DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20231988

Original Research Article

A decade of experience in tumors of femur- from local resection to amputation

Subbiah Shanmugam*, Sathiyaseelan Balakrishnan

Department of Surgical Oncology, Kilpauk medical College, Chennai, Tamil Nadu, India

Received: 07 May 2023
Revised: 05 June 2023
Accepted: 08 June 2023

***Correspondence:**
Dr. Subbiah Shanmugam,
E-mail: subbiahshanmugam67@gmail.com

ABSTRACT

Background: Femur is the most common site for long bone tumor especially in young adults. The main function of femur is weight bearing and it plays a vital role in stability of gait.
Methods: A total of 42 patients underwent surgery for tumors in femur between 2013 and 2022 in our institution. We analysed the demographic data, type of tumor, nature of treatment given, functional outcome, complication rate and nature, recurrence and readmission patterns in those patients.
Results: Of the 42 surgeries, 35 were performed for malignant femoral tumor while the remaining seven for benign femoral tumor. Among the 42 patients, 34 underwent treatment for distal femoral tumor and eight for proximal tumor of which 3 patients underwent total femoral resection with reconstruction. Osteosarcoma was the most common malignant tumor. In total, 30 patients underwent custom made endo prosthesis (CMP) reconstruction after bone resection. Nine patients underwent amputation. Among those 30 patients who underwent CMP reconstruction, three patients were salvaged with amputation for tumor recurrence. Considering the age of one patient we did local resection and cementing for a benign tumor. One patient underwent expandable prosthesis reconstruction and one underwent modular prosthesis.
Conclusions: Limb salvage surgery in the form of CMP reconstruction has been the standard of care in our institution with a good functional outcome and low morbidity rate. A combination of surgery with adequate clearance, prompt early physiotherapy and better prosthetic design help our patients to resume their day-to-day activities at the earliest.

Keywords: Bone tumors, CMP reconstruction, Femur tumor, Osteosarcoma, Limb salvage surgery

INTRODUCTION

The most frequent malignant primary bone tumours in people with skeletally immature skeletons are osteosarcoma and Ewing's sarcoma. Ewing's sarcoma is common in the first decade of life, but osteosarcoma is more common in the second decade of life and primarily affects the knee.[1] Chemotherapy, radiation, and surgery are all used in conjunction as part of multidisciplinary treatments.[2] Previously, amputation was thought to be the primary surgical procedure to ensure a radical margin; however, new chemotherapy regimens facilitate limb sparing surgery and increases the survival rates.[3,4]

The accepted standard of care for malignant tumours today is limb salvage surgery.[5] The adoption of a megaprosthesis is thought to be the most common technique for reconstruction after the removal of a bone tumour.[6] This is true for adults and patients who have reached adulthood; for patients who are still developing, expandable prosthesis may be an option, provided that the size of the bone segment allows for the insertion of such a large device.[7,8]

The outcomes of limb-sparing resections and amputations were compared in 227 patients with distal femur osteosarcoma by Simon et al. They came to the conclusion

that doing a limb-sparing procedure rather than an amputation did not decrease the disease-free period or jeopardize the patients' long-term survival.[9] However, with the preservation of knee motion and the capacity to ambulate early, cosmesis and function were much improved.

Since due to the advent of novel surgical techniques, newer chemotherapeutic agents and improvements in radiological imagining, it's now possible to do endoprosthetic reconstruction for primary bone sarcoma of femur in almost 90 to 95 percent of patients.[10]

METHODS

Study type

It was a retrospective observational study.

In this study we collected data of patients of all benign and malignant tumors of femur (which includes proximal, shaft and distal femur) who underwent treatment in centre for oncology, Government Royapettah hospital, Chennai from January 2013 to December 2022 from medical records department and from our central database.

Inclusion and exclusion criteria

We included all patients whom presented to our institution with tumors in femur irrespective of age. Patients with metastatic disease were excluded from the study.

We retrospectively analysed the demographic data, type of tumor, nature of treatment given, functional outcome, complications rate and nature, recurrence and readmission patterns in those patients. Ethical committee approval was obtained.

Statistical analysis

Descriptive statistics was used for data analysis. Software tool used was SPSS version 28.

RESULTS

We collected data of 42 patients of which 22 patients were male and 20 Patients were female. 15 patients were under the age of 18 years.

Table 1: Male/female ratio.

Gender	Number (%)
Male	22 (52.3)
Female	20 (47.7)
Total	42

The mean age of the patients was 34 which ranged from 6 to 69 years. The mean age of male patients was 38 which ranged from 6 to 65 years.

The mean age of female patients was 31 which ranged from 9 to 69 years. Almost 28.5% of patients were in second decade of life.

Table 2: Age of presentation.

Decade of presentation	No. of patients (%)
First decade	9 (21.42)
Second decade	12 (28.57)
Third decade	4 (9.52)
Fourth decade	4 (9.52)
Fifth decade	6 (14.28)
Sixth decade	4 (9.52)
Seventh decade	3 (7.14)

Table 3: Diagnosis.

