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Arthrosis and late growth

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Osteoarthrosis (OA) is thought to be a degenerative process, but the high metabolic activity of the OA-cartilage and the subchondral bone contradicts this theory. Putting together old observations with new research in molecular biology and biomechanics, it is proposed that *primary OA* depends on an exaggeration of the normally occurring remodelling of the mineralized cartilage (remnants of the growth zone of childhood). It is thus a reactivation of those growth factors which managed the growth in childhood. There are also indications that in some cases the joint cartilage starts to grow in thickness due to liberation of growth factors within the joint cavity. When the joint end expands or the cartilage becomes thicker (1–2 mm might be sufficient), the cartilage becomes vulnerable and is injured mechanically or due to inhibited diffusion of nutrients. Deep ulcerations (down to the vascularized cartilage and bone) in the joint surface and phagocytosis in the synovial membrane start a vicious circle with release of cytokines, growth and angiogenetic factors and proteolytic enzymes which together with continued weight-bearing destroy the joint. A successful osteotomy which unloads the joint surface stops progression of the disease. With this concept everything can be explained: the typical cartilage changes, the bone deformities, the capsular changes, the increased vascularity and high intraosseous pressure. The *secondary OA* is due to injuries, arthritides, and developmental or metabolic disturbances which make the cartilage brittle. Ulcerations occur, noxious factors are being released, which together with weight-bearing destroy the joint.

Studies on cartilage and bone matrix proteins provide new insights into tissue biology

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Connective tissue properties depend on a multitude of interactions between its matrix constituents. A detailed knowledge of the properties and the interactions of these matrix molecules is a prerequisite for understanding tissue function.

Major components are collagens and in some cases highly polyanionic proteoglycans. The collagens form fibers of variable dimensions and directions, that provide tensile properties to the tissue. The apparently tight regulation of collagen fibril assembly remains an enigma, but studies in vitro have identified a number of proteins that can bind to the collagen and modulate fibrillogenesis. These proteins, fibromodulin with keratan sulphate side chains, decorin and biglycan both with chondroitin/dermatan sulphate side chains, all contained anionic substitutents, that do not interfere with binding and appear to project away from the collagen. Thus, this family of homologous proteglycans, also including a fourth member called lumican with keratan sulphate side chains, has the potential for forming ionic interactions with neighboring collagen fibrils, e.g. in cartilage with cationic domains of collagen IX bound along the collagen II fibres. These interactions should provide important stabilization of the collagen network. Interestingly, also domains in the large aggregating proteglycan appear to have the capacity for collagen binding.

Cells in the tissue depend on a number of molecules interacting with cell surface receptors and also with components in the matrix. Several molecules that bind such receptors, integrins, have been identified. Often, they bind via an RGD-sequence. Thus, bone contains at least two such cell binding molecules, osteopontin and BSP, both produced by the osteblasts. Osteopontin, binds osteoclasts in vitro, its synthesis is stimulated by 1,25-dihydroxyvitamin-D3, it binds hydroxyapatite and therefore appears to be a candidate for anchoring osteoclasts to the bone surface. In support a dominating localization in bone is at the osteoclast anchoring region, i.e. the clear zone area. On the cell surface a V-beta-3 vitronectin receptor recognizing the protein is found with a restricted dis-

tribution along the osteoclast plasma membrane to the corresponding domain. BSP, is prominent in osteoid, its synthesis is stimulated by glucocorticoids, while inhibited by vitamin-D3, and it binds both mineral and other matrix constituents as well as cells via a vitronectin receptor. This protein appears not to be involved in the binding of osteoclasts to the bone surface. It is , however, enriched at the interphase between cartilage and bone, being one of the first proteins to be secreted by the osteoblasts migrating in to form the initial osteoid.

Although the function of the protein is not clear it appears to have an important function at the interphase between bone and cartilage.

Other proteins in cartilage and bone appear to have roles in providing feed-back between cell and surrounding matrix and perhaps have roles in tissue assembly.

One of the major molecules in cartilage matrix is the large aggregating proteoglycan, aggrecan, which by providing a domain with an extreme density of fixed negatively charged groups provide a swelling pressure to tissue. These proteoglycans are made up of domains with different structure and with different properties and function. The most N-terminal of these domains has a structure that allows specific interaction with hyaluronan, which allows several of these proteoglycans to bind to a single strand of this polymer to provide an even higher level of organization of the fixed negatively charged groups.

