Prevalence of radiographic primary hip and knee osteoarthritis in a representative Central European population

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Abstract The aim of our study was to determine the radiographic prevalence of hip and knee osteoarthritis and compare our results with prevalence data reported by other studies, as no similar study had been performed in Hungary previously. Our aim was also to investigate the usefulness of the different radiological scoring methods for the definition of osteoarthritis. Patients who earlier reported complaints and gave written consent were asked to participate in a clinical follow-up. In the 682 participants Harris hip score, visual analogue pain scale values for both joints, Knee Society score and knee functional score were calculated. Weight-bearing radiographs were taken of both joints. Kellgren-Lawrence radiological evaluation was performed and osteoarthritis prevalence was defined. Hip osteoarthritis was found in 109 cases (16.49%), and knee osteoarthritis was found in 111 cases (16.54%). Harris hip score, Knee Society score, functional score and visual analogue scale values were significantly worse in people with radiographically proven osteoarthritis compared to the

control group ($p < 0.05$). Significantly higher osteoarthritis prevalence of both joints was found in those with increased body mass index values. Age also plays a significant role in the development of both hip and knee osteoarthritis. No significant difference was observed between male and female participants regarding osteoarthritis prevalence. The Kellgren-Lawrence score with a cut-off value of 2 or more is a useful evaluation method for the detection of osteoarthritis prevalence in epidemiological studies; according to our observations, in clinical practice a cut-off value of three or more is more relevant.

Introduction

Osteoarthritis is one of the most frequent causes of musculoskeletal pain, and one of the leading causes of work absenteeism in the general adult population in the developed countries. The disease most frequently affects the weight-bearing joints, primarily the knee joint followed by the hip joint [1]. Apart from known aetiology leading to secondary osteoarthritis, in the vast majority of the cases the cause remains unknown, leaving primary osteoarthritis the most frequent form of degeneration in both joints.

Although the symptoms and presentation of the disease vary widely, with progression surgical management including total hip and knee arthroplasty remains the main treatment option for these patients. For decision makers in the health care systems it is important to know at what rate the number of candidates for joint replacement surgery is increasing. On the basis of population and health trends, and only partially relying on epidemiological data, the American Academy of Orthopaedic Surgeons (AAOS) made predictions regarding the need for primary hip and knee arthroplasty by 2030. These calculations proved to be

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gross underestimations by 2005 [2]. To promote more precise estimations, epidemiological reports on osteoarthritis prevalence can be very helpful.

Although the relationship between radiographic hip osteoarthritis and the need for total hip arthroplasty (THA) is not fully established, according to Ingvarsson severe osteoarthritis and range of motion (ROM) restriction eventually necessitate surgical intervention [3]. A recent review article investigated reports regarding hip osteoarthritis prevalence published in previous decades. Point prevalence of radiographic hip osteoarthritis varied from 0.9 to 27% depending on the selection criteria and method of evaluation [4]. Several methods are used for radiographic evaluation of both joints, most widely the scoring system of Kellgren and Lawrence, and for good intra- and inter-observer reliability the joint space width narrowing [5]. Neither in the hip nor in the knee joints is there is consensus regarding the epidemiological definition of osteoarthritis [6]; however, it has been suggested that longstanding pain of both joints shows the closest correlation with radiographic structural changes [7].

Prevalence data of major degenerative joint complaints have already been reported in our earlier publication with 22.2% of the surveyed having hip and 30.3% having knee pain [8]. In this study our aim was to give radiographic prevalence data—using the Kellgren-Lawrence classification—on primary hip and knee osteoarthritis for the first time in a Hungarian population. The functional status of the patients was also evaluated using the Harris hip score and the Knee Society score and cross-matched with the radiographic findings [9, 10]. The influence of body mass index (BMI), age and gender on the development of osteoarthritis was also investigated.

Materials and methods

From the participants of our previous representative questionnaire survey—carried out in the south-western part of

Fig. 1 Effect of BMI on Harris hip score

Fig. 2 Prevalence of hip osteoarthritis (%)

Hungary—those who reported either hip or knee pain and had given written consent were invited for a clinical and radiological follow-up in the search for primary osteoarthritis. From this patient pool of 2,241 people, 682 (244 men and 438 women) with an average age 52.31 years (20–67) came for a follow-up to our outpatient department. Detailed information regarding general health and musculoskeletal condition was obtained; patients' anthropometric parameters were recorded. Participants were asked to describe the severity of their pain on a visual analogue scale and to localise it on a pain drawing test for both hip and knee joints. This was followed by a musculoskeletal physical examination performed by one of two experienced orthopaedic surgeons. ROM of both joints, alignment of the knee and ligament balance were defined. Possible contractures, Trendelenburg's sign and lower limb discrepancy were also recorded. Standardised weight-bearing anteroposterior (AP) pelvis and bilateral weight-bearing AP and lateral view radiographs of both knee joints were taken in 676 cases.

