OSTEO-ARTHROSIS AND DISK DEGENERATION IN AN URBAN POPULATION*

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This study of osteo-arthritis, or degenerative joint disease, is based on the same survey material as the corresponding paper on rheumatoid arthritis (Kellgren and Lawrence, 1956). A one-in-ten random sample of the population aged 55-64 years in the Lancashire town of Leigh was studied clinically, radiologically, and serologically for all forms of arthritis. After a detailed clinical examination of the joints, routine x rays were taken of the hands, feet, pelvis, knees, and cervical and lumbar spine, and a blood sample was taken for the sheep cell agglutination test (SCAT). The clinical and radiological part of the survey was 79 per cent. complete. In a previous survey of rheumatic complaints made in the town of Leigh in 1949-50, osteo-arthritis was diagnosed on clinical grounds more frequently than any other form of rheumatism (Kellgren, Lawrence, and Aitken-Swan, 1953). The prevalence of complaints attributable to osteo-arthritis was exceptionally high in females over 50 years of age, and in this sex was more often polyarticular and was less closely associated with trauma or occupation than in males. A separate study of patients seen at the University Rheumatism Clinic had shown that women frequently suffer from a polyarticular form of osteo-arthritis which has a distinct symptomatology, course, and pattern of joint involvement. This condition has been described as "primary generalized osteo-arthritis" (Kellgren and Moore, 1952). The present study was designed to obtain more precise information about this condition, and to investigate causative factors in osteo-arthritis in general.

For details of sampling and for the method of conducting the survey, the paper on rheumatoid arthritis should be consulted. At the clinical examination all persons seen were given a grading for rheumatoid arthritis and for local and generalized osteo-arthritis. The x rays were later read by two observers in consultation. Problems of observer

error and observer difference in reading x rays for rheumatic disorders have been discussed in previous papers (Kellgren and Lawrence, 1952; Lawrence, 1955; Kellgren and Bier, 1956). The particular problems of observer difference in relation to osteo-arthritis and the standard gradings used for radiological osteo-arthritis in this study have been described elsewhere (Kellgren and Lawrence, 1957).

In reading x rays of the spine, the classification of Collins (1949) has been followed; the term osteo-arthritis is confined to disease in the apophyseal joints, whereas osteophytosis of vertebral bodies and narrowing of disk spaces are referred to as disk degeneration.

In determining the number of joints affected by osteo-arthritis each type of joint was considered as a group. Thus the distal interphalangeal joints of the fingers of both hands were considered as one group, the knees as another, and the apophyseal joints of the cervical spine as a third. In each group, osteo-arthritis was divided into five grades of severity (0 to 4) as in previous papers, the worst joint in the group being used to assess the grading.

Results

Prevalence of Osteo-Arthritis and Disk Degeneration

In the 55-64 age group, some radiological evidence of osteo-arthritis was almost universal (Table I, opposite).

Of those who attended for x ray, 83 per cent. of males and 87 per cent. of females had radiological evidence of osteo-arthritis in one or other of the joints x rayed. The actual prevalence in the population, however, may have been slightly lower than this since there were fewer persons with rheumatic pain amongst the refusals than in those attending for x ray. The proportions are, therefore, assessed both from the total population sample and from the total of those attending for x ray, thus giving a "minimal" and "maximal" prevalence. The true proportion should fall between these values.

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TABLE I
PREVALENCE OF RADIOLOGICAL OSTEO-ARTHROSIS AND DISK DEGENERATION IN A
RANDOM SAMPLE OF 204 MALES AND 277 FEMALES AGED 55-64

Type of Affection		Males				Females				Maximal Prevalence
		Total No. X-rayed	Grades 2-4			Total No. X-rayed	Grades 2-4			Significance of Difference between Sexes (P)
			No.	in per cent. of Total			No.	in per cent. of Total		
				X-rayed: Maximal	Sample: Minimal			X-rayed: Maximal	Sample: Minimal	
Osteo-arthritis	Total	173	143	83	70	207	183	88	66	<0.12
	More than three Joint Groups	173	51	29	25	207	97	47	35	<0.001
	With Symptoms ..	173	73	42	35	207	121	58	44	<0.003
Disk Degeneration		170	141	83	69	201	145	72	52	<0.02

N.B.—As set out in this Table, maximal prevalences have been calculated as a percentage of the total attending for x ray, and minimal prevalences as a percentage of the total in the sample. Significances in this paper are assessed from χ^2 , using either the 2×2 table, with correction for continuity where required, or Yates' comparison of mean scores.

