Osteoarthritis of the knee in the middle-aged recreational athlete

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A painful osteoarthritic knee in a middle-aged recreational athlete is one of the most difficult problems to manage. Initially, all patients should be treated conservatively; however, when exacerbations become frequent as the degenerative changes progress, surgical treatment should be considered. This article outlines the treatment options for this difficult condition.

■ For the purposes of this discussion we will define middle-aged as between 35 and 60 years. There are two major types of osteoarthritis in this age group – post-traumatic and nontraumatic.

Post-traumatic osteoarthritis occurs in patients who have had a previous knee injury as a young adult. The previous injury is commonly a combined ligament and meniscal injury that resulted in surgical removal of one or both menisci. The loss of the cushioning effect of the meniscus commonly results in arthritic changes 10 to 20 years later.

Nontraumatic osteoarthritis occurs in patients who have not had a previous knee injury and in whom the osteoarthritis is strongly genetically determined. Such patients often report a family history of early osteoarthritis.

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Pathophysiology

Although osteoarthritis is the most common form of arthritis, very little is known about its pathological basis. On a cellular level, osteoarthritis may be the result of a failed attempt of chondrocytes to repair the damaged cartilage, as well as an increased water content and altered proteoglycan and collagen content of the affected cartilage. The changes that occur in osteoarthritis begin with the deterioration and loss of the weight-bearing surface, followed by the development of osteophytes and the breakdown of the osteochondral junction. Finally, the cartilage disintegrates and subchondral microfractures occur, exposing the bony surface.

Clinical features

Symptoms

The predominant symptoms of osteoarthritis of the knee are pain, swelling and a decreased activity level. The pain generally worsens with activity and improves with rest. The pain can be present along the joint line or it may be felt as a generalised anterior ache. Commonly, reflex inhibition of the quadriceps occurs, resulting in wasting of this muscle. This in turn may exacerbate anterior patellofemoral type pain and may also cause symptoms of giving way due to poor muscular control. Mechanical symptoms associated with a large effusion and pinpoint joint line tenderness, such as locking, catching and giving way, may be superimposed if an unstable meniscal tear or a loose chondral flap is present.

Signs

The patient with osteoarthritis of the knee commonly has an antalgic gait. Genu varum or valgum may be present, indicating a loss of joint space resulting in deformity. An effusion is often present and is usually large if the patient has an unstable meniscal tear or a loose chondral flap. Knees that have previously been injured may be ligamentously unstable. In this situation it is usually the anterior cruciate ligament that is damaged and this is best illustrated with the Lachman test (anterior translations of the tibia on the femur with the knee at 30° flexion).

The joint should be assessed for quadriceps wastage and palpated for tenderness, osteophytes and cysts. Baker's cysts are commonly felt in the popliteal region, and pseudocysts are usually felt along the joint line and are associated with degenerative meniscal tears. Rotational tests (for example, McMurray's test) should be performed to assess for meniscal

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pathology. An important test is to check for pain and crepitus whilst loading the affected compartment and moving the knee through a range of motion. This will elicit wear on the weight-bearing surface and often allows painful bone-on-bone crepitus to be felt.

X-ray findings

The minimum x-ray requirement for the assessment of osteoarthritis of the knee includes the following views:

- weight-bearing anterior–posterior
- lateral
- intercondylar
- patellar skyline
- weight-bearing posterior–anterior with 30° knee flexion.

This last view, known as the Rosenberg view, is more sensitive for demonstrating joint space narrowing because initially the weight-bearing surface tends to wear at the position of 30 to 40° of knee flexion.

The classical radiographic findings in osteoarthritis include subchondral sclerosis, subchondral cyst formation (secondary to subchondral microfractures), osteophytes and joint space narrowing. Three-foot weight-bearing alignment views are not required in the initial assessment but need to be performed preoperatively by a specialist if an osteotomy is to be performed.

Differential diagnosis

If the patient does not display the typical characteristics of osteoarthritis, other possible diagnoses should be considered. These include spontaneous osteonecrosis of the knee, inflammatory arthritis and crystal deposition diseases. Further studies should then be considered to document the true cause of the arthritis, and specialist rheumatological referral should be arranged if necessary.

Special investigations

Bone scan

A bone scan is helpful if spontaneous osteonecrosis around the knee is suspected. Typically this condition is seen in women nearing the age of 60. Although it is most common in the medial femoral condyle it can also appear in the tibial plateau or on the lateral side of the femur. A bone scan will show focally increased uptake before the radiographs are abnormal.

The cause of spontaneous osteonecrosis is unknown, but vascular ischaemia or microfractures in osteoporotic bone are suspected. Many patients have a benign course followed by resolution of symptoms. Because of this, conservative management is indicated initially. However, if progressive collapse occurs, surgical treatment in the form of osteotomy or arthroplasty may have to be considered.