Using anamnestic data and our records, joint function was evaluated by calculating the Harris hip score and Knee Society scores for the hip and the knee joints, respectively.

Radiographic evaluation was performed using the Kellgren-Lawrence osteoarthritis score. The diagnosis of osteoarthritis was established at Kellgren-Lawrence ≥ 2 points and severe osteoarthritis at Kellgren-Lawrence ≥ 3 points in our study. Joint space widths of the hip and knee joints were measured with 0.5 mm accuracy on the AP pelvis and AP knee radiographs. The narrowest part was recorded as joint space width.

Participants were categorised according to their BMI values: (1) under 25 normal, (2) 26–30 overweight, (3) 31–35 obese and (4) above 35 extremely obese.

Fig. 3 Prevalence of knee osteoarthritis (%)

Fig. 4 Knee Society score, knee functional score and visual analogue pain scale in patients with proven osteoarthritis and radiographically negative cases

Associations between functional scores and radiographic findings were analysed. The influence of BMI, age and gender on symptoms and osteoarthritis prevalence was further investigated.

Our results were statistically analysed. Continuous variables were analysed in terms of mean $\pm$ standard deviation. The χ^2 test was used to establish data correlation. Standard Student's *t* test for paired samples or one-way analysis of variance (ANOVA) were performed for comparing data, as needed. A *p* value <0.05 was considered significant. All analyses were carried out with SPSS software for Windows version 13.0.

Results

Of the patients, 15 had undergone THA, three of them total knee arthroplasty and two of them unicompartmental knee arthroplasty, leaving 661 radiographs for hip osteoarthritis and 672 radiographs for knee osteoarthritis evaluation.

Regarding hip osteoarthritis prevalence, 101 hips of 63 women and 69 hips of 46 men had Kellgren-Lawrence ≥ 2 , of which 18 had Kellgren-Lawrence ≥ 3 . Overall 16.49% had hip osteoarthritis with 2.7% having severe osteoarthritis.

Harris hip score was calculated in 682 cases and averaged 85.72 points. Patients with osteoarthritis had an average value significantly lower (77.37) in comparison

with the negative reference group (87.75) ($p \geq 0.05$). A visual analogue scale for hip pain was completed by 661 patients who averaged 2.9 points. These values showed a significant negative correlation with the Harris hip score values ($p \geq 0.05$).

The associations between BMI and Harris hip score values are summarised in Fig. 1. The prevalence of hip osteoarthritis with respect to the BMI values is presented in Fig. 2. The average joint space width was 3.56 for the right and 3.52 for the left hip joints.

We investigated whether age influences the different hip parameters and BMI. BMI and visual analogue scale score showed a significant positive correlation and joint space width and Harris hip score a significant negative correlation ($p \geq 0.05$).

A total of 117 knees of 70 women and 68 knees of 41 men had Kellgren-Lawrence ≥ 2 , of which 20 had Kellgren-Lawrence ≥ 3 which means 16.54% knee osteoarthritis prevalence with 2.9% having advanced osteoarthritis. Similarly in the hip joint, BMI average was significantly higher in the osteoarthritic group (31.13) than in the control group (28.39) ($p < 0.05$). A positive correlation is clearly visible: only 10% of the normal BMI group had osteoarthritis, whereas in the extremely obese group almost a third of the patients were affected (Fig. 3). Knee Society score, knee functional score and visual analogue pain scale showed that patients with proven osteoarthritis have significantly lower values than radiographically negative cases, showing marked pain and worse functional status (Fig. 4). The influence of age on knee osteoarthritis could also be proven as ages of 56.8 vs 51.4 years were observed in the osteoarthritic and the control groups, respectively ($p < 0.05$). We found that the average joint space width was 2.9 mm in the affected compared to the 4 mm in the negative control group.

The coexistence of hip and knee osteoarthritis was also investigated (Table 1). Radiographs helped us identify those who are affected by both conditions, as very often knee pain is a misleading clinical symptom of hip osteoarthritis.