Markers of cartilage matrix metabolism in osteoarthrosis

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Joint disorders are an important cause of morbidity and disability and impose a considerable burden on the community. Epidemiological studies and surveys of disability in developed countries identify 20-50% of the population over the age of 50 as having joint problems, with the ages over 70 representing the higher figures. The changing demographic structure in these countries will in the future only emphasize the magnitude of the problem. Out of the joint disorders in this age group, osteoarthrosis is by far the dominating diagnosis.

Osteoarthrosis is a heterogeneous disease of synovial joints: "joint failure". The rate of disease progress is variable but generally slow, occurring over decades. We lack a clear definition of the disease, definite diagnostic criteria or process markers and, most importantly, an understanding of disease mechanisms on the tissue or cell level.

As a consequence of these shortcomings, several specific problem areas can be identified. The true prevalence of osteoarthrosis is difficult to establish. We can identify some general risk factors such as age, obesity, genetics, joint insult etc., but cannot translate these risk factors into specific underlying causes or understand how ageing changes in the cartilage matrix interact with the other risk factors. The role of inflammation as a direct cause of symptoms or disease progress in osteoarthrosis is not clear. Treatment in general does not affect the rate of disease progress: we can treat the symptoms but we cannot treat the disease. We lack the appropriate means to monitor the outcome of treatment: evaluation of new and improved treatments is therefore very difficult even if a new treatment rationale is identified. Process markers are much needed.

Changes in the properties and loss of joint cartilage are an integral part of osteoarthrosis. During this process, matrix molecule fragments are released to the joint fluid and other body fluid compartments. These fragments could be used as disease markers and a detailed study of their structure may improve our understanding of cartilage degradation in osteoarthrosis. Patients with injury to ligaments and menisci of the knee often develop posttraumatic osteoarthrosis. They may thus provide a convenient human model for OA (1).

We have shown that fragments of aggrecan and other matrix molecules are released to joint fluid shortly after trauma and that increased levels are sustained for many years (2). Immunoassays show that in the same samples of joint fluid concentrations of both the proteinase stromelysin-1 (SL) and its inhibitor TIMP increase within a few hours after trauma, and both remain increased for many years (3). However, the molar ratio of SL to TIMP changes from an excess of TIMP in the normal joint fluid to an excess of SL in connection with trauma, late after injury and in overt, posttraumatic osteoarthrosis. Assay of SL in joint fluid detects joint pathology with a sensitivity of 84% and a specificity of 90%. With techniques for the sequencing of small amounts of peptides, we can now determine the N-terminal sequences of proteolytic fragments of aggrecan in joint fluid. We have shown that the release of aggrecan fragments from articular cartilage in all stages of human osteoarthrosis is promoted by the action of a cartilage proteinase which cleaves the Glu 373-Ala 374 bond of the interglobular domain (4). The identity of this proteinase remains to be determined. Such information, together with quantitative data on fragments, proteinases and inhibitors, may offer the means for improved diagnostic and prognostic tools in osteoarthrosis, and a basis for the rational development of treatment with the aim of retarding cartilage destruction in this common disease.

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Assessment of disease process and disease progression in osteoarthritis of the knee joint

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Osteoarthritis is a heterogeneous condition, with a common pathology but variable expression. It can be thought of as the visible response of a synovial joint to injury. But OA of the various joint sites involved (knee, hip etc) has differing associations and expression, and they should be considered as different conditions.

Factors involved in the aetiopathogenesis of OA include those that confer a generalized predisposition to OA, and local, biomechanical factors that probably control the sites of involvement and severity of OA. However, different factors may be involved in both the initiation and progression of OA at different joint sites.

The knee joint is the most important joint site for OA, and the main focus of current studies on the epidemiology, process and progression of OA being undertaken in Bristol, England. This presentation will focus on the techniques being developed to study the process within the knee joint, and the progression of the disorder. Three types of methodology will be discussed: clinical (symptoms and signs and their assocations and reproducibility), imaging (assessing radiographs, scintigraphy and MRI) and biochemical (serum and synovial fluid assays of connective tissue products). The study groups include a cohort of 500 patients with established OA who are being followed prospectively.

The process of OA involves synovial inflammation and remodelling of the subchondral bone, as well as cartilage destruction. Synovial fluid assays are being explored as ways of assessing the inflammatory component, but MRI offers an alternative. The subchondral bone acitivy is being assessed scintigraphically, and by measuring synovial fluid osteocalcin levels. The cartilage damage can be estimated arthroscopically and by a variety of imaging techniques. The value of assaying synthetic and degradative products of the matrix in the serum and synovial fluid is also being examined.

