

## Aggressive Bone Tumor around the Knee Managed with Tumor Prosthesis Retrospective Case Series in a Developing Country

Diana C Bandong\*, Philip T Ko and Isagani E Garin

<sup>1</sup>Baguio City, Benguet, Philippines

<sup>2,3</sup>Baguio General Hospital and Medical Center, Philippines

### Abstract

This study aims to know the functional status of patients who underwent limb-sparing surgery using the Enneking MSTS scoring system. It will also evaluate the demographics of the patients and the complications arising from the procedure. A retrospective review of our hospital records was carried from 2009-2022. There were 12 (9 men and 3 women) patients with aggressive bone tumors around the knee who underwent tumor resection and endoprosthetic reconstruction. In this review, five patients had poor MSTS, while the rest had good to excellent results. Most complications noted were related to patients' poor response to chemotherapy, which may contribute to poor outcomes. Other problems were hardware breakage at the proximal stem, flap necrosis for a too-medial previous incision, aseptic loosening, non-incorporation of the infrapatellar tenodesis causing patella alta, and skin allergy on the incision site. Limb salvage surgery with endoprosthesis is a viable option, safe and gives patients a sense of independence and return to daily activities.

**Keywords:** MSTS, Endoprosthesis; Aggressive bone tumor

### Introduction

Sarcoma is a rare type of cancer seen most frequently in long bones and soft tissue of the extremity [1]. Musculoskeletal tumors account for 0.2-0.5% of all malignancies most often seen in children and adolescents [2]. Most affect the lower extremities, followed by the upper extremity and torso, pelvic tumors are less common but with lower survival rates [3]. Eighty percent arises from soft tissue and 20% from bone [4]. Most common tumors were osteosarcoma with incidence of 1.68/million/year, chondrosarcoma with 0.79/million/year and Ewing sarcoma with 0.76/million/year.

Management of extremity tumors has evolved. In the early 1950s, amputation is the standard of treatment, up until Buchanan introduced limb salvage surgery, however with noted high recurrence rate [5]. In the advent of potent chemotherapeutic drugs, the five-year survival rate of primary sarcoma improved and limb saving and limb reconstruction became possible [6]. In the 1980s, metallic mega prosthesis has been used for reconstruction after tumor resection due to the availability, ease of use, immediate fixation and allows early weight bearing, restoration of function, excellent cosmetic appearance and emotional acceptance [7].

Endo-prosthetic reconstruction after tumor resection has been widely used for limb sparing surgery. With the improvements in the long-term patient survival rate, functional outcomes of limb sparing reconstructions became an important consideration [8]. The concept of limb salvage surgery gave both surgeons and patients more options for treatment other than amputation. In the current time, 90-95% of extremity sarcomas undergo limb salvage surgery with successful result. The advantage of mega prosthesis around the knee allows the patient to do range of motion, immediate weight bearing and early return to function [9].

Endo-prosthetic functional outcome became a topic of several studies and the most used assessment tool is the Musculoskeletal Tumor Society (MSTS) score. It is composed of six items including pain, function, emotional acceptance, use of any external support, walking ability and gait alteration. Each item is rated on a scale of 0 to 5, total score ranges from 0 to 30, with higher scores indicating better function.

The MSTS questionnaire facilitated valid evaluation of functional results and can be easily used in the clinical practice. The MSTS score is found to have good inter-observer reliability and correlate well with other functional scoring system [10].

The purpose of this study is to know the functional status of patients who underwent limb sparing surgery using the MSTS scoring system. It will also evaluate the demographics of the patients and the complications arising from the procedure.

### Materials and Methods

A retrospective review was carried out including 12 (9 men and 3 women) patients with soft tissue and bone sarcoma around the knee who underwent tumor resection and endoprosthetic reconstruction in the institution from 2009-2022. The data gathered comprised the demographic profile, clinical characteristics, functional results and survival. Limb sparing surgery was performed on all patients by an orthopedic oncologist. MSTS evaluation was done by the surgeon and the resident in charge on their latest follow up. Complications such as infection, recurrence and mortality were also reviewed. Kaplan Meier survival analysis was used to determine survival data and function.

