Tumor - Limb Sparing – Arthroplasty

Off the shelf....Options

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Proximal Femoral Replacement

5 yr post op

15 yr post op

42 yr post op
Surgical procedures aimed to accomplish:

- **Removal** of a malignant tumour.
- **Reconstruction** of the limb with an acceptable **Oncologic**, **Functional**, and **Cosmetic** result.
When to Reconstruct

- Impending pathological fractures
- Pathological fracture
- Suboptimal Response to Chemo and/or radio-therapy
- Pain / Tumour Growth despite adjuvant therapy.
Relative Contraindications

- Inappropriately performed biopsy or biopsy-site complications
- Extensive muscle or soft-tissue involvement
- Major neurovascular structures encased by tumor
- Pathologic fracture with extensive Extra compartmental involvement
- Infection in the surgical field
Reconstructive procedures

- Osteoarticular Allografts

- Radiated or autoclaved autografts with or without prosthetic Composites

- Allograft endoprosthetic composites

- Segmental Endoprosthetic Reconstruction with custom or Modular Implants
Chondrosarcoma
Bone Scan
Happy Patient
Acetabular Lesion
LABORATORY INVESTIGATION REPORT

Patient Name : Mr. DHARAM PAL
Age/Sex : 45 Year(s) / Male
UHID : EHPG.220990
Ref. Doctor : Anil Arora

Location : Patparganj
IP No : 53999
Order Date / Collection Date : 29/04/2010 / 29/04/2010
Report Date : 07/05/2010

Histo Biopsy Medium specimens
Histopathology Number:

S-4176/10

Specimen Type:
Tumor tissue from Acetabulum -
  1) Large tumor mass.
  2) Small marginal tissue.

Clinical Data / Impression:
Chondrosarcoma, grade - II.

Gross Description:
Bone and soft tissue, resected specimen measures 10 x 11 x 4 cm, acetabular tumour is present infiltrating bone. The tumour consists of myxoid, focally fragile, greyish bluish tissue, with a chondroid sheen in loci. The tumour measures 5 x 4 cm, approximately with a closest peripheral margin of 1 cm formed by soft tissue. All bone and soft tissue margin grossly free.
Surgical Incision
Prosthesis survival in various studies

<table>
<thead>
<tr>
<th>Author (year of study)</th>
<th>Cemented</th>
<th>Type of Implant</th>
<th>5-year Survival</th>
<th>10-year Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zeegan\textsuperscript{33} (2004)</td>
<td>Yes</td>
<td>MRS</td>
<td>76%</td>
<td>NA</td>
</tr>
<tr>
<td>Mascard\textsuperscript{21} (1998)</td>
<td>Yes</td>
<td>Guepar</td>
<td>NA</td>
<td>60%</td>
</tr>
<tr>
<td>Kumar\textsuperscript{19} (2003)</td>
<td>Yes</td>
<td>Stanmore</td>
<td>NA</td>
<td>42%</td>
</tr>
<tr>
<td>Unwin\textsuperscript{27} (1996)</td>
<td>Yes</td>
<td>Stanmore</td>
<td>NA</td>
<td>67.4%</td>
</tr>
<tr>
<td>Mittermayer\textsuperscript{22} (2001)</td>
<td>No</td>
<td>Kotz</td>
<td>79%</td>
<td>71%</td>
</tr>
<tr>
<td>Ilyas\textsuperscript{15} (2001)</td>
<td>No</td>
<td>Kotz</td>
<td>90%</td>
<td>NA</td>
</tr>
<tr>
<td>Gosheger\textsuperscript{14} (2006)</td>
<td>No</td>
<td>Mulars</td>
<td>71.2%</td>
<td>NA</td>
</tr>
<tr>
<td>Kawai\textsuperscript{17} (1999)</td>
<td>Mixed</td>
<td>Lane-Burnstein, Finn</td>
<td>71%</td>
<td>50%</td>
</tr>
<tr>
<td>Kawai\textsuperscript{18} (1999)</td>
<td>Mixed</td>
<td>Modified Finn</td>
<td>81%</td>
<td>NA</td>
</tr>
<tr>
<td>Plotz\textsuperscript{23} (2002)</td>
<td>Mixed</td>
<td>Link, Howmedica, S&amp;G, ESKA</td>
<td>72%</td>
<td>69%</td>
</tr>
<tr>
<td>Current series</td>
<td>Yes</td>
<td>MRS</td>
<td>78%</td>
<td>59%</td>
</tr>
</tbody>
</table>

NA = not applicable
<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Management</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local recurrence</td>
<td>5% to 10%</td>
<td>5%</td>
</tr>
<tr>
<td>Survival</td>
<td>70%</td>
<td>70%</td>
</tr>
<tr>
<td>Functional outcome</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Initial cost</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Long-term cost</td>
<td>Less than amputation</td>
<td>More than limb-sparing procedure</td>
</tr>
</tbody>
</table>

* 85% to 90% of patients with extremity bone sarcomas can be managed with limb-sparing surgery.