Progression of OA is usually assessed by a combination of clinical features (pain, deformity, instability etc) and subjective scoring of radiographs. The reproducibility of some of the clinical signs has been assessed and new semi-objective ways of measuring x-ray progression are being developed. In addition, the value of various measures of disability is being investigated.

Data on a group of 100 patients with knee OA studied for 5 years will be presented. Baseline associations between serum keratin sulphate and hyaluronate levels, and some of the clinical, radiographic and scintigraphic features were established. Disease progression has been associated with a tendency for synovial fluid keratin sulphate levels to fall and osteocalcin levels to rise. After 5 years, surgical intervention and radiographic progression could be correlated with the type of scintigraphic abnormality recorded at entry to the study. "Predictors" of progression are thereby being developed.

Does running increase the risk of hip osteoarthritis?

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One major area of public health concern, given the recent increase in leisure time running, is the possibility that such activity leads to an increased risk of osteoarthritis (OA) in the lower limb large joints. Given the frequency of both the exposure and the disease it is perhaps surprising that relatively few studies have been undertaken in this area. This paucity of data reflects at least in part the inherent difficulty in undertaking such studies in human populations. In this review the nature of these difficulties will be discussed from an epidemiological perspective. As illustration 4 studies designed to investigate the relationship between running (amongst other exposure) and the subsequent development of hip OA are considered in detail.

The conclusion is that the association between long distance running and hip OA remains to be elucidated. None of the studies reviewed is sufficiently free of methodological problems to provide an estimate of risk that can be accepted without reservation. The wide variation in the results obtained can, in fact, be easily ascribed to problems in study design, conduct and analysis.

Occupation and knee osteoarthritis: Evidence from two population-based studies

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While studies have documented that specific occupational groups have high rates of osteoarthritis (OA) in overused joints, the association of occupations with osteoarthritis in the population at large has not been examined. We studied occupational physical activity and its relation to knee osteoarthritis in two population-based studies in the U.S., the first National Health and Nutrition Examination Survey (NHANES I) and the Framingham Study.

The U.S. NHANES I study conducted between 1971 and 1975 surveyed a population-based nationwide sample and included measurement of weight and questions on occupational status, age and joint symptoms. 4011 subjects age 35 to 64 years obtained non-weight bearing knee radiographs which were read according to the Kellgren and Lawrence criteria. OA was defined as present when x-rays showed at least grade 2 changes (definte osteophytes ± joint space narrowing). We computed the physical demand and knee bending requirements of each occupational group using the Dictionary of Occupational Titles. For men and women, the highest rates of knee OA occurred among laborers and service workers. After adjusting for race, education level and body mass index, strength demand of job was associated with concurrent radio-

graphic knee OA in men and women at least 55 years old (for men age 55–64, odds ratio of OA among those with demanding jobs was 1.88, p = NS; for women, odds ratio = 3.13, $p < .05$). In this age group, jobs with knee bending were even more strongly associated with an increased risk of knee OA in both sexes (for men, odds ratio = 2.45, $p < .05$; for women, odds ratio = 3.49, $p < .05$). We found no association of occupational physical demands and concurrent knee OA in adults under age 55.

In the Framingham Study, we sought to assess occupational joint use and OA longitudinally in a population with multiple occupations. Subjects were members of the Framingham Heart Study Cohort followed 35 years with occupational status assessed at the beginning of the Heart Study—from examination one (1948–51) through examination six (1958–61) and knee OA assessed by a weight-bearing knee radiograph at examination eighteen (1983–85)—when the mean age of subjects was 73 years. Each subject's job was characterized by its level of physical demand (weight of objects one must lift) and whether the job was associated with knee bending. Odds ratios (OR) testing the association of job demand with OA were adjusted by logistic regression for age, body mass, knee injury history, smoking, and educational level. Men whose jobs required knee bending and at least medium physical demands had higher rates of later x-ray knee OA (at least definite osteophytes) than men whose jobs required neither (43.4% vs. 26.8%; OR of OA = 2.22, 95% CI 1.38, 3.58). Rates of severe x-ray OA (osteophytes and joint space narrowing) and of bilateral x-ray OA were also significantly increased in these men. For severe radiographic knee OA, the proportion of disease attributable to occupational physical activity was 15.4% (vs. 10% for obesity in this group). Few women had jobs requiring knee bending or that were physically demanding and these jobs were generally unassociated with later radiographic OA.