Aspiration of joint fluid

If the history is not typical of osteoarthritis, aspiration of joint fluid is worthwhile. In osteoarthritis, joint fluid analysis usually reveals a straw-coloured aspirate with normal viscosity and a low white blood cell count (0.2 x 10^9/L with 25% polymorphonuclear cells). Glucose and protein levels are equal to those found in serum.

In an inflammatory arthritis, a yellow–green coloured aspirate with low viscosity is found and the white blood cell count is elevated (2 to 75 x 10^9/L per mL with 50% polymorphonuclear cells). The glucose level is moderately decreased (1.39 mmol/L lower than the serum level).

An infected knee produces an opaque fluid with a white cell count greater than 80 x 10^9/L and 75% polymorphonuclear cells. The glucose level is low (more than 1.39 mmol/L less than serum values), and Gram stain and culture are often positive.

In crystal deposition disease, joint fluid analysis shows an inflammatory aspirate with crystals evident. In gout the crystals are thin, tapered, intracellular and strongly negatively birefringent (yellow). In chondrocalcinosis (pseudogout) the crystals are rhomboid-shaped rods that are weakly positively birefringent (purple).

MRI scan

MRI scanning has very little to offer in the work up of an osteoarthritic knee. The results can be misleading since 50% of the asymptomatic normal population aged 40 will show changes in their menisci on MRI. Clinical and radiological investigations are far more accurate and less expensive.

Management

Initially, all patients should be treated conservatively. The reason for this is that degenerative knees have a natural history of acute exacerbation which settles over several weeks, followed by remission. Ultimately, the exacerbations become more frequent as the degenerative changes progress, and when this happens surgical treatment should be considered.

Conservative treatment

Conservative treatment consists of a four-week course of analgesic or nonsteroidal anti-inflammatory medications. We prefer the regular dosage of an analgesic, such as paracetomol, because they are safe and effective. Anti-inflammatory agents are used infrequently because they have significant side effects and the inflammatory component of osteoarthritis is usually minimal.

Physiotherapy should be used to strengthen the quadriceps muscle, as this improves the mechanics of the knee joint and thus reduces symptoms. Local therapies for tender areas around

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the joint are also helpful. Weight reduction is important if the patient is obese. The patient should be given advice on avoiding high impact activities and should be encouraged to stay fit by cycling and swimming rather than running.

It is not uncommon for intra-articular corticosteroids to be used in the treatment of osteoarthritis. The aim of using corticosteroids is to control pain by decreasing inflammation. As degenerative osteoarthritis is mostly a biomechanical disorder with minimal inflammation, we generally avoid corticosteroid treatment. There are also known deleterious effects of corticosteroids on chondrocytes and the menisci as well as systemic side effects, such as infection and suppression of the hypopituitary–adrenal axis. Patients awaiting total knee arthroplasty may gain some short term pain relief, but there is no documented long term benefit for the use of corticosteroids in large weight-bearing joints. Certainly in a middle-aged recreational athlete with osteoarthritis of the knee, the risks of corticosteroid use outweigh the benefits.

If conservative measures fail, consideration can be given to surgical treatment.

Arthroscopy

If the history and physical findings suggest the presence of a torn degenerative meniscus or a loose body and minimal wear on the weight-bearing surface, an arthroscopic procedure may be worthwhile. Unfortunately, in middle-aged patients the success of arthroscopic meniscectomy in knees with minimal wear is only approximately 80%. The remaining 20% of patients have subclinical degenerative changes that cause persistent pain and swelling – frequently the symptoms with which the patient first presented. Accordingly, arthroscopy should only be carried out if conservative measures have failed and the patient has been made clearly aware of the likelihood of success of this type of surgery. It should also be stressed that the middle-aged athlete is unlikely to be able to return to high impact activities, such as jogging and running, following arthroscopy, and that frequently the joint becomes asymptomatic with cessation of these activities without arthroscopy.