Only if the refusals had more osteo-arthritis than the respondents would the true prevalence be greater than "maximum" as here stated.

The proportion of individuals with some osteo-arthritis was not markedly greater in females than in males, but osteo-arthritis in multiple joints was more frequent in females. Disk degeneration on the other hand was more frequent in males.

With a view to elucidating the factors responsible for this sex difference, the pattern of joint involvement was studied.

Pattern of Joint Involvement

The proportion of each group of joints affected by osteo-arthritis is illustrated in Fig. 1 (see also Table II, overleaf). Some joints are almost universally affected whereas others are almost completely spared.

In males cervical and lumbar disk degeneration completely overshadowed osteo-arthritis even of joints so commonly affected as the distal interphalangeals, but in females disk degeneration had a similar frequency to osteo-arthritis of the fingers.

A certain pattern of joint involvement was common to both sexes, but there were also sex differences. Thus the distal interphalangeal joints of the fingers and first metatarsophalangeal joints of the feet were most commonly affected in both sexes, but beyond this the pattern was quite different. The females had far more osteo-arthritis in the distal and proximal interphalangeal joints of the fingers, in the first carpometacarpal joints, and in the metatarsophalangeal joints. The males had more involvement of the wrists and hips. Certain other differences were suggestive, notably the increased affection of the knees and sacro-iliac joints in females. When only those with moderate or severe grades are

Fig. 1.—Pattern of osteo-arthritis and disk degeneration in males and females.

Each column represents the proportion of groups of joints x rayed which showed radiological signs of osteo-arthritis or disk degeneration. The grade recorded is that of the most severely affected joint in each group.

considered, disk degeneration was still more prevalent in males, but the sex difference for osteo-arthritis was in general less marked. Females, however, still had more disease in the distal and proximal interphalangeal and first carpometacarpal joints of the hands, in the knees, and in the metatarsophalangeal joints of the feet, and the males more in the metacarpophalangeal joints, wrists, and hips.

TABLE II
JOINT PATTERN OF RADIOLOGICAL OSTEO-ARTHRITIS AND DISK DEGENERATION

Joints Affected				Males		Females			
				Total x-rayed	Grade		Total x-rayed	Grade	
					2-4	3-4		2-4	3-4
Osteo-arthritis	D.I.P.	Hands	173	71	19	206	128	35	
	P.I.P.		173	30	4	206	82	25	
	M.P.		173	40	11	206	42	3	
	First C.M.C.		173	33	11	206	69	33	
	Wrists	172	17	3	205	9	0		
	Cervical Spine	170	45	6	201	45	6		
	Lumbar Spine	165	49	13	193	53	14		
	Hips	167	31	14	191	23	6		
	Sacro-iliac Joints	164	9	2	191	20	3		
	Knees	171	51	19	199	81	30		
	Tarsi	173	9	2	206	15	6		
	Lateral M.P.	Feet	173	4	0	206	18	2	
	First M.P.		173	61	15	206	104	36	
		Total	173	143	75	207	183	97	
Disk Degeneration	Cervical Spine	170	116	70	201	124	55		
	Lumbar Spine	165	109	38	193	86	25		

N.B.—The shoulders, elbows and ankles were not routinely x rayed. No assessment of the prevalence of osteo-arthritis in these joints is therefore possible.

It would thus appear likely, on the grounds both of total prevalence and of pattern of joint involvement, that the factors producing osteo-arthritis are not identical in the two sexes. With a view to elucidating this further, the effect of known causative factors, such as injury, occupation, and body weight, were considered in relation to sex and joint pattern.

