Knee ligament injury, surgery and osteoarthrosis

Truth or consequences?

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We reviewed reports that describe development of osteoarthrosis of the knee after anterior cruciate ligament or meniscus injury. The occurrence of posttraumatic osteoarthrosis varied considerably from one report to another. The literature does not lend support to the efficacy of cruciate ligament repair or reconstruction in retarding the progression of osteoarthrosis after knee injury. We encourage prospective, controlled, randomized and masked studies that aim to evaluate the utility of ligament reconstruction, meniscus suture or meniscus transplantation for preventing posttraumatic osteoarthrosis.

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Up to 50 percent of patients treated with a partial or total meniscectomy show radiological signs of osteoarthrosis (arthrosis) 5–15 years after the meniscus injury (Appel 1970, Jörgensen et al. 1987, Hede et al. 1992, Neyret et al. 1993). Similarly, rupture of the anterior cruciate ligament, isolated or combined with meniscal or collateral ligament injury, leads to radiological changes that suggest arthrosis in 60–90 percent of the patients 10–15 years after the injury (McDaniel and Dameron 1980, Noyes et al. 1983, Sherman et al. 1988, Neyret et al. 1993). Most patients with knee ligament injury and posttraumatic arthrosis are 35–50 years old, or some 10–20 years younger than patients with primary arthrosis (Roos et al. 1994). These patients represent a therapeutic challenge, in the light of the high revision rate for knee arthroplasty in this age group (Knutson et al. 1994).

In U.S.A., more than 40,000 cruciate ligament repair procedures were performed in 1988 (Praemer et al. 1992) and in Sweden, about 2,400 were done in 1993 (Lysholm, personal communication). However, little unequivocal long-term data exist to prove the effect of surgical intervention on the initiation or progression of arthrosis.

One reason for the paucity of consistent data on the effects of intervention after knee injury may be a lack of reliable methods to assess in vivo in a reproducible and standardized manner the condition of the cartilage and subchondral bone. Current "gold standards" such as radiographs are insufficient, particularly for early-stage disease (Lysholm et al. 1987, Brandt et al. 1991, Fife et al. 1991, Dougados et al. 1992, Ayral et al. 1993).

We review 33 published reports on knee arthrosis after ligament or meniscus injury.

Literature and methods

A literature search (including Medline) for the years 1948–1994 located English-language reports (numbered in alphabetical order in the reference list) containing specific information on the development of knee arthrosis after injury to the cruciate ligament and/or meniscus. Additional articles were found through bibliographies, to yield a total of 33 reports. The observations in the reports were tabulated with regard to the number of patients followed, age at the time of injury, type(s) of injury described, type(s) of intervention, follow-up time and the method(s) used to evaluate joint and cartilage changes. These variables were often described in insufficient detail and a strict comparison between the different studies was rarely possible. Only 3 studies were considered prospective (McDaniel and Dameron 1980, Jörgensen et al. 1987, Hede et al. 1992).

Results

The type of injury and method of surgical intervention were usually described in adequate detail. However, information on the specific types of meniscus

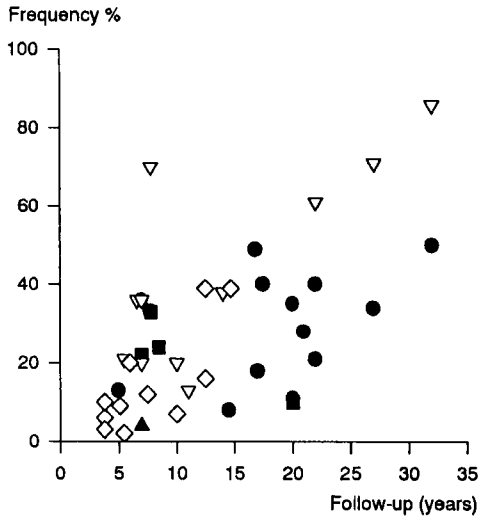

Figure 1. The frequency of *joint space narrowing* related to the follow-up time, type of knee injury and treatment are shown. A statement for a study group on the frequency of joint space narrowing, irrespective of degree, was used to make one data point in the diagram. A single publication could result in more than one data point because it included multiple groups and follow-up times. Partial meniscectomy ■, total meniscectomy ●, meniscus repair ▲, total cruciate ligament rupture isolated or in combination with meniscus rupture ▽, cruciate ligament repair or replacement ◇.

