Unipolar proximal femoral endoprosthetic replacement for tumour
THE RISK OF REVISION IN YOUNG PATIENTS

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We undertook a cemental unipolar proximal femoral endoprosthetic replacement in 131 patients with a mean age of 50 years (2 to 84). Primary malignant tumours were present in 54 patients and 67 had metastatic disease. In addition, eight patients had either lymphoma or myeloma and two had non-oncological disorders. The mean follow-up was 27 months (0 to 180). An acetabular revision was required later in 14 patients, 12 of whom had been under the age of 21 years at the time of insertion of their original prosthesis. The risk of acetabular revision in patients over 21 years of age was 8% at five years compared with 36% in those aged under 21 years. All the unipolar hips in this younger age group required revision within 11 years of the initial operation.

We conclude that unipolar replacement should not be used in younger patients and should be avoided in patients with a life expectancy of more than five years.

The proximal femur is a common site for primary bone tumours and the most common long bone to be affected by secondary malignant deposits.1,2 The use of endoprostheses for the treatment of malignant tumours of the proximal femur is well recognised and their use in metastatic disease is also becoming more common. Proximal femoral endoprosthetic replacement can be performed with or without acetabular resurfacing. Although the latter procedure is undertaken in total hip replacement (THR) performed for osteoarthritis, the acetabulum is intact in most patients who require a proximal femoral replacement. The main benefit of a unipolar replacement is the lower risk of dislocation of the prosthesis which is a major problem after proximal femoral replacement, but there remains the risk of subsequent damage to the articular cartilage leading to pain and the possibility of subluxation of the hip, especially in younger patients.3-12

Because of the high incidence of dislocation in adult patients with a proximal femoral endoprosthesys and an acetabular replacement, and the desire not to use these in younger patients, in 1990 we began to employ unipolar prostheses in most patients who needed proximal femoral replacement. We have now assessed the outcome of these cases with particular reference to the consequence of using a unipolar head.

We have recently reported a high rate of failure after prosthetic replacement of the hip for tumours in children3 and we wished further to review the outcome for those patients who underwent unipolar proximal femoral endoprosthetic replacement.

Patients and Methods
Between 1990 and 2006, 131 patients underwent unipolar endoprosthetic replacement of the proximal femur. There were 63 males and 66 females with a mean age of 50 years (2 to 84); 24 were aged 21 years or less at the time of the operation. The diagnoses are shown in Table I. A total of 56 patients had a pathological fracture before surgery. Fractures had occurred in 13 (24.1%) of the patients with primary malignant bone tumours and in 37 (55.2%) of those with metastases. Of these patients, 19 presented with failed fixation after a previous fracture secondary to metastases.

All the patients had appropriate staging studies including MRI of the pelvis and the proximal femur. The operations were all carried out at a single institution by the oncological surgical team. Adjuvant chemotherapy was administered when appropriate, according to nationally agreed protocols, at the patient’s local oncology unit. Details of all the patients were entered prospectively into a database.

All the custom-made and modular prostheses were designed and manufactured at the Department of Biomedical Engineering of the
the trochanteric re-attachment plate and screws or cable-grip wires. If it was not possible to preserve the greater trochanter the abductor mechanism was sutured to vastus lateralis and the fascia lata. Trial components were used to select the appropriate size needed to restore limb length and stability. A unipolar head was matched to the size of the resected femoral head. The heads were available in sizes from 32 mm to 56 mm in increments of 2 mm. A cemented acetabular component was used in patients with either degenerative changes in the hip or when there was possible involvement of the acetabulum with tumour. These were not included in this study. The unipolar femoral components were cemented, using antibiotic-containing bone cement, introduced with a gun.

After the operation the patients were mobilised partially weight-bearing and progressed to full weight-bearing by the time of discharge. After six weeks they were re-admitted to hospital for a period of intensive physiotherapy. They were followed up every three months for two years, then at six months until five years after the operation and yearly thereafter. We recorded the survival of the patient and the prosthesis, the risk of revision of the prosthesis because of acetabular symptoms, the incidence of the failure of limb salvage because of amputation and complications such as dislocation and infection. We used Kaplan-Meier survival curves to assess the rates of failure of the prostheses.

**Results**

The mean follow-up was 27 months (0 to 180). The mean follow-up for patients with metastases was 17 months (0 to 72) and for those with a primary bone tumour 37 months (1 to 180).

There were two peri-operative deaths, both due to pulmonary embolism in elderly patients who had been on prolonged bed rest before the operation. A further three elderly patients had a pulmonary embolus after the operation and all survived after appropriate supportive treatment. Of the 131 patients, 78 (59.5%) survived for more than 12 months. The median survival time was 24 months and the overall patient survival was 50% at five years. At the time of review 83 of 107 patients in the older and seven of 24 in the younger age group had died.

There were three cases of early post-operative dislocation of the hip, all in patients over the age of 80 years, which required open reduction and had a soft-tissue repair which corrected the problem.

