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Modular megaprosthesis for proximal femoral tumors

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Abstract Fifteen patients with proximal femoral tumors had resection and limb salvage with an uncemented Kotz (HMRS) megaprosthesis. There were five osteosarcomas, four chondrosarcomas, one hemangioendothelioma, three fibrosarcomas, and two Ewing's sarcomas. The mean follow-up was 6.7 (range 3–10) years. Two patients died of causes not related to the prosthesis. The postoperative Musculoskeletal Tumor Society score (MSTS) score was 19 (range 12–26) for the remaining 13 patients. There were one aseptic loosening, two infections, and one local recurrence. The most frequent complication was hip dislocation at 20%. Reconstruction of proximal femoral tumors with a modular megaprosthesis is a good procedure, but hip instability remains a major problem.

Résumé Nous avons opéré 15 patients porteurs de tumeur maligne du fémur proximal par résection et reconstruction avec une mégaprothese du type Kotz. Il y avait 5 ostéosarcomes, 4 chondrosarcomes, une hemangioendothelioma, 3 fibrosarcomes et 2 sarcomes d'Ewing. La suivie moyenne fut 6.7 ans (entre 3 et 10 ans). Deux patients sont décédés de causes sans relation avec la prothèse. Le score de la société des tumeurs musculo–skelettiques américaine fut 19 en moyenne (de 12 a 26) pour les 13 autres patients. Nous avons noté un descellement aseptique, deux infections et une récidive locale. La complication la plus fréquente fut la luxation chez 3 malades, donc 20%. La reconstruction après résection d'une tumeur du fémur proximal par une mégaprothese modulaire est une bonne méthode, mais l'instabilité de la hanche reste un problème majeur.

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Introduction

Limb salvage surgery is now the preferred treatment for proximal femoral tumors in most centers. One option is the use of modular prosthesis following resection of the tumor, a procedure that is technically demanding. The resection of tumor at the level of proximal femur results in loss of abductors and other musculature necessary for hip stability. This often leads to a higher dislocation rate.

Hip dislocation is a recognized problem after the use of megaprosthesis, with rates of dislocation varying from 1.7% to around 28% [1, 5, 11]. Several new surgical techniques have been described to lower the rate of dislocation to acceptable levels [1, 7].

Materials and methods

Between March 1991 and March 1998, the 15 patients in our series had resection of the proximal femoral tumor and implantation with a modular megaprostheses, Howmedica Modular Resection System (HMRS), using a bipolar acetabular cup (Figs. 1 and 2). There were seven women and eight men, and the mean age at the time of surgery was 37 (18–68) years. The diagnoses were osteosarcoma (five), hemangioendothelioma (one), chondrosarcoma (four), fibrosarcoma (three), and Ewing's sarcoma (two). All patients had a complete tumor workup prior to surgery that included routine blood work, bone scan, CT of the chest, and MRI of the femur. All patients had an open biopsy to confirm the diagnosis. They were given preoperative radiotherapy and chemotherapy as required.

Operative technique

An extensile posterolateral approach was used. The sciatic nerve and femoral artery were protected, and the profunda femoris artery was ligated if involved in the tumor. The gluteus medius was resected at the tendinous insertion. A T-shaped capsulotomy was performed. The femur was resected distally 4 cm below the lower margin of the tumor, and a noncemented HMRS the exact length of the resected femur was inserted. No acetabular resurfacing was done. Capsuloraphy was performed and abductors were attached to the prosthesis and vastus lateralis if not resected with the tumor.

Postoperative antibiotics were given for 72 h. Adequate thromboprophylaxis of low-molecular-weight heparin was given.

Fig. 1 Preoperative radiographs showing osteosarcoma of the proximal femur

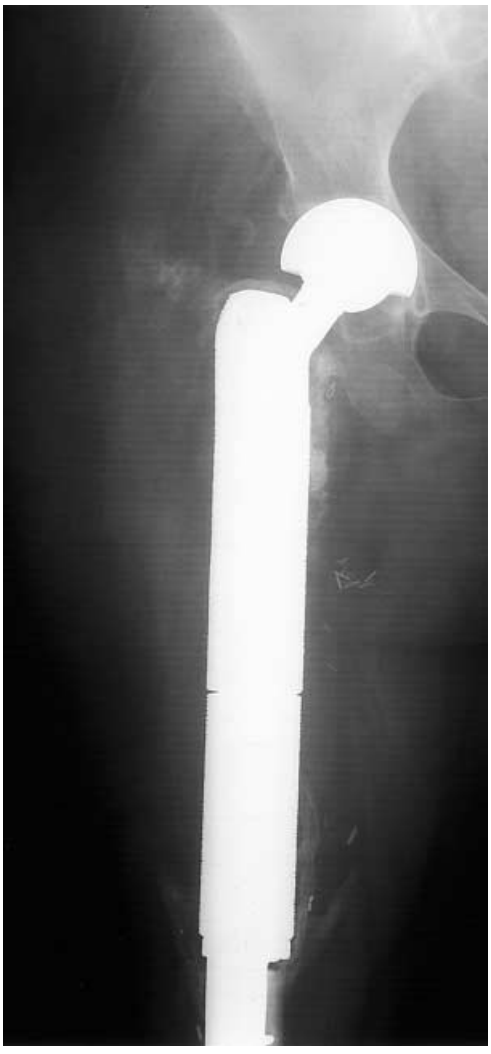

Fig. 2 Postoperative radiograph at 5 years

The patients were mobilized after 72 h and then wore a hip brace for 6 weeks.

The mean femoral resection was 24.5 (18–35) cm. Clinical assessment was done using the Musculoskeletal Tumor Society score (MSTS) [3]. Radiographs were assessed for radiolucency, resorption, or failure of prosthesis.