Injury.—In a proportion of those with osteo-arthritis, there was either a history of previous trauma or radiological evidence of an injury. The prevalence of traumatic osteo-arthritis so defined in males and females is compared in Fig. 2 and Table III.

Fig. 2.—Pattern of osteo-arthritis and disk degeneration recorded as being related to injury in males and females.

TABLE III
INJURY IN RELATION TO RADIOLOGICAL OSTEO-ARTHRITIS AND DISK DEGENERATION

Joints Affected				Males			Females		
				Total x-rayed	Related to Injury Only		Total x-rayed	Related to Injury Only	
					Grade 2-4	Grade 3-4		Grade 2-4	Grade 3-4
Osteo-arthritis	D.I.P.	} Hands	173	4	2	206	1	1	
	P.I.P.		173	1	1	206	1	1	
	M.P.		173	3	2	206	0	0	
	C.M.C.		173	5	1	206	2	1	
	Wrists		172	2	1	205	0	0	
	Cervical Spine		170	0	0	201	0	0	
	Lumbar Spine		165	11	1	193	3	0	
	Hips		167	4	2	191	3	1	
	Sacro-iliac Joints		165	0	0	191	0	0	
	Knees		171	21	13	199	18	8	
	Tarsi		173	5	1	206	1	0	
	Lateral M.P.	} Feet	173	1	0	206	1	1	
	First M.P.		173	3	2	206	2	1	
		Total		173	60	26	207	31	14
Disk Degeneration	Cervical Spine		170	8	3	201	0	0	
	Lumbar Spine		165	16	2	193	2	1	

Our previous study had shown that a history of injury was more frequently encountered in males. In the present study, 35 per cent. of the males and 15 per cent. of the females were found to have osteo-arthritis at the site of an injury. In both sexes the knees most frequently showed this association and indeed few females had traumatic osteo-arthritis at any other site. In males, the lumbar spine was frequently involved, and though disk degeneration was more commonly associated with back injury, osteo-arthritis was also often found in those with such a history, usually in conjunction with disk degeneration. Less frequent sites of post-traumatic osteo-arthritis in males were the first carpometacarpal joints and the tarsi. The shoulders and elbows were not x rayed as a routine in this study, but symptoms and signs of osteo-arthritis were not uncommonly encountered in association with a history of injury in both these joints.

A comparison of the joint pattern of post-traumatic osteo-arthritis with the general pattern makes it clear that trauma produces a distinctive pattern and is an important factor in males. Indeed, in men, trauma was associated with osteo-arthritis in about half of the affected knees and tarsal joints, and in a proportion of certain other joints, such as the lumbar spine, hips, wrists, and first carpometacarpals, and this association was most prominent when the osteo-arthritis was of moderate or severe degree. Injury, however, appeared to have a negligible influence on the general pattern of osteo-arthritis in females, and did not explain the more frequent multiple joint involvement in this sex.

Occupation.—The data in Table IV refer to predominant occupation and not necessarily to employment at the time of the survey.

In this sample of males, both the 74 miners and the eighteen cotton workers had more osteo-arthritis than the 81 men engaged in other miscellaneous occupations, but the joints affected were different in these two occupational groups.

In the miners the lumbar spine and knees were significantly more affected ($P < 0.01$) and the hips and metacarpophalangeal joints showed a suggestive trend. The most striking feature in the miners, however, was the excess of lumbar disk degeneration ($P < 0.003$). These findings are in agreement with our previous results (Kellgren and Lawrence, 1952). In the cotton workers all the small joints of the hands and the cervical spine appeared to be more frequently affected, but the number of cotton workers was too small for the observed differences to reach accepted levels of significance except in the first carpometacarpal joints ($P < 0.01$).

The miscellaneous group was made up of small numbers of men engaged in a wide variety of occupations which could not usefully be analysed.

