational factors and knee OA has been observed in previous studies in populations of different ethnicity. The aim of this study was to examine the relation between knee OA and body weight and occupational factors in a Moroccan sample of patients with knee OA. Our cases were consecutive patients diagnosed in our department with knee OA utilizing radiography in a 1-year period. No cases displayed established causes of secondary OA. Controls were selected randomly from the general population and were individually matched to each case for age and sex. Interviews were obtained from 95 cases and controls. Detailed information on general health status, height, weight, smoking habits, specific physical loads from occupation and housework, and sports activities was collected. The risk of knee OA increased with higher body mass index, odds ratio (OR)=3.12 (95% confidence interval [CI]=1.67–5.81; $p<0.0001$). Sitting more than 3 h/day and climbing stairs more than 50 steps/day were associated with decreased risk of knee OA, OR=0.29 (95% CI=0.15–0.56; $p=0.02$) and 0.48 (95% CI=0.26–0.91; $p<0.0001$), respectively. Overweight is a risk factor for knee OA, whereas sitting and climbing stairs are inversely associated with knee OA.

Keywords Knee · Morocco · Osteoarthritis · Overweight · Risk factors

Introduction

Osteoarthritis (OA) is a common degenerative disease of joints. The major clinical features are pain and stiffness, leading to a decline in physical function. Considerable pain and disability result from large joint OA, which is the major cause of joint replacement surgery and cost to the community. The focus of current medical intervention is on symptomatic relief, given that no cure for the disease exists. As curative intervention is unlikely in the near future, both the prevention of disease onset and progression of the disease are of great importance. OA of the knee is a common form of arthritis in the elderly. It is a complex multifactorial disease. Risk factors are broadly divisible into those that are constitutional or genetic and those that are local and driven by biomechanical elements, such as joint usage. As incidence of knee OA is expected to rise as the proportion of elderly population continues to increase and knee OA has a substantial impact on activities of daily living, several epidemiological studies in Western and Oriental countries [1–4] have investigated risk factors of knee OA, finding a consistent association between the incidence or progression of knee OA and age, obesity, history of knee injury, occupational physical demands, physical activity, and regular sport activities. However, no data exist from countries of the south bank of the Mediterranean Sea. Thus, we aimed in this study to look for risk factors for OA of the knee in a sample of symptomatic patients from the Moroccan population.

Materials and methods

The study was conducted from June 2005 to July 2006. Patients with OA of the knee were recruited prospectively

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from consecutive outpatients of a rheumatology center. Cases comprised of patients who suffered from knee pain and walking difficulties and were first diagnosed as displaying a tibiofemoral joint with radiographic grade greater than or equal to 3 on the Kellgren and Lawrence scale [5] within the year preceding the start of the study. All the radiographs of OA of the knee were read by the same investigators (Mounach and El Maghraoui) who referred to a copy of the Atlas of Standard Radiographs [6]. Cases with a history of knee injury in the previous year, or those who fulfilled the American College of Rheumatology criteria [7] for rheumatoid arthritis or the modified New York criteria for ankylosing spondylitis were excluded. For each case, we randomly selected a single control from the general population and individually matched to the cases by age and sex. Controls that had a history of knee pain were replaced, as were controls that declined to participate in the study. The rationale for excluding all patients with knee pain was to avoid misclassification. After providing informed consent, controls were interviewed by the same trained interviewer (Mounach). Subjects completed a structured questionnaire that requested details of medical history, socioeconomic status and education, cigarette smoking and alcohol consumption, functional status, and lifetime history of leisure activities. Information about six types of occupational physical activity was obtained namely, standing, sitting, climbing stairs, kneeling, squatting, walking, and heavy lifting. The questionnaire enquired whether work entailed lifting weights greater than or equal to 10 kg, greater than or equal to 25 kg, and greater than or equal to 50 kg, more than once during an average working week. Subjects were also asked if they performed sports activities regularly. A list of sports activities was then read out to the study subjects, and records of activity were made. The body height and weight of all subjects were measured.

