Joint Space Narrowing and Relationship with Symptoms and Signs in Adults Consulting for Hip Pain in Primary Care

SITA M.A. BIERMA-ZEINSTRA, J. DORINDE OSTER, ROOS M.D. BERNSEN, JAN A.N. VERHAAR, ABIDA Z. GINAI, and ARTHUR M. BOHNEN

ABSTRACT. ***Objective.*** To study whether clinical symptoms and signs can predict radiological osteoarthritis (OA) of the hip in primary care patients with hip pain.

Methods. Consecutive patients (n = 220) aged 50 years or older consulting the general practitioner for hip pain and referred for radiological investigation underwent a standardized history, radiological, laboratory, and physical examination. Radiological OA was confirmed with joint space ≤ 2.5 mm. Additionally, a more stringent definition was used (≤ 1.5 mm). The relationship between radiological OA and possible clinical symptoms/signs of OA was tested. Combinations of clinical symptoms/signs that had shown an independent relationship with radiological OA in multivariate analyses were tested for their predictive value.

Results. Radiological OA (joint space ≤ 2.5 mm) of the (more) symptomatic hip was present in 35.5% of the study population and more severe OA (joint space ≤ 1.5 mm) in 11.4%. Presence of 4 specific symptoms/signs from history and examination showed a positive predictive value (PPV) of 73% (specificity 91%, sensitivity 45%) for radiological OA. When 5 specific symptoms/signs were present, the PPV for the more severe radiological OA was 82% (specificity 98%, sensitivity 72%), and when 6 or 7 specific symptoms/signs were present the PPV was 100% (specificity 100%, sensitivity 40% and 8%, respectively). Negative predictive values were high for almost all combinations.

Conclusion. In primary care patients with hip pain, clinical symptoms and signs can to a moderate extent predict radiological OA and to a large extent more severe radiological OA. (J Rheumatol 2002;29:1713–8)

Key Indexing Terms:

HIP JOINT | RADIOLOGY | OSTEOARTHRITIS
PRIMARY CARE | SYMPTOMS | SIGNS

The poor relationship between radiological signs of osteoarthritis (OA) of the hip and clinical symptoms has frequently been reported[1]. However, this relationship was mainly studied in the open population and only the clinical symptom "presence of pain" was used to distinguish between symptomatic and asymptomatic subjects[2-4].

In clinical settings, patients consult because they are symptomatic, and most patients with musculoskeletal complaints consult presumably for reasons of pain. Further, the pain is not always caused by OA. Therefore, in clinical settings the relationship between radiological signs and clinical symptoms/signs should be studied for symptoms/signs other than pain alone. It is known that in settings with severe cases the relationship between radiological signs of OA of the hip and clinical symptoms is much stronger than that in the open population[5]. However, most patients with hip pain are seen in primary care and only a minority of them will subsequently be referred to an orthopedic or rheumatology clinic[6,7]. Although in many countries the general practitioner (GP) plays the key role in diagnosing and advising the patient with hip pain, as well as in initiating possible therapy or referring to medical specialists, there are very few clinical studies on this subject with primary care patients. To our knowledge the study of Birrell, *et al*[8] is the only study of the relationship between radiological and clinical signs of OA in primary care patients; they investigated to what extent restricted motion predicts radiological hip OA.

In the present primary care study all possible symptoms and signs of OA are studied for their relationship with radiological OA.

The main radiological features of OA are joint space narrowing, subchondral sclerosis, osteophytes, cyst formation, and ultimately deformation of the femoral head. For many decades the Kellgren score, which combines these features, has been used to assess the severity of radiological

From the Department of General Practice, Department of Rehabilitation Medicine, Department of Orthopaedic Surgery, Department of Radiology, Erasmus University, Rotterdam, The Netherlands.

S.M.A. Bierma-Zeinstra, PhD; R.M.D. Bernsen, MSc; A.M. Bohnen, MD, PhD, Department of General Practice; J.D. Oster, MD, Department of Rehabilitation Medicine; J.A.N. Verhaar, MD, PhD, Department of Orthopaedic Surgery; A.Z. Ginai, MD, PhD, Department of Radiology.