In the females of this age group, domestic work overshadowed all other types of work and was the predominant occupation in 130 (63 per cent.). Even in those whose occupation had been predominantly non-domestic, household chores probably occupied a large part of their time. It is therefore not surprising that the pattern of osteo-arthritis in housewives was almost identical with the pattern found in all females and that no significant differences were

TABLE IV

PREDOMINANT OCCUPATION IN RELATION TO RADIOLOGICAL OSTEO-ARTHRITIS AND DISK DEGENERATION

Joints Affected		Males									Females								
		Miners			Cotton Workers			Others			Domestic			Cotton Workers			Others		
		Grade 2-4		No. x-rayed	Grade 2-4		No. x-rayed	Grade 2-4		No. x-rayed	Grade 2-4		No. x-rayed	Grade 2-4		No. x-rayed	Grade 2-4		No. x-rayed
		No.	%		No.	%		No.	%		No.	%		No.	%		No.	%	
Osteo-arthritis	D.I.P. } Hands	74	33	45	18	10	56	81	28	35	130	80	62	50	32	64	26	16	62
	P.I.P. }	74	14	19	18	6	33	81	10	25	130	49	38	50	24	48	26	9	35
	M.P. }	74	20	27	18	6	33	81	14	17	130	26	20	50	9	18	26	7	27
	C.M.C. }	74	13	18	18	8	44	81	12	15	130	41	52	50	20	40	26	8	31
	Wrists ..	73	8	11	18	2	11	81	7	9	129	5	4	50	3	6	26	1	4
	Cervical Spine ..	74	19	26	17	7	41	79	19	24	128	24	19	48	12	25	25	9	36
	Lumbar Spine ..	71	29	41	17	4	24	77	16	21	124	33	27	45	15	33	24	5	21
	Hips ..	73	15	21	17	3	18	77	13	17	122	13	11	45	4	9	24	6	25
	Sacro-iliac Joints ..	72	4	6	17	1	6	75	4	5	122	12	10	45	6	13	24	2	8
	Knees ..	74	31	42	17	4	24	80	16	20	127	56	44	47	15	32	25	10	40
	Tarsi ..	74	1	1	18	1	6	81	7	9	129	9	7	50	4	8	27	2	7
	Lateral M.P. } Feet ..	74	2	3	18	1	6	81	1	1	129	12	9	50	4	8	27	2	7
	First M.P. }	74	26	35	18	7	39	81	28	35	129	61	47	50	29	58	27	14	52
	Total ..	74	65	88	18	17	95	81	60	74	130	114	88	50	45	90	27	24	89
Disk Degeneration	Cervical Spine ..	74	51	70	17	14	83	79	51	65	128	78	61	48	30	62	25	16	64
	Lumbar Spine ..	71	56	79	17	11	65	77	42	55	123	58	47	46	17	37	24	11	46

found between the housewives and the women who were working outside the home.

Obesity.—An association between osteo-arthritis and obesity was indicated by the findings of Fletcher and Lewis-Faning (1945). In the present study obesity was assessed from standard height/weight tables (Abrahams and Widdowson, 1940), those more than 10 per cent. above average weight being classified as obese. On this basis, 27 per cent. of

the males and 44 per cent. of the females were considered to be overweight. The pattern of osteo-arthritis in obese individuals (Fig. 3 and Table V) differed in several respects from that in the remainder of the population. In both sexes the metatarsophalangeal joint of the great toe was more commonly affected by osteo-arthritis in the obese ($P < 0.004$ in males, <0.01 in females). The knee joint was affected more than twice as often in obese females

Fig. 3.—Pattern of osteo-arthritis and disk degeneration in obese and non-obese males and females.