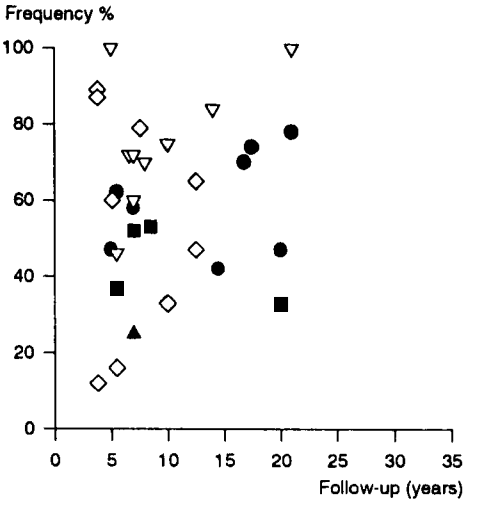

Figure 2. The frequency of *Fairbank changes* related to follow-up time, type of knee injury and treatment. The definition of presence of Fairbank changes varied between different publications. See Figure 1 for symbols.

lesions was often lacking. One third of the papers lacked information on age at injury and the reports that did contain information on this variable showed a range between 10 and 65 years (average age varied between 14 and 34 years). Exclusion and response rates varied widely and the criteria for exclusion were frequently not explicitly stated. The number of patients reported on in each study varied from 15 to 440, with a drop-out rate between 2 percent and 75 percent over the median duration of follow-up, which ranged from 4 to 22 years.

Joint and cartilage changes were evaluated by radiographs, which were usually graded according to previously published methods (Fairbank 1948, Kellgren and Lawrence 1957, Ahlbäck 1968). A problem associated with the use of these methods is that the original publications contain insufficient details on how to obtain reproducible images and to grade the joint changes, leaving considerable latitude in their interpretation and use.

The best interpretation of the data contained in the different reports for type of injury, follow-up time, type of intervention and the proportion of patients with cartilage and joint changes is shown in Figures 1 and 2. A wide scatter was noted for the frequency of changes both according to the Fairbank scale and joint space narrowing, with a weak correlation to the type of injury or mode of treatment or the time elapsed after injury.

Discussion

Several reasons may be suggested for the considerable variability in outcome of knee injury, measured as radiographic joint changes.

Ruptures of the meniscus or cruciate ligament may be caused by different traumas and mechanisms, with seemingly similar results, if measured only as the presence or absence of rupture and a normal radiograph. Magnetic resonance imaging of a knee after an acute injury of the cruciate ligament, however, frequently shows bone bruises, which probably represent blunt injury to the joint cartilage and fractures of the subchondral bone (Graf et al. 1993, Spindler et al. 1993). These injuries, which can be present even when the arthroscopic findings are normal may be as important for the initiation and development of post-traumatic arthrosis as the chronic instability and abnormal joint-loading caused by meniscus or cruciate ligament rupture. This is supported by animal studies (Donohue et al. 1983, Vener et al. 1992).

Several studies have demonstrated that a higher age at injury or onset of symptoms is associated with an increased rate of progression of arthrosis (Appel 1970, Allen et al. 1984, Felson 1993, Hochberg et al. 1993, Roos et al. 1994). Yet, several of the reports analyzed by us fail to present adequate data on the age of the patients at the time of injury. Moreover, the age at injury in the other reports varied widely.

An increase in frequency of joint changes with increasing time after injury has been noted in several reports (Johnson et al. 1974, Jacobsen 1977, Arnold et al. 1979, Jörgensen et al. 1987, Sherman et al. 1988, Roos et al. 1994), while others have failed to confirm this observation (Appel 1970, Allen et al. 1984, Neyret et al. 1993). This variability may be explained by the fact that not all cases of knee arthrosis progress (Spector et al. 1992, Sahlström et al. 1993). It may also, however, be due to small and heterogeneous study groups with respect to the type of injury and age, and the use of evaluation techniques with low precision and reproducibility.