Address reprint requests to Dr. S.M.A. Bierma-Zeinstra, Department of General Practice, Erasmus University, Room Ff 320, Postbox 1738, 3000 DR Rotterdam, the Netherlands. E-mail: Bierma@hag.fgg.eur.nl

Submitted July 23, 2001; revision accepted January 30, 2002.

hip OA[9]. However, many experts have criticized the lack of clarity in interpretation of this score, and the relatively strong influence of the presence of osteophytes. It also has been shown that presence, size, or number of osteophytes do not relate to radiological or symptomatic progression of hip OA[10,11]. Moreover, assessment of radiological OA based on joint space measurements has shown better reproducibility than radiological assessment based on the Kellgren grading system[12,13]. In epidemiological studies it has been shown that joint space narrowing correlates much better with pain than with osteophytes[2,14], in contrast to knee OA, where osteophytes correlate better with pain than with joint space narrowing[15]. On this basis, it seems preferable to define radiological OA of the hip by joint space narrowing instead of by the Kellgren score.

At present, Dutch GP refer 30% of adult patients with hip pain for radiological examination, with very high variation between individual physicians[6,7]. We believe that more knowledge of the relationship between clinical symptoms/signs and outcomes from radiological investigations in primary care patients could help physicians decide which patients they should send for radiological investigation. Thus we investigated how clinical symptoms/signs in primary care patients with hip pain relate to radiological OA (based on joint space narrowing), and to what extent the GP should be able to predict the presence or absence of radiological OA by comprehensive history taking and physical examination.

MATERIALS AND METHODS

Patients. Over one year in 2 hospitals in Rotterdam, consecutive patients aged 50 years and older consulting for hip pain and referred by the GP for a first-time radiological investigation of the hip were enlisted for study. Exclusion criteria were a suspected fracture or tumor on the radiograph request, the difficulty of history taking or physical examination due to comorbidity, and a hip arthroplasty on the painful side. To create a relatively homogenous study group in which the physician was especially in need of diagnostic confirmation, we also excluded short-lived pain (pain duration < 2 weeks) as well as long-established hip disorders (pain lasting > 2 years). Approval for this study was obtained from the ethical committees of both hospitals.

History and examination. The history taking and physical examination in all patients was done by the same observer (SMABZ), who is clinically experienced in examination of the musculoskeletal system, and was measured and recorded in a standardized manner. For analysis we selected features from the history and examination, and used laboratory tests indicated by the ACR classification committee[16] as important to discriminate hip OA from other disorders; these test results were recorded for every patient in the ACR study[16]. However, some features noted by the ACR committee (i.e., Achilles and patellar reflexes, leg length, knee temperature, bony enlargement of the knee, and rheumatoid factor from laboratory tests) were not available for our study population and could not be included in the analysis. In our study pain was defined as pain during the previous week. Passive hip motion was measured with a 2-arm goniometer, which has been shown to be as reliable as an electronic inclinometer with an intraobserver variability (intraobserver SD) for the different hip motions in healthy subjects ranging from 2.2 to 4.4 degrees[17]. Normal values for range of motion in adults were used to define cutoff values for decreased motion[18–20]. However, because normal values for hip adduction and hip internal rotation are smaller for men than for women[20], and because there are always interindividual differences for normal joint motion, we also used left-right differences to define decreased motion. Because of recent evidence about the important role of muscle weakness in OA[21] we also tested muscle weakness of the abductor muscle with the patient lying (in addition to the Trendelenburg sign with the patient standing). The quantitative measurements of range of motion were extended with the quality of restricted motion (bony restriction or not). Finally, in addition to tenderness related to other hip problems (e.g., trochanteric tenderness, tenderness of pubic attachment of the adductor muscles, of the inguinal ligament just below the superior iliac spine, and of the iliopsoas muscle) or related to low back disorders (e.g., sacroiliac tenderness, ischial nerve tenderness, etc.), we also examined tenderness of the anterior hip joint in the groin itself.

