Acta Orthop. Belg., 2006, **72**, 502-506

CASE REPORT

Ankylosis due to heterotopic ossification following primary total knee arthroplasty

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We present a case of ankylosis of the knee after knee arthroplasty due to heterotopic ossification in the ligaments. Treatment with resection of the collateral ligaments, reconstruction with a hinged implant and radiotherapy was successful.

Keywords : heterotopic ossification ; total knee arthroplasty.

INTRODUCTION

Heterotopic ossification is a well known complication after total hip arthroplasty and neurologic injuries, such as spinal cord injury or cerebral trauma (*5, 10-14*). In 1973, Freeman (*9*) reported a case of ectopic ossification following cemented primary total knee arthroplasty in a patient with a previously ankylosed knee. Since then variable rates of heterotopic ossification, between 1 to 42%, have been reported following total knee arthroplasty (*1-5, 7, 8, 11, 15*). Usually it is described anterior to the femur, adjacent to the periosteum in the quadriceps expansion (*1-4, 7, 8, 11, 15*).

We report a case of ankylosis of the knee after primary total knee replacement due to ossification of the collateral ligaments and intra-articular bone formation.

CASE REPORT

In 2003 a 58-year-old man presented at our department with an ankylosed right knee after a primary total knee arthroplasty performed in another hospital.

His history revealed a skiing accident with a lateral tibial plateau fracture of that right knee, treated with an articulating fracture brace in 1984. He recovered a full range of motion after this conservative treatment and was able to resume all professional and sporting activities for 10 years. In 1995 an arthroscopy of this right knee was done for mechanical pain.

Debridement of a degenerative lateral meniscus was done and arthrosis of the lateral compartment was observed. Further conservative treatment was continued and knee pain was well controlled with anti-inflammatory drugs.

In 1996 he underwent bilateral cemented total hip replacement for osteoarthritis. In 2001 pain became sufficient for knee replacement surgery despite the young age of this patient. Preoperative

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No benefits or funds were received in support of this study

notes showed a range of motion between -8° and 135° of flexion. Stability in the mediolateral and anteroposterior plane was normal. Standing radiographs showed a slight valgus alignment of 3° and osteoarthritis of the lateral compartment. Primary total knee arthroplasty was performed through a medial parapatellar arthrotomy. The medial soft tissue sleeve was released up to the middle of the tibial condyle with progressive external rotation of the leg.

Intramedullary guides were used both for the femur and the tibia. Cuts perpendicular to the mechanical axis of the leg in the frontal plane and a 5° tibial slope cut in the sagittal plane were obtained. The posterior cruciate ligament was retained. After positioning of the trial components soft tissue release was decided. A femoral subperiosteal release of the lateral collateral ligament and a "pie crust" release of the iliotibial band were performed. The patella was resurfaced with an inlay button and no lateral release was necessary. A Genesis II (Richards, Memphis, USA) cruciate retaining fixed bearing knee was implanted using cement for all three components.

Because of early limited range of motion (-5°-0°-70°) a manipulation under anaesthesia was done three weeks postoperatively. Full extension and 95° of flexion were achieved. However, three months later the patient maintained only 40° of active flexion. An open debridement with resection of anterior scar tissue, recreation of both gutters, and a release of the deep medial collateral ligament, the popliteus tendon and the tibial insertion of the posterior cruciate ligament was performed. Once again an acceptable flexion of 110° was reached. A few months postoperatively he experienced progressive pain and loss of motion despite physiotherapy.

The initial examination at our clinic was significant for diffuse inflammation of the knee and a fixed position of 15° flexion. Radiographs revealed adequate positioning of the femoral and tibial components. There was obvious ossification of the medial collateral ligament (fig 1). A pelvic radiograph revealed Brooker grade III heterotopic ossification around the total hip replacements. No prophylaxis had been used after the arthrolysis, neither after the total knee arthroplasty.

The erythrocyte sedimentation rate (ESR) was 29 mm/hr and the C-reactive protein (CRP) was 0.3 mg/dl, alkaline phosphatases 306 IU/l.

Aspiration of the knee produced serous fluid with a negative bacterial culture and negative Polymerase Chain Reaction (PCR). A technetium^{99} bone scan showed hot spots in the collateral ligaments and intra-articularly (fig 2). An indium^{111} white blood cell scan was negative.