TABLE V
OBESITY IN RELATION TO RADIOLOGICAL OSTEO-ARTHRITIS AND DISK DEGENERATION

Joints Affected		Males						Females					
		Obese			Non-Obese			Obese			Non-Obese		
		No. x rayed	Grade		No. x rayed	Grade		No. x rayed	Grade		No. x rayed	Grade	
Osteo-arthritis	D.I.P.	46	27	6	127	44	13	86	54	17	120	74	18
	P.I.P.	46	12	2	127	18	2	86	38	13	120	44	12
	M.P.	46	13	4	127	27	7	86	20	1	120	22	2
	C.M.C.	46	8	4	127	25	7	86	33	15	120	36	18
	Wrists	45	4	2	127	13	1	85	4	0	120	5	0
	Cervical Spine	46	14	3	124	31	3	85	19	2	116	26	4
	Lumbar Spine	45	19	8	120	30	5	81	27	8	112	26	5
	Hips	46	9	6	121	22	8	80	12	1	111	11	5
	Sacro-iliac Joints	45	0	0	119	9	2	81	7	1	110	13	2
	Knees	46	18	11	125	33	8	84	51	24	115	30	6
	Tarsi	46	3	1	127	6	1	86	11	5	120	4	1
	Lateral M.P.	46	2	0	127	2	0	86	10	1	120	8	1
	First M.P.	46	25	3	127	36	12	86	53	21	120	51	15
Total		46	40	26	127	102	35	87	80	48	120	101	49
Disk Degeneration		46	36	18	124	80	52	85	53	22	116	71	33
		45	29	14	120	79	24	81	38	14	112	48	11

($P < 0.000,01$) and was also more often affected in obese males, the difference being greatest in severe grades of change ($P < 0.004$). The lumbar spine was also more commonly affected by osteoarthrosis in males ($P < 0.05$). A surprising finding was that, in obese males, the distal interphalangeal joints of the fingers were more affected ($P < 0.01$). This did not apply to obese females, but the joint pattern in obese males resembled that in the total females.

Rheumatoid Arthritis

This is frequently mentioned as a causative factor in osteoarthrosis. In this series clinical rheumatoid arthritis or past polyarthritis was associated with an increased prevalence of osteoarthrosis in some joints, for example the carpometacarpal joints, wrists, and lumbar spine in males, and the knees in females; there was less in other joints and none of the differences were significant statistically. Nor was the number of joints affected by osteoarthrosis in females greater in those with either clinical or radiological evidence of rheumatoid arthritis or a positive sheep cell test. There was, however, in males a trend towards osteoarthrosis of multiple joints in those with clinical or radiological evidence of rheumatoid arthritis, but no clear relationship between the results of the sheep cell test and osteoarthrosis. It may be concluded, therefore, that rheumatoid arthritis does not affect appreciably the general pattern of osteoarthrosis in females of this age group, but may do so to some extent in males.

Paget's Disease

Radiological evidence of this condition in the parts x rayed in this series was encountered in thirteen males and two females. The prevalence was thus 8 per cent. in males and 1 per cent. in females. All those with Paget's disease had osteoarthrosis. It may be concluded, therefore, that rheumatoid arthritis does not affect appreciably the general pattern of osteoarthrosis in females of this age group, but may do so to some extent in males.

Mechanical Factors

Congenital deformities were rarely encountered in this series. Congenital dislocation of the hip, sacralization of the 5th lumbar vertebra, and short 4th and 5th metacarpals were each encountered once, and spondylolisthesis was seen eleven times (in eight females and three males). Of those with spondylo-

listhesis, eight had osteoarthrosis of the lumbar spine; more than in the general population sample.

Hallux valgus was encountered in greater or less degree in most of the sample. Only the more severe degrees were related to osteoarthrosis of the first metatarsophalangeal joint.

It may be concluded that deformities of sufficient grade to predispose to osteoarthrosis are too infrequent to affect the general pattern of the disease.

Constitutional Factor

Stecher (1955) has produced evidence that the digital nodes described by Heberden (1802) are inherited as a single autosomal gene, dominant in females and possibly recessive in males. An association between Heberden's nodes and osteoarthrosis of multiple joints has long been recognized, having been observed by Haygarth (1805). As this condition is commoner in middle-aged women it was labelled "menopausal" by Cecil and Archer (1926), but Kellgren and Moore (1952) found no accurate correlation with the menopause. Stecher found no evidence of an association between Heberden's nodes and osteoarthrosis elsewhere, but his investigation was based on a clinical examination.