Radiological examination. The radiographs were evaluated according to a standardized protocol. Measurements of joint space (lateral, superior, and axial just superior from the fovea) were standardized[22] and performed on the anteroposterior pelvic radiograph. For these measurements, interobserver variability between 2 observers was tested in a random subset of 64 patients. We defined radiological OA as present when one of the measured joint spaces (lateral, superior, and axial) was ≤ 2.5 mm. We also used a more stringent definition for radiological OA; by this definition more severe radiological OA was present when one of the measured joint spaces (lateral, superior, axial) was ≤ 1.5 mm. These cutoffs were adapted from the cutoffs for minimal joint space[3]. Additionally, a qualitative assessment of radiographic features of hip OA was performed and expressed in the Kellgren score (0–4)[9]. All radiographs were assessed by an independent observer, who was unaware of the clinical status of the patients or specific questions or other statements made by the GP on the radiograph request.

Sonographic and laboratory examination. Increased 1 hour erythrocyte sedimentation rate (ESR), determined in a capillary blood sample, was defined as ESR > 25 mm/h. The results of a standardized sonographic examination are described[23].

Statistical analysis. The relationship between radiological OA according to the 2 different definitions and clinical symptoms/signs was tested with univariate logistic regression analysis. Symptoms/signs showing a significant relationship ($p < 0.05$) with radiological OA according to one of the 2 definitions were included in a multivariate logistic regression model. Symptoms/signs that had a significant OR ($p < 0.1$) in the multivariate model were used to compute a score: i.e., the number of symptoms/signs present. As well, the positive predictive value (PPV), negative predictive value (NPV), specificity, and sensitivity for different cutoff values of this score were computed.

For all these analyses, the features of the symptomatic hip were included. In case of bilateral symptoms, the features of the more symptomatic hip were included. Statistical Package for the Social Sciences 8.0 (SPSS Inc., Chicago, IL, USA) was used for the analyses.

RESULTS

Of the 244 consecutive patients eligible for inclusion 227 gave informed consent. Three patients were excluded because of comorbidity and data for 4 patients were not complete, resulting in a study population of 220 (73% female), mean age 66 (SD 9.6) years. Patients had a mean pain severity score of 6.2 (SD 2) on a 10 point visual analog scale. Among patients studied, 29 (13%) consulted for bilateral hip problems. Radiological OA of the (more) symptomatic hip according to the definition based on joint space ≤ 2.5 mm was present in 35.5% of the patients; more severe radiological OA based on joint space ≤ 1.5 mm was present in 11.4%. On the Kellgren grading system 33.8% of the patients had a score ≥ 2 and 14% had a score ≥ 3.

Interobserver variability in the random subset of 64 cases was determined for both hips, but data are given here for only the (more) symptomatic hip: the intraclass correlation coefficient (ICC) was 0.91 (95% CI 0.92, 0.97) for lateral joint space measurements, 0.92 (95% CI 0.86, 0.95) for superior joint space measurements, and 0.96 (95% CI 0.94, 0.98) for axial joint space measurements. The kappa for radiological OA (joint space ≤ 2.5 mm) was 0.63; for the more stringent definition (joint space ≤ 1.5 mm) the kappa was 0.91. Blood samples were obtained from 218 patients; the mean ESR was 12 mm/h (range 2–87 mm/h) and only 2 patients had an ESR > 45 mm/h.

Diagnoses given by the GP from the results of radiological examination are listed in Table 1. Features from the history, physical examination, and laboratory tests in the study population and their univariate significance level in relation to the 2 different definitions of radiological OA in the (more) symptomatic hip are given in Table 2.

Multiple logistic regression analysis included clinical variables that had a significant relationship with joint space narrowing in the univariate analysis, and showed that the combination of these clinical variables explained 30% of the variability for radiological OA (joint space ≤ 2.5 mm) and 78% of the variability for the more stringent definition (joint space ≤ 1.5 mm).

Symptoms that still showed an independent relationship with radiological OA (joint space ≤ 2.5 mm) or with the more stringent definition (joint space ≤ 1.5 mm) in multivariate analysis and that subsequently were included in the "number of symptoms/signs present" score are given in Table 3.