Knee arthrodesis was not acceptable to this patient. Therefore, we proposed revision surgery, two years after the index operation, with a hinged knee arthroplasty which allowed us to resect the ossified collateral ligaments. The day before surgery, one session of radiation therapy (7 Gy) was scheduled. At the revision surgery, a quadriceps snip approach was used. The collateral ligaments were completely ossified and bone had also formed anteriorly between the femoral component and the tibial polyethylene. The components were well fixed. Bacterial cultures obtained during surgery were found sterile after seven days. Both collaterals and the posterior cruciate ligament were completely resected. A cemented Finn rotating hinge knee prosthesis (Biomet, Warsaw, USA) with uncemented stems was used (fig 3). A standard rehabilitation schedule for total knee arthroplasty was followed.

Indomethacin was administrated orally for six weeks. Two years postoperative, his active range of motion was from full extension to 115° of flexion. Standard radiographs showed satisfactory position and alignment with no recurrence of heterotopic ossification (fig 3).

DISCUSSION

The incidence of heterotopic ossification following total knee arthroplasty is considerably lower than following total hip arthroplasty and neurological injuries (*1-4, 7, 8, 10-13, 15*). Although the reported incidence has a wide range (1 to 42%), few cases are clinically significant (*1-5, 7, 8, 11, 15*). The common anterior femoral ossicle rarely results in functional limitation (*1-5, 7, 8, 11, 15*).

Several risk factors have been identified including both genders, a history of previous trauma,

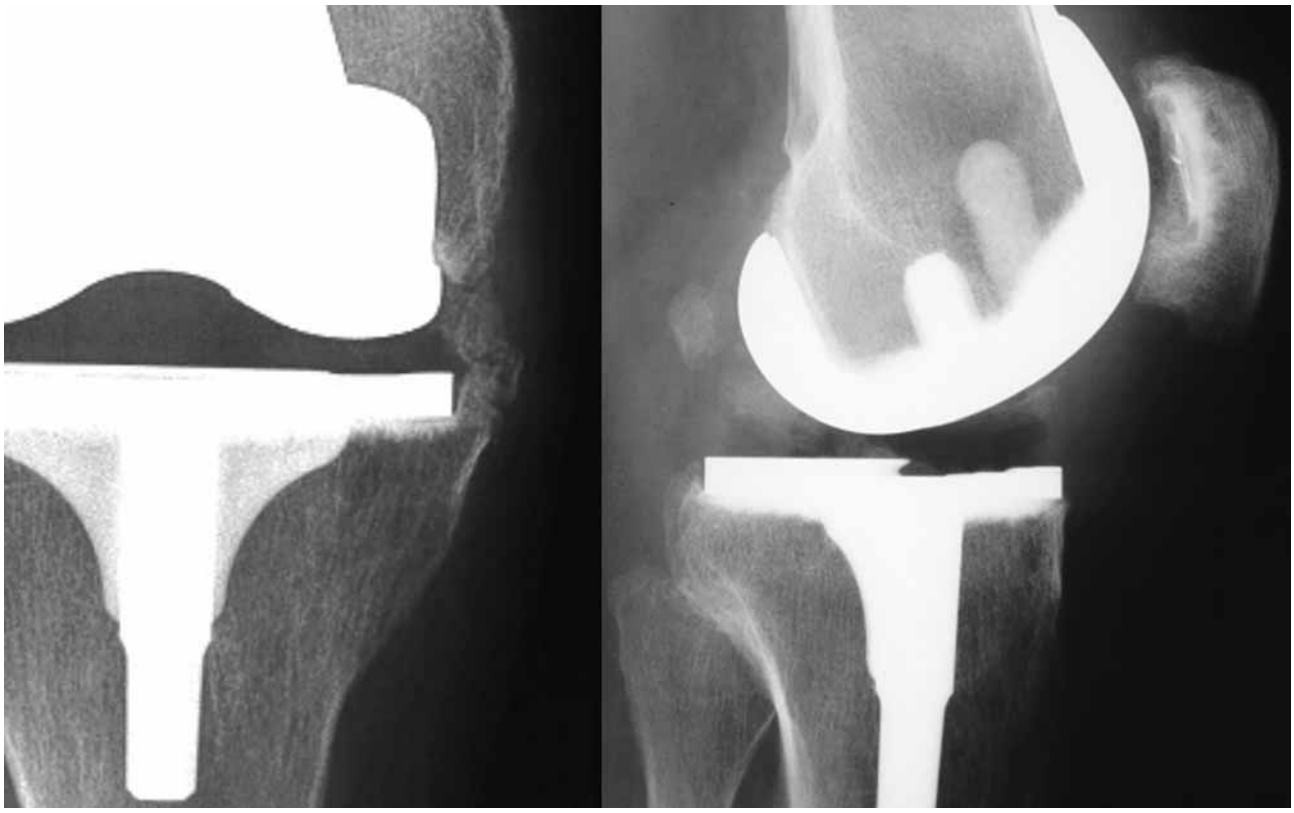

Fig. 1. — (A) Anteroposterior radiograph showing ossification of the medial collateral ligament ; (B) Lateral radiograph showing new bone formation anteriorly between the femoral component and the polyethylene tibial insert.