Discussion

In this study radiographic prevalence data are reported on primary hip and knee osteoarthritis. In a recent review

Table 1 Coexistence of hip and knee osteoarthritis in the group examined

Knee condition	Hip condition			
	Negative	Hip osteoarthritis	No radiograph	Total
Negative	483	74	3	560
Knee osteoarthritis	69	41	1	111
Total	552	115	4	671

article our previous study was rightfully criticised for not presenting prevalence data based on radiographic evidence, despite the fact that the aim of our previous work was to give data based on self-reported pain of the major weight-bearing joints [4, 8]. Although osteoarthritis is the leading cause of joint pain, in several cases patients with severe, radiographically proven hip osteoarthritis are free of clinical symptoms as reported by Birrell et al. [11]. As far as we know, with the exception of Cvijetić et al., who published Croatian prevalence data on hip osteoarthritis recently no representative study has been carried out in the Central European region [12].

Upon reviewing the literature we have found that most publications reporting osteoarthritis prevalence of the knee focus on an elderly population. Although most of the previous studies used the Kellgren-Lawrence classification system for radiographic evaluation of the weight-bearing joints, no clear recommendation is given regarding the cut-off value for the definition of osteoarthritis [3, 13–15]. Due to this fact we differentiated two cut-off values for mild and more advanced osteoarthritis using 2 and 3 as cut-off values, respectively.

In their study Lawrence and Sebo reported 12–25% hip osteoarthritis prevalence in the Caucasian race depending on the country surveyed [14]. In our study a similar value was found for hip osteoarthritis prevalence at 16.5%. Even though the reproducibility of the Kellgren-Lawrence scoring is reported to be 75% by the authors in the original article, several publications use joint space width narrowing to establish the diagnosis of hip osteoarthritis. Cut-off values are between 1.5 and 4 mm resulting in huge differences in prevalence data. Ingvarsson used 2.5 mm as a cut-off value in his survey of 1,517 people in Iceland and found a high 8% prevalence based on coronagraphs [3]. Danielsson and Lindbergh screening a Swedish population found 1.2% [16]. Even though we also used the Kellgren-Lawrence classification system, in the advanced cases (2.7%) joint space width was less than 2 mm.

Regarding the knee joint most studies in the literature use the Kellgren-Lawrence classification for its clinical usefulness [17]. Scandinavian authors using the same classification method found 1.5% knee osteoarthritis prevalence in a group aged 35–54, although anthropometric parameters of the subjects examined are not reported [18]. In a recent Asian population study over 30% radiographic prevalence is reported in a group of 598 people aged above 65 (17.7% men and 36.5% women) [19]. According to their observations higher age, BMI, female sex and higher bone density play a significant role in the development of knee osteoarthritis. Depending on the Kellgren-Lawrence cut-off value prevalence data were 16.5 and 2.9% in our study with a higher, yet not significant prevalence in male patients.

Due to these large prevalence differences observed in both the hip and knee joints when using different Kellgren-Lawrence cut-off values, we think it is desirable to differentiate according to study design. For epidemiological purposes only, Kellgren-Lawrence 2 is a good alternative, whereas in studies with the aim of screening those with more clinical relevance Kellgren-Lawrence 3 is a better choice. In this study joint space width narrowing in the diagnosis of osteoarthritis directly was not investigated, yet substantial functional decline was observed at 2 mm in both the hip and knee joints. The limitation of our study of osteoarthritis is that it could only assess prevalence within the group examined. Thus the sample is only representative regarding age, municipal structure and employment.

We found that higher BMI and age also show a positive correlation with both hip and knee osteoarthritis. Felson and Zhang in their review article showed that in both joints the higher the BMI value, the higher the prevalence of symptoms and radiographic osteoarthritis. They found that the correlation was stronger in the knee joint [20]. Several publications discuss the role of higher BMI as a risk factor in degenerative conditions [21–23]. Other authors emphasise rather the body composition as BMI values may incorporate the mass of the skeletal muscle which plays a protective role as opposed to adipose tissue [24].

According to our observations, patients with hip pain and lower Harris hip score had a higher prevalence of knee osteoarthritis and lower Knee Society and functional scores. Whether this is caused by radiating pain or the greater age causing multiple joint involvements needs further investigation.

Conflict of interest The authors declare that they have no conflict of interest.

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