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Original Research

Limb Salvage Surgery For Osteosarcoma

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ABSTRACT

Introduction- The current surgical standard for malignant bone tumours is limb salvage surgery (LSS). Recent developments in biomedical engineering, chemotherapeutic agents, imaging, and surgery have rendered LSS more functionally successful and safe for use in cancer patients. The aim of present study is to assess the oncological and functional outcome of osteosarcoma patients undergoing limb salvage surgery.

Material and methods- The present retrospective study was done among 12 patients with osteosarcoma undergone limb savage surgery at Sri Ram Murti Medical College, Bareilly during the study period of one year. The musculoskeletal tumour society (MSTS) scoring system was used on a regular basis to assess each patient's functional outcome. Descriptive and inferential statistics were used in statistical analysis to analyse data.

Results – The mean age was 20.34 years. There were 8 males and 4 femlaes. The distal femur (n = 7) and proximal tibia (n = 5) were the most often occurring sites. 3 patients presented in Stage I, Seven patients in Stage II, and two patients in Stage III disease. 9 patients went non biological reconstruction and 3 went biological reconstruction. The overall survival was 65% and event free survival was 60.7%. Influence of variables on overall survival showed that the surgical specimen's stage, percentage of tumor necrosis (≥99%) and site of tumor showed significant results with survival.

Conclusion – In Indian patients with osteosarcoma, the current study demonstrates oncological and functional outcomes of limb salvage in conjunction with chemotherapy that are on par with those reported in international literature. It is advised to conduct larger studies on the Indian population with longer follow-up.

Keywords- Bone, Limb, Osteosarcoma, Outcome, Surgery, Tumor

INTRODUCTION

The most frequent malignant bone tumor is osteosarcoma. Every year, out of 120 there are 80 new patients with osteosarcoma, of whom 40 to 50 percent have either metastatic or locally advanced disease at the time of presentation. [1] Osteosarcoma has a bimodal age distribution, with peaks in early adolescence and in individuals over 65.[2-4] Osteosarcoma patients may have localized discomfort and edema when they first appear, usually lasting several months. Upon physical examination, the most significant finding is usually a big, tender bone swelling with a soft tissue mass. At the time of presentation, 10%–20% of patients have visible metastatic illness, most frequently lung disease.[5] The presence of a malignant sarcomatous stroma, linked to the formation of tumor osteoid and bone, provides the basis for the histologic diagnosis of osteosarcoma. About 90% of all osteosarcomas are conventional (intramedullary high grade) osteosarcomas.[6] Neoadjuvant chemotherapy followed by extensive excision and repair of the defect has become the global standard of care for patients eligible for limb salvage.

The current global standard of care for osteosarcoma is multiagent chemotherapy and limb salvage surgery, with most studies reporting 5 year survival rates of 60–70% and limb salvage being possible for up to 90% of patients at most specialist hospitals.[7] A skilled team of surgeons and oncologists, high-quality prostheses, a good tissue bank for allografts, a good blood bank and facilities for transfusion of blood products, and good intensive care units are all necessary for limb salvage operations. These demands pose a problem in a developing nation with tight financial resources.[8] Few single-institution studies on the current management of osteosarcoma in Indian patients have been conducted.[9] Hence due to scarcity of literature on current topic the present study was done to assess the oncological and functional outcome of osteosarcoma patients undergoing limb salvage surgery.

MATERIAL AND METHODS

The present retrospective study was done among patients with osteosarcoma undergone limb savage surgery at Sri Ram Murti Medical College, Bareilly during the study period of one year. Ethical permission was taken from institutional ethical committee before the commencement of study.

Total 12 patients who were diagnosed with osteosarcoma and underwent limb savage surgery were selected after convenient sampling with following inclusion and exclusion criteria-

Inclusion criteria: Patients with age above 12 years with osteosarcoma diagnosis and gave consent for the study with details of follow up period.

Exclusion criteria: Patients below the age of 12 years and does not gave consent for study.