The PPV for radiological OA (joint space ≤ 2.5 mm) increased from 36% to 73% when one to 5 of the symptoms/signs (Table 3) were present. PPV for the more stringent OA (joint space ≤ 1.5 mm) increased from 12% to 100% when one to 7 of the symptoms/signs were present. NPV were high (89%–100%) for all combinations to predict absence of radiological OA according to the more stringent definition (joint space ≤ 1.5 mm). The NPV were also high (75%–100%) for the different combinations to predict absence of radiological OA (joint space ≤ 2.5 mm), except for all 5 symptoms/signs present (67%). PPV and NPV for the different combinations are given in Table 4.

Figure 1 shows a receiver-operator characteristic curve showing the test sensitivity and specificity for the increasing number of symptoms/signs present for radiological OA.

Table 1. Diagnosis given by the GP after receiving the results of radiological investigation in 220 patients consulting for hip pain in primary care.

Diagnosis	n (%)
Hip OA	89 (40)
Hip arthritis	1 (0.5)
Trochanteric bursitis/tendinitis	22 (10)
Neurological disorder	5 (2.3)
Low back disorder	18 (8.2)
Contusion hip	9 (4.1)
Other	15 (6.8)
No diagnosis	31 (14.1)
Unknown (missing)	30 (13.6)

DISCUSSION

This study explored whether clinical symptoms/signs can be used to predict radiological OA of the hip and showed that radiological OA was moderately well predicted, and more severe radiological OA was very well predicted by specific clinical symptoms/signs. Predictive values of symptoms/signs are important test values in clinical practice. When a certain symptom/sign or combination of symptoms/signs shows a high PPV for radiological OA, referral for a radiograph, unless the radiograph is needed for other reasons (i.e., referral to the orthopedic surgeon or exclusion of malignancy), can be avoided because the GP is almost certain that the radiograph will show signs of OA. In this study the PPV for the more severe radiological OA reached high values. High NPV based on the absence of several symptoms/signs were reached for both definitions of OA.

In case of a high NPV the GP can be almost certain that the radiograph will not show signs of OA (or more severe OA). Especially in this case a lot of unnecessary radiographs can be avoided because radiological OA based on absence of some specific symptoms/signs could be predicted for the large majority of our patients referred for radiological investigation by the GP.

A recent UK study in a primary care setting investigated to what extent restricted motion (internal rotation, external rotation, and flexion) could predict radiological OA of the hip, and, based on their population, defined ideal thresholds for restricted motion[8]. These thresholds (internal and external rotation both ≤ 23°, flexion ≤ 94°) appeared very similar to our cutoff levels, although our cutoff levels for restricted motion were defined beforehand and were more arbitrary. Our investigation and the UK study[8] confirmed the stronger positive relationship between symptoms/signs and more severe radiological OA[5]. It is probable that the symptoms/signs of early/mild OA are less specific and/or radiological signs are yet not present. Moreover, less severe radiological signs may not always cause problems; therefore the patient may consult for another type of hip or low back disorder even though moderate joint space narrowing is present.

Several specific symptoms/signs shown to be discriminating in our study are already well known symptoms/signs (pain duration, decreased motion, tenderness in the groin, etc.). However, tenderness of the inguinal ligament is not known as one of the signs of OA. The fact that in our study increased ESR and presence of morning stiffness were not discriminating variables, in contrast to the ACR classifica-

Table 2. Relationship (by univariate analysis expressed in odds ratios) between clinical symptoms/signs and joint space narrowing in patients (n = 220) consulting for hip pain in primary care. Statistically significant relationships ($\rho < 0.05$) are shown in bold.

