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Osteoarthritis of the hip and occupational activity

by Peter Croft, MRCP¹, Cyrus Cooper, MRCP², Carol Wickham, MSc¹, David Coggon MRCP¹

CROFT P, COOPER C, WICKHAM C, COGGON D. Osteoarthritis of the hip and occupational activity. *Scand J Work Environ Health* 1992;18:59-63. This case-referent study investigated the relation between hip osteoarthritis and occupational activity. The subjects were 60- to 75-year-old men who had undergone intravenous urography. Interviews were obtained for 245 cases who had a hip replacement for osteoarthritis or a joint space of ≤ 2.5 mm and 294 referents whose joint space was ≥ 3.5 mm in both hips. No clear associations were found in an analysis of all the cases, but severe disease (hip replacement for osteoarthritis or a joint space of ≤ 1.5 mm) was more common in the farmers, especially in those with ≥ 10 years in agricultural work [odds ratio (OR) 2.0, 95% confidence interval (95% CI) 0.9-4.4]. Severe disease was also associated with prolonged standing at work (OR 2.7, 95% CI 1.0-7.3) and heavy lifting (OR 2.5, 95% CI 1.1-5.7). These associations could not be explained by obesity or sporting activity. The findings suggest an increased risk of degenerative hip disease for farmers and indicate that mechanical overloading may contribute to its pathogenesis.

Key terms: hip, occupational diseases, osteoarthritis, risk factors, sports.

The repetitive use and excessive mechanical loading of certain joints appear to cause osteoarthritis. Thus, for example, cotton mill workers are unusually prone to degenerative change in the joints of their fingers (1), and osteoarthritis of the knee is associated with weight bearing and bending of the knee at work (2). The contribution of mechanical stress to osteoarthritis of the hip is, however, less certain. A survey of patients with asymmetrical paralysis of the lower limbs following poliomyelitis showed a lower prevalence of hip osteoarthritis on the weaker side (3). But examinations of runners and ballplayers who stress their hips in the course of their sport have produced conflicting findings, some studies indicating high rates of osteoarthritis (4-5) and others no such increased risk (6-9).

Occupation is an important determinant of cumulative stress on the hip joint, but few studies have examined the relation of hip osteoarthritis to occupation. Cross-sectional surveys of industrial populations have suggested that risk differs little for manual and non-manual workers (10, 11). However, people with severe disease may have been selected out from the most physically demanding jobs, and the findings cannot therefore be regarded as conclusive. When occupations have been classified more specifically, the most consistent observation has been an increased prevalence among agricultural workers (12-16). If real, this association could provide clues to the pathogenesis of

the disease. We have therefore carried out a case-referent study of osteoarthritis of the hip and occupation, looking particularly at risk in relation to farming and at occupational activities which might explain an association with agricultural work.

Subjects and methods

The cases and referents were ascertained through the radiology departments of the North Staffordshire and Shrewsbury hospitals. From X-ray registers we identified all men who had had an outpatient intravenous urogram during 1982-1987 and who were aged 60-75 years at the time of the examination. Most of these examinations were performed for prostatic symptoms. We then assessed their hip joints from the reference or postmicturition film. A radiograph was excluded if neither hip could be adequately visualized. If a patient had been examined more than once during the study period, the earliest suitable radiograph was used.

We took as cases those men who had had a total hip replacement for osteoarthritis and those in whom the shortest distance between the femoral head and the acetabular roof (the "minimal joint space") was less than or equal to 2.5 mm in at least one hip. Within this group we defined a subset of "severe" cases with a hip replacement or a minimal joint space of less than or equal to 1.5 mm in at least one hip. Our reference group comprised those men whose minimal joint space was greater than or equal to 3.5 mm in both hips and who showed no other radiographic evidence of osteoarthritis (ie, no osteophytes, no cysts, and no subchondral sclerosis of more than 5 mm in thickness).

The cases and referents were approached through their general practitioners to exclude those who had died since their radiographic examination and those

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who were too ill to be seen. The men who agreed to participate were interviewed in their homes by a single interviewer (PC), who was unaware of their status as a case or a referent. The information sought included a lifetime occupational history with details of whether or not jobs involved each of 12 specified activities, and a history of sports and hobbies pursued since leaving school. Heights were measured with a Harpenden stadiometer, and weights with portable scales (Seca).