Unfortunately, patients with more advanced degenerative changes do not appear to benefit from arthroscopic procedures. This is particularly true of patients with advanced varus or valgus deformity or associated chondrocalcinosis. It has been fashionable to perform arthroscopic debridement, which removes loose pieces of articular cartilage, shaves rough surfaces and removes tags of torn cartilage. Some 'freshening up' of the exposed subchondral bone (abrasion osteoplasty) may also be carried out. Another

Osteotomy for osteoarthritis in a varus knee

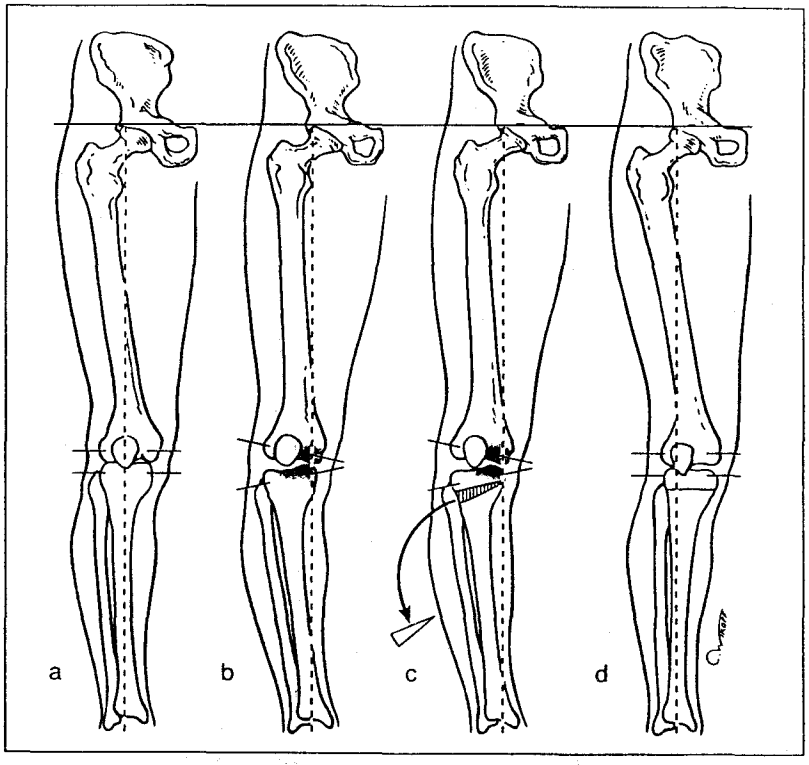

Figure 1. a. In a normally aligned leg the weight-bearing axis (dotted line) runs through the centre of the hip, knee and ankle. b. With a varus deformity, the weight-bearing axis runs through the centre of the hip and ankle, but through the diseased medial side of knee. c. A lateral closing wedge high tibial osteotomy removes a wedge of bone from the lateral side of the proximal tibia. d. Postosteotomy the leg is aligned in an appropriately over-corrected valgus position and the healthy lateral compartment takes the majority of the load. This relieves the pain and gives the medial compartment a chance to heal.

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The inflammatory component of osteoarthritis is usually minimal; therefore, anti-inflammatory agents are infrequently used.

High tibial osteotomy

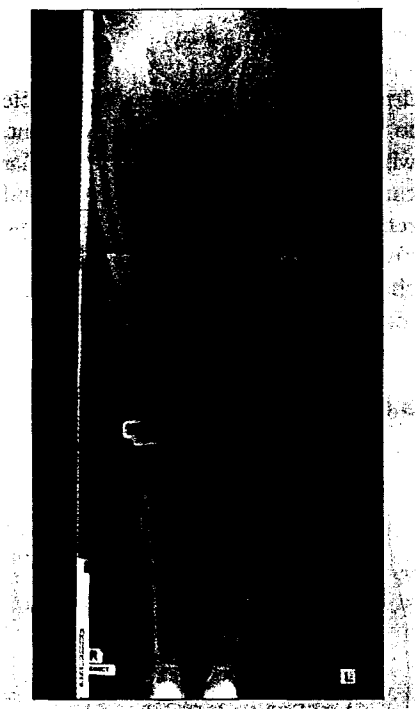

Figure 2. A patient, formerly with a bilateral varus deformity, after recent high tibial osteotomy of the right leg.

commonly performed operation is a lavage, in which loose fragments are washed from the joint using the arthroscope.

These arthroscopic techniques, although commonly performed, rarely afford a successful outcome. Anecdotally, in my experience, approximately one-third of patients improve, one-third of patients remain unchanged, and one-third of patients suffer a deterioration of symptoms necessitating more major surgery. Several studies have been performed which scientifically support this anecdotal evidence.[1,2] A recent well-designed, double-blind, randomised pilot study has also shown that some or all of the favourable effects of arthroscopy for osteoarthritis of the knee may be due to a placebo effect.[3] In this study, patients who only had arthroscopic porthole puncture wounds continued to have better symptom relief at six months than those who had arthroscopic debridement or lavage.

Osteotomy

Osteotomy is an appropriate surgical option in selected cases of unicompartmental degenerative arthritis with an associated varus or valgus malalignment. The purpose of osteotomy is to transfer the load to an uninvolved tibial–femoral joint surface.