Results from these studies suggest that OA secondary to job-related overuse may be a concern in many occupations and may be a substantial public health problem.

Relationship of hip osteoarthritis to obesity and bone mineral density in older American women: Preliminary results. From the Study of Osteoporotic Fractures

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Osteoarthritis (OA) and osteoporosis both increase with age in women, are inversely related to one another, and are related in opposite directions to obesity. However, it is uncertain if older white women with hip OA have increased bone mass, and if so, whether anthropometric factors, such as obesity, account for higher bone mass. In addition, obesity is associated with an increased risk of osteoarthritis (OA) at several sites, including the knee, but the association of obesity and hip OA is uncertain. We are examining these questions in an existing cohort of elderly women in the United States, all of whom had AP pelvic radiographs taken at a baseline examination.

The Study of Osteoporotic Fractures is a multicenter, prospective cohort study with a baseline enrollment of 9,704 mostly Caucasian women aged 65 years and over, recruited in 4 metropolitan areas in the United States.1 The baseline examinations took place from 1986 to 1988. At this examination, subjects had radiographs of the hand, lateral spine and pelvis, measurement of bone mass in the radius and calcaneus using single photon absorptiometry (Osteon OsteoAnalyzer) and anthropometric measurements including height, weight and strength. Bone mass of the hip and spine was measured with dual x-ray absorptiometry (Hologic QDR 1000) at a second clinic visit two years after the baseline examination. At the second visit, a consecutive subsample of 1,545 women was identified who underwent additional examinations and interviews measuring risk factors for and outcomes of OA.

Hip radiographs in the OA subsample were assessed for individual radiographic features (IRFs) of hip OA using an atlas of standard radiographs. Joint space narrowing and osteophytes were graded on a 0–3 scale (definite if grade > 2); sclerosis, cysts and deformity of the femoral head were scored present or absent. A 0–4 summary grade for each hip was based on the number of IRFs present.2 Intraclass correlation for inter-rater (3 readers) and test-retest agreement for the IRF:s and the summary grade were generally good and ranged from 0.61 to 0.87. The analyses which follow are based on 1,363 women ages 65–79; women with rheumatoid arthritis and Paget¥s disease, and hips with prior surgery or hip fracture, were excluded.

The prevalence of joint space narrowing and summary grades 3–4 radiographic hip OA (> 3 of 5 IRF:s present) increased significantly with age. The prevalence of hip pain "on most days for at least one month" in the past year increased with the summary grade of hip OA and was significantly higher in subjects with grades 3–4 in the worst hip compared to grade 0 ($P < .05$).

We examined the association of quintiles of weight and body mass index (BMI), defined as weight divided by heigth squared, with the summary grade of OA in the worst hip. BMI and weight in the fourth or fifth quintile, compared to quintiles 1-3, were not associated with an increase in grade 2–4 (> 2 of 5 IRFs present) or grade 3–4 hip OA. This was the case in unadjusted analyses and in analyses adjusting for age, activity level, diabetes and muscle strength. Since bilateral and unilateral hip OA may represent distinct subsets of disease with different relationships to obesity, we divided subjects into those with bilateral disease (grade > 3 in one hip and grade > 2 in the other) and unilateral disease > 3 in one hip and grade <2 in the other). Subjects in the fourth and fifth quintiles for weight had significantly increased grade 3–4 hip OA compared to quintiles 1–3 ($P < .05$).

We also evaluated the association of bone mass and radiographic hip OA in 1,172 women who had bone mineral density (BMD) of the radius and calcaneus measured at baseline by single photon absorptiometry and BMD of the right hip and lumbar spine 2 years later by dual x-ray absorptiometry. BMD

declined with age at all sites. Grade 3–4 vs grade 0–1 right hip OA was associated with higher BMD ($P < .05$) at 5 of 7 sites, after adjustment for age, BMI and strength.

In these preliminary analyses, older white women with radiographic hip OA had higher BMD, particularly at the hip and spine, which was not accounted for by adjustment for anthropometric factors, including BMI. Bilateral hip OA was associated with body weight. These preliminary findings suggest a possible role for metabolic factors in at least one subset of hip OA. Whether obesity is associated with hip OA through biomechanical or metabolic pathways remains to be determined.

