

# Functional Outcome in Osteosarcoma

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## ABSTRACT

This study aims to evaluate the oncological and functional outcome in patients of osteosarcoma. Plus the parallel recording of MSTs score, TESS score, and SF-36 Questionnaire provides a better measure reflecting the complex situation of the patients by combining objective and subjective parameters.

**Keywords:** TESS-Toronto Extremity Salvage Scoring System, MTSS- Musculoskeletal Tumour Society Score, SF-36- Short Form -36

## INTRODUCTION

Osteosarcoma is the most common primary malignant bone tumor in children and adolescents, accounting for 4% of all childhood cancers worldwide. In India, the incidence varies from 4.7% to 11.6%, where this malignancy is associated with significant morbidity and mortality.<sup>1</sup> Beyond survival there is little information on physical impairment and disability, but evaluation of functional outcome is becoming more important in the increasing proportion of long term survivors. Over the past three decades the focus has now shifted from controversy over the various forms of limb salvage to methods enhancing functional outcome after endoprosthetic replacement.<sup>2</sup> However, the issues are different from a developing nations perspective, where the debate still moves around the most cost effective method of treatment.

This study aims to evaluate the functional outcome in patients of osteosarcoma treated

with limb salvage surgery or limb amputation at follow up of 2 years from the date of surgery. The functional outcome will be assessed using the Musculoskeletal Tumour Society Score (MSTS) which evaluates the functional condition (impairment) after tumour treatment, the Toronto Extremity Salvage Scoring System (TESS) which is a self administered questionnaire developed to record the physical and functional impairment in daily life (disability) and Short Form -36 (SF-36) Questionnaire which is also a self administered questionnaire.

## LITERATURE REVIEW

Renard et al in the year 2000 evaluated the functional results and the complications after several limb-saving and ablative treatments because of lower extremity bone sarcoma. 77 surviving patients were evaluated according to the MSTS (American Musculoskeletal Tumour Society) functional rating system. 52 patients had limb-saving and 25 had ablative therapy. Functional results in the limb-saving group were significantly better than in the ablative group ( $P = 0.0001$ ). Functional results in patients with tumours about the knee joint were significantly better ( $P = 0.0064$ ) after limb-saving surgery (i.e., endoprosthesis, knee arthrodesis, or rotationplasty) compared to functional results after ablative surgery (i.e., hip or knee disarticulation or above knee amputation).<sup>3</sup>

Cottias P et al conducted a study of 17 patients in 2001 to study complication and functional outcome in patients with periacetabular tumours for which saddle prosthesis was done. Functional outcome was evaluated using the modified Musculoskeletal Tumour Society Score (MSTS) and the Toronto Extremity Salvage Score (TESS) and it was found though it provided early pain free mobilisation but due to a limited range of motion and a poor abductor strength the functional results remained fair in most patients.<sup>4</sup>

Kumar et al conducted a retrospective cohort of 100 patients in 2003 who had undergone endoprosthetic replacement of the proximal humerus between 1976 and 1998 and function was determined in the 47 surviving patients, of whom 30 were assessed using the Musculoskeletal Tumour Society (MSTS) rating scale and 38 completed the Toronto Extremity Salvage Score (TESS) questionnaire and concluded that endoprosthetic replacement of the proximal humerus is a predictable procedure providing reasonable function of the arm with a low rate of complications at long-term follow-up.<sup>5</sup>

Tunn PU et al evaluated 78 children in 2004 who were treated for osteosarcoma with endoprosthesis in whom functional results were assessed using the scoring system of the Musculoskeletal Tumour Society and the Toronto Extremity Salvage Score and concluded that Limb-saving therapy in children with osteosarcoma enables a return to activities of daily living in long-term survivors with a minimum of remaining disability.<sup>6</sup>

Wright et al in 2008 assessed the functional and oncological outcomes of limb salvage surgery for primary sarcoma of the upper limb and limb girdle in 72 patients over 9 years. All patients underwent excision of the sarcoma with reconstruction and adjuvant treatment as needed. Functional outcome was assessed using the Toronto Extremity Salvage Score (TESS) after discharge from hospital. The upper

limb sarcomas treated by limb-salvage surgery achieved planned margins of excision in 85% of cases with primary surgery. This increased to 100% with re-excision, resulting in local recurrence in 15% and survival of 75% among those at 5 years or more after surgery, while retaining good to excellent function (TESS mean of 87 out of 100). Patient age, anatomical site of tumour and adjuvant treatment made no significant difference to TESS.<sup>7</sup>

Qadir et al carried out a study in 2012 on functional outcome of limb salvage surgery with megaendoprosthetic reconstruction for bone tumours using the MSTS score in 16 patients and concluded that Mega-endoprosthetic reconstruction in salvage provides good functional outcome in patients with bone tumors.<sup>8</sup>

