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Ceramic endoprosthesis for aggressive giant cell tumors near the knee: eight cases followed for more than 10 years

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Abstract Eight patients with locally aggressive giant cell tumor were treated with marginal resection and implantation of a ceramic endoprosthesis with a non-hinged knee joint. The patients have been followed-up for between 10 to 16 years. Newly formed bone appeared at the junction between implant and cortex and in 2 cases subsidence of the implant was seen. All the patients had good function of the knee and no revision was needed.

Résumé Huit patients avec une tumeur à cellules géantes agressive ont été traités par résection marginale et implantation d'un prothèse de genou en céramique sans charnière. Les malades ont été suivis de 10 à 16 années. De l'os récemment formé est apparu à la jonction entre l'implant et la corticale. Dans deux cas un enfoncement de l'implant a été constaté. Tous les patients avaient une bonne fonction du genou et aucune révision n'a été nécessaire.

Introduction

A 10-year follow-up study is reported for 8 patients with a locally aggressive giant cell tumor (GCT) near the knee joint, who had undergone an endoprosthesis after a marginal resection.

Patients and methods

Eight patients (6 females and 2 males), with a locally aggressive GCT near the knee joint were treated between 1982 and 1989. The average age at time of surgery was 47 (31–66) years. Five GCT

were located in the distal femur and three in the proximal tibia. All lesions radiologically showed a large and diffuse osteolysis with cortical expansion, accompanied by severe thinning or destruction of the cortex. In 6 cases there was an incomplete and in 2 a complete pathological fracture (Fig. 1). The follow-up period was 15 (10–16) years.

Two types of endoprosthesis had been used. The distal femur type consisted of a partial distal femur segment connected to an intramedullary stem and a total condylar type (non-hinge) knee joint with a posterior stabilizer (Kyocera Co, Kyoto, Japan). The proximal tibia type consisted of a partial proximal tibia segment connected to a stem and a total condylar type knee joint. Both intramedullary stems were made of monocrystal alumina ceramic, whereas the femoral and tibial segments were made of polycrystalline ceramic. In the knee joint the gliding surfaces were ceramic to high-density polyethylene (HDP) (Fig. 2).

Results

All 8 patients were continuously free of disease and there was no local recurrence. Functional evaluation was performed by ISOLS criteria [5] (Table 1). The average functional score was 85.8% (77–93%). The motion of the knee joint ranged from 10° to 120°. None of the patients complained of pain and in spite of the hingeless type implant, none of the patients demonstrated serious instability of the knee joint. Most of the patients could walk for half an hour or more without a brace or cane.

In one patient, the score dropped once, due to an increase in pain and decrease in walking ability caused by a subsidence of the implant. In the remaining patients, the function did not change significantly during the follow up. Within 2 years after surgery there was cortical hypertrophy and abundant new bone formation at the junction between implant and femoral cortex radiographically in 4 femoral cases (Fig. 3.). A clear zone less than 1 mm thick between bone and stem was detected in all cases. One femoral case showed proximal osteolysis within 5 years after surgery and subsidence of the femoral implant with axial migration (>2 mm). However, since then the subsidence has ceased (Fig. 4.). On the tibial side cortical hypertrophy and new bone formation around the implant was rarely seen. In one case subsi-

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Table 1 Functional evaluation of the 8 cases studied [5]

No	Age	Sex	Location	Pain	Function	Emotional acceptance	Supports	Walking ability	Gait	Total score
1	34	F	Femur	5	4	4	5	4	4	26
2	31	F	Femur	4	3	4	4	4	4	23
3	47	M	Femur	5	4	5	5	5	4	28
4	66	F	Femur	4	4	4	5	4	4	25
5	51	M	Femur	5	4	4	5	4	4	26
6	55	F	Tibia	5	4	4	5	4	4	26
7	31	F	Tibia	5	4	4	5	4	4	26
8	57	F	Tibia	5	4	4	5	4	4	26

Fig. 1 Preoperative AP and lateral view of case 1. Severe thinning and destruction of cortex with pathological fracture can be seen

dence of a tibial component was found 6 years after surgery. However, the subsidence also ceased after 2 years in this case.

Discussion

Alumina ceramic is bioinert but osteoconductive in bone formation, and shows low friction against HDP [6, 11]. Although bone cement packing after curettage of the lesion is common in the treatment of GCT, locally aggressive GCT with pathological fracture involving the joint still indicates marginal or wide tumor resection and requires limb reconstruction with endoprosthesis or osteoarticular allograft [1, 3, 8, 9, 10]. However, high complication rates including infection, resorption of the graft, fracture and collapse of the articular surface after reconstruction of allograft have been reported in the literature [7, 9]. On the other hand, various types of endoprosthesis are available for limb reconstruction for bone tumors involving the knee joint [2, 4, 6, 12]. However, a consensus has not yet been reached on bio-

Fig. 2 The two types of endoprosthesis used

Fig. 3 AP and lateral view radiographs of case 1, at 6 months after surgery

Fig. 4 Lateral view radiographs at 6 months, 2 and 7 years after surgery in case 4 with subsidence of the prosthesis

materials, shape and length of the stem, porous coating, fixation technique (cemented or cementless), and the mechanism of knee joint (plain hinge, rotating hinge or hingeless).

In this study the average limb function was maintained for more than 10 years. There was local recurrence and no revision. Radiographically new bone formation was detected in all cases at the junction between the implant and the bone cortex even in the case with subsidence of the implant. This may be due to the bioinert character, which relates to the osteoconductive effect of alumina ceramics. Breakage of the ceramic stem is one of the common problems. Fortunately, our patients did not encounter this problem. We conclude that the alumina ceramic endoprosthesis with a hingeless knee joint is useful for limb reconstruction in aggressive GCT.

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