The subjects' occupations were coded according to the 1970 classification of the Office of Population Censuses and Surveys (17), and the subjects were grouped according to how long they had worked in each of eight occupational categories before the radiographic exami-

nation. These categories were selected to cover the most commonly reported jobs in the study sample and were defined before any comparisons were made between the cases and referents. In the analysis of occupational activities, the subjects were classified according to how long they had been exposed to each activity. The durations of exposure were grouped into two or three levels, which again were defined before any case-referent comparisons.

The odds ratios (OR) for associations with osteoarthritis were estimated by logistic regression with adjustment for age at the time of the radiographic examination (60–64, 65–69, and 70–75 years) and hospital group (North Staffordshire, Shrewsbury).

Results

From the radiographs we identified 353 cases and 434 referents, of whom 245 cases (69%) and 294 referents (68%) were interviewed. The reasons for the incomplete response are summarized in table 1. One hundred and fifty-three interviewed cases were from North Staffordshire and 92 were from Shrewsbury. They included 53 severe cases, of whom seven had had hip replacements for osteoarthritis.

Table 2 shows the relation between osteoarthritis of the hip and the most frequently reported occupations

Table 1. Numbers of cases and referents interviewed and reasons for incomplete response.

	Cases	Referents
Subject untraceable	17	22
Subject dead or too ill for interview	38	57
Subject declined interview	36	44
No interview for other reasons	7	10
Interview unsatisfactory (eg, because subject was confused)	10	7
Interview satisfactorily completed	245	294

Table 2. Associations between osteoarthritis of the hip and selected occupations.^a (OR = odds ratio, 95% CI = 95% confidence interval)

Occupation ^b	Referents (N)	All cases			Severe cases		
		N	OR	95% CI	N	OR	95% CI
Farmers and agricultural workers (002, 003)	65	52	0.9	0.6–1.4	19	1.6	0.8–3.1
Underground coal miners (007)	33	22	0.8	0.4–1.4	3	0.6	0.2–2.3
Ceramics makers and laborers (013–017, 112)	49	42	1.0	0.6–1.6	8	1.2	0.5–3.0
Construction workers and laborers (093–098, 113)	37	35	1.2	0.7–1.9	9	1.5	0.7–3.4
Truck, bus and car drivers (120–122)	51	41	0.9	0.6–1.4	11	1.1	0.5–2.4
Warehousemen (136)	27	26	1.1	0.6–1.9	6	1.3	0.5–3.5
Clerks (139)	49	38	0.9	0.6–1.5	9	1.1	0.5–2.4
Shop workers (143–144)	31	28	1.2	0.7–2.1	3	0.6	0.2–2.1

^a Odds ratios were estimated for each occupation independently, with adjustment for age and hospital group. They are for men who worked in the occupation for at least one year relative to those who did not.

^b Code of the Classification of Occupations of the Office of Population Censuses and Surveys (17) in parentheses.

Table 3. Associations between osteoarthritis of the hip and lifetime duration of employment in farming and construction work.^a (OR = odds ratio, 95% CI = 95% confidence interval)

Occupation	Referents (N)	All cases			Severe cases		
		N	OR	95% CI	N	OR	95% CI
Farmers and agricultural workers							
<1 year of employment	229	193	1	·	34	1	·
1–9 years of employment	28	19	0.8	0.4–1.5	4	1.0	0.3–3.1
≥10 years of employment	37	33	1.0	0.6–1.8	15	2.0	0.9–4.4
Construction workers and laborers							
<1 year of employment	257	210	1	·	44	1	·
1–9 years of employment	13	20	1.9	0.9–4.0	7	3.3	1.2–9.2
≥10 years of employment	24	15	0.8	0.4–1.5	2	0.5	0.1–2.3

^a Odds ratios were estimated for each occupation independently, with adjustment for age and hospital group.

in the study sample. A comparison of all the cases with all the referents did not point to any occupational associations, but, when the analysis was restricted to severe cases, the odds ratio was moderately elevated for those who had worked for at least one year as a farmer or agricultural worker (OR 1.6) or as a construction worker or laborer (OR 1.5). To explore these associations further, we calculated the odds ratios according to the length of employment in each job (table 3). There was no evidence of a dose-response effect in relation to construction work, but among the

farmers and agricultural workers the risk of severe disease was highest for those who had been in the job for more than 10 years (OR 2.0, 95% CI 0.9–4.4).