Sewell MD et al carried out a retrospective study in 2012 on Proximal ulna endoprosthetic replacement for bone tumours in young patients assessing their functional outcome at a mean follow up period of 84 months (14-194 months) using MSTS score and TESS questionnaire and thus concluded that custom-made proximal ulna endoprosthetic replacement following resection of malignant bone tumours in young patients provides a stable reconstruction option with satisfactory function and without apparent compromise in patient survival.<sup>9</sup>

Sharil et al in 2013, evaluated functional outcomes for patients who underwent surgery for resection and endoprosthesis replacement for primary tumours around the knee in which the study sample included 34 cases of distal femur and 20 cases of proximal tibia endoprosthesis replacement and functional outcome was measured using MSTS score and concluded that endoprosthesis replacement for primary bone tumours had early good to excellent functional outcome.<sup>10</sup>

## **MATERIALS & METHODS**

Twenty Five patients with biopsy proven cases of Osteosarcoma presenting to Government Medical

College and Hospital, Chandigarh, were treated by either limb salvage surgery or limb amputation. The MSTS score was evaluated for the patients and the means for each individual parameter was compared. It was done only for alive patients in the limb salvage surgery group. The SF-36 scores were evaluated for all the alive patients in the limb salvage surgery group and the amputation group.

**STATISTICAL ANALYSIS**

Oncological and Functional outcome was be compared. Quantitative outcome parameters were compared during the course of follow up by using the Wilcoxon Singed rank test

and qualitative outcomes will be compared by using the test of proportions. Outcome was also compared according to the patient characteristics like age, gender , onset of disease by using the Student T tests. Factors affecting outcome measure in terms of restoration to normality was assessed by using Chi Square Test.

**RESULT**

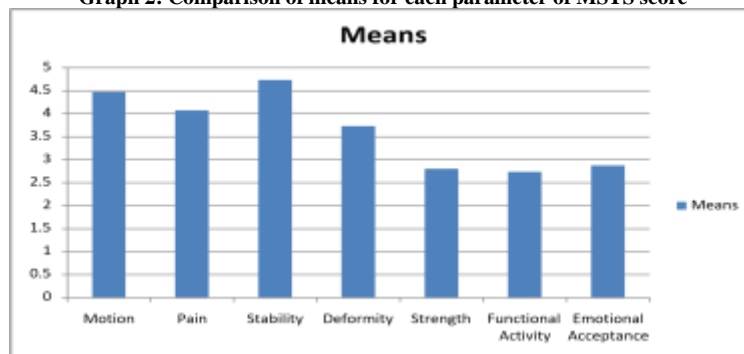
**Musculoskeletal Tumour Society Score**

The MSTS score was evaluated for the patients and the means for each individual parameter was compared. It was done only for alive patients in the limb salvage surgery group(Table 1,2 and 3).

**Table 1: Comparison of means for each parameter of MSTS score**

	Motion	Pain	Stability	Deformity	Strength	Functional Activity	Emotional Acceptance
Mean	4.47	4.07	4.73	3.73	2.8	2.73	2.87
Number of patients	15	15	15	15	15	15	15
Standard deviation	0.915	1.033	0.704	1.438	1.082	1.033	0.516
Minimum score	3	3	3	0	0	1	1
Maximum score	5	5	5	5	5	5	3
Range	2	2	2	5	5	4	2
Median	5	5	3	3	3	3	3

**Graph 2: Comparison of means for each parameter of MSTS score**



**Table 2: Comparison of MSTS and TESS score**

	MSTS		TESS	
	LSS	Amputation	LSS	Amputation
Number of patients	15	0	15	2
Mean	25.40	0	80.60	58.50
SD	4.290	0	12.362	2.121
Minimum	17	0	55	57
Maximum	33	0	96	60
Range	16	0	41	3

**Table 3: Comparison of MSTS and TESS score**

	MSTS	TESS
Number of patients	15	15
Mean	25.40	80.60
Percentage score	72.57 %	80.6%

**Short Form -36 Scores**

The SF-36 scores were evaluated for all the alive patients in the limb salvage surgery

group and the amputation group, and statistically significant difference was found in physical functioning, Role limitations due to physical health, Role limitations due to emotional problems(Table 4,5 and Graph 2).

