Scientific papers

Osteoarthritis of the knee joint: an eight year prospective study

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SUMMARY Thirty one patients (25 women, six men, mean age 71.7 years) with established osteoarthritis (OA) of the knee were examined clinically and radiologically on two occasions, eight years apart. Four patients thought they had got better, two of whom had striking functional improvement. Seven remained the same and 20 patients got worse, two needing knee surgery and many developing severe disabilities. Most of the patients had a history of slow acquisition of OA at new joint sites, hand disease emerging as the commonest other site of involvement. Changes in symptoms, disability, and radiographs did not correlate. Three of the four patients who improved symptomatically lost range of motion at the knee and developed more severe changes on their radiographs. Chondrocalcinosis of the knee was seen in five patients, including two of those who improved.

Very little is known about the natural history of osteoarthritis (OA). It is difficult to report the starting point of the condition, and disease assessment is both crude and imprecise.¹ Disease heterogeneity also creates problems. Many different patterns of joint distribution and radiological change are seen.² Some subsets with a specific pattern of distribution and special associations, such as generalised OA and chronic pyrophosphate arthropathy, have been described,^{3,4} but their definition and validity remain controversial.^{5,6} The term osteoarthritis may include many different diseases with a similar end point, or encompass a wide variety of reaction patterns in damaged joints.⁷

Osteoarthritis of the knee is of special concern because it is one of the commonest causes of pain and disability in the community.⁸ Previous cross sectional studies have indicated that knee pain correlates poorly with radiological evidence of OA,⁹ but little is known about the development of symptoms and disability or their relation to *x* ray changes over time. The knee is one of the joints often involved in both generalised OA and pyrophosphate arthropathy, but the pattern of other joints involved in those with knee OA in general is not well known. Furthermore, the relation between aging and knee OA remains controversial. Although

OA is clearly age related, some studies suggest that the disorder may remain static or even improve in the very elderly.^{10,11}

Further understanding of these and other aspects of knee OA is more likely to be gained from prospective, long term studies than from cross sectional data. There is, however, only one previously published paper on the natural history of the condition.¹² Our study describes an eight year follow up of a small group of patients with knee OA first seen in 1979. The evolution of the disorder, pattern of joint involvement, radiological changes, and relations between changing pain, disability, and *x* ray signs are described.

Patients and methods

In 1979 48 patients with established, symptomatic OA of the knees took part in two short drug trials: 39 in a placebo controlled study of the efficacy of a non-steroidal anti-inflammatory agent and 10 in a crossover trial of knee intra-articular steroid v placebo.¹³ The entry (first visit) data for this study were recorded at that time. In 1987 the same patients were reviewed. Seven who had died and 10 who could not be re-examined in 1987 were omitted from the study, leaving 31 patients in whom data collected over eight years could be compared. Outcome data (second visit) for this report were recorded at that examination.

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CLINICAL DATA

The age, sex, and symptom duration were recorded in all patients. Pain (0–3 score), the most troublesome joint, other involved joints, the total range of knee flexion, presence of knee swelling, use of walking aids, history of previous joint surgery, and current treatment were recorded at each visit. At the second visit (1987) a full history of the evolution of joint involvement and disability, assessed by walking ability, was also taken. Reported walking distance was recorded as normal, some impairment (difficulty outside the house), or major impairment (difficulty inside the house or walking impossible). Patients completed a health assessment questionnaire¹⁴ and their Steinbrocker class was also recorded. A full examination of the knees, hands, and other joints was performed. Patients were asked to report whether their joint disease had got better, worse, or stayed the same since visit 1 (1979) and over the past year. The examining physician also recorded her impression of overall change (better, same, worse) based on the history and examination findings at each visit.

INVESTIGATIONS

A full blood count, viscosity, C reactive protein, and latex test for rheumatoid factor were performed on both occasions. Anteroposterior x rays of the hands and anteroposterior and lateral knee radiographs were also taken at each visit. The x rays were independently reviewed by a radiologist unaware of the clinical findings. Joints were recorded as having OA or not (defined as joint space narrowing with a subchondral bone reaction). Osteophytosis, loss of cortical integrity, and chondrocalcinosis were recorded separately as present or absent. Differences in x rays between 1979 and 1987 were recorded as no change, minor change, or major change in the degree of joint space narrowing and extent of subchondral bone reaction. The radiographic features and x ray changes were then compared with the clinical findings.