Table 4 illustrates the relation between osteoarthritis of the hip and the duration of exposure to occupational activities. The analysis using all of the cases showed significant associations with work that entailed standing for more than 2 h/d, but otherwise was unremarkable. When attention was restricted to severe cases, a more interesting pattern emerged. Again risk was increased for the men whose jobs had required

Table 4. Associations between osteoarthritis of the hip and lifetime duration of exposure to occupational activities.^a (OR = odds ratio, 95% CI = 95% confidence interval)

Occupational activity	Referents (N)	All cases			Severe cases		
		N	OR	95% CI	N	OR	95% CI
Sitting for >2 h/d							
<1 year of exposure	78	59	1	·	14	1	·
1–19 years of exposure	91	67	1.1	0.7–1.7	16	1.0	0.4–2.2
≥20 years of exposure	114	103	1.2	0.8–1.8	18	0.8	0.3–1.7
Standing for >2 h/d							
<20 years of exposure	59	34	1	·	5	1	·
20–39 years of exposure	78	67	1.8	1.0–3.1	10	1.5	0.5–4.8
≥40 years of exposure	147	131	1.7	1.0–2.8	36	2.7	1.0–7.3
Bending for >2 h/d							
<1 year of exposure	58	55	1	·	9	1	·
1–19 years of exposure	101	58	0.7	0.4–1.1	10	0.8	0.3–2.0
≥20 years of exposure	100	99	1.2	0.7–1.9	27	1.9	0.8–4.5
Kneeling for >30 min/d							
<1 year of exposure	170	154	1	·	33	1	·
1–19 years of exposure	48	26	0.6	0.4–1.0	4	0.5	0.2–1.4
≥20 years of exposure	26	17	0.7	0.4–1.3	4	1.0	0.3–3.2
Squatting for >30 min/d							
<1 year of exposure	208	174	1	·	35	1	·
≥1 year of exposure	30	16	0.7	0.4–1.4	5	1.3	0.4–3.6
Walking >2 miles/d (3.2 km/d)							
<1 year of exposure	32	32	1	·	4	1	·
1–19 years of exposure	97	80	0.8	0.5–1.5	16	1.4	0.4–4.6
≥20 years of exposure	146	117	0.8	0.5–1.5	31	1.6	0.5–5.1
Walking >2 miles/d (3.2 km/d) over rough ground							
<1 year of exposure	146	115	1	·	18	1	·
1–19 years of exposure	63	60	1.2	0.7–1.8	17	2.0	0.9–4.3
≥20 years of exposure	55	43	1.0	0.6–1.6	14	1.9	0.9–4.1
Running for >1 h/d							
<1 year of exposure	259	218	1	·	49	1	·
≥1 year of exposure	10	10	1.3	0.5–3.3	1	0.5	0.1–4.2
Climbing ladders							
<1 year of exposure	168	151	1	·	29	1	·
1–19 years of exposure	64	52	0.9	0.6–1.4	9	0.8	0.3–1.8
≥20 years of exposure	32	23	0.8	0.5–1.5	9	1.6	0.7–3.8
Climbing >30 flights of stairs/d							
<1 year of exposure	199	172	1	·	37	1	·
≥1 year of exposure	61	53	1.0	0.6–1.5	13	1.2	0.6–2.5
Lifting or moving weights >56 lbs (>25.4 kg) by hand							
<1 year of exposure	71	62	1	·	9	1	·
1–19 years of exposure	106	80	0.9	0.6–1.4	14	1.2	0.5–2.9
≥20 years of exposure	85	82	1.2	0.7–1.9	26	2.5	1.1–5.7
Driving for >4 h/d							
<1 year of exposure	195	170	1	·	33	1	·
≥1 year of exposure	79	58	0.8	0.5–1.2	14	0.9	0.4–1.8

^a Odds ratios were estimated for each activity independently, with adjustment for age and hospital group.

them to stand for more than 2 h/d, particularly if they had done this work for at least 40 years (OR 2.7, 95% CI 1.0–7.3). There was also a significant association with employment for more than 20 years in jobs that entailed heavy lifting (OR 2.5, 95% CI 1.1–5.7). Weaker associations were found with work that involved walking more than 2 miles/d (3.2 km/d), particularly if this walking was over rough ground.

The most frequently reported sports activities were soccer, cricket, tennis, and running, but none of these sports was significantly associated with osteoarthritis, whether it was defined to include all cases or only more severe disease. The risk of more severe osteoarthritis increased with body mass index, but again not to the point of statistical significance. The odds ratio for the highest third of the distribution (>27.5 kg/m²) relative to the lowest third (<24.7 kg/m²) was 1.6 (95% CI 0.7–3.4).

