

CASE REPORT

Shinichiro Nakamura · Katsuyuki Kusuzaki
 Hiroaki Murata · Hideyuki Takeshita
 Masazumi Hirata · Shin Hashiguchi
 Yasusuke Hirasawa

More than 10 years of follow-up of two patients after total femur replacement for malignant bone tumor

Accepted: 17 March 2000

Abstract One patient with osteosarcoma and one with Ewing's sarcoma of the femur were in 1987 and 1988 treated with prosthetic replacement of the femur and chemotherapy. There has been no loosening of the prostheses and no recurrence of the tumor. The patients have maintained 60% and 63% limb function scores evaluated by ISOLS criteria.

Résumé Deux patients, l'un avec un ostéosarcome, l'autre avec un sarcome d'EWING, furent opérés en 1987–1988 avec remplacement prothétique du fémur, associé à une chimiothérapie. Ces patients ont été suivis sans qu'il soit noté de récurrence. Il n'y a pas de descèlement, ni de luxation de la prothèse. Un score fonctionnel évalué selon les critères de l'ISOLS, montre une conservation de 60% et 63% de la fonction du membre inférieur.

Introduction

Total femur replacement is a rarely performed procedure after wide tumor resection for patients with malignant bone tumors in the whole femur, although partial replacement of the proximal or distal femoral replacement is commonly performed for malignant bone tumors [1, 2, 4–10].

Patients and methods

The patient with a Ewing's sarcoma underwent wide intra-capsular resection at the hip and knee joint. The patient with an osteosarco-

S. Nakamura · K. Kusuzaki · H. Murata · H. Takeshita · M. Hirata
 S. Hashiguchi · Y. Hirasawa
 Department of Orthopaedic Surgery,
 Kyoto Prefectural University of Medicine, Kyoto, Japan

S. Nakamura (✉)
 Department of Orthopaedic Surgery, Ayabe Municipal Hospital,
 20-1 Otsuka Aono-cho Ayabe city, Kyoto, 623-0011 Japan
 e-mail: ayabe_hp@mx.nkansai.ne.jp
 Tel: +81-773-430123, Fax: +81-773-427870

ma underwent extra-capsular resection as the massive tumor had invaded the knee joint. In both patients the rectus femoris muscle was preserved for knee extension and most of the flexor muscles were also retained. Much musculature around the hip joint was sacrificed in both patients with the resection of the greater and lesser trochanters. The endoprosthesis which was used is shown in Fig. 1. The total femoral component is made of titanium alloy (Ti-6Al-4V). The femoral head is bipolar. The knee joint is a rotat-



Fig. 1A, B Endoprosthesis for total femoral replacement



Fig. 2A,B Pre-operative radiograph of case 1

ing hinge design, with a high density polyethylene tibial component, fixed with cement. Active and passive exercises of the knee joint were started 4 days after surgery. Partial weight bearing was started 3 weeks later and full weight bearing allowed at 6 weeks.

Results

Case 1 was a 17-year-old girl with a Ewing's sarcoma of the left femur. A pre-operative radiograph showed diffuse periosteal reaction with spicule formation in the proximal and middle aspects of the femur (Fig. 2). After pre-operative chemotherapy according to Rosen's T-11 protocol, total femoral replacement was performed. Twelve years after surgery the patient remains disease free. Post-operative radiography shows no migration of the femoral head or loosening of the tibial component (Fig. 3). There was some skin necrosis requiring a graft. The function of the reconstructed limb was evaluated (ISOLS criteria; Enneking et al. [3]) as 60%.

Case 2 was an 11-year-old girl with a massive osteosarcoma of the left femur. The radiograph revealed a large periosteal lesion in the distal two thirds of the femur (Fig. 4). Pre-operative radiography, CT and MRI suggested intra-capsular invasion into the knee joint. After pre-operative chemotherapy with cisplatin and doxo-



Fig. 3A,B Post-operative radiograph of case 1 12 years after surgery

rubicin, resection of the whole femur including adjacent muscles with an extra-capsular wide resection of the knee joint was performed. The limb was reconstructed with total femoral replacement. Post-operative radiography showed no signs of central migration or loosening of the implant 11 years after surgery (Fig. 5). There was a sciatic nerve palsy but the patient is able to walk with a walking stick and an ankle and knee stabilising brace. Movements of the hip, knee and ankle are poor. The reconstructed limb function was evaluated as 63%.

Discussion

The surgical procedure of total femoral replacement was first described by Buchman in 1965 [1]; and he reported his first experience in 1952. There have been few reports describing the surgical procedure and clinical results following total femoral replacement. The major problem following this extensive surgery is to obtain a satisfactory functional outcome. Whole femoral allograft is another surgical option in these patients, but it is difficult to



Fig. 4A,B Pre-operative radiograph of case 2



Fig. 5A,B Post-operative radiograph of case 2 11 years after surgery

stabilise both the hip and the knee with this technique. Although, recently, various types of endoprosthesis for limb reconstruction after malignant bone tumour resection have been reported [2, 4–8, 10], there remains much controversy concerning biomaterials, coating, design of stem and joints, and the type of fixation. The endoprosthesis used for these two patients has a bipolar-type femoral head and a rotating hinge-type knee joint. Pre-operatively there was anxiety about hip dislocation and stability of the knee as adequate tumor resection included resection of muscles and ligaments required for stabilisation of both joints. However, there has been no dislocation of the hip or knee instability in these patients after more than 10 years follow-up. As expected, there is considerable limitation of movement of the hip and knee but the limb is preserved and stable enough, with external support for mobility. Nerubay et al. [8] have also described a prosthesis without a hinged knee with excellent stability. We conclude that total femoral replacement is an available option for limb salvage surgery in patients with massive malignant bony lesions of the femur.

References

1. Buchman J (1965) Total femur and knee joint replacement with a vitallium endoprosthesis. *Bull Hosp Joint Dis* 26:21
2. Capanna R, Ruggieri P, Biagini G, Gamberini G, Rock M, Campanacci M (1986) Subtotal and total femoral resection: an alternative to total femoral prosthetic replacement. *Int Orthop* 10:121–126
3. Enneking WF, Dunham W, Gebhardt MC, Malawar M, Pritchard DJ (1993) A system for the functional evaluation of reconstructive procedures after surgical tumors of the musculoskeletal system. *Clin Orthop* 286:241–246
4. Fabroni RH, Castagno A, Aguilera AL, Steverlynck AM, Zeballos J (1999) Long-term results of limb salvage with the Fabroni custom made endoprosthesis. *Clin Orthop* 358:41–52
5. Ham SJ, Schraffordt KH, Veth RP, Horn JR van, Molenaar WM, Hoekstra HJ (1998) Limb salvage surgery for primary bone sarcoma of lower extremities: long-term consequences of endoprosthetic reconstructions. *Ann Surg Oncol* 5:423–436
6. Kotz R (1993) Tumor endoprosthesis in malignant bone tumors. *Orthopäde* 22:160–166
7. Marcove RC, Lewis MM, Rosen G, Huvos AG (1977) Total femur and total knee replacement: a preliminary report. *Clin Orthop* 126:147–152
8. Nerubay J, Katznelson A, Tichler T, Rubinstein Z, Morag B, Bubis JJ (1988) Total femur replacement. *Clin Orthop* 229:143–148
9. Present DA, Kuschner SH (1990) Total femur replacement. A case report with 35-year follow-up study. *Clin Orthop* 251:166–167
10. Steinbrink K, Englebret E, Fenclon GC (1982) The total femoral prosthesis. A preliminary report. *J Bone Joint Surg [Br]* 64:305–312