

## SEVERE HETEROTOPIC OSSIFICATIONS AFTER TOTAL KNEE ARTHROPLASTY

J. BELLEMANS, P. CLAERHOUT, T. EID, G. FABRY

**The authors report a case of severe heterotopic ossifications after a total knee arthroplasty in an 83-year-old woman. She showed a dramatic loss in range of motion between the third and sixth postoperative week, after she had obtained a satisfactory 0° to 90° range of motion at the 14th postoperative day.**

**A treatment program of radiotherapy combined with indomethacin and nonaggressive antiinflammatory physiotherapy resulted in a slow but steady improvement with complete relief of symptoms 6 months postoperatively.**

**Keywords :** heterotopic ossification ; total knee arthroplasty.

**Mots-clés :** ossifications hétérotopiques ; prothèse totale de genou.

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### INTRODUCTION

Myositis ossificans or heterotopic ossification is a nonneoplastic soft tissue formation of cartilage or bone that usually follows a traumatic event. In the last two decades, only a few cases of myositis ossificans have been reported after total knee arthroplasty procedures, although it recently has been recognized that the incidence of minor heterotopic bone formations might be higher than previously expected (3, 5). We report a case with severe heterotopic ossifications occurring in the early postoperative period, which responded well to a conservative treatment program.

### CASE REPORT

An 83-year-old woman with a previous history of a total hysterectomy at the age of 57 was seen

in the orthopedic clinic for severe left knee pain on ambulation, with a maximal walking distance of only a few hundred meters. On clinical examination a severe varus deformity was noted, with a flexion contracture of 10° and a maximum flexion up to 120°. Marked crepitus was noted at both the femorotibial and patellofemoral articulations. Laxity of 10 to 15° was noted on the medial side under valgus stress. The strength of the quadriceps was normal. Radiographic examination showed severe osteoarthritis of the knee with moderate bone loss on the medial tibial side. It was decided that this patient could be treated adequately by a total knee prosthesis, after routine preoperative screening. The procedure was performed under general anesthesia. A tourniquet was applied and a routine medial parapatellar incision was used. A Duracon® total knee arthroplasty was inserted, with the use of nonslotted cutting guides, and with cement fixation of the three components. Adequate ligament balancing was obtained after partial release of the deep and superficial medial collateral ligament. With the trial components in situ, flexion of 125° could be obtained, together with a full extension, without PCL or posterior capsular release. After deflation of the tourniquet, hemostasis was carefully achieved, followed by routine closure over 2 drains. The early postoperative period was uncomplicated, with continuous passive motion exercises

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started on the third postoperative day, together with quadriceps settings.

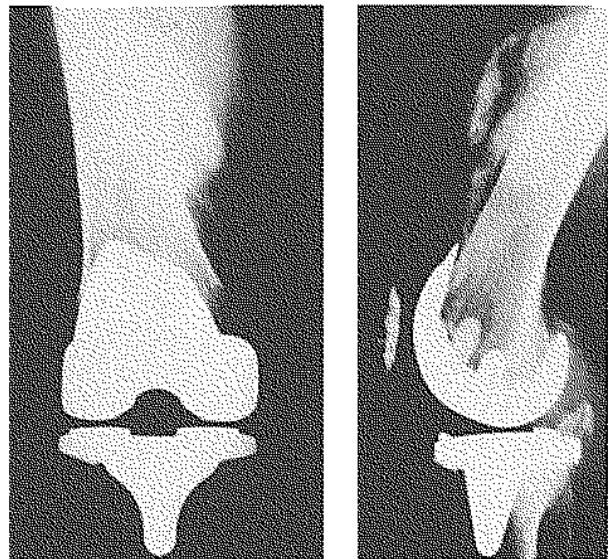
On the fourteenth postoperative day, the patient was discharged from the hospital, when complete wound healing, flexion of  $90^\circ$ , and full active and passive extension was obtained.