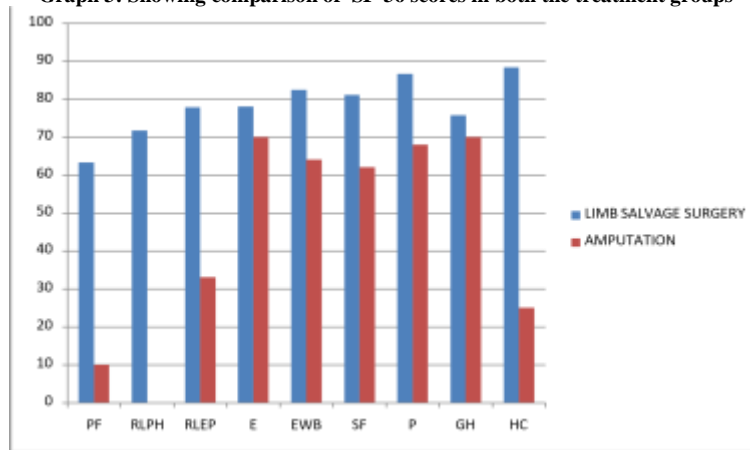
Table 4: Showing SF SCORES in the Limb Salvage Group

LIMB SALVAGE GROUP	PF	RLPH	RLEP	E	EWB	SF	P	GH	HC
NUMBER	15	15	15	15	15	15	15	15	15
MEAN	63.33	71.67	77.87	78.00	82.40	81.07	86.67	75.67	88.33
Std. Deviation	22.254	33.894	24.148	13.470	17.091	12.589	16.910	16.994	22.887
Minimum	30	0	33	45	36	50	55	40	25
Maximum	95	100	100	90	96	100	100	95	100
Range	65	100	67	45	60	50	45	55	75
Median	65.00	75.00	67.00	85.00	88.00	88.00	100.00	80.00	100.00

Table 5: Showing SF 36 SCORES in the Amputation Group

LIMB AMPUTATION GROUP	PF	RLPH	RLEP	E	EWB	SF	P	GH	HC
NUMBER	2	2	2	2	2	2	2	2	2
MEAN	10.00	.00	33.00	70.00	64.00	62.00	68.00	70.00	25.00
Std. Deviation	.000	.000	.000	.000	.000	.000	.000	.000	.000
Minimum	10	0	33	70	64	62	68	70	25
Maximum	10	0	33	70	64	62	68	70	25
Range	0	0	0	0	0	0	0	0	0
Median	10.00	.00	33.00	70.00	64.00	62.00	68.00	70.00	25.00

Graph 3: Showing comparison of SF-36 scores in both the treatment groups



**DISCUSSION**

In our study all the patients were assessed at 2 years follow up, and functional outcome was evaluated using MSTS score, TESS and SF-36 questionnaire. The mean MSTS score in the Limb Salvage Group was 25.4 (72.57 %) and the mean TESS score was 80.6/100. SF-36 scores were compared between the Limb Salvage and the amputation group. We found significant difference in PF (p value=0.005), RLPH (p value=0.011), RLEP (p value=0.022), HC(p value=0.002). Similar to our results Kumar et al found the mean MSTS score was found to be 79% in patients who underwent endoprosthetic replacement of proximal humerus.<sup>5</sup> Renard et al found that functional results in limb salvage surgery group was significantly better than in ablative group (p value =0.00001). Functional results in

tumours above the knee joint were significantly better after limb salvage surgery compared to functional results after ablative surgery.<sup>3</sup> On the other hand Tunn showed that functional scores MSTS did not show statistically significant difference (p value=0.62) in limb amputation and partial or total non conventional prosthesis .The only statistically significant difference was concerned to stability.<sup>6</sup> Cottias et al found the functional outcome using MSTS and TESS scores in periacetabular tumors for which saddle prosthesis was done and he found it to be fair in most of the patients.<sup>4</sup> The Arpaci et al found that out of 22 patients ,the functional scores were excellent in 8, good in 9, fair in 2, and poor in 3 patients following limb sparing surgery.<sup>11</sup> Wright et al performed salvage surgeries for primary sarcomas of the upper

limb and found good to excellent functional scores with mean TESS 87/100.<sup>7</sup> Megaendoprosthetic reconstruction in limb salvage surgeries done by Qadir et al provided good functional outcome in patients with osteosarcoma.<sup>8</sup> Hayashi et al, Sewell et al, Sharil et al evaluated functional outcome using MSTs and concluded that endoprosthetic replacement for osteosarcoma has early good to excellent outcome.<sup>12</sup>

## CONCLUSION

Despite the limited sample size and shorter duration of follow up, we would like to conclude that our results in patients with osteosarcoma have been excellent and encouraging with better oncological and functional outcome following limb salvage with endoprosthetic reconstruction. Because local or systemic relapse, prosthetic related complications are possible even after two years after beginning of treatment, a long term follow up is recommended for these patients.

### Declaration by Authors

**Ethical Approval:** Approved

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**Conflict of Interest:** The authors declare no conflict of interest.

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