Results

CLINICAL DATA

Clinical data were obtained from 25 women and six men with a mean age of 71.7 years at visit 2 (range 58–87) and a mean duration of joint symptoms of 19 years (range 9–37). The study therefore reviewed the second half of a long period of symptomatic OA in a selected group of patients whose mean age at disease onset was 53 years.

Of the known risk factors for the development of knee OA, four patients had undergone a unilateral meniscectomy (including three of the six men) and 17 were obese (including 15 of the 25 women). No other host or environmental risk factors were apparent.

Patterns of joint disease

The first symptomatic site involved was the knees in 15 (unilateral in 12), the hands in 11, and other joints in five. Table 1 records the subsequent evolution of symptomatic OA, which was characterised by slow acquisition of new sites of involvement.

Of the 15 patients whose knees were affected first, all developed bilateral problems (including those with a history of a unilateral meniscectomy) and in seven the disorder spread to other sites (the hands in five, including two of the four patients after meniscectomy). All those with hand problems initially subsequently developed knee disease. Only two developed OA of other sites, in both cases the hip joint. Acquisition of new painful joints in the hands was observed in eight patients during the study period. The rate of development of new symptomatic joint sites was difficult to record accurately but apparently varied from one to four years. The peripheral joint site causing most pain remained or became the knee in most patients (20 at first visit, 23 at second visit). The hands were more likely to stabilise or become asymptomatic, and individual finger joints were often only painful for a few years.

Table 1 Distribution of joint disease and pattern of change in non-spinal sites in 31 patients with knee osteoarthritis

	Joint site				
	1 Knee	Both knees	Hands	Hips	Other joints
First site of symptoms	12	3	11	0	5
Worst site 1979	17	3	10	0	1
Worst site 1987	18	5	5	0	3
Development of osteoarthritis during study period in those whose first site was:					
Knees (n=15)	—	—	5	0	2 (1 ankle 1 shoulder)
Hands (n=11)	0	11	—	2	0
Others (n=5)	0	5	3	0	0

Table 2 *Change in clinical signs and function over eight years in 31 patients with knee osteoarthritis*

	1979	1987
Knee symptoms	31	30
Total knee flexion (mean)	128°	106°
Knee effusion (number with sign)	21	14
Knee crepitus (number with sign)	—	23
Hand symptoms	10	16
Hand signs of osteoarthritis	18	22
Other symptomatic sites	1	3
Other sites with signs of osteoarthritis	5	8
Use of walking aids	5	20
Walking difficulty		
None	9	5
Some	20	13
Severe	0	13
Mean HAQ*	—	1.2 (0-2.8)
Steinbrocker class		
1	—	14
2	—	12
3	—	4
4	—	1
Patient report of change over 8 years:		
Better	—	4
Same	—	7
Worse	—	20

*HAQ=health assessment questionnaire.¹⁴

Changes in clinical findings

All patients remained symptomatic in at least one joint site throughout the study, though overall pain scores did not change significantly and nine reported pain free periods in individual joints during the course of their disease. Table 2 records change in other clinical variables. As shown, knee flexion deteriorated overall, and only one patient maintained the same range of movement between visits. Sixteen patients started to use walking aids during the study period compared with only one who was able to discard a stick. Significant loss of walking ability developed in most patients. Four patients underwent joint surgery (two hip replacements, one bilateral knee and shoulder replacement, one knee débridement). The degree of overall disability apparent by 1987 is reflected by the mean health assessment questionnaire score of 1.2 (range 0-2.85) and a Steinbrocker score of 2 in 12 patients and 3 or 4 in five cases. This disability was largely due to knee disease.