Pathological diagnosis	No. of patients (%)
Osteosarcoma	31 (73.8)
Ewing's sarcoma	2 (4.76)
Chondrosarcoma	2 (4.76)
Giant cell tumor	5 (11.9)
Chondroblastoma	1 (2.38)
Fibrosis dysplasia	1 (2.38)

Among the 42 bone tumors, 83.3% of patients had malignant disease and 16.7% of patients had benign bone disease. Among the malignant tumors, osteosarcoma was the most common tumor which accounted for 88.5 percent. Among the benign tumors giant cell tumor was the most common entity. Proximal bone tumors accounted for 19 percent and distal femur tumor accounted for 81 percent.

Our patients underwent treatment based on various factors like age, malignant nature of tumor, metastatic disease, neurovascular bundle involvement. We subjected patients with osteosarcoma and Ewing's sarcoma to neoadjuvant chemotherapy followed by surgery based on response to chemotherapy.

Table 4: Nature of surgery.

Nature of surgery	No. of patients (%)
CMP reconstruction	30 (71.42)
Amputation	9 (21.42)
Modular prosthesis reconstruction	1 (2.38)
Expandable prosthesis reconstruction	1 (2.38)
Wide excision and cementing	1 (2.38)
Re-surgery	6 (14.28)

After surgery, the average post operative stay was 14 days for endoprosthesis reconstruction and it was about seven days for amputation.

Functional outcome

The functional outcome of these patients was analysed by musculoskeletal tumor society scoring system. The mean MSTS score for distal femur was 20. It was around 18 for proximal tumors. Around 40% of patients were well satisfied with their prosthesis and 30% patients were satisfied but didn't meet their expectations. 30% were not at all satisfied with their prosthesis.

Among the complication rate, the most common was type I complication which accounted around 42%.

Table 5: Complication rate.[12]

Complication type	No. of patients (%)
Type 1 complication	8 (42)
Type 2 complication	2 (10.5)
Type 3 complication	2 (10.5)
Type 4 complication	4 (21)
Type 5 complication	3 (15.7)

Readmission pattern

Among the 42 patients, 10 patients got readmitted for various complications and recurrence. Four patients readmitted for wound related morbidity, 2 patients readmitted for prosthetic failure, 5 patients readmitted for local and metastatic recurrence. 6 percent of patients had undergone resurgery either for a local recurrence or for complications.

Recurrence and death

Among the 42 patients, 3 patients had local recurrence for which salvage amputation was done. 12 patients had metastatic disease for which those patients underwent salvage chemotherapy. 7 patients were dead.

DISCUSSION

When a tumor can be removed entirely, limb salvage surgery must be the preferred option. Amputation has become less necessary as a result of the significant advancements in sarcoma treatment, although it still plays a crucial part in some circumstances.[11]

In our institution, for benign bone tumors, we proceeded with wide excision of tumor along with the bone and reconstruction was done with custom made endo prosthesis. One of the patients with localized chondroblastoma in distal femur, due to confined nature of disease to a single condyle and considering the young age of the patient we proceeded with wide excision along with cementing.

In case of osteosarcoma, we subjected the patient to neoadjuvant chemotherapy MAP regimen (methotrexate adriamycin and cisplatin) and for Ewing's sarcoma, patients were subjected to VAC-IE (vincristine adriamycin cyclophosphamide- ifosfamide etoposide) regimen. After 3 to 4 cycles of chemotherapy, they underwent femur resection along with the tumor with custom made endo prosthesis reconstruction.

One of our patients underwent modular prosthesis reconstruction. Considering the age, another underwent expandable prosthesis reconstruction.

We categorized our complications into five types based on Henderson classification.[12] Soft-tissue failures (type 1), aseptic loosening (type 2), structural failures (type 3), infection (type 4), and tumor progression (type 5).

We treated all patients with type 1 and type 2 complication in conservative manner. 2 patients with type 3 complication underwent re-surgery with prosthetic replacement. One patient with type 4 complication underwent salvage amputation while others were treated with intravenous antibiotics. Patients with type 5 complication underwent salvage amputation.

Cemented endoprosthetic reconstruction is used in reconstructive surgery and offers instant stability, allowing for early mobilisation and weightbearing.[13] Resections are significantly delayed as a result of the preoperative design and manufacturing processes, which take at least a few weeks. The difficulty of estimating the precise length and width of the resected bone based solely on imaging modalities was a second disadvantage of custom-made prostheses.[14,15]

For all our patients we started physiotherapy (isometric exercises) on 3rd day. Partial weight bearing was initiated to all patients on day 7 and full weight bearing on pod 10.

Most of our patients have non-disabling type of pain, with restricted recreational activity. Most of our patients were emotionally satisfied with minor cosmetic issues with their gait. Even though there was a restriction in recreational and sports activities, our patients were able to do day to day activities without any supports. In order to improve more functional outcome, we should encourage the patient for prompt early and persistent physiotherapy.