Statistical analysis was conducted on different steps:

1. The first step consisted on the description of the study population.
2. In the second step, we performed variable by variable analysis, without any adjustment, using the student test for paired variables and chi-squared univariate analysis for qualitative variables. This was done to explore the association between each variable and OA of the knee.
3. We then proceeded to a conditional logistic regression analysis, by putting all variables that were found to be statistically significant by univariate analysis into the model. This was done to adjust for confounding factors between variables. Results were summarized as odds ratios (OR) with 95% confidence intervals (CI). OR were calculated for categories of exposure, and tests of trend were performed across these categories. Statistical analyses were performed using SPSS statistical software (SPSS, Chicago, IL).

Results

A total of 95 patients with OA of the knee were recruited. Their mean age was 59.7 years (standard deviation 8.5 years, range 37–76 years). There were 69 women (72.6%) and 26 men. There were no differences between the cases ($n=95$) and the controls ($n=95$) with respect to sex or age distribution. Table 1 shows background characteristics for the 95 pairs of cases and controls at present. Mean body weight of cases was significantly greater than for controls ($p<0.0001$). Furthermore, body mass index (BMI) of cases was significantly higher than BMI of controls ($p<0.0001$). There were 54 patients (56.8%) with a BMI greater than 30 compared to 29 among the controls (30.5%) with a statistically significant difference ($p<0.0001$). More than half of the patients and the controls were housewives. Among the cases, seven were current smokers, whereas none of the controls were.

Obesity was identified—in the univariate analysis—as an important risk factor for knee OA: OR=2.99 (95% CI=1.65–5.44; $p<0.0001$). We did not have any case with a history of joint injury. Occupational activities of sitting for greater than 3 h each day and climbing stairs (>50/day) were associated with significantly reduced risk of knee OA. No other activities showed association with knee OA, including standing for 5 h or more, kneeling for an hour or more each day, or lifting weight (Table 2). Few subjects performed recreational sports activities regularly.

The results of multiple logistic regression analysis are presented in Table 3. A BMI greater than 30 (OR=3.12, 95% CI=1.67–5.81), sitting greater than or equal to 3 h/day (OR=0.29, 95% CI=0.15–0.56), and climbing greater than or equal to 50 steps/day (OR=0.48, 95% CI=0.26–0.91) represented independent factors associated with knee OA after controlling for other factors.

Table 1 Baseline characteristics of participants

	Cases ($n=95$)	Controls ($n=95$)	<i>p</i> value
Age, years: mean (SD)	59.7 (8.5)	60.0 (8.5)	NS
Sex: F/M	69/26	69/26	NS
Weight, kg: mean (SD)	77.9 (11.0)	71.3 (12.0)	$p<0.0001$
Height, cm: mean (SD)	1.59 (0.1)	1.60 (0.1)	NS
BMI, kg/m ² : mean (SD)	30.5 (4.4)	27.6 (3.8)	$p<0.0001$
Current smoking, <i>n</i> (%)	7 (7.3)	0 (0)	NS
Workers, <i>n</i> (%)	45 (47.4)	45 (47.4)	NS
Previous joint injury, <i>n</i> (%)	0 (0)	0 (0)	NS

Table 2 Association of knee osteoarthritis with occupational activities

Risk factors	Cases (n=95)	Controls (n=95)	OR (95% CI)
Sitting \geq 3 h/day: n (%)	53 (55.7)	77 (81)	0.58 (0.44–0.75)**
Standing \geq 5 h/day: n (%)	68 (71.5)	72 (75.7)	0.80 (0.42–1.53)
Kneeling \geq 1 h/day: n (%)	21 (22.1)	26 (27.3)	0.75 (0.38–1.46)
Walking \geq 2 km/day: n (%)	36 (37.8)	49 (51.5)	0.57 (0.32–1.02)
Climbing \geq 50 steps/day: n (%)	36 (37.8)	52 (54.7)	0.50 (0.2–0.9)*
Lifting weights $>$ 25 kg: n (%)	19 (20)	27 (28.4)	0.63 (0.32–1.23)

* $p=0.02$ ** $p<0.0001$

Discussion

We report here the first study on factors associated with OA of the knee in Morocco. Both constitutional and occupational factors were found to be associated with these conditions. Obese subjects were at an increased risk for OA of the knee. We did not find any occupational activity that increases the risk of developing knee OA. Subjects whose jobs entailed sitting for a long time and walking up stairs frequently were at a lower risk of knee OA.