† Only 10% to 15% of patients require ablative surgery as initial management.
Loosening, Infection & Dislocations

- Infection rates range from 0% to 13%.
- Proximal tibial reconstructions carry the highest risk of infection,
- Most common reason for amputation post reconstruction.

- Dislocation rates for the hip range from 10% to 15%.
- Reconstruction of the abductor mechanism and the use of bipolar components have improved stability and function.
Conclusion

Combination of *Adjuvant therapy, Resection,* and *Reconstruction* with an endoprosthesi is a safe modality of treatment in selected patients.
Thanks
Results of proximal femoral replacement

- 16 proximal femur,

- Minimum FU was 24 months (Mean 80 months).

- Prosthesis survival at 5 years was 88%,

- Aseptic loosening approximately 20% at 5 & 30% at 10 years.

- Limb survival was 87% at 5 years and 81% at 10 years.

Results of distal femoral replacement

- 61 distal femur

- Minimum follow-up was 24 months (mean, 80 months).

- Prosthesis survival at 5 years was 59%

- The overall event-free prosthesis survival was 63% at 5 years and 36% at 10 years.
Results of Proximal Tibial Replacement

- 16 proximal tibia

- Minimum FU 24 months (mean 80 months).

- Prosthesis survival at 5 years - 54%

- Event-free prosthesis survival - 63% at 5 & 36% at 10 years.

- Limb survival was 87% at 5 years and 81% at 10 years.
PROXIMAL FEMORAL REPLACEMENT
Proximal femur replacement
Hip joint reconstruction for Acetabular Chondrosarcoma
Preop ROM
Distal femoral replacement
Ewing sarcoma femur
Allogenic graft+distal femur replacement
Proximal Tibia replacement
Total Femoral replacement
Implant type: \textbf{EXTENDABLE, DISTAL FEMORAL REPLACEMENT}
\textbf{NON-INVASIVE GROWER}
Type of fixation: Cemented Stems
Joint type: Smiles Rotating Hinge Knee – STANDARD
Max Extension: 50mm (Do not over extend)
Material: Titanium / CoCrMo / UHMWPE / HA
Side: LEFT

Driver A

![Diagram]

CEMENTED FEMORAL STEM TAPERED $\Omega 10.5 > \Omega 9$

HA COLLAR

**SAFETY CLIP**
Please remove after inserting the implant to release the extending mechanism
Fill Grooves with supplied plastic clips

MAGNET & GEARBOX

STANDARD CoCrMo FEMORAL COMPONENT

CEMENTED POLY TIBA TAPERED $\Omega 18.5 > \Omega 13.5$
Total Humerus replacement
REVIEW

Endoprosthetic proximal femur replacement: Metastatic versus primary tumors

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KEYWORDS
Proximal femur;
Endoprosthesis;
Mega-prosthesis;
Sarcoma;
Metastasis;
Tumor

Abstract
Few studies have examined the impact of underlying diagnosis on the functional and oncologic outcomes following endoprosthesis proximal femur replacement (PFR). We performed a retrospective review of 61 consecutive cemented bipolar PFR in 59 patients for treatment neoplastic lesions with a minimum follow-up of 24 months. Twenty-two patients had primary bone tumors and 39 had metastatic disease. Average follow-up for the 30 surviving patients was 55.4 months and the mean postoperative survival for the 29 patients who died was 12.2 months. Patients with primary tumors demonstrated significantly better functional outcomes than those with metastatic disease, with mean Musculoskeletal Tumor Society functional scores of 80.2 and 66.8%, respectively (p = 0.0002). Age correlated inversely with functional scores (r = −0.48; p = 0.0002), while femoral resection length did not. Preoperative pathologic fracture did not appear to adversely impact final functional outcomes. The Kaplan–Meier 5-year implant survival estimate was 92.5%, with aseptic loosening as the endpoint. Both functional results and survival are increased for primary tumors versus metastatic disease following PFR. However, PFR results in excellent local disease control, reliable pain relief and good functional results in both groups, with prosthesis survival exceeding that of the patient in many cases.

