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Dr. Jalaluddin Akbar KC
Associate Professor, Department
of Onco-Surgery, Yenepoya
Medical College, Mangalore,
Karnataka, India

Dr. Adarsh Vajrangi
Research Scholar, Department of
Orthopaedics, Yenepoya Medical
College, Mangalore, Karnataka,
India

Dr. Abhishek Shetty
Assistant Professor, Department
of Orthopaedics, Yenepoya
Medical College, Mangalore,
Karnataka, India

Dr. Imthiaz Ahmed
Professor, Department of
Orthopaedics, Yenepoya Medical
College, Mangalore, Karnataka,
India

Corresponding Author:
Dr. Abhishek Shetty
Assistant Professor, Department
of Orthopaedics, Yenepoya
Medical College, Mangalore,
Karnataka, India

Functional outcome of limb salvage surgery in gaint cell tumour around knee with mega-endoprosthesis reconstruction

Dr. Jalaluddin Akbar KC, Dr. Adarsh Vajrangi, Dr. Abhishek Shetty and Dr. Imthiaz Ahmed

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Abstract

Introduction: Giant cell tumors (GCTs) represent 3-4% of all primary tumors of bone [1]. These tumour are locally aggressive and predominantly affect the ends of long bones (usually the distal femur and proximal tibia) in young adults. The ideal aim in the management of GCT is to eradicate the tumor without sacrificing the joint. Wide resection should be the treatment of choice, especially for situations such as recurrences, pathological fractures and tumors which are frankly malignant tumor

Aim: To determine the functional outcome and complications of mega endoprosthesis in treatment of gaint cell tumour around knee joint

Materials and Methods: Retrospective study conducted from 2010 to 2016 with age ranging from 16 to 30 years with follow up period- 48 months. All patient with primary GCTs around knee who had met with inclusion criteria underwent surgery. All patient underwent definitive wide local resection and Mega-endoprosthesis reconstruction, Functional outcome was scored by musculoskeletal tumour society scoring (MSTS). Complications related to surgery such as Infection, Aseptic loosening, Dislocation, Skin necrosis and Fractures were evaluated. The diagnosis was based on histopathological features noted on a core biopsy. Patients with a high-grade GCT were subjected to computed tomography of the chest and bone scan for metastatic evaluation.

Results: The average MSTS functional score was 75% (Range- 60% to 100%), 4-year survival rate was 100% in our study. Average range of movements at 4 years was 80 (70-90). Among the 8 patients, 2 had complications related to surgery. One had infection which required intravenous antibiotics treatment but infections did not subsided so patient underwent allograft bone transplant with arthrodesis. One had foot drop secondary to common peroneal palsy, Six months post-surgery, he was able to walk with a single crutch and coped well with his foot drop.

Conclusions: Wide resection and endoprosthesis replacement should be considered as a preferred treatment option in treatment of aggressive gaint cell tumour around knee joint. Mega-endoprosthesis reconstruction provides good functional outcome in patients with these kind of tumour and can be considered as treatment of choice if and when the limb can be salvageable.

Keywords: Endoprosthesis megaprosthesis, giant cell tumor of bone

Introduction

Giant cell tumors (GCTs) represent 3-4% of all primary tumors of bone [1]. These tumour are locally aggressive and predominantly affect the ends of long bones (usually the distal femur and proximal tibia) in young adults [2]. 1 Oncological and functional results are variable after treatments ranging from extended curettage to wide resection [3]. Distal femur and proximal tibia are the most common sites followed by the distal radius. The ideal aim in the management of GCT is to eradicate the tumor without sacrificing the joint [4]. Current treatment modalities including a meticulous curettage with extension of tumor removal using high speed burrs and adjuvant local therapy [2]. However, with these modalities there is a recurrence rate of 60%. Wide resection should be the treatment of choice, especially for situations such as recurrences, pathological fractures and tumors which are frankly malignant tumors [5, 6]. En bloc resection of major joints creates a problem for the reconstruction of large defects. Limb salvage surgery widely accepted alternative to amputation in patients with bone

tumours [1]. Success of limb salvage –Understanding of the Biology and Staging of tumour, Reconstructive technique, Effective Adjuvant Chemotherapy [7, 8]. Primary goal to restore and maintain stability and ambulation, In addition to the use of biologic solutions, endoprostheses have gained increasing acceptance among orthopaedic oncology surgeons during the last 30 years [15]. Last few decades limb salvage surgery Gained wide acceptance among orthopaedic oncology surgeon, Modular systems have replaced one-piece prosthesis construction [15]. High rate of late complications such as loosening, infection and mechanical failure [9, 10].

Objectives

To determine the functional outcome and complications of megaendoprosthesis in treatment of giant cell tumour around knee joint.