Table VI, and Fig. 4 (overleaf), suggest a definite association between clinical Heberden's nodes and radiological evidence of multiple osteoarthrosis in both sexes, though this is most marked in the females. If we compare the distribution of radiological signs of osteoarthrosis in multiple joints in individuals with definite clinical nodes and in those who have no nodes or only doubtful clinical changes, the association between Heberden's nodes and radiological signs of multiple osteoarthrosis is highly significant ($P < 0.003$ in males and < 0.00000001 in females).

TABLE VI
CLINICAL HEBERDEN'S NODES AND JOINT GROUPS
SHOWING RADIOLOGICAL OSTEO-ARTHRISIS

No. of Joint Groups showing Radiological Osteoarthrosis	Males			Females		
	X-rayed	Heberden's Nodes		X-rayed	Heberden's Nodes	
		Absent	Present		Absent	Present
0-2	99	90	9	79	71	8
3-5	52	40	12	97	60	37
6+	22	7	15	31	8	23
Total	173	137	36	207	139	68

The reason for the discrepancy between our own results and those of Stecher is probably due to our different approach to the problem. Whereas

Fig. 4.—Relationship between definite Heberden's nodes, as recorded at the clinical examination, and the number of groups of joints showing definite radiological signs of osteo-arthritis in males and females.

Stecher used a clinical approach, we have assessed osteo-arthritis radiologically. Since the anatomical changes of osteo-arthritis are only occasionally associated with appropriate symptoms, the majority of these changes would remain unrecognized in the type of clinical study conducted by Stecher. The radiological method used by us, on the other hand, readily demonstrates all except the earliest anatomical changes of osteo-arthritis.

The pattern of joint involvement in males and females with and without radiological signs of osteo-arthritis of the distal interphalangeal joints of the fingers is shown in Table VII and Fig. 5 (opposite).

The individuals with osteo-arthritis of the distal interphalangeal joints clearly also have much more osteo-arthritis of all the other joints, this association being specially pronounced in females. In both sexes this association is most marked in the small joints of the hands and feet, the interfacetal joints of the cervical and lumbar spine, and the knees. This corresponds well with the picture of generalized osteo-arthritis described previously (Kellgren and Moore, 1952).

In males disk degeneration shows no such association with osteo-arthritis of the distal interphalangeal joints, but females with osteo-arthritis of the distal interphalangeal joints do have some excess of disk degeneration in the lumbar spine and also of osteo-arthritis in the sacro-iliac joints.

Discussion

The main findings which emerge from this study are that osteo-arthritis when present usually affects many joints and has a rather characteristic pattern of joint involvement. The pattern of joint involvement, the severity of the changes in the individual joints, and the number of joints affected, are all more pronounced in females than in males. These findings suggest that a major factor in the causation of osteo-arthritis may be some sex-linked metabolic characteristic.

A high prevalence of osteo-arthritis in the distal interphalangeal joints in females has long been recognized in the form of Heberden's nodes, and a clear association between these nodes and radiological signs of osteo-arthritis in multiple joints has been demonstrated in both sexes but especially in females.

Stecher (1955) has suggested that the factor responsible for Heberden's nodes is inherited as a single autosomal gene dominant in females and possibly recessive in males. This factor need not be specific for Heberden's nodes in particular, but may be a tendency to osteo-arthritis in general, which expresses itself more strongly in the fingers of females because of the special mechanical stresses to which their fingers are exposed in domestic work.

In males, the basic pattern of osteo-arthritis is modified to a great extent by occupational stresses and also by individual episodes of trauma, so that in this sex environmental mechanical factors play an important part in determining both the severity and the site of osteo-arthritis.

The effect of obesity is apparent in both sexes and is mainly associated with an excess of osteo-arthritis in the weight-bearing joints suggesting a mechanical effect, but in males obesity is also associated with an excess of osteo-arthritis of the distal interphalangeal joints and the general pattern of osteo-arthritis in obese males approximates to that seen in the total females. This is not due to occupational stresses since the occupational spectrum of the obese males did not differ from that of the total males.