The associations with occupational exposure to standing, walking, walking over rough ground, and heavy lifting changed little with allowance for body mass index and participation in soccer, cricket, tennis, and running. They were, however, interrelated. Thus, when the four activities were examined in a single regression model, again with allowance for body mass index and sports, the risk estimates were generally lower than those shown in table 4. Severe disease was the most strongly associated with more than 20 years of exposure to heavy lifting (OR 2.1, 95% CI 0.7–6.6) and more than 40 years of exposure to standing (OR 1.6, 95% CI 0.5–5.1).

Discussion

In this study our main diagnostic criterion for hip osteoarthritis was joint space narrowing. We have previously shown that minimal joint space is a repeatable measure which correlates with other radiographic features of the disease and with symptoms (18). Its distribution in our sample of urological patients, however, was unimodal, and there was therefore no natural cut-off by which to define the cases. Our choice of 2.5 mm (the tenth centile in the original sample of radiographs) was arbitrary, and the dearth of associations when the disease was classified in this way suggests that the definition may have been too wide. The tighter cut-off of 1.5 mm (2.7% of hips) gave a more specific measure of disease, as evidenced by stronger associations with other radiographic changes of osteoarthritis and a higher predictive value for hip pain (56.0% compared with 28.3%) (18).

By using intravenous urograms as our source of cases and referents, we avoided the bias that is possible when cases are patients who present themselves for diagnosis or treatment of hip symptoms. Some occupational groups may be more inclined to seek medical advice for a given level of disease because it is more of a handicap to them in their work. However, there

is no reason why the relative prevalence of osteoarthritis in such occupations should be overrepresented in a sample of urological patients.

Although the number of cases with severe disease was small, our data support earlier studies which have suggested that osteoarthritis of the hip is more common among farmers (12–16). The risk of severe disease for the men with more than 10 years of employment in agriculture was doubled. No other occupation showed a comparable association. Against these positive findings, Lawrence (19) reported no excess of degenerative hip disease among agricultural workers in radiographic surveys of rural populations in England, Germany, and Switzerland, but the numbers of subjects in the relevant age groups were small.

Various mechanisms have been proposed to explain the apparently increased risk of osteoarthritis of the hip among farmers, including stress on the hip joint from heavy lifting and walking over rough ground (14, 20). Our data accord with the latter hypothesis in that severe disease was associated with standing, walking and lifting at work, and these associations could not be explained by a confounding effect of obesity or sporting activity. In the only other study to examine the relation of hip osteoarthritis to specific workplace activities, heavy lifting but not prolonged standing was associated with degenerative changes in the joint (14). In studies using broader classifications of occupational activity, associations with heavy physical work have been less consistent (11, 13, 21, 22). We did not ask about work with machinery, but earlier studies have found that tractor driving for long periods carried an elevated risk of hip osteoarthritis (14, 16, 20). Other possible explanations for the link with farming include a high incidence of infection or childhood hip disorders such as slipped capital epiphysis in agricultural workers. Brucellosis, for example, can cause osteoarthritic change in the hip (23), and slipped epiphysis is more common in rural than in urban areas (24).

The occupational activities which were positively associated with hip osteoarthritis in this study tended to occur together in the same jobs. Given the relatively small number of severe cases, it is therefore not possible to determine which of these activities were of prime importance. Furthermore it is possible that other physical activities that we examined failed to show positive associations because of a lack of statistical power. Larger investigations will be necessary to resolve these questions.

The other determinants of joint stress assessed in this study were leisure activity and body mass index. Most studies of top athletes and sportsmen have found no increase in the occurrence of osteoarthritis of the hip (6–9). These findings agree with our own findings and suggest that sport is unlikely to contribute greatly to the burden of disease in the general population.

A high body mass index is a strong risk factor for knee osteoarthritis (25), but studies of hip osteoarthritis

have indicated only a weak association with obesity (10) or one confined to certain subgroups of patients (26, 27) or no relationship at all (28, 29). Our finding of a modest elevation of risk of severe osteoarthritis in the heaviest third of the subjects is consistent with results of a prospective study suggesting that elevated body mass index may influence the progression of established osteoarthritis rather than disease onset (21). As with sport, however, it appears unlikely that obesity can explain much of the burden of degenerative hip disease among the older male population.

The pathogenesis of osteoarthritis at different joint sites broadly depends on the interplay between a generalized susceptibility to the disorder and local mechanical abnormalities. There is ample laboratory evidence supporting a role for mechanical stress in the disease, although whether the stress acts primarily on bone or cartilage is in dispute (30). The relative importance of repetitive use, abnormal use, and overloading is also unclear. This study provides further evidence implicating mechanical overloading in the etiology of osteoarthritis of the hip.

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