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Work, sports, overweight and osteoarthrosis of the hip

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Osteoarthrosis of the hip is a degenerative articular disorder with changes in the cartilage and subchondral bone. Population surveys in Sweden have shown a prevalence of 3.1% for persons 55 years and older. The aim of this thesis was to study if physical loads from occupation, sports, and overweight are contributing causes to the development of symptomatic osteoarthrosis of the hip.

In the cohort study men and women alive 1980, according to the census, who each had reported the same blue collar occupation in the 1960 and 1970 censuses were followed in the Hospital Discharge Register concerning hospital care because of osteoarthrosis of the hip 1981 to 1983. Blue collar occupations were classified as giving high or low forces to the lower extremities. Persons employed in high exposure occupations had an elevated relative risk for hospitalization compared to persons in low exposure occupations. Farmers, construction workers, fire fighters and food processing workers were those with the highest relative risks.

In a case-control study men, 50 to 70 years of age, from parts of Stockholm comprised the study population. All men from this study population who had had hip prosthesis surgery because of primary hip arthrosis and a random sample from the study population were interviewed about physical load in occupation, sports activities and weight to the age of 49. Men with high exposures to load from occupation had a relative risk of 2.4 (1.5–4.0) to receive hip joint prosthesis compared to men with low exposures. The relative risk to have prosthesis surgery for those with high exposure to all sports combined was 4.5 (2.7–7.6). Men with high exposure to physical loads both from occupation and sports had the highest relative risks 8.5 (4.0–17.9) for developing symptomatic osteoarthrosis of the hip.

The relative risks of developing osteoarthrosis of the hip for overweight individuals were increased in all age groups with the highest value 2.5 (1.4–4.5), for those overweight at the age of 40.

In a case-control study disability pensions because of osteoarthrosis of the hip for men born in 1915 to 1934 and living in Stockholm county were investigated. Information about occupation the last 20 years was collected. All occupations were classified into four different exposure classes. The relative risk was 12.4 (6.7–23.0) for those with high exposure compared to those with low exposure. When different occupations were compared construction workers, metal workers, farmers and forestry workers had elevated relative risks of disability pension due to osteoarthrosis of the hip.

The studies in this thesis indicate that physical loads from different origins may be contributing causes to symptomatic osteoarthrosis of the hip.

Farming and osteoarthritis of the hip

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Osteoarthritis of the hip is an important cause of pain and disability among the elderly, yet the aetiology of this disorder remains unknown. Excessive mechanical loading of joints has been implicated as a risk factor for osteoarthritis, and occupation is an important determinant of cumulative stress on the hip joint. We have therefore performed two epidemiologic studies examining the relationship between occupation and the subsequent risk of hip osteoarthritis.

The initial study had a case-control design. The study population comprised all men aged 60–75 years who attended two hospital radiology departments for intravenous urography during a five-year period. The reference or post-micturition radiographs were used to identify cases and controls. The 245 cases were defined by a previous total hip arthroplasty for osteoarthritis, or by a minimal joint space in either hip of 2.5 mm or less. Within this group a subset of severe cases were defined, with a minimal joint space of 1.5 mm or less. The control group comprised all 294 men with a minimal joint space of 3.5 mm or greater, who showed no other radiographic features of osteoarthritis. Exposure information was ascertained using a structured questionnaire. No clear associations were found in an analysis of all the cases, but severe disease was more common among farmers, especially those with more than ten years

in agricultural work (OR 2.0; 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 were not explained by obesity or sporting activity.

The second study was a cross-sectional survey. A postal questionnaire containing an occupational history was sent to all men aged 60–75 years registered with five rural general practices. 167 current and ex-farmers were compared with 83 controls from mainly sedentary jobs. These men underwent standardised pelvic radiography and completed a structured questionnaire. The prevalence of hip osteoarthritis was higher in farmers than in controls, especially in those who had farmed for more than 10 years (OR 9.3; 95%CI 1.9–44.5). This excess could not be attributed to any one type of farming, and appeared to be consistently associated with heavy lifting.

Our findings suggest an increased risk of hip oseoarthritis among farmers, and indicate that mechanical overuse might contribute to its pathogenesis. Consideration will have to be given to making hip osteoarthritis a prescribed industrial disease in farmers, and the hazard may have wider implications for the prevention of hip osteoarthritis in the general population.