A hereditary tendency to osteo-arthritis has been encountered in animals other than man, for example, in certain inbred strains of mice. It closely simulates its human counterpart in anatomical features, in its relationship to postural characteristics, and in its occurrence in older age groups (Sokoloff, 1956). It may be modified by external factors, such as a high fat diet in susceptible strains, though it is little affected by such diet in other strains. To some extent this may be related in mice to strain differences in thyroid activity, but even in the absence

OSTEO-ARTHROSIS AND DISK DEGENERATION

395

TABLE VII
RADIOLOGICAL HEBERDEN'S NODES IN RELATION TO JOINT PATTERN OF
RADIOLOGICAL OSTEO-ARTHROSIS AND DISK DEGENERATION

Joints Affected			Males						Females					
			Radiological Heberden's Nodes (Osteo-Arthrosis D.I.P.)											
			Absent (Grade 0-1)			Present (Grade 2-4)			Absent (Grade 0-1)			Present (Grade 2-4)		
			Radiological Osteo-Arthrosis and Disk Degeneration in Other Joint Groups											
			Total x rayed	Grade		Total x rayed	Grade		Total x rayed	Grade		Total x rayed	Grade	
			2-4	3-4		2-4	3-4		2-4	3-4		2-4	3-4	
Osteo-arthritis	D.I.P.	Hands	102	0	0	71	71	19	0	0	128	128	35	
	P.I.P.		102	3	1	71	27	3	78	10	1	128	72	24
	M.P.		102	12	1	71	28	10	78	5	0	128	37	3
	C.M.C.		102	9	0	71	24	11	78	8	4	128	61	29
	Wrists	101	6	1	71	11	2	78	1	0	127	8	0	
	Cervical Spine	99	18	0	71	27	6	75	6	0	125	39	6	
	Lumbar Spine	95	18	3	70	31	10	71	14	2	121	39	12	
	Hips	96	15	6	71	16	8	73	7	3	118	16	3	
	Sacro-iliac Joints	94	4	1	70	5	1	72	3	0	119	17	3	
	Knees	100	17	4	71	34	15	76	24	8	123	57	22	
	Tarsi	102	4	0	71	5	2	77	2	0	128	13	6	
	Lateral M.P.	102	1	0	71	3	0	77	5	1	128	13	1	
	First M.P.	102	25	5	71	36	10	77	21	9	128	82	27	
		Total	102	71	22	71	69	24	78	54	23	128	121	39
Disk Degeneration	Cervical Spine	99	62	39	71	54	31	75	43	13	125	81	42	
	Lumbar Spine	95	58	17	70	51	21	71	19	5	121	67	20	

N.B.—In counting the total with osteo-arthritis, the D.I.P. joints have been excluded.

Fig. 5.—Pattern of osteo-arthritis and disk degeneration in males and females in whom definite radiological signs of osteo-arthritis of the distal interphalangeal joints were absent or present.

of thyroid secretion following radiothyroidectomy strain differences in susceptibility to osteo-arthritis on a high fat diet are found (Silberberg and Silberberg, 1955). It is unrelated to skeletal ageing as determined by epiphyseal union, though the degree of fusion of epiphyses is also determined genetically (Sokoloff and Jay, 1956).

Disk degeneration does not appear to be associated with generalized osteo-arthritis, and we have as yet no evidence about constitutional factors causing this condition except in certain rare diseases like alkaptonuria, but degeneration of the lumbar disks is very closely related to the mechanical stresses inherent in certain laborious occupations such as coal mining and also to individual episodes of trauma.

Summary

The prevalence of degenerative joint disease in a population sample of 380 persons between the ages of 55 and 64 years has been investigated clinically and radiologically.