### Results

Total of 12 patients were included in the study, 9 (75%) were males and 3 (25%) were females. The mean age was 22.5 years (range of 11-56 years). Seven (58.33%) patients were diagnosed with osteosarcoma of the distal femur (Figure 1), 2 (16.67%) patients were diagnosed

**\*Corresponding author:** Isagani E Garin, Baguio General Hospital and Medical Center, Philippines, E-mail: garinisagani@gmail.com

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with osteosarcoma of the proximal tibia (Figure 2), 1 (8.33%) patient each for chondrosarcoma (Figure 3), chondroblastoma, and Ewing sarcoma. All patients underwent wide resection with mega-prosthesis reconstruction (Table 1).

The Musculoskeletal Tumor Society Score (MSTS) was used for limb function evaluation. The mean MSTS was 20.67, with a range of 9-27.



Figure 1: CA 25-year-old male osteosarcoma distal femur left covid (+).



Figure 2: 18-year-old male osteosarcoma proximal tibia right.

On the breakdown of MSTS score (Table 2), on the pain score, 5 patients had reported no pain, 1 with intermediate pain and 6 with modest pain. On the function score 7 reported intermediate restriction, 4 reported recreational restriction and 1 reported intermediate restriction. On the emotional score, 2 were enthused, 5 were intermediate, 3 were satisfied, 1 was intermediate and 1 had acceptance. On the support score, 1 did not need support, 5 needed intermediate support, 4 needed brace, 1 needed intermediate support and 1 used crutch. On the walking score, 6 patients had intermediate score, 4 had limited walking, 1 had intermediate score and 1 reported walking inside only. On the gait score, 6 patients had intermediate gait, 4 had minor cosmetic issues, 1 had intermediate score and 1 had major cosmetic issue. Two patients had excellent outcomes, 4 patients had good outcomes, 1 patient had fair outcome and 5 patients had poor outcomes. The length of survival is proportional to a higher MSTS score (Table 3).

All patients underwent post-op chemotherapy and rehabilitation to restore independence. For the complications, 7 patients had metastasis, 1 had implant breakage, 1 had skin allergy on incision site, 1 had flap necrosis and 1 had aseptic loosening. Seven patients died of the disease and 5 were alive without disease (Figure 4).

### Discussion

The main goal of limb sparing surgery is to avoid disability and to give the patient a chance to return to normal life. The patient is given a chance to mobilize with support with preserved limb sensation.



Figure 3: 56-year-old male Chondrosarcoma proximal tibia.

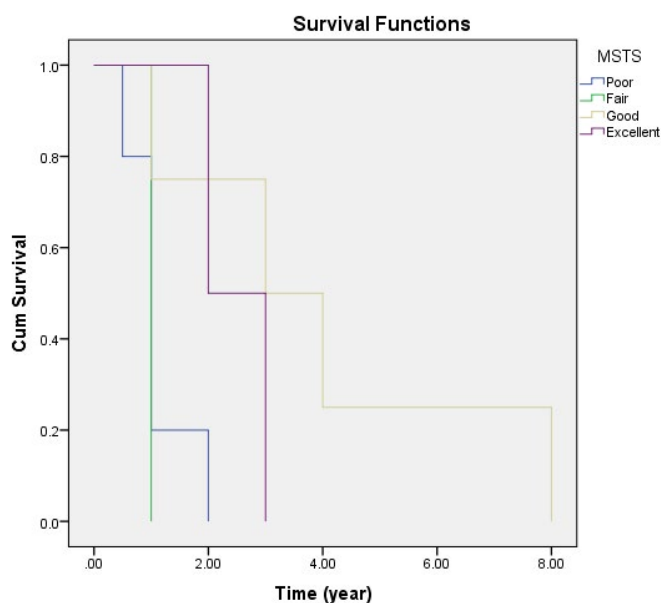
Table 1: Patients' characteristics.