Results

Two patients had expired at the last follow-up but were functioning well at that time. No patient was lost to follow-up; therefore, 13 patients were available for clinical and radiological review.

Complications

Three dislocations required revision by further reaming of the acetabulum and use of a hip brace. There was one aseptic loosening, which was also revised. One patient had a deep prosthetic infection and one had a superficial wound infection. The causative organism was *Staphylococcus epidermidis* in both cases, which were successfully treated with wound debridement and antibiotics. There was one local tumor recurrence, but no further surgery was performed. The mean functional score was 21 (12–26), and the mean flexion was 80° (30°–110°). An extensor lag was present in seven patients, and most patients used a cane.

Discussion

Limb salvage surgery is now standard treatment in many centers around the world. With the development of modern chemotherapy the outlook for malignant tumors has greatly improved and encouraged surgeons to consider limb salvage surgery in most cases [2]. Resection of proximal femoral tumors results in major bone and soft tissue loss. Reconstruction is, therefore, both challenging

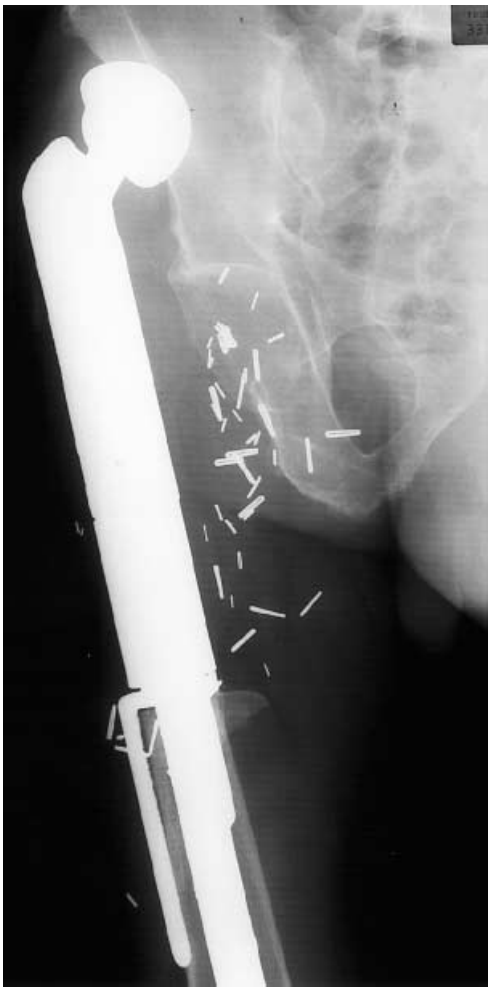

Fig. 3 Radiograph of patient with recurrent dislocation

and demanding. Reconstructive options include osteochondral allograft, allograft prosthetic composite, and megaprosthesis.

No single treatment option is considered definitive. Osteochondral allograft and allograft prosthetic composite may help in restoring bone stock but have the disadvantages of nonunion, resorption, fracture, and possible disease transmission [4, 6, 11]. The rate of infection reported in one series of 28 patients by Jofe et al. was 20%, and they reported two nonunions at the graft–host junction. There was, however, only one instability [4]. Similarly, Zehr at al. found a high rate of instability in the group of patients treated by resection of proximal femur and use of megaprosthesis (28%) compared to none in the group treated with prosthetic allograft composite. There was little difference in functional outcomes [11].

Megaprosthesis, though an attractive option, has its own limitations. While results for aseptic loosening continue to improve [8] (at a mean follow-up of 7 years we saw one aseptic loosening), implant instability is common due to the loss of abductors, the short external rotators, and, in many cases, the loss of knee extensors. Soft tissue loss may also predispose the patient to aseptic loosening and infection. In the orthopaedic literature the rate of hip dislocation following reconstruction of proximal femoral tumors with megaprosthesis varies from 2 to 28% [1, 11]. Kabukcuoglu et al., who sutured the abductors to the fascia lata, experienced six dislocations in their series (11%). Two of these patients required revision [5]. Ward et al. reported a 14.3% dislocation rate in a review of 21 patients [9]. Bickels et al. reviewed 57 patients who underwent proximal femoral reconstruction and found a dislocation rate of only 1.7% in their series [1]. They attributed this success to three variables: No acetabular resurfacing was performed, capsuloraphy was performed, and abductors were attached to the prosthesis and vastus lateralis.

We routinely have used bipolar hemiarthroplasties, as they are inherently more stable [10]. We performed capsuloraphy in all patients as these patients had intraarticular resection, and we sutured the abductors to the prosthesis with nonabsorbable sutures. Our rate of dislocation was 20%. Our hypothesis for this high rate of dislocation is the failure of the abductor mechanism. We believe that either the tendon detaches or forms a thin fibrous tissue, which leads to the atrophy of the abductors and loss of function. Other factors to consider, however, are correct anteversion of the femoral neck, the tension of tissues around the prosthetic hip after completion of the procedure by checking the telescoping effect, and sufficient reaming of the acetabular cup. Some authors have had early success with the use of mesh to reinforce the capsule [7]. In our series there were three dislocations in the early period (Fig. 3). These were revised by reaming the acetabulum and medializing the cup, which prevented further dislocation in one patient only. The other two patients had further episodes of dislocation, and both were treated with closed reduction and permanent use of a hip brace.

The use of megaprosthesis is a good procedure for reconstruction of the proximal femur after resection of malignant proximal femoral tumors. There is a high risk of dislocation, even with soft tissue balancing and reinforcement. Additional investigations are required to improve attachment and function of the abductors.

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