The choice of postoperative rehabilitation techniques can have a significant impact on the functional outcome; whereas premature mobilization and weight-bearing can raise the risk of dislocation, prolonged immobilization can result in excessive muscular fibrosis and weakening.

During the follow up period, 12 patients were diagnosed to have metastatic disease in lung. Those patients were subjected to chemotherapy. Three patients had local recurrence and they were salvaged with amputation. For patients who underwent amputation, ambulation was started as early as Post operative day one. All amputees were counselled in both preoperative and post operative

period and arrangements were made for artificial limbs/clutches even before the discharge of the patient.

There are some limitations. We were unable to precisely measure the overall survival and disease-free interval in our institution since some of our patients were lost to follow-up. Additionally, the data were gathered over a 10-year period by a number of different people, raising the chance of discrepancies during data entry.

CONCLUSION

Limb salvage surgery in the form of CMP reconstruction has been the standard of care in our institution with a good functional outcome and low morbidity rate. A combination of surgery with adequate clearance, prompt early physiotherapy and better prosthetic design help our patients to resume their day to day activities at the earliest. Also, a proper psychological counseling help them to sustain a good quality of life.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Granowetter L, Womer R, Devidas M, Krailo M, Wang C, Bernstein M, et al. Dose-intensified compared with standard chemotherapy for nonmetastatic ewing sarcoma family of tumors: a children's oncology group study. J Clin Oncol. 2009;27:2536-41.
2. Cirstoiu C, Cretu B, Serban B, Panti Z, Nica M. Current review of surgical management options for extremity bone sarcomas. EFORT Open Rev. 2019;4:174-82. [
3. Hesla AC, Papakonstantinou A, Tsagkozis P. Current status of management and outcome for patients with Ewing sarcoma. Cancers. 2021;13:1202.
4. Ferrari S, Palmerini E. Adjuvant and neoadjuvant combination chemotherapy for osteogenic sarcoma. Curr Opin Oncol. 2007;19:341-6.
5. Goryń T, Pieńkowski A, Szostakowski B, Zdzienicki M, Ługowska I, Rutkowski P. Functional outcome of surgical treatment of adults with extremity osteosarcoma after megaprosthetic reconstruction-Single-center experience. J Orthop Surg Res. 2019;14.
6. Pala E, Trovarelli G, Angelini A, Maraldi M, Berizzi A, Ruggieri P. Megaprosthesis of the knee in tumor and revision surgery. Acta Biomed. 2017;88:129-38.
7. Dukan R, Mascard E, Langlais T, Ouchrif Y, Glorion C, Pannier S, Bouthors C. Long-term outcomes of non-invasive expandable endoprostheses for primary malignant tumors around the knee in skeletally-immature patients. Arch Orthop Trauma Surg. 2021:1-10.
8. Torner F, Segur JM, Ullot R, Soldado F, Domenech P, DeSena L, Knorr J. Non-invasive expandable prosthesis in musculoskeletal oncology paediatric patients for the distal and proximal femur. First Results Int Orthop. 2016;40:1683-8.
9. Simon MA, Aschliman MA, Thomas N, Mankin HJ. Limb-salvage treatment versus amputation for osteosarcoma of the distal end of the femur. J Bone Joint Surg. 1986;68A:1331-7.
10. Bickels J, Wittig JC, Kollender Y, Henshaw RM, Kellar-Graney KL, Meller I, et al. Distal femur resection with endoprosthetic reconstruction: a long-term followup study. Clin Orthop Relat Res. 2002;(400):225-35.
11. Weisstein JS, Goldsby RE, O'Donnell RJ. Oncologic approaches to pediatric limb preservation. J Am Acad Orthop Surg. 2005;13:544-54.
12. Henderson ER, O'connor MI, Ruggieri P, Windhager R, Funovics PT, Gibbons CL, et al. Classification of failure of limb salvage after reconstructive surgery for bone tumours. Bone Joint J. 2014;96-B(11):1436-40.
13. Malawer MM. Distal femoral resection for sarcomas of bone. In Sugarbaker PH, Malawer MM, eds. Musculoskeletal Surgery for Cancer. New-York: Thieme Medical Publisher; 1992:243-259.
14. Henshaw RM, Bickels J, Malawer MM. Modular endoprosthetic reconstruction for lower extremity skeletal defects: oncologic and reconstructive considerations. Semin Arthroplast. 1999;10:180-7.
15. Unwin PS, Cannon SR, Grimer RJ, Kemp HB, Sneath RS, Walker PS. Aseptic loosening in cemented custom-made prosthetic replacements for bone tumours of the lower limb. J Bone Joint Surg.. 1996;78(1):5-13.

Cite this article as: Shanmugam S, Balakrishnan S. A decade of experience in tumors of femur- from local resection to amputation. Int J Res Orthop 2023;9:695-8.