Osteotomy is most commonly performed for medial compartment disease with a varus deformity. In this situation, high tibial osteotomy is performed (Figure 1). The normally aligned leg is in a slightly valgus position, with the weight-bearing axis passing directly through the centre of the hip, knee and ankle (Figure 1a). Once varus deformity occurs, the weight-bearing axis passes through the painful degenerative medial compartment and the healthy lateral compartment carries minimal load (Figure 1b). This becomes a progressive disorder and worsens exponentially – there are minimal symptoms for many years and as symptoms worsen the deterioration accelerates. The reason for this is that the force through the affected compartment is related to the square of the distance of the weight-bearing line from the centre of the knee joint.

A lateral closing wedge high tibial osteotomy removes a lateral wedge from the proximal tibia and places the leg in a slightly over-corrected valgus position, thus unloading the medial compartment.(Figures 1c, d and 2). The healthy lateral compartment takes the majority of the load and gives the medial compartment a chance to heal with the production of new fibrocartilage. The patient will be in hospital for the first five to seven days after surgery and will be required to wear a straight leg cast for six weeks. The leg should not bear weight for the first four weeks in the cast, so the patient will need to use crutches.

In lateral compartment disease with a valgus deformity a distal femoral osteotomy is performed. A medial wedge of bone is removed from the distal femur, placing the leg in a varus position and thus unloading the lateral compartment.

It should be stressed that these osteotomies are designed to allow patients to walk without discomfort, not to return them to sporting activities. If adequate correction is achieved, the success rate of high tibial osteotomy is 90% at the 12 month mark and 65% at 10 years. Those patients who fail to achieve such long term relief usually obtain at least a few of years of relief and are then eligible for joint replacement.

Osteotomy is strongly recommended in the middle-aged patient with osteoarthritis and deformity. If the patient is nearing the age of 60, it is worth considering continuing with conservative measures for as long as possible so that when complete deterioration of the joint has occurred, joint replacement may be performed.

Arthroplasty

Unfortunately, joint replacement surgery is not a realistic option in middle-aged patients with osteoarthritis. Even with today's technology there is no currently available implant that will not wear or fail prematurely. Revision procedures are likely to be required, carrying increased risk and limitations for the patient. Also, joint replacement does not allow the patient to return to running and jumping sporting activity, which is often the goal of treatment. We prefer to wait

until the patient nears the age of 60 and has exhausted all other treatment options such that they are willing to accept the risks of undergoing major surgery.

Arthrodesis

Arthrodesis is indicated only in young patients with severe, painful articular cartilage damage throughout the joint which is not amenable to other surgical options. Other indications for arthrodesis include uncontrollable septic arthritis and complete joint destruction, neuropathic joint disease and failed total knee arthroplasty.

Experimental treatments

Experimental treatments include osteochondral allografts, as well as implantation of growth factors, cartilage cells and artificial matrices in an attempt to stimulate restoration of the articular surface. None of these approaches has led to successful regeneration of tissue that duplicates the structured composition, mechanical properties or durability of articular cartilage.

Conclusion

Osteoarthritis in the middle-aged recreational athlete is one of the most difficult problems to treat. Once all conservative measures have failed, the surgeon relies primarily on the success of osteotomy to afford pain relief for these patients. Unfortunately arthroscopy has only a limited role in the treatment of osteoarthritis, and joint replacement arthroplasty is not a reasonable option until patients near the age of 60. Hopefully, further advances in orthopaedic technology will give the treating physician more options for managing these patients. ■

References

1. Ogilvie-Harris DJ, Fitsialos DP. Arthroscopic management of the degenerative knee. Arthroscopy 1991; 7: 151-157.
2. Rand JA. Role of arthroscopy in osteoarthritis of the knee. Arthroscopy 1991; 7: 358-363.
3. Mosely JB, Wary NP, Kuykendall D, Willis K, Landon GC. Arthroscopic treatment of osteoarthritis of the knee: a prospective, randomised, placebo controlled trail. Results of a pilot study. Presented at American Orthopedic Society for Sports Medicine Specialty Day. Orlando, USA, 1995.

Further reading

1. Coventry MB, Ilstrup DM, Wallrichs SL. Proximal tibial osteotomy. A critical long-term study of eighty-seven cases. J Bone Joint Surg Am 1993; 75: 196-201.
2. Ecker ML, Lotke PA. Spontaneous osteonecrosis of the knee. J Am Acad Orthop Surg 1994; 2: 173-178.
3. Fadale PD, Wiggins ME. Corticosteroid injections: their use and abuse. J Am Acad Orthop Surg 1994; 2: 133-140.
4. Fairbank TJ. Knee joint changes after meniscectomy. J Bone Joint Surg Br 1948; 30: 664-670.