Three weeks later, however, the patient was sent back to the clinic by her physiotherapist because of a large decrease in the range of motion, together with increased pain. On clinical examination an extension deficit of  $20^\circ$ , both active and passive, was noted, with a maximal flexion of  $40^\circ$ . On palpation the knee was warm, and was moderately swollen. The patient's temperature at that time was  $36.8^\circ$ , and there had been no fever in the previous week. Blood analysis showed a sedimentation rate of 58 mm/hr and a CRP of 2.9 mg/dl. Routine AP and lateral x rays showed adequate positioning of the prosthetic components, together with the presence of ossifications in the suprapatellar region, just proximal to the femoral component (fig. 1). The diagnosis of myositis ossificans was made, and the patient was admitted to the hospital for treatment. The treatment program consisted of a radiotherapy regimen of a total of 6 Gray in 3 fractions, combined with indomethacin suppositories 100 mg g.d., and antiinflammatory physiotherapy consisting of ice applications and passive range of motion exercises within the pain-free range. After completing the radiotherapy, the patient was discharged from the hospital and was

instructed to proceed with indomethacin and physiotherapy. Three weeks later she was seen back in the clinic, without any improvement in pain or range of motion. Nevertheless she was instructed to prolong the indomethacin therapy and the antiinflammatory physiotherapy for a total duration of three months. Four weeks later the situation had improved minimally with some regression of the pain sensation and an improvement in the range of motion, now with full extension and flexion to  $40^\circ$ . Four weeks later however the situation had improved considerably, with the patient obtaining full extension and flexion up to  $90^\circ$ , and with marked pain improvement. Four weeks later the patient was walking comfortably without pain and without using crutches, either inside or outdoors, and she had no difficulty in obtaining full extension and flexion of  $95^\circ$ . X rays at that moment showed signs of maturation of the calcified zone, with a trabecular architecture becoming apparent (fig. 2). At that moment it was decided to stop the indomethacin treatment and the physiotherapy. Two months later the situation was unchanged, i.e. comfortable walking without pain, full active and passive extension and flexion up to  $95^\circ$ . At 18 months postoperatively the patient was still without pain and had an active and passive range of motion of 0 to  $115^\circ$ .



*Fig. 1.* — Follow-up x ray 5 weeks after operation.



*Fig. 2.* — x ray 5 months after operation.

## DISCUSSION

In contrast to total hip arthroplasty, heterotopic bone formation following total knee arthroplasty is an infrequent event. In the last two decades, only a few case reports have been made by various authors (1, 5). In recent papers however, the incidence of minor heterotopic bone formation after total knee arthroplasty has been suggested to be higher than previously expected, ranging between 1% and 26% (2, 3). Risk factors include male sex, a previous history of heterotopic ossification, diffuse idiopathic skeletal hyperostosis, ankylosing spondylitis, and elevated bone mineral density. Technical surgical factors have also been associated with a higher frequency of heterotopic bone formation, including the amount of periosteal trauma, femoral notching, quadriceps muscle damage, anterior femoral synovectomy, and inadequate hemostasis (3, 4). The leakage of bone marrow and osteogenic substances during femoral preparation might be an important factor in the pathogenesis.

It is currently believed that primordial mesenchymal cells differentiate into osteoprogenitor cells which then modulate into osteoblasts. This process has been noted to occur as soon as 16 hours postoperatively, with a peak response noted at approximately 32 hours.

In analogy to the Brooker system for classification of heterotopic bone formation in total hip arthroplasty, Furia *et al.* (3) recently developed a classification system for total knee arthroplasty. Two grades of heterotopic ossification were defined, based on the size of the largest visible bone segment: grade A  $\leq 5$  cm and grade B  $> 5$  cm, with class I heterotopic ossification consisting of islands of bone localized to the suprapatellar soft tissue areas of the distal femur, and class II heterotopic formation, organized into areas of ossification continuous with the anterior surface of the distal femur.

The case presented here could then be classified as II B, since the heterotopic bone was larger than 5 cm in diameter, and in contact with the anterior surface of the distal femur.