Variable (dichotomous)	Presence, %	Odds Ratio	
		Minimal Joint Space ≤ 2.5 mm, 35.5%	Minimal Joint Space ≤ 1.5 mm, 11.4%
History			
Pain duration ≥ 3 mo	64	**2.34 (1.26, 4.32)**	2.49 (0.9, 6.94)
Nocturnal pain	15	2.0 (1.00, 4.33)	0.8 (0.22, 2.78)
Morning stiffness	36	**2.0 (1.15, 3.62)**	**2.6 (1.12, 6.06)**
Bilateral complaints	13	1.34 (0.6, 2.94)	1.78 (0.61, 5.19)
Female	73	1.56 (0.82, 2.97)	0.96 (0.38, 2.43)
Age ≥ 60 yrs	68	**2.14 (1.13, 4.04)**	**13.06 (1.74, 98.08)**
Pain aggravation			
By sitting	31	**0.4 (0.21, 0.80)**	**0.2 (0.04, 0.76)**
By only moving the hip joint	34	1.2 (0.65, 2.09)	**3.5 (1.47, 8.14)**
By lying on the side	62	0.7 (0.39, 1.20)	0.9 (0.38, 2.10)
By walking	67	1.2 (0.64, 2.08)	2.1 (0.75, 5.83)
After load	51	1.0 (0.56, 1.69)	1.9 (0.79, 4.44)
On initial steps after rest	76	1.5 (0.75, 2.91)	4.0 (0.90, 17.4)
Pain distribution			
Worst pain: groin	22	1.8 (0.91, 3.36)	**4.1 (1.72, 9.67)**
Worst pain: trochanter	31	0.8 (0.42, 1.42)	0.7 (0.26, 1.82)
Worst pain: medial thigh	3	*	**8.7 (1.66, 45.90)**
Worst pain: anterior thigh	9	1.6 (0.61, 3.93)	1.4 (0.39, 5.27)
Worst pain: lateral thigh	7	0.8 (0.27, 2.44)	0.5 (0.06, 3.96)
Worst pain: buttock	29	0.7 (0.37, 1.30)	0.3 (0.09, 1.04)
Radiation to knee	30	0.9 (0.49, 1.66)	1.14 (0.46, 2.79)
Radiation to lower leg	34	0.6 (0.33, 1.1)	0.33 (0.11, 1.01)
Physical examination			
Heberden/Bouchard noduli	28	1.1 (0.57, 1.96)	1.5 (0.64, 3.69)
Trochantric tenderness			
Tensor fascia lata muscle	23	1.3 (0.67, 2.46)	**2.6 (1.08, 6.18)**
Gluteus maximus muscle	40	0.7 (0.36, 1.15)	1.5 (0.63, 3.33)
Gluteus medius muscle	41	1.2 (0.70, 2.14)	**2.5 (1.05, 5.74)**
Greater trochanter	61	0.9 (0.52, 1.60)	0.8 (0.35, 1.88)
Groin tenderness			
Hip capsule in groin	24	**2.8 (1.46, 5.21)**	**3.6 (1.52, 8.44)**
Inguinal ligament	29	1.7 (0.91, 3.00)	**4.5 (1.89, 10.60)**
Iliopsoas muscle	17	0.9 (0.40, 1.80)	1.3 (0.45, 3.64)
Buttock tenderness			
Superior iliac posterior spines	36	0.64 (0.34, 1.23)	0.74 (0.27, 2.02)
Sacroiliac joint	36	1.15 (0.65, 2.04)	0.72 (0.75, 3.98)
Ischial nerve	16	0.89 (0.42, 1.9)	0.67 (0.19, 2.37)
Pain at straight leg raising	11	0.44 (0.16, 1.24)	0.31 (0.04, 2.41)
Decreased hip motion			
Flexion	44	1.2 (0.67, 2.04)	**3.9 (1.54, 9.67)**
Extension	37	**1.9 (1.05, 3.26)**	**6.8 (2.59, 17.85)**
Abduction	58	**1.9 (1.06, 3.38)**	**6.2 (1.78, 21.25)**
Adduction	26	**2.2 (1.18, 4.04)**	**17.1 (6.02, 48.49)**
Internal rotation	41	**2.4 (1.34, 4.15)**	**14.0 (4.05, 48.51)**
External rotation	41	**2.6 (1.45, 4.53)**	**5.7 (2.16, 14.82)**
Bony restriction	28	**2.0 (1.07, 3.57)**	**5.8 (2.39, 13.90)**
Muscle weakness			
Abductor weakness	14	1.5 (0.67, 3.21)	**7.3 (2.90, 18.28)**
Trendelenburg sign positive	37	1.0 (0.57, 1.08)	1.6 (0.71, 3.78)
Painful hip motion			
Flexion	65	1.3 (0.74, 2.42)	**3.1 (1.04, 9.51)**
Extension	42	1.5 (0.86, 2.63)	2.3 (0.96, 5.26)
Abduction	71	**2.3 (1.18, 4.42)**	**5.5 (1.23, 24.01)**
Adduction	57	1.2 (0.66, 2.01)	**3.4 (1.24, 9.51)**
Internal rotation	65	1.4 (0.77, 2.49)	**4.6 (1.33, 15.84)**
External rotation	42	**1.8 (1.01, 3.09)**	**2.7 (1.15, 6.48)**
Laboratory tests			
ESR< 20 mm/h	85	1.45 (0.63, 3.33)	0.79 (0.25, 2.52)