Patient number	Age/Sex	Prosthesis	Histology	MSTS score	Complications	Follow-up	Status
1. KR	11/M	Distal femur	Osteosarcoma	23 (Good)	Implant breakage	3 years	AWOD
2. DD	18/M	Proximal tibia	Osteosarcoma	27 (Excellent)	Skin allergy on incision site	2 years	AWOD
3. AB	56/M	Proximal tibia	Chondrosarcoma	25 (Good)	Aseptic loosening Patella alta	8 years	AWOD
4. MM	22/M	Distal femur	Chondroblastoma, Recurrent	27 (Excellent)	Flap necrosis	3 years	AWOD
5. CA	25/M	Distal femur	Osteosarcoma	22 (Fair)	None	1 year	AWOD
6. EB	14/M	Distal femur	Osteosarcoma	24 (Good)	Refused post-operative chemotherapy Metastasis	1 year	DOD
7. JD	19/M	Distal femur	Osteosarcoma	18 (Poor)	Metastasis	2 years	DOD
8. CC	16/F	Distal femur	Osteosarcoma	25 (Good)	Hearing loss due to Cisplatin Tumor recurrence Metastasis	4 years	DOD
9. DC	20/M	Distal femur	Osteosarcoma	18 (Poor)	Metastasis	1 year	DOD
10. JL	18/M	Distal femur	Osteosarcoma	18 (Poor)	Tumor recurrence Metastasis	1 year	DOD
11. SR	19/M	Proximal tibia	Ewing's sarcoma	13 (Poor)	Metastasis	1 year	DOD
12. MS	32/F	Proximal tibia	Osteosarcoma	9 (Poor)	Recurrence Metastasis	6 mos	DOD

AWOD: alive without disease. AWD: alive with disease. DOD: died of disease. DOC: died of other cause

**Table 2:** Cross tabulation of MSTS and Clinico-demographic profile.

		MSTS				Total	P-Value
		Poor	Fair	Good	Excellent		
Sex	Male	4	1	3	2	10	0.84ns
	Female	1	0	1	0	2	
Total		5	1	4	2	12	
Age	18 and below	1	0	3	1	5	0.312 ns
	19 and above	4	1	1	1	7	
Total		5	1	4	2	12	
Prosthesis	Distal Femur	3	1	3	1	8	0.807 ns
	Proximal Tibia	2	0	1	1	4	
Total		5	1	4	2	12	
Histology	Osteosarcoma	4	1	3	1	9	0.654 ns
	Chondrosarcoma	0	0	1	1	2	
	Ewing's Sarcoma	1	0	0	0	1	
Total		5	1	4	2	12	
Status	Alive	0	1	2	2	5	0.048*s
	Died	5	0	2	0	7	
Total		5	1	4	2	12	
Time (year)	0.5	1	0	0	0	1	0.647 ns
	1	3	1	1	0	5	
	2	1	0	0	1	2	
	3	0	0	1	1	2	
	4	0	0	1	0	1	
	8	0	0	1	0	1	
Total		5	1	4	2	12	



**Figure 4:** Survival function.

Resection and proper reconstruction allow patients to return to their activities such as work and sports [11]. Advances in chemotherapy and surgical treatment for sarcomas improved survival rates and one study showed 79% 3-year survival rate and 65-70% 5-year survival rate [12].

The MSTS score provides a standard evaluation and comparison of functional outcomes of patients with primary bone tumors and treated with endoprosthesis [13]. In the study of Kamal et al., MSTS score was higher in limb salvage surgery than amputation group. LSS had higher survival rate than amputation in osteosarcoma patients [14].

In the study of Smolle et al., they observed that patients with tumors located at the distal femur had better functional outcomes compared to those with tumors located at the proximal tibia [15]. In this review, the 2 patients under the osteosarcoma, proximal tibia group had the highest and lowest MSTS score. However, in general, those with tumors located at the distal femur had good functional outcome.

Following surgery, postoperative morbidity occurred in 7 (58.33%) patients wherein they had metastasis, 2 (16.67%) had implant related complications, 1 (8.33%) had skin allergy on the incision site and 1 (8.33%) had flap necrosis. Seven (58.33%) patients died of cancer complication and 5 (41.67%) were alive without disease.

The limitations of this study are the small sample size and heterogeneous diagnoses of the patients.

### Conclusion

Functional outcomes were good following limb sparing surgery with endoprosthesis. Those with tumors located on the distal femur had good functional outcome compared to those with tumors located on the proximal tibia. LSS with endoprosthesis is favorable and gives patients sense of independence and return to the daily activities.

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### Conflict of Interest

There is no conflict of interest.

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