When asked to report change in knee problems over the eight years, four patients said that their knees were better, seven the same, and 20 worse. Twelve reported that they had deteriorated further in the past year. The physician recorded improvement in the same two of the four 'better' patients who reported sustained improvement over the past year. The patients' idea of overall change correlated

well with their reported use of walking aids and walking ability, but not with their pain scores.

The four patients who reported improvement in knee disease were all women, three had hand as well as knee disease and two were obese. The two with the most striking remission of pain or functional problems, or both, exercised regularly (swimming, golf, walking), and both had extensive osteophytosis and chondrocalcinosis on their 1987 knee radiographs (also visible in 1979 in one). One had no knee symptoms in 1987 and had maintained the same range of movement. The other three all had marked loss of knee flexion despite their symptomatic and functional improvement.

Medical treatment could not be directly implicated as responsible for the differences in clinical outcome. Most patients had continued to take non-steroidal anti-inflammatory drugs (13) or analgesics (19), seven had had intra-articular steroids, and 14 regular courses of physiotherapy. Use of these treatments did not show any obvious correlation with change in symptoms, signs, or x rays.

INVESTIGATIONS

The full blood count, viscosity, C reactive protein, and latex test were normal in 30 of the 31 patients studied. One patient developed an inflammatory polyarthritis with a raised viscosity, C reactive protein, and positive latex test between visits and was diagnosed as having acquired rheumatoid arthritis in addition to her OA.

Knee radiographs

Medial compartment disease predominated and showed most change. After exclusion of lost or inadequate films and the patient with knee replacements, 26 pairs of bilateral knee radiographs were available to assess change. Ten cases were reported as unchanged over eight years, 16 had more signs of OA, and none was thought to have improved. As shown (Tables 3 and 4) x ray change and symptomatic change did not correlate; for example, the two patients with most obvious symptomatic benefit had both acquired more x ray damage during the study period. Only one patient developed destructive changes with loss of cortical bone during the study.

Hand radiographs

The most commonly involved joints were, as expected, the distal interphalangeal joints (20 patients), proximal interphalangeal joints (10), and thumb base (15). Of 25 paired hand x rays, 11 were considered unchanged and 14 to show progression of OA during the study period (Table 3). As in the knee, symptom change and x ray change showed a poor correlation.

Table 3 *Change in radiographic findings in 31 patients with knee osteoarthritis observed for eight years*

	1979	1987
<i>Knees (n=26)</i>		
Predominant medial compartment OA*	16	19
Predominant lateral compartment OA	3	2
Predominant patellofemoral compartment OA	7	5
Chondrocalcinosis	3	5
<i>Hands (n=27)</i>		
DIP* OA	5	4
DIP+PIP* OA	3	4
Thumb base OA	2	3
DIP+thumb base OA	8	6
DIP+PIP+thumb base OA	3	6
Wrist+MCP* OA	1	1
Normal	3	2
Chondrocalcinosis	2	4

*OA=osteoarthritis; DIP=distal interphalangeal; PIP=proximal interphalangeal; MCP=metacarpophalangeal.

Table 4 *Relation between clinical and radiological changes at the knee joint in 26 patients with paired radiographs*

<i>Symptoms</i>	<i>Radiographs</i>		
	<i>Better</i>	<i>Same</i>	<i>Worse</i>
Better	0	1	2
Same	0	2	5
Worse	0	7	9

Change in hand and knee radiographs also differed over the eight years. Of the 15 with deterioration in knee x rays, only nine had hand changes, and only nine of the 14 with hand deterioration had also progressed at the knee. The incidence of chondrocalcinosis increased from its presence in three knees and two hands in 1979 to five knees and four hands in 1987.

Discussion

The aim of this study was to describe the outcome of a group of patients with established knee joint OA followed up for eight years. Although limited in value by its small size, as far as we know this is the only paper in which clinical, functional, and radiographic changes have been recorded prospectively over a period of years in patients with OA of the knee joint.