Revision of the prosthesis for acetabular problems was needed in 14 patients (10.7%). Of the 24 patients aged under 21 years, 12 (50%) required revision, seven for subluxation in patients aged between 2 and 15 years at the time of implantation, and five for pain in patients aged between 11 and 21 years at the initial procedure. Ten of these patients had Ewing's sarcoma and two osteosarcoma. The median time to failure in this group was 4.8 years (mean 63 months, 18 to 126). The rate of failure in these patients under the age of 21 years was such that none retained their unipolar
reconstruction for more than 10.5 years. One patient, aged 15 years at the time of the initial procedure, is now aged 24 years and is starting to experience pain in the hip which will need acetabular revision in the near future. In the younger children the consistent finding was superolateral subluxation of the hip which was usually painless (Fig. 1), but progressive, while in the older children there was superolateral erosion of the articular cartilage leading to pain.

In the 107 patients over the age of 21 years only two required revision for an acetabular problem. One 59-year-old woman had pain in the acetabulum after 14 months while another 54-year-old woman with type-I neurofibromatosis developed a central erosion of the acetabulum 3.6 years after a proximal femoral replacement.

The survival of the implant with revision for acetabular complications as the endpoint was assessed using Kaplan-Meier analysis comparing the younger patients up to 21 years of age with those who were older (Fig. 2). The estimated survival at five years was 64% and 92%, respectively. No unipolar replacement lasted for more than 10.5 years without being revised, although none of the older patients has survived for more than ten years after the surgery.

After removal of the unipolar component the type of reconstruction varied with the age of the patient, but in general an attempt was made to use a THR with as large a head size as possible to reduce the risk of dislocation. Of the 12 patients in the younger group who underwent revision, all but two had revision with a large modular head and the acetabular component from a metal-on-metal resurfacing arthroplasty. None of these patients have had pain or dislocation since the revision at a mean follow-up of 25.7 months (8 to 120). Two patients received an uncemented THR with a 32 mm head. One was successful, but the other continued to dislocate and has undergone further revision with the insertion of a mesh around the prosthesis. Both adult patients were successfully revised to cemented THRs with a 32 mm head.

Discussion
We began to use unipolar heads for patients with a proximal femoral endoprosthesis in 1990 because of the unacceptably high rate of dislocation (11%) which we had encountered when using cemented hip replacements. The rate of dislocation was high because there was usually a considerable loss of muscle around the hip, and both psoas and the abductors were detached from the proximal femur. We used cemented unipolar replacements in patients with an otherwise normal acetabulum, expecting that in elderly patients this would cause little problem and that in younger patients it would preserve the acetabulum for as long as possible. The problem of dislocation has virtually been abolished by the use of the unipolar replacement. In the elderly group the unipolar replacement has been very successful.
successful at intermediate follow-up. Many of these patients will have a limited life expectancy and a unipolar reconstruction offers a simple, stable and inexpensive option.

There have been studies which have compared the outcome of unipolar, bipolar and THR in patients with intra-capsular fractures of the neck of the femur. They have a low life expectancy which may explain the low incidence of complications which included infection, dislocation, acetabular erosion, protrusio acetabulum, periprosthetic fractures and revision.

Our study included patients of all age groups with both primary and secondary bone tumours involving the proximal femur without acetabular involvement. The patients with metastatic tumours of the proximal femur with unipolar heads had a shorter life expectancy and the implant survived without the need for acetabular revision in all but two. This group of patients is more comparable with the elderly patients with a fractured neck of femur with low life expectancy and the revision rates for acetabular symptoms are similar. Therefore, it is reasonable to use unipolar heads if the life expectancy is less than five years. It is still too early to identify whether older patients with a good prognosis will develop problems in the future from a unipolar reconstruction.

An alternative may be to use a bipolar component, but Nakata et al7 observed that 77% of bipolar components migrated superiorly with 18% requiring revision within 7.4 years. Pellegrini et al16 found that 81% of the primary bipolar arthroplasties for osteoarthritis of the hip survived without acetabular revision after a mean follow-up of 12.2 years. We are unable to comment on the advantages of bi- over unipolar heads in patients with tumours of the proximal femur since we do not have long-term experience of their use.

The dilemma of THR in young children with bone tumours has been discussed by van Kampen et al3 and our study confirms that the high rate of revision for acetabular symptoms continues for patients up to the age of 21 years at the time of insertion. We are not able to make a definite recommendation about the best type of hip reconstruction for younger patients. The bipolar hip may be better, or possibly a hip replacement with a large size of head. Although we have used the modular components from metal-on-metal hip resurfacing for most of the revisions in younger patients, we are mindful of the ongoing controversy in relation to the release of metal ions from these implants, which may be of considerable relevance in this young population. Young patients and their parents should be informed about the potential risk of carcinogenicity from metal ions and the six- to ten-fold increase in the occurrence of a second malignancy in survivors of childhood cancer because of treatment by chemotherapy and sometimes radiotherapy. Until there is proven evidence of a significant adverse effect secondary to metallosis, metal-on-metal THR remains a possible option in young patients.

Unipolar proximal femoral endoprosthetic replacement is useful for primary and secondary bone tumours when the life expectancy is less than five years since there is unlikely to be need for early revision for acetabular erosion. There is, however, a high rate of failure in young patients and we recommend that an alternative hip reconstruction should be considered. Uni- or bipolar heads may still have a role in children aged less than 11 years in order to preserve acetabular growth and development.

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References