Many reports have noted different frequencies of arthrosis, depending on which criteria were used to define the presence of arthrosis on radiographs. In this review, the average frequency of detectable joint space-narrowing 10 years after an cruciate ligament tear was about 35 percent, while the corresponding frequency of changes on the Fairbank scale was almost 80 percent at the same time (Figures 1 and 2). Clearly, the method used to evaluate the radiographs has a significant influence on the apparent outcome of the study. Since many studies present either the frequency of Fairbank changes or joint space-narrowing, but not both, results of different studies are difficult to compare.

Endogenous factors may contribute to the development of arthrosis and will cause further variation in the frequency of posttraumatic arthrosis. It was shown, for example, that patients with meniscectomy who had an endogenous risk factor for primary arthrosis, reflected by distal interphalangeal arthrosis, had a higher frequency of knee arthrosis than patients without this sign (Doherty et al. 1983). Other endogenous risk factors may be present in the form of genetic variability in the structure of the gene of cartilage type II collagen (Williams and Jimenez 1993, Vikkula et al. 1994).

Two retrospective studies suggested a lower frequency of arthrosis after a partial meniscectomy than after a total (McGinty et al. 1977, Sommerlath et al. 1991), while a prospective, randomized study failed to find a difference (Hede et al. 1992). The outcomes of other studies indicate that meniscal repair, as compared to meniscus resection, may reduce the frequency of arthrosis (Lynch et al. 1983, Sommerlath 1991). The complexities of the injured knee with different types of tears in stable or unstable knees make prospective trials difficult to design and control. A number of investigators have studied the outcome after repair or reconstruction of the cruciate ligament (McDaniel and Dameron 1980, Johnson et al. 1984, Engebretsen et al. 1989, Sommerlath et al. 1991, Ahlgren et al. 1992). However, all except one are retrospective. Some of the studies express doubts with regard to the ability of cruciate ligament repair to prevent arthrosis. These doubts seem substantiated in this meta-analysis of 33 studies by the apparent inability of repair or reconstruction of the cruciate ligament to retard the progression of arthrosis after knee injury (Figures 1 and 2). It is also doubtful if cruciate ligament surgery, at least as performed between 1986 and 1991 in Sweden, accelerates the return to demanding physical activity, as compared to cases with no surgery (Roos et al. 1995).

Future studies which aim to prove the ability of, e.g., cruciate ligament reconstruction, meniscus suture or meniscus transplantation to prevent posttraumatic arthrosis should compare outcome with the natural history of knee injury and use sensitive, reproducible and validated techniques to monitor the progress of cartilage and joint changes. Recent reports suggest that the sensitivity and specificity of radiography can be improved by using standardized conditions (Altman et al. 1987, Cooper et al. 1992, Spector et al. 1994). Other methods for monitoring the progression of arthrosis may soon be available (Noyes and Stabler 1989, Ayral et al. 1993, Spindler et al. 1993, Berkenblit et al. 1994, Dougados et al. 1994, Lohmander 1994, Myers et al. 1994).

The efficacy of surgical intervention in preventing posttraumatic knee arthrosis has thus not yet been demonstrated in prospective, controlled, randomized, masked trials. We regard such adequately designed trials as the minimum standard in testing the safety and efficacy of new drugs. It is time that we scrutinize surgical procedures by the same standards used for judging pharmaceutical agents. Retrospective, open, cross-sectional studies may serve to provide preliminary data that can assist in the design of prospective trials

Masking of surgical trials presents obvious problems, but a minimum requirement should be that patients are not evaluated by the surgeon but by an independent, unbiased investigator and that evaluation of radiographs, etc., is done without knowledge of patient identity, time of sampling and, if possible, the treatment. The accomplishment of such trials is demanding and requires long-term follow-up. They

may further require multicenter design to recruit homogeneous study groups within a reasonable time. The Swedish national registers for knee and hip arthroplasty outcome provide valuable role-models (Malchau et al. 1993, Knutson et al. 1994). Perhaps the time is right for a similar national register of reconstructive procedures for knee ligament injury. This could assist in the identification of suitable procedures and ensure good quality.

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