* One cell was empty; no proper estimate of OR could be made. Flexion: decreased= < 100° or ≥ 5° decrease in relation to the other side (d). Extension: decrease = < 5° or ≥ 5° d. Abduction: decreased = < 21° or ≥ 5° d. Adduction: decreased = < 10° or ≥ 5° d. Internal rotation: decreased = < 21° or ≥ 5° d. External rotation: decreased = < 21° or ≥ 5° d.

Table 3. Symptoms/signs that showed an independent relationship with joint space narrowing in multivariate analysis and subsequently were included in the "number of symptoms/signs present" score.

Minimal Joint Space ≤ 2.5 mm	Minimal Joint Space ≤ 1.5 mm
Age over 60 years	Age over 60 years
Pain lasting longer that 3 months	Tenderness over inguinal ligament
No pain aggravation by sitting	Decreased external rotation
Tenderness in groin	Decreased internal rotation
Decreased external rotation	Decreased adduction
	Bony restriction in one of the directions during passive hip movement
	Muscle weakness of the hip abductors

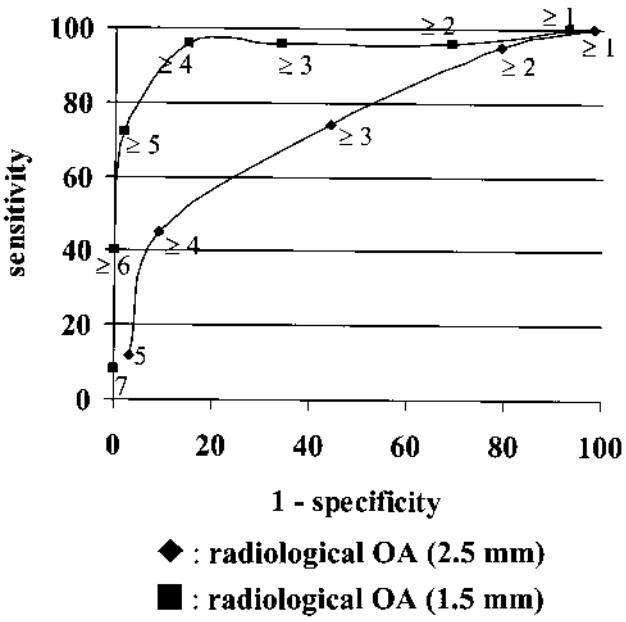

Figure 1. Receiver-operator characteristic curve for joint space narrowing based on the presence of one or more specific clinical symptoms/signs in patients consulting for hip pain in primary care (n = 220).

Table 4. Positive (PPV) and negative predictive values (NPV) for joint space narrowing based on presence (or absence) of one or more specific clinical symptoms/signs in patients (n = 220) consulting for hip pain in primary care.