Patient selection was based on the presence of knee symptoms sufficient to warrant entry into a drug trial at the first visit in 1979. Most of the patients had been symptomatic for many years previously, and the data only record outcome during

the later part of the evolution of well established peripheral joint OA. Furthermore, selection by willingness to become involved in hospital based drug studies, and our subsequent ability to re-examine patients in 1987, suggests that this group of 31 patients is unlikely to be representative of all those with knee OA in the community. The age at onset (mean 53 years), sex distribution (F:M 4:1), incidence of meniscectomies (4/31 (13%)) and obesity (17/31 (55%)) are very similar, however, to other, larger series of patients with OA of the knee joint.¹⁵ The predominance of obese women and high incidence of previous joint damage in the men are also compatible with other series.

The data on distribution of OA and its evolution indicate the need for longitudinal studies of this disease. Onset in either the hand or one knee was common, and subsequent development of symptoms at other sites was often delayed for many years. Early cross sectional data on these patients would have recorded a high incidence of disease limited to one joint or one site. By 1987 (mean age 72), however, all patients had an oligoarticular disorder. Slow addition of new joint sites occurred in all patients, but it was not random. There was a striking relation between hand and knee disease, other sites being affected much less frequently. This suggests that a limited form of 'generalised' OA, focusing on these two sites, may be common. The same pattern is emerging from other studies of patients with OA.¹⁶

Most of our 31 patients became significantly disabled during the study period. In two cases hip disease developed, but replacement surgery with good outcome prevented this from causing long term problems. In most patients it was their knee disease which continued to be or became the main cause of pain and disability. Although aging alone may account for some of this change, the functional impairment is far greater than that which would be expected in an aging but otherwise normal population.¹⁰ This marked overall deterioration is made more striking by the finding that four patients reported a general improvement in their condition, two of whom had unequivocal symptomatic and functional gains during the study. Apparently, deterioration is common but not inevitable.

Unfortunately, factors that might predict outcome were not apparent. We were unable to find any entry criteria that separated those who deteriorated from those who stayed the same or improved. The only factors to emerge were the presence of radiological chondrocalcinosis and a hypertrophic bone pattern as well as continuing physical activity in the two patients who showed the most striking and sustained improvement in knee disease. Larger

numbers would be required to draw definite conclusions, though these data indicate that both chondrocalcinosis and sustained exercise may predict a good outcome. It is also worth noting that a relatively good outcome of hip OA has also been correlated with a hypertrophic bone response.¹⁷ It is difficult to know whether the increase in chondrocalcinosis was due to aging alone or came as a result of the OA.^{6, 18}

In contrast with the striking clinical changes, the radiographs were surprisingly stable over the eight years. We had not expected to be unable to detect any change in 10 of 26 bilateral knee radiographs in patients with established OA and an eight year time interval between films. This indicates that either the anatomical changes in the joint were very limited or that radiographs are very insensitive to anatomical and pathological changes. Equally striking was the complete lack of relation between x ray and symptomatic changes with time. That these variables correlate poorly in cross sectional studies is well known,⁹ but their divergence and discordance over time have not been reported before. This emphasises the need to explore causes of pain and disability independently of the pathological and radiographic changes used to diagnose OA. Similarly, three of the four patients whose symptoms improved had much reduced ranges of knee flexion in 1987.

The only comparable published study is that of Hernborg and Nilson.¹² They selected 71 patients with evidence of knee OA on previous radiographs, and reviewed them clinically and radiologically several years after the initial x ray (mean interval 13 years, range 10–18). The patients reported that their symptoms had improved in 17% of cases and worsened in 56%, figures very similar to our own (13% and 65% respectively). Most radiographs deteriorated, with a progression from lone medial compartment involvement, to medial and lateral disease in 25% of cases. This progression was not apparent in our series of cases, in whom medial compartment disease, with or without patellofemoral changes, predominated throughout the study period.

The findings reported here, in conjunction with current publications on OA, emphasise the heterogeneity of the outcome of diseases. A few cases of OA of the knee can apparently improve without specific treatment. Most, however, deteriorated with time, sometimes quite quickly. It is apparent that radio-

graphic changes, symptoms, and function must be treated as three separate, potentially independent outcome measures, and that more and larger studies are needed for a further understanding of the many aspects of outcome in OA.

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