An in-house biopsy was used to establish the diagnosis. A full body bone scan and a chest computed tomography (CT) scan, or an alternative, positron emission tomography scan, were included of the metastatic work-up. The tumor's size was classified as little or large (either less than 8 cm or larger than 8 cm) based on a gross histological examination performed after surgery. Reconstruction methods were divided into three categories: biological (vascular or nonvascular autograft, extra corporeally irradiated tumor bone), nonbiological (prosthesis/cement spacer), and no reconstruction. Res TOR or GMRS megaprostheses were the two types of megapros theses used for limb salvage. Tumor necrosis following neoadjuvant chemotherapy was categorized as either poor (less than 90% of tumor) or good (greater than or equal to 90% of tumor).[10] Surgery was done two to three weeks following the final chemotherapy round, depending on the patient's condition, including their hematological and biochemical data. If good wound healing was observed following surgery, chemotherapy was resumed two to three weeks later. Following the conclusion of the treatment, a follow-up was conducted. Local examination (clinical evaluation to rule out return of edema and for functional assessment) was the first step in every follow-up appointment. Additionally, a noncontrast CT scan of the chest, a regional examination to rule out lymphadenopathy, and local imaging—routine X-rays combined with CT, ultrasounds, and magnetic resonance imaging—were performed when there was a suspicion of a local relapse. Events included the development of the disease (formation of new metastatic lesions) and local or systemic relapse. Age, sex, tumor size, stage at presentation, site, histological subtype, type of chemotherapy protocol used, and necrosis observed on postoperative examination of resected specimen were all connected with the oncological outcome. The musculoskeletal tumor society (MSTS) grading system[8] was used to assess the patients' functional result, which was then associated with the resection site, reconstruction type, and length. The length of time it took for patients to recover—that is, to return to their limbs' maximum function—was also assessed and linked with the kind of reconstruction. Early and late postoperative problems were also assessed in these patients. The results were examined with SPSS 25.0.

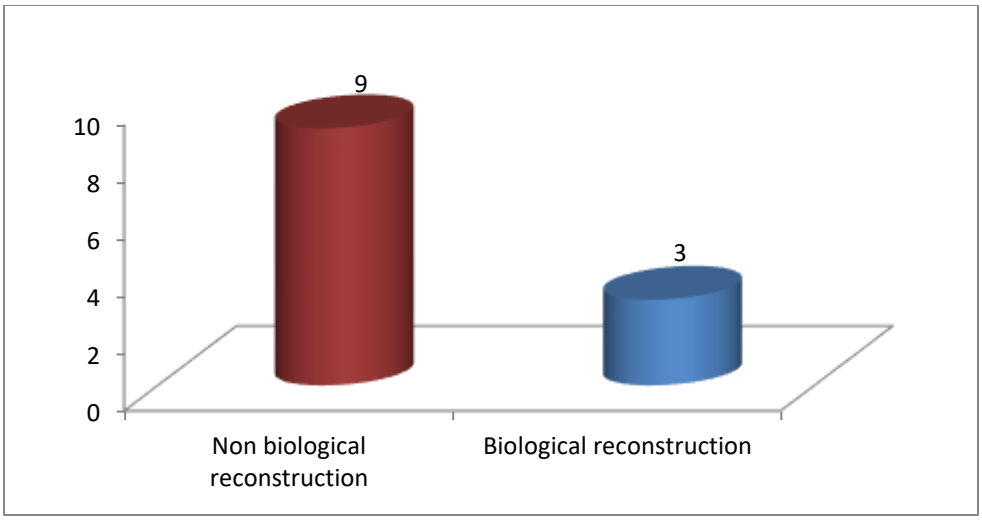
RESULTS

The mean age was 20.34 years. There were 8 males and 4 femlaes. The distal femur (n = 7) and proximal tibia (n = 5) were the most often occurring sites. According to Enneking staging for malignant musculoskeletal tumors, 3 patients presented in Stage I, Seven patients in Stage II, and two patients in Stage III disease as shown in table 1. Out of 12 patients 9 went non biological reconstruction and 3 went biological reconstruction as shown in graph 1.

Table 1: Demographic data of patients

Variable		Mean ±SD/ frequency
Mean age (years)		20.34±5.8
Gender	Male	8
	Female	4
Site	Distal femur	7
	Proximal tibula	5
Enneking staging	Stage I	3
	Stage II	7
	Stage III	2

Figure: 1 Methods of reconstruction



Mean musculoskeletal tumor society scores with duration of assessment from the date of completion of the treatment for proximal tibia tumor and tumor of distal femur is shown in table 2.

Table: 2 Mean musculoskeletal tumor society scores with duration of assessment from the date of completion of the treatment

Duration from completion of treatment	Mean MSTS score – proximal tibial tumor	Mean MSTS score- tumor of distal femur	Mean MSTS score of all patients	P value
3 months	33.09±9.8	35.09±8.0	36.13±6.9	.001
6 months	54.38±7.9	63.07±7.8	56.89±8.2	
1 year	64.02±8.3	78.67±6.0	73.45±6.3	

Postoperative complications were divided in to two parts early and late. Early complications were deep infection (3), wound dehiscence (1) and seroma (2) whereas late complications were local recurrence (4), graft fracture (3), non union of graft (2) and breakage of prosthesis (1) as shown on table 3.