Materials and Methods

Retrospective study conducted from 2010 to 2016 with age ranging from 16 to 30 years with follow up period- 48 months. All patient with primary GCTs of the around knee were included. Inclusion criteria were: (1) a primary GCT with extensive bone lysis (Campanacci stage III)5 and soft-tissue spill, (2) multiple recurrent lesions following failed curettage (3) patients giving informed consent for a prosthetic replacement. Patients with GCTs in Campanacci stages I and II were excluded. All patient underwent definitive wide local resection and Mega-endoprosthetic reconstruction, Functional outcome was scored by Musculoskeletal tumour society scoring(MSTS) Numerical values from 0 to 5 points were assigned for each of the following 6 categories: pain, function, emotional acceptance, use of supports, walking ability and gait. These values were added, and the functional score was presented as a percentage of the maximum possible score. The results were graded according to the following scale: Excellent – 75% to 100%; good – 70% to 74%; moderate – 60% to 69%; fair – 50% to 59% and poor – <50%. Complications related to surgery such as Infection, Aseptic loosening, Dislocation, Skin necrosis and Fractures were evaluated. Pain was the most common symptom, followed by swelling, routine radiology (chest radiography and magnetic resonance imaging) was performed. The diagnosis was based on histopathological features noted on a core biopsy. Patients with a high-grade GCT were subjected to computed tomography of the chest and bone scan for metastatic evaluation, This study aims to evaluate the functional outcome of 8 patients with aggressive benign bone tumours that necessitated large bone segment resection and mega-endoprosthetic replacement in yenepeya medical college, mangalore between 2010 and 2016.

Table 1: Involvement of site

SITE	N-8
Distal Femur	5
Proximal Tibia	3

Fig 1: Pre-operative

Fig 2: Intra-Operative

Fig 3: Post-operative and follow-up

Fig 4: Patient achieved around 90 degree of painless range of motion

Fig 5: Patient achieved full extension of knee

Results

- The average MSTS functional score was 75% (Range-60% to 100%).
- 4-year survival rate was 100% in our study.
- Average range of movements at 4 years was 80 (70-90).

The age of the patients ranged from 10 to 30 years. Eight patients underwent lower limb surgical procedures. Among the 8 patients, 2 had complications related to surgery. One had infection which required intravenous antibiotics treatment but infections did not subside so prosthesis was removed and external fixator application followed by allograft bone transplant with arthrodesis. None had implant loosening, breakage or periprosthetic fractures. One had foot drop secondary to common peroneal palsy. Six months post-surgery, he was able to walk with a single crutch and coped well with his foot drop.

Table 2: Associated complication in our study

COMPLICATION	NUMBER
Foot drop	1 (Foot drop splint)
Infection	1- Antibiotics ↓ Prosthesis removal ↓ Allograft bone transplant+Arthrodesis

Fig 6: Loosening of prosthesis secondary to infection followed by prosthesis removal and external fixator application

Fig 7: Allograft bone

Fig 8: Arthrodesis of knee after external fixator removal

Fig 9: Immediate post op x ray

Discussion

The treatment of GCTs is directed toward local control without sacrificing joint function. This has traditionally been achieved by intralesional curettage with autograft reconstruction by packing the cavity of excised tumor with morselized iliac cortico-cancellous bone. Regardless of how thoroughly performed, intralesional excision leaves microscopic disease in the bone and hence a reported recurrence rate as high as 60%. Use of modern instruments such as high power burr, pulsatile jet lavage system, headlamp and dental mirror combined with multiple angled curettes to identify and access small pockets of residual disease failed to provide 100% results. Recurrence has been reported instead of the use of adjuvants such as phenol and hydrogen peroxide. Cryosurgery using liquid nitrogen is associated with high incidence of local wound and bone complications [9, 10].

Adequate removal of tumor seems to be a more important predictive factor for the outcome of surgery. However, it leaves large bone defects. Methyl methacrylate cement, used to fill the defect is though strong in compression is relatively weak when subjected to shear and torsional forces. Moreover, it can lead to degeneration of articular cartilage in subchondral lesions. Autografts can be used to fill the defect, but its quantity is limited and harvesting autograft causes donor site morbidity. Allograft is expensive and requires a bone bank. Allograft itself can lead to infection, fracture, non-union and joint instability. Bone lengthening is a time-

consuming procedure. Arthrodesis has complications including a high risk of delayed or non-union and fractures. An arthrodesed knee is awkward and causes problems when sitting, particularly in public transport such as buses, trains etc. The cosmetic outcome of rotation plasty is a serious disadvantage^[11, 12].

Hence, custom mega prosthetic arthroplasty has become the method of choice after bone tumor resection at the knee. It is the primary modality in the treatment of aggressive bone tumors of lower limb. The use of custom mega prosthesis is a simple and technically superior method of feeling the bone defects in benign aggressive lesions with pathological fractures and where skeletal reconstruction is difficult after intralesional curettage. Limb-sparing surgery has drastically increased in last decade with advantages of Immediate stability, earlier rehabilitation with immediate full weight-bearing. Endo-prosthetic survival improved due to advances in prosthetic design with modular components, manufacturing, surgical techniques. But complication rate is still high (eg, aseptic loosening, stem fracture, infection, and dislocation) and hence Individual approach is essential to Choose the most suitable surgical treatment. Our patients were below 30 years, 2/3rd were below 25 years of age hence limb salvage is preferred over amputation. Oncological reconstruction may appear to have higher complication rates compared with standard total joint arthroplasty due to the extensive nature of the operation, extensive tissue loss, and the compromising effects of associated radiotherapy and chemotherapy. In addition, reconstructions are often done in younger patients who are relatively more active, thus incurring a higher rate of wear.

Limitation

- Retrospective study
- Short follow up period
- Small sample size

Conclusion

- Mega-endoprosthetic reconstruction provides good functional outcome in patients with bone tumours around the knee.
- Can be considered as treatment of choice for bone tumours around the knee if and when the limb can be salvageable.
- Patients have been evaluated and seem to have acceptable functional outcomes in our institution.

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