Previous indications of a relatively greater prevalence of intervertebral disk degeneration in males and of osteo-arthritis in females have been confirmed. It has been demonstrated that in females osteo-arthritis more often affects multiple joints. Factors responsible for these sex differences have been investigated.

The higher prevalence of osteo-arthritis in females was unrelated to occupation, to a history of injury, or to evidence of rheumatoid arthritis. Obesity was more frequent in females and was associated with an increased prevalence of osteo-arthritis of the weight-bearing joints, but did not account for the high prevalence of multiple osteo-arthritis in females. Heberden's nodes were also more frequent in females and were found to be associated to a highly significant degree with multiple osteo-arthritis affecting chiefly the interphalangeal joints of the fingers, the first carpometacarpal joints, the apophyseal joints of the spine, and the sacro-iliac joints.

A similar association between Heberden's nodes and multiple osteo-arthritis was demonstrated in males, but it was less marked in this sex, and in males both trauma and occupational stresses were shown to play an important role in determining both the site and the severity of osteo-arthritis and disk degeneration.

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Ostéo-arthrite et dégénérescence du disque dans une population urbaine

RÉSUMÉ

On procéda à une enquête clinique et radiologique sur la fréquence des maladies articulaires dégénératives chez 380 personnes, âgées de 55 à 64 ans, constituant un échantillon d'une population.

Les indications antérieures, que la fréquence de la dégénérescence du disque intervertébral était relativement plus grande chez les hommes et celle de l'ostéo-arthrite chez les femmes, furent confirmées. On étudia les facteurs responsables de ces différences de sexe.

La fréquence plus grande de l'ostéo-arthrite chez les femmes était sans rapport avec métier, antécédents traumatiques ou signes de rhumatisme articulaire. L'obésité se trouvait plus souvent chez les femmes et était associée à une fréquence augmentée d'ostéo-arthrite des articulations d'appui, mais n'expliquait pas la fréquence élevée de l'ostéo-arthrite multiple des femmes. Les nodosités d'Heberden étaient aussi plus fréquentes chez les femmes et se voyaient associées dans une très grande mesure à un type d'ostéo-arthrite multiple attaquant surtout les articulations interphalangiennes des doigts, les carpo-métacarpiennes, les apophysaires vertébrales et les sacro-iliaques.

Une association similaire entre les nodosités de Heberden et l'ostéo-arthrite multiple fut trouvée chez les hommes, bien que à un degré moindre; on trouva aussi que le traumatisme et la fatigue professionnelle jouaient un rôle important dans la détermination du siège et de la sévérité de l'ostéo-arthrite et de la dégénérescence du disque.

Osteoarthritis y degeneración discal en una población urbana

SUMARIO

Se hizo un reconocimiento clínico y radiológico de 380 personas de edad de 55 a 64 años, representando una muestra de una población urbana, con el fin de hallar la frecuencia de las enfermedades articulares degenerativas.

Se comprobaron los datos anteriores, que la frecuencia de la degeneración del disco intervertebral fue relativamente mayor en los hombres y la de la osteoarthritis en las mujeres. Se estudiaron los factores responsables de esta diferencia entre los sexos.

La frecuencia mayor de la osteoarthritis en las mujeres fue sin relación alguna con ocupación, antecedentes traumáticos o signos de reumatismo articular. La obesidad fue más frecuente en las mujeres, viéndose

asociada a una frecuencia aumentada de ósteoartritis de las articulaciones de apoyo, sin explicar la frecuencia aumentada de la osteoartritis múltiple de la mujeres. Las nudosidades de Heberden fueron también más frecuentes en las mujeres, asociándose a menudo al tipo de osteoartritis múltiple que ataca primeramente las articulaciones interfalángicas de los dedos, carpo-

metacarpeanas, apofisarias vertebrales y sacro-iliacas. Una asociación similar, aunque menos pronunciada, entre nudosidades de Heberden y osteoartritis múltiple, fué encontrada en los hombres; se vió también que el traumatismo y la fatiga profesional desempeñaban un papel importante en la determinación del sitio y de la severidad de la osteoartritis y de la degeneración discal.