	Minimal Joint Space ≤ 2.5 mm Present: n = 78, absent: n = 142			Minimal Joint Space ≤ 1.5 mm Present: n = 25, absent: n = 195	
	PPV, %	NPV, %		PPV, %	NPV, %
≥ 1 symptom/ sign present	36 (78/217)*	100 (3/3)	≥ 1 symptom/ sign present	12 (25/207)*	100 (13/13)
≥ 2 symptoms/ signs present	40 (74/185)	89 (31/35)	≥ 2 symptoms/ signs present	15 (24/158)	98 (61/62)
≥ 3 symptoms/ signs present	48 (58/121)	80 (79/99)	≥ 3 symptoms/ signs present	27 (24/90)	99 (129/130)
≥ 4 symptoms/ signs present	73 (35/48)	75 (129/172)	≥ 4 symptoms/ signs present	46 (24/52)	99 (167/168)
All 5 symptoms/ signs present	70 (9/13)	67 (138/207)	≥ 5 symptoms/ signs present	82 (18/22)	97 (191/198)
			≥ 6 symptoms/ signs present	100 (10/10)	93 (195/210)
			All 7 symptoms/ signs present	100 (2/2)	89 (195/218)

* Number positive for minimal joint space ≤ 2.5 mm/number positive for ≥ 1 symptom/sign present.

tion study[16], was to be expected. In the ACR study the setting was a rheumatology clinic, where it is important to discriminate between patients with OA and those with other arthritis, whereas our study was performed in primary care. In the primary care setting arthritis is very rare. As well, in the ACR study clinical features were compared with the clinical diagnosis of OA, while in our study clinical features were compared with the radiological definition. The diagnosis given by the GP was collected after they had received the radiographic results and was therefore not independent of the radiographic examination. For this reason and because GP show a high variability in diagnosing OA[6], and also because the diagnosis in our study was not confirmed by another clinician or team of experts (as in the ACR classification study), we did not use the GP's diagnosis in our analysis.

A possible shortcoming of our study may be that we did not measure minimal joint space as an indicator of radiological OA, as advised by Croft and colleagues based on hip joint assessment from intravenous urograms of 1315 men[3].

Instead, we measured the joint space at 3 standardized locations only (lateral, superior, and axial just superior from the fovea). A UK primary care study[24] showed a prevalence of radiological OA in new presenters with hip pain using the method advised by Croft that was very similar to our prevalence. This suggests that these methods imply no major differences in case definition. However, even stronger relationships may have been found if the minimal joint space measure had been available and used in the current analyses. Also, in a mathematically more appropriate model to predict radiological OA, specific weights should have been given to the different symptoms/signs. However, we considered that a model based on the number of symptoms/signs present would be easier for clinicians to use and thus we tested such a model.

All patients in our study were referred for radiological investigation by GP. Therefore not all primary care patients consulting for hip pain are represented in this study. Patients in whom the GP had difficulty with the diagnosis may therefore be overrepresented in this study and patients with very clear symptoms/signs of trochanteric tendinitis or bursitis may be underrepresented. Nevertheless, we assume that this possible selection bias was minimal, because the distribution of the diagnoses given by the GP is very similar to that of disorders in a randomly selected population of middle aged and elderly hip patients[6] and the distribution in the Dutch National Survey of Morbidity and Interventions in Primary Care[7].

We used preselected variables to avoid coincidental effects in our study. Nevertheless, the unexpected relationship between the tenderness of inguinal ligament and radiological OA shows that our results should be retested and confirmed in another study population. In addition, future followup studies should investigate to what extent the presence of one or more of the specific symptoms/signs in combination with the absence of radiological OA predict future radiological OA.

ACKNOWLEDGMENT

We are grateful to the staff of the radiological and laboratory departments of the University Hospital Rotterdam, and the radiological department of St. Franciscus Hospital, Rotterdam; without their help we could not have performed this study.