Furia *et al.* noted that grade B heterotopic ossifications demonstrated an average postoperative

loss of flexion of  $14^\circ$ , while grade A showed similar average knee flexion angles postoperatively, compared to preoperatively. Unlike the grade, the class of heterotopic ossification did not influence final knee flexion. Therefore it was concluded that the extent of heterotopic ossification assessed by radiographic grades was a better predictor of follow-up range of motion than the location of heterotopic ossification. Little is known about the optimal prevention and treatment of heterotopic ossification after total knee arthroplasty, and most of the treatment guidelines have been suggested based on the experience in total hip arthroplasty.

For prevention it has been recommended that oral diphosphonates can be administered one to two months preoperatively and continued three to six months postoperatively. Although diphosphonates could inhibit mineralization of osteoid, they have no effect on the actual formation of the osteoid matrix. In addition, the osteoid tissue is likely to mineralize when the treatment is discontinued.

A prophylactic effect of indomethacin in preventing the formation of heterotopic bone after total hip arthroplasty has been reported. Inhibition of prostaglandin synthesis and of the inflammatory response that occurs after the operative trauma has been proposed as the mechanism. No data however are available on the minimal dosage and treatment required for optimal prevention. Not only indomethacin, but also other NSAID's and aspirin have been shown to be effective in lessening the severity of heterotopic bone formation after T.H.A. NSAID's however are often contraindicated or not tolerated.

Radiotherapy was first recommended in 1981 as a preventive measure against heterotopic ossification in total hip arthroplasty. Initially, 10 doses were given over a 12-day course, providing a total of 20 Gray. Treatment failures were attributed to a delay in the initiation of treatment beyond 5 days postoperatively. More recently the use of irradiation in one or two fractions for a total of 6 to 8 Gray in the early postoperative period has been advocated for the hip. Disadvantages of radiotherapy are the inhibition of bony ingrowth into the porous-coated prosthesis, and the theoretical possibility of the late development

of malignancy, although, no malignancy could be found in several studies up to 8 years' follow-up.

Surgical resection of heterotopic bone should be delayed until six months, permitting maturation of the bone tissue and development of a distinct fibrous capsule. Because of the high incidence of recurrence noted in the literature, prophylactic radiotherapy should be used whenever surgical excision is done.

In the case reported no formal prevention of heterotopic ossification had been performed. The patient only developed symptoms after a few weeks, and after an uneventful immediate postoperative recovery. Loss of flexion after the second postoperative week and an increase in pain sensation were the symptoms leading to the diagnosis of myositis ossificans or massive heterotopic ossification. A treatment program of irradiation for a total of 6 Grays over 3 fractions, combined with indomethacin and antiinflammatory physiotherapy, resulted in a slow but steady improvement both subjectively and clinically, with a pain-free situation and 0° to 95° R.O.M. achieved at 6 months postoperatively.

As a result of this case, we now use a single dose of 7 Gray irradiation together with indomethacin as prevention for patients with significant risk factors undergoing total knee arthroplasty. The same regimen is prescribed as soon as ossifications are noted in the first postoperative weeks, with the purpose to limit the progression of this disease, rather than to resolve the ossifications.

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## SAMENVATTING

*J. BELLEMANS, P. CLAERHOUT, T. EID, G. FABRY. Heterope ossificaties na totale knieprothese.*

De auteurs melden een geval van myositis ossificans na het plaatsen van een totale knieprothese. De patiënt werd behandeld met radiotherapie, indomethacine en antiflogistische fysiotherapie, resulterend in een succesvol resultaat 6 maand postoperatief.

## RÉSUMÉ

*J. BELLEMANS, P. CLAERHOUT, T. EID, G. FABRY. Ossifications hétérotopiques importantes après prothèse totale de genou.*

Les auteurs présentent un cas d'ossifications hétérotopiques après prothèse totale de genou. La patiente a été traitée par radiothérapie, indométhacine, et physiothérapie anti-inflammatoire, avec un résultat satisfaisant 6 mois après l'opération.