Proteoglycan fragments in rabbit joint fluid as a quantitative response to increasing osteoarthritis

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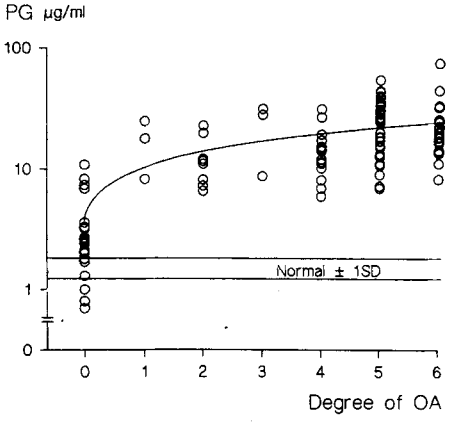
To determine whether the concentration of proteoglycan fragments in joint fluid reflect the condition of the articular cartilage in a commonly used model of osteoarthritis, proteoglycan fragment concentrations were measured in rabbits with various operations on their menisci and ligaments, including artificial meniscal replacement. At sacrifice the level of proteoglycan fragments of the joint fluid was analyzed in relation to the gross appearance of the articular cartilage. Knees free from osteoarthritis, knees with moderate, and knees with severe osteoarthritis were distinguishable by the concentration of proteglycan fragments in joint fluid. We found a correlation ($r = 0.61$) between increasing osteoarthritis and increasing levels of proteoglycan fragments (Figure). The increase in proteoglycan concentration was especially pronounced at early stage osteoarthritis. The highest level of proteoglycan fragments was found in knees with cartilage destruction down to bone. We conclude that the level of proteoglycan fragments in joint fluid is a quantitative indicator for osteoarthritis in this experimental model. The sensitivity (86%) and specificity (100%) of this method for early osteoarthritic changes suggests future clinical applications.



Coxarthrosis in farmers

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Recent studies have suggested an excess of coxarthrosis (osteoarthritis of the hip joint) among Swedish farmers. The prevalence of coxarthrosis in the city of Malmö has previously been studied by examining the hip joints on colon radiograms. The present study estimates the prevalence of coxarthrosis in farmers by examining the hip joint on radiograms of the colon and urinary tract. Fifteen thousand farmers and farm workers affiliated to the Swedish Farmers' Safety and Preventive Health Association and all farmers aged 40 or more in the Swedish county of Östergötland were questioned about previous roentgen examinations. Four hundred and thirty-five colon examinations and 465 urograms were available and scrutinized by the same physician. Forty-five out of 565 male farmers and farm workers, aged 40-64, were found to have radiographic signs of primary coxarthrosis as compared with 10 out of 1,250 men in the corresponding age-group in the urban population of Malmö. The difference represents a risk ratio of 12 with a 95% confidence interval 6.7 - 21.4. There was no difference in the prevalence of coxarthrosis among the female farmers and women in the urban population. The result suggests a relationship between coxarthrosis and farm work in men.

Coxarthrosis on the island of Gotland

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On the island of Gotland and in the city of Malmö, the prevalence of coxarthrosis was calculated using the hip projections in colon roentgen examinations. The prevalence of coxarthrosis among the Gotland islanders was about twice that of the Malmö urbanites, and the condition became obvious earlier in life. The population of the local Gotland city of Visby did not contribute to this difference; the difference was entirely due to an increased incidence in the rural population of the island. Heavy labor in conjunction with farming is believed to be the cause of the deviation.

The prevalence of gonarthrosis in former soccer players and its relation to meniscectomy

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The prevalence of radiographic signs of gonarthrosis and its relation to knee injuries were studied in 286 former soccer players and 572 age-matched controls with a mean age of 55 years. The prevalence of gonarthrosis among the controls was 1.6%, among the whole group of soccer players 7.0% and among the elite players 15.5%. Seven of the soccer players had known anterior cruciate injuries and 40 had had meniscectomies. Of the 47 players with knee injuries 9 (19%) had gonarthrosis and of the 239 without known knee injuries 11 (5%). Among the elite players the prevalence of gonarthrosis in uninjured knees was 11%. We conclude that soccer, especially on high level, is associated with an increased risk of gonarthrosis, even in the absence of diagnosed knee injuries.