Table: 3 Postoperative complications

Post operative complications		Frequency
Early complications	Deep infection	3
	Wound dehiscence	1
	Seroma	2
Late complications	Local recurrence	4
	Graft fracture	3
	Non union of graft	2
	Breakage of prosthesis	1

On survival analysis, the overall survival was 65% and event free survival was 60.7%. Influence of variables on overall survival showed that the surgical specimen's stage and percentage of tumor necrosis (≥99%) had a substantial impact on survival . Compared to patients with primary in the tibia, those with primary in the femur had a lower prognosis. Age or gender had no effect on survival as shown in table 4.

Table :4 Influence of variables on overall survival

Variable		Mean overall survival± SD (95%CI) in months	P value
Age	Less than 20	117.67±16.71	0.350
	Greater than 20	74.7±17.8	
Gender	Male	66.73±10.45	0.134
	Female	87.34±9.13	
Tumor necrosis	≥99%	86.89±9.12	0.031

	<99%	58.23±11.98	
Stage	Stage I	95.3±12.67	0.030
	Stage II	76.58±8.97	
	Stage III	35.89±13.47	
Tumor site	Distal femur	53.47±8.90	0.028
	Proximal tibula	94.47±11.43	

DISCUSSION

For many years, limb salvage surgery has been the accepted treatment for osteosarcoma.[11,12,9] It is commonly acknowledged that these treatments should only be carried out at facilities that have sufficient training in many diagnostic and therapeutic oncological specializations in addition to orthopedic oncology. Little information is available regarding limb salvage surgery for osteosarcoma in Indian patients receiving care at one or more hospitals.[13] Some of the causes of this shortage include the dearth of committed interdisciplinary teams, the absence of an organized referral system, and the constraints placed on available resources. Research has demonstrated that racial and socioeconomic characteristics impact the prognosis of patients with osteosarcoma [14]. Therefore, it is critical to examine how Indian individuals with osteosarcoma are responding to current treatment. Despite being brief, the survival rates in our study are consistent with global literature. The mean age at presentation of the 12 osteosarcoma patients in our research who had limb salvage surgery (LSS) was 20.34 years. Of the 12, men were 8 and 4 were female. The proximal tibia (5) and distal femur (7) were the two most often occurring tumor sites. The projected OS and RFS were 65% and 60.7%, respectively. The 5-year OS was 63.3% and the RFS was 52.8% in a study of 1702 patients who were participated in the neoadjuvant investigations by the Cooperative Osteosarcoma Study Group in Germany prior to July 1998.[15] Patients with localized disease at initial presentation had a 10-year OS and RFS of 70% and 59%, respectively, according to a Rizzoli Institute study.[16] Our findings revealed OS and RFS rates that were similar to those of earlier international and Indian studies.[17-20]

It is often known that there is a considerable risk of serious complications following limb salvage surgery, which can range from 20% to 40%.[21,22] Our patients reported some early and late complications. A lengthier follow-up period may result in a higher likelihood of complications. And it was evident that a good outcome requires early management of problems. A comparative analysis with a 20-year age threshold revealed no appreciable variations in survival. In our research, gender did not significantly correlate with survival, and the literature that is currently accessible does not appear to reach a consensus on the subject.[23] The likelihood of the lesion growing larger and affecting survival increases with proximity to the site of the lesion. Research indicates that people with tumours in the femur or humerus had a lower prognosis than those with tumours in the tibia or fibula.[15] When comparing patients with Enneking Stage III to those with Stage I and II, the latter group's survival was noticeably worse. In high-grade osteosarcoma, the degree of tumour necrosis as the histological response to NACT is thought to be the most significant prognostic predictor. The literature reports between 50% and 60% of patients to have a favourable response (≥90% tumour necrosis).[24,25]. In good responders, Bacci et al. found a 5-year RFS of 66.9%, while in bad responders, it was 49%.[1] Histological response and oncological prognosis have a substantial association, as demonstrated by McTiernan et al.[10] We did a brief follow-up to our retrospective investigation. For Indian patients with osteosarcoma, larger single/multicenter trials with longer follow-up are needed to assess the results of limb salvage surgery. In this group of Indian patients, state-of-the-art care—including limb salvage surgery with several reconstructive techniques and multimodal chemotherapy, including regimens based on HDMTX—was found to be safe, practicable, and effective.

CONCLUSION

On the other hand, we can assume that the results of limb salvage surgery in Indian patients with osteosarcoma are functionally and oncologically equivalent to those reported in international literature. In LSS, a custom-made prosthesis offers a comparable functional outcome at a lower cost of reconstruction. In osteosarcoma, favorable prognostic variables include tumor necrosis (>99%) caused by treatment and the stage of presentation.

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