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Background and Objectives: Limb salvage and reconstruction with tumor endoprostheses is considered as therapeutic standard in the treatment of bone defects at the knee. Few studies report long-term results so far.

Methods: Seventy-seven patients who had a cementless or cemented MUTARS® endoprosthesis implanted were followed-up for a mean period of 46 months (3–128 months). The defects were due to primary tumor lesions in 69 cases or metastases in 8 cases. The distal femur (n = 49) or the proximal tibia (n = 28) was reconstructed predominantly with cementless implants (femur: 69%, tibia: 92%). The resection of the tumor was intraarticular in 46 and extraarticular in 31 patients.

Results: After 10 years probability of limb salvage was 92% with a recurrence rate of 3%. Complications were frequent with a revision rate of 58% and lead to a cumulative probability of survival of the initially implanted prosthesis of 57% after 5 years. Locking mechanism failure (n = 15) and aseptic loosening (n = 13) were the most frequent failure modes.

Conclusions: Regardless of achieving a low recurrence rate and satisfactory functional results, we found a high complication rate after implantation of a megaprosthesis. This was particularly evident for extraarticular resections and cemented fixation, which should be avoided when possible.

Endoprosthetic reconstruction using total femoral custom mega prosthesis in malignant bone tumours

Mayil Vahanan Natarajan - Navin Balasubramanian - Viswanath Jayasankar - Mohammad Sameer

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Abstract We analysed 17 patients with primary malignant bone tumour of the femur who underwent limb salvage surgery with the total femoral custom mega prosthesis during the period 1994–2008. The patients were in the age group of 12–73 years, with a mean age of 30.94 years. There were 14 males. The most common diagnosis was osteosarcoma. The average follow-up period was 54.05 months with the longest being 168 months. The average Musculoskeletal Tumour Society (MSTS) functional score was 66.6%. The two- to 14-year overall survival was 82.4%. Three patients died of disease and one patient required amputation. Complications encountered were deep infection and dislocation of the prosthesis.

methods of limb reconstruction have become an important issue. Total femoral replacement, although a major undertaking, provides a means of limb salvage.

The use of allografts [7, 10, 16] and allograft-prosthetic composites [7] for reconstruction of bony defects after resection have been well described. The complications associated with allografts or alloprosthetic composites limit their use in certain situations. Massive femoral tumours, tumours of the diaphysis and recurrent tumours after limb salvage surgery pose unique problems with respect to reconstruction options. The role of a total femoral endoprosthesis becomes vital in these situations. Progress in biomechanical engineering along with better surgical and chemotherapeutic techniques has increased the overall five-
In case of Ewing sarcoma the treatment is induction chemotherapy with IVAD (Ifosfamide, Vincristine, Adriamycin, Actinomycin D) followed by reconstruction if indicated.

_Sarcoma_ (1998) 2, 49–51  

**CASE REPORT**

**Bilateral endoprosthetic replacements of the proximal femur**

**ATHANASIOS F. FOUKAS & ROBERT J. GRIMER**  

*Royal Orthopaedic Hospital Oncology Service, Birmingham, UK*

**Abstract**

_Patient._ We report the case of a 20-year-old caucasian male with an Ewing’s sarcoma in the left upper femur. After induction chemotherapy, he underwent resection of the left upper femur and insertion of a cemented proximal femoral replacement. Four years later, he presented with a solitary bone metastasis in the right upper femur. He underwent further chemotherapy followed by resection and endoprosthetic replacement of the other proximal femur. He remains disease free with excellent function almost a year after the second operation.  