Our observation on the association between obesity and OA of the knee concurs with those in Caucasians [2–4]. Obesity has also been identified as a significant risk factor for knee OA in Britain [8], Sweden [9], and Japan [10]. These findings indicate that the influence of excessive weight on the development of knee OA is consistent across ethnic groups. The stress and amount of force on the weight-bearing joints are increased in overweight subjects. This additional physical load could cause cartilage breakdown leading to OA [11]. Some studies have shown that obesity is associated with OA in nonweight-bearing joints such as the small joints of the hand, which might indicate metabolic effects of overweight involved in the arthrotic process [12, 13]. However, Davies et al. [14] and the Baltimore Longitudinal study [15] did not find any association between metabolic factors such as serum

Table 3 Association of knee OA with obesity and occupational activities using multiple regression analysis

Risk Factors	OR (95% CI)	<i>p</i> value
BMI $>$ 30	3.12 (1.67–5.81)	<0.001
Sitting \geq 3 h/day	0.29 (0.15–0.56)	<0.0001
Climbing \geq 50 steps/day	0.48 (0.26–0.91)	0.024

cholesterol, blood pressure or diabetes, and the development of knee osteoarthritis. One twin study found a 9–13% increased risk for the onset of the disease with every kilogram increase in body weight [16]. In addition, obesity is also a risk factor for the progression of radiological OA [17, 18]. Given that obesity is associated with the onset and progression of OA, weight loss represents an important preventive strategy [19]. The Framingham study showed that weight control significantly affected the risk of developing knee OA [20]. Women who reduced their BMI by two units or more reduced the odds for developing OA by greater than 50%. Combined weight loss and exercise regimens lead to improvements in pain, disability, and performance in patients with knee OA [21].

We could not study the influence of history of joint injury because no participant had had a joint injury. Kellgren and Lawrence [22] had demonstrated the relation between joint injury and OA of the knee as early as 1958.

In our study, where there was a low number of smokers, no association between smoking and knee OA was found. In the Framingham study [23], the association showed a dose–response relation, and smokers were more protected than light smokers. In the cross-sectional Chingford study, a protective effect of smoking for radiological OA in the hand and knee could not be seen, but for subjects with generalized OA, a possible inverse association was found [24]. In the National Health and Nutrition Examination Survey, the rate ratios for smoking demonstrated a protective effect in men and women, and heavy smokers were more protected than light smokers [23].

Although our study did not identify any significant risk factor for knee OA among specific occupational activities, prolonged sitting at work was found to be associated with reduced prevalence of knee OA. This suggests that sitting is inversely associated with knee OA. The results of studies investigating the influence of sedentary work on knee OA are controversial. A Japanese study found prolonged sitting at work to be associated with reduced prevalence of knee OA [10]. A case–control study in which cases were confirmed radiographically showed sitting at jobs tended to increase risk of knee OA but not significantly [25]. By contrast, in a case–control study in the UK, sedentary work tended to decrease risk in women, although again, no significant association was observed [8].

Although the sitting position clearly involves reduced load on many joints compared to other working activities, no other studies have reported a relationship between sedentary activity and knee OA. Inversely to many other studies [26], we found that climbing stairs frequently was associated with decreased risk of OA of the knee. One can speculate about the role of climbing stairs in reinforcing the quadriceps as a reasonable explanation of the results seen in our study.

We considered the potential sources of bias in our study. It was based on a relatively small number of cases and controls. However, this is the first study of risk factors in radiographically confirmed knee OA in Morocco. The current study was designed to investigate risk factors for symptomatic and advanced cases of OA. We recruited patients from a rheumatology center of one hospital to minimize referral bias. Controls were general-practice patients. Subjects with a history of joint pain and stiffness were excluded. The objective of such a design was to avoid misclassification. However, in doing so, we ended up comparing subjects with fairly severe OA with a very healthy (with respect to joint pain) control group. This may have resulted in superiorly high ORs. Nevertheless, some inference can be made on risk factors that are associated with severe OA.

In summary, our analysis of individual risk factors for symptomatic knee OA in women in Morocco confirms that obesity represents the main independent risk factor for knee OA as observed in both Oriental and Western populations. Moreover, occupational physical activities clearly influence the development of knee OA in Morocco, as in Britain and Japan, although differences exist in the specific activities that exert influence. Further studies of conditions among populations in different regions are needed to better characterize variant risk profiles of knee OA.

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