REFERENCES

1. Balint G, Szebenyi B. Diagnosis of osteoarthritis. Guidelines and current pitfalls. Drugs 1996;52:Suppl 1-13.
2. Laurence JS, Brenner JM, Bier F. Osteoarthritis: prevalence in the population and relationship between symptoms and X-ray changes. Ann Rheum Dis 1966;25:1-24.
3. Croft P, Cooper C, Wickham C, Coggon D. Defining osteoarthritis of the hip for epidemiologic studies. Am J Epidemiol 1990;132:514-22.
4. Odding E, Valkenburg HA, Algra D, Vandenouweland FA, Grobbee DE, Hofman A. Associations of radiological osteoarthritis of the hip and knee with locomotor disability in the Rotterdam Study. Ann Rheum Dis 1998;57:203-8.
5. Fox KM, Hochberg MC, Resnick CS, et al. Severity of radiographic findings in hip osteoarthritis associated with total hip arthroplasty. J Rheumatol 1996;23:693-7.
6. Bierma-Zeinstra SMA, Lipschart SS, KH Njoo, et al. How do general practitioners manage hip problems in adults? Scand J Prim Health Care 2000;18:159-64.
7. Miedema HS. Reuma onderzoek meerdere echalons (ROME): basisrapport. Leiden: Nederlands Instituut voor Preventieve Gezondheidszorg TNO; 1993.
8. Birrell F, Croft, P Cooper C, Hosie G, Macfarlaine G, Silman A. Predicting radiographic hip osteoarthritis from range of movement. Rheumatol 2001;40:506-12.
9. Kellgren JH, Lawrence JS. Radiologic assessment of osteoarthrosis. Ann Rheum Dis 1957;16:494-502.
10. Dougados M, Gueguen A, Nguyen M, et al. Radiological progression of hip osteoarthritis: definition, risk factors and correlations with clinical status. Ann Rheum Dis 1996;55:356-62.
11. Danielsson L. Incidence and prognosis of coxarthrosis. Acta Orthop Scand 1964;Suppl 66:1-114.
12. Sun Y, Günther KP, Brenner H. Reliability of radiographic grading of osteoarthritis of the hip and knee. Scand J Rheumatol 1997;26:155-65.
13. Ingavarsson T, Hagglund G, Lindberg H, Lohmander LS. Assessment of primary hip osteoarthritis: comparison of radiographic methods using colon radiographs. Ann Rheum Dis 2000;59:650-3.
14. Scott JC, Nevitt MC, Lane NE, Genant HK, Hochberg MC. Associations of individual radiographic features of hip osteoarthritis with pain [abstract]. Arthritis Rheum 1992;35 Suppl:S81.
15. Spector TD, Hart DJ, Byrne J, Harris PA, Dacre JE, Doyle DV. Definition of osteoarthritis of the knee for epidemiological studies. Ann Rheum Dis 1993;52:790-4.
16. Altman RD, Alarcon G, Applerouth D, et al. The American College of Rheumatology criteria for the classification and reporting of osteoarthritis of the hip. Arthritis Rheum 1991;34:505-14.
17. Bierma-Zeinstra SMA, Bohnen AM, Ramlal R, Ridderikhoff J, Verhaar JAN, Prins A. Comparison between two devices for measuring hip joint motions. Clin Rehabil 1998;12:496-504.
18. Roach KE, Miles TP. Normal hip and knee active range of motion: relationship to age. Phys Ther 1991;71:656-65.
19. Boone DC, Azen SP. Normal range of motion of joints in male subjects. J Bone Joint Surg Am 1979;61:756-9.
20. Walker JM, Sue D, Miles-Elkousy N, Ford G, Trevelyan H. Active mobility of the extremities in older subjects. Phys Ther 1984;64:919-23.
21. Felson DT, Zhang Y. An update on the epidemiology of knee and hip osteoarthritis with a view to prevention. Arthritis Rheum 1998;41:1343-55.
22. Resnick D, Niwayama G. Degenerative disease of extraspinal locations. Diagnosis of bone and joint disorders. 2nd edition. Philadelphia: W.B. Saunders; 1988.
23. Bierma-Zeinstra SMA, Bohnen AM, Ginai-Karamat AZ, Verhaar JAN, Prins A, Lameris JS. Sonography of the adult hip joint. Ann Rheum Dis 2000;59:178-82.
24. Birrell F, Croft P, Cooper C, Hosie G, Macfarlane GJ, Silman A. Radiographic change is common in new presenters in primary care with hip pain. Rheumatology 2000;39:772-5.