_Production._ We believe this is the first reported case of bilateral proximal femoral endoprostheses.
Megaprostheses in the Treatment of Primary Malignant and Metastatic Tumors in the Hip Region

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From the Department of Orthopaedic Surgery (R.P.H.V., H.K.L.N.), Department of Radiotherapy (D.M.), Division of Paediatric Oncology (W.A.K.), Division of Surgical Oncology (J.O., H.S.K.), Department of Rehabilitation (L.N.H.G.), and Department of Pathology (J.W.O.) University Hospital Groningen, The Netherlands

Twenty patients with malignant bone tumors of the hip region were treated surgically by resection and reconstruction with an endoprosthesis. Histologic types included five primary bone tumors and 15 metastatic lesions. At review four primary bone tumor patients are still alive without evidence of disease. The length of the observation period varied from 26 to 104 months. Eleven patients with metastatic bone disease died. The average postsurgical survival time was 23 months. All patients were able to walk with or without a cane. Failure of an endoprosthesis occurred in one case. According to the Enneking Evaluation System 11 patients had a good and 9 a fair result.
Modular megaprostheses for proximal femoral tumors

Abstract Fifteen patients with proximal femoral tumors had resection and limb salvage with an uncemented Kotz (HMRS) megaprostheses. 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 megaprostheses is a good procedure, but hip instability remains a major problem.
Implant survival

The Kaplan-Meier 5-year implant survival estimate was 92.5%, with aseptic loosening as the endpoint.

Both functional results and survival are increased for primary tumors versus metastatic disease following PFR.

However, PFR results in excellent local disease control, reliable pain relief and good functional results in both groups, with prosthesis survival exceeding that of the patient in many cases.
Few studies have examined the impact of underlying diagnosis on the functional and oncologic outcomes following endoprosthetic proximal femur replacement (PFR). We performed a retrospective review of 61 consecutive cemented bipolar PFR in 59 patients for treatment neoplastic lesions with a minimum follow-up of 24 months. Twenty-two patients had primary bone tumors and 39 had metastatic disease. Average follow-up for the 30 surviving patients was 55.4 months and the mean postoperative survival for the 29 patients who died was 12.2 months. Patients with primary tumors demonstrated significantly better functional outcomes than those with metastatic disease, with mean Musculoskeletal Tumor Society functional scores of 80.2 and 66.8%, respectively (p < 0.0002). Age correlated inversely with functional scores (r = 0.48; p < 0.0002), while femoral resection length did not. Preoperative pathologic fracture did not appear to adversely impact final functional outcomes. The Kaplan-Meier 5-year implant survival estimate was 92.5%, with aseptic loosening as the endpoint. Both functional results and survival are increased for primary tumors versus metastatic disease following PFR. However, PFR results in excellent local disease control, reliable pain relief and good functional results in both groups, with prosthesis survival exceeding that of the patient in many cases.
Quick recovery

- First - *Eradication* of the tumor
- Second- *Reconstructive* procedure
Data from 44 patients (23 males, 21 females) with a median age of 39 (range 13–80) years who underwent total hip arthroplasty for proximal femoral tumours (1994–2004) were analysed. The histological diagnoses included 14 metastases, six osteosarcomas, six chondrosarcomas, four Ewing’s sarcomas, four giant cell tumours, three malignant Afibrous histiocytomas, two parosteal and two periosteal osteosarcomas, and one each primary neuroectodermal tumour, myeloid disease, and aneurysmal bone cyst. Twenty-one patients (48%) had pathological fractures. The cause of the pathological fracture was metastasis in 12 patients (57%). Twenty-eight patients (64%) had soft tissue invasion. Complications observed in 17 patients (37%) were local recurrence in two, postoperative haematoma in two, dislocation of prosthesis in five, deep infection in six, and one patient died of myocardial infarction in the early postoperative period. During our midterm survival analysis, functional results were excellent in 25% of patients, good in 57%, fair in 12%, and poor in 6%.
Results with cemented prosthesis

The 5-year survival rates for distal femoral were 84% and 70%;
the 10-year survival rates were 79% and 59%.

The 5-year survival rates for proximal femur and proximal tibia replacements were 78% and 37%.

Average Musculoskeletal Tumor Society 1987 scores and Toronto Extremity Salvage Scores

21.5 and 73% for proximal femur,
28.1 and 67% for distal femur,
21 and 78% for proximal humerus.
Prosthesis survival for proximal femoral replacements is generally reported as 77% to 100% at 10 years, falling to 57% at 20 years.9,11-13

Overall survival of a simple hinge distal femoral knee replacement prosthesis at 5, 10, and 20 years is 80%, 65%, and 53%, respectively.9,10 Functional evaluation reveals 69% to 93% good to excellent results with less than 10 years of follow-up.7-11,15
To plan and implement appropriate preoperative chemotherapy or radiation,

To plan the limb salvage procedure.