The relationship between soccer and coxarthrosis

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286 former male soccer players in Malmö, Sweden, with a mean age of 55.6 years were compared with an age-matched control group randomly selected from the population records regarding the occurrence of coxarthrosis. Over the last decades about one fifth in both groups had been referred to roentgenographic examination of the hip. Coxarthrosis occurred in 5.6% of the former soccer players and in 2.8% of the control group ($p < 0.05$). Among the 71 élite soccer players the prevalence of coxarthrosis was 14%. It is concluded that soccer—particularly in élite teams—is a risk factor for developing coxarthrosis.

Sports and osteoarthrosis of the hip

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In discussing the relationship between sports and osteoarthrosis some questions arise like e.g. does running cause, accelerate, slow down or have little effect on the development of osteoarthrosis? Do bones and ligaments become stronger as an effect of sports and may then joints become protected against osteoarthrosis? Or do joints on the contrary become worn out?

One theory of the development of osteoarthrosis is that joints "wear out" by repetitive impulse loading. This impulse loading results in trabecular microfracture, bone remodelling, sclerosis and stiffened bone. The rigidity increases stress on articular cartilage with subsequent cartilage breakdown and joint degeneration. (It has been observed that total paralysis severely reduces intraarticular stress and appears to spare joints from further degeneration.)

Thus many authorities claim that sports are at fault in causing osteoarthrosis—in particular of the hip—based on assumptions described above and also on epidemiologic surveys.

On the other hand it has been claimed in a number of studies that the physical strain to which runners are exposed, despite all, excluded the possibility that this strain would contribute to the development of osteoarthrosis of the hips. -The principal methodological problem with cross-sectional studies of sports and osteoarthrosis is that of possible self-selection of subjects. It is possible that runners are more likely to be resistant to osteoarthrosis, that non-runners do not run because of early osteoarthrosis, or that runners experiencing joint pain on running stop running for that reason.

In a case-control study we investigated the sports activities to 49 years of age in 233 men who were recent recipients of total hip replacement for osteoarthrosis and 302 men randomly selected from the general population. The assessment of sports, job history etc. were made by an interview.

Results: Men with high exposure to sports of all kinds combined (in hours) had a relative risk to develop osteoarthrosis of the hip of 4.5 (95% CI 2.7–7.6) compared to those with low exposure. Track and field sports and racket sports seemed to be the most hazardous to the hip joint. Men, who had been exposed to high physical loads both from occupation and sports had a relative risk of 8.5 (95% CI 4.0–17.9) to develop osteoarthrosis of the hip compared to those with low physical load in both activities. Potential confounding from age, body mass index, and smoking were considered.

Conclusion: Long term exposure to sports among men seems to be a risk factor for developing severe osteoarthrosis of the hip and even worse combined with heavy load from occupation.

A comparative population study to examine the possible genetic basis of primary hip osteoarthritis

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Does primary osteoarthritis of the hip among Asians, Blacks, and Hispanics occur with the same or different incidence in San Francisco as it does in the native countries of these people?

A retrospective survey was conducted that identified all patients who had undergone a total hip replacement in San Francisco during the 5-year period, 1984–1988, and were also residents of San Francisco. All of these patients were categorized by race, sex, and age. The patients who had had their operation during the last six months of the study period were categorized by specific hip disease after examination of their preoperative pelvic x-rays; in cases of osteoarthritis, patients were further categorized by the specific pattern of this disease. San Francisco census data were used to calculate the incidences of total hip replacement for osteoarthritis and for any indication, by race, sex, and age.

During the 5-year study period, 1,617 residents of San Francisco had undergone a total hip replacement in San Francisco. The diagnosis of osteoarthritis was made in 70% of the white patients, in 47% of the Hispanic patients, in 44% of the black patients, and in less than 32% of the Asian patients. The following standardized rates of primary hip osteoarthritis, expressed in number of cases per 100,000 population per year, were obtained: Japanese, 1.5; Chinese, 1.5; Filipino, 1.6; Hispanic, 5:1; Blacks, 8.3; Whites, 29.4.

Conclusion: The high rate of primary hip osteoarthritis among white patients and the low rates among the non-white groups in San Francisco are supported by previous studies of these groups in their native countries. Primary osteoarthritis of the hip is largely a disease of white patients and very probably has a genetic basis. The comparison of cultural similarities and differences and body size among these races argues against load factors or occupation in the etiology of this disease. The low prevalence of this condition among Blacks is comparable to the proposed white gene frequency in Blacks, as determined by Duffy blood group factors. The rarity of this condition among Asians could be explained on the basis of genetic mutation, while the slightly higher rate among Hispanics might be the results of transmission of the gene through intermarriage with Northern Europeans.