multiple arthroscopic surgeries, hypertrophic osteoarthritis, increased lumbar bone mineral density, anterior notching or dissection of the distal femoral cortex with periosteal trauma, surgical trauma to the quadriceps expansion and postoperative haematoma formation (*1-4, 7, 8, 10, 11, 14, 15*). Especially forced knee manipulation was recognised as an important factor in heterotopic ossification (*5-7, 11, 15*).

Similar to the hip, prevention is the most efficient treatment for HO of the knee (*1-4, 7, 10-15*). However since it is rare, prophylaxis is only necessary when several risk factors are combined (*11-14*). Optimal prophylactic regimens are instituted preoperatively or within the first 24 to 48 hours postoperatively, but are still somewhat effective within the first 4 days after surgery (*11-14*).

The efficacy of non-steroidal anti-inflammatory drugs (NSAIDS) and local radiation are both well documented (*10-14*). NSAIDS are routinely used in the postoperative period following total knee arthroplasty in the analgesic protocol, and they have an influence on HO through their effect on the synthesis of prostaglandins (*12-14*). Prophylactic regimens with indomethacin for 7, 10 and 14 days (25 mg three times daily) were equally effective in HO prevention as postoperative radiation protocols (*11-14*). Radiation of the surgical site has also successfully been used as a prophylaxis in patients after total hip arthroplasty (*5, 10, 11, 14*).

Since the general incidence of HO after total knee arthroplasty is only 10% and since HO very rarely interferes with the clinical outcome, radiation is only advocated if several risk factors are combined (*5, 10, 11*). Single-dose regimens of 700 Gy have shown equivalent results compared with protocols requiring higher cumulative dose and multiple treatments as long as administration occurred before postoperative day five (*5, 10, 11*). A single dose of 550 Gy was inadequate for prevention (*10*).

Fig. 2. — Technetium bone scan with increased uptake in both collateral ligaments.

Fig. 3. — Two year postoperative radiograph showing the Finn rotating hinge in good position without heterotopic ossification.

The most important factor in prevention is probably surgical technique including the amount of periosteal trauma, femoral notching, quadriceps muscle damage, anterior femoral synovectomy and inadequate haemostasis (*1-4, 7, 11, 15*).

Most knees with HO have a satisfactory clinical result without additional surgery (*1-4, 8, 11, 15*). Spontaneous resolution of pain with restricted flexion has also been reported (*1, 3, 11, 15*). Surgical excision has been used especially to resect the bony masses found in the quadriceps expansion which lead to limited range of motion, pain and snapping (*1-3, 8, 11*). The procedure, as in our case, should be delayed until at least 12 months after the index arthroplasty (preferably 18 to 24 months) to permit maturation of HO and the development of a fibrous capsule (*8, 11, 15*). Timing can be guided by bone scan activity, since a marked decrease in activity is a sign of HO maturation (*8, 11*).

Especially good quality radiographs in two plains will show when the remodelling is completed and the heterotopic ossification mature (*8*).

Prophylaxis during this surgery is strongly advised either with radiation or NSAIDS, or both (*5, 8, 11-14*). The medication should be given in the same dose as in prophylaxis, but for a longer period (6 to 12 weeks) (*3, 11-13*).

In this case, the HO was extensive and formed intra-articularly and in the collateral ligaments. The risk factors included a susceptible patient (HO following THR), trauma from manipulation and surgical trauma associated with extensive soft tissue releases at surgery. Resection of the collateral ligaments was necessary to restore motion and a hinged implant was an excellent solution to substitute for the ligaments and to allow easy flexion. Careful surgical exposure and haemostasis reduced the risk of recurrence combined with preoperative radiation and oral NSAIDS. Surgeons should be

aware of this rare complication in total knee arthroplasty and employ prophylaxis when manipulation or extensive soft tissue releases are done in patients with multiple risk factors for heterotopic ossification (*6, 7, 11, 15*).

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