

# Comparison of Functional Outcome in Osteosarcoma of Distal Femur and Proximal Tibia

Varun Sachdeva<sup>1</sup>, Richa Mehra<sup>2</sup>

<sup>1</sup>MS Orthopaedics, Zonal Hospital Mandi (H.P.)

<sup>2</sup>MS ENT Zonal Hospital Mandi (H.P.)

Corresponding Author: Richa Mehra

DOI: <https://doi.org/10.52403/ijshr.20230238>

## ABSTRACT

Limb-saving therapy for primary bone tumours is the treatment of choice. We aimed at analysing the quality of life of this group of patients by combining three different tools. Thirteen patients with a primary bone tumour of the extremity, 5 patients with osteosarcoma of proximal tibia and 8 with osteosarcoma of distal femur who had undergone endoprosthetic reconstruction between 2017-2018 were included in this retrospective study. Parallel recording of the MSTS score, TESS and SF-36 provides a better measure reflecting the complex situation of the patients by combining objective and subjective parameters.

**Keywords:** MSTS-Musculoskeletal Tumour Society Score, TESS-Toronto Extremity Salvage Scoring System, SF-36 Short Form -36 Questionnaire, EA-emotional acceptance, FA-overall function., PF- physical functioning, RLPH-role limitation due to physical health, RLEP- role limitation due to emotional health, E-energy, EWB-emotional wellbeing, SF- social functioning, P-pain, GH-general health, HC-health change

## INTRODUCTION

Osteosarcoma has a bimodal age distribution, with a first peak during the second decade of life and the second peak in older adults. Osteosarcoma develops in adolescents most often at the metaphysis of lower extremity long bones. The most common location for osteosarcoma is

around the knee i.e. distal femur, proximal tibia and proximal humerus.

Limb-saving therapy has become the treatment of choice in primary bone tumours during the past decades. Reconstructive procedures as part of a multidisciplinary treatment concept have abolished primary amputation without compromising survival and local recurrence-free survival. Evaluation of the functional outcome is becoming increasingly important in increasing proportion of long-term survivors.

This target group comprises mainly adolescents and young adults. Prolongation of survival resulted in subsequent surgical revisions of the implant and exchange operations as a result of endoprosthesis complications. These include periprosthetic infections, aseptic and septic loosening, and wear of the joint components, dislocations and fatigue fractures. The long-term outcome along with the oncological outcome is also determined by therapy-associated (late) complications. Another aspect is the functional result after limb-sparing surgery. When the complex medical treatment finishes, patients often must accept physical disability after implantation of a tumour endoprosthesis, which can lead to long-term impairment in the personal and social sphere. The aim of this study was to obtain a standardised evaluation and comparison of the functional long-term outcome at 2 years follow up in patients with osteosarcoma of distal femur and

proximal tibia who were treated by means of an endoprosthesis, 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

Tunn et al. recorded the Toronto Extremity Salvage Score (TESS) and the Reintegration to Normal Living index (RNL) for an average of 5.8 years after reconstruction and the Musculoskeletal Tumour Society Score (MSTS) after an average of 6.5 years. The mean MSTS score was 77% (13–93%). The mean TESS was 82% (22–99%), and the mean RNL index was 87% (32–98%). The subjective satisfaction and acceptance of physical impairment were significantly higher than the objective score ( $p < 0.001$ ). The TESS was 88% in patients aged 12–25 years, 81% in those aged 26–40 years and 57% in those aged 41–73 years.<sup>1</sup>

Function in seventy-eight living patients was assessed with the system of the Musculoskeletal Tumor Society for evaluation of function and by the functional assessment portion of the 1989 scoring system of the Knee Society; the scores were higher for the patients who had had a limb-salvage procedure than for the two groups of patients who had had an amputation.<sup>2</sup>

The mean MSTS functional score tended to be higher in patients who had limb salvage compared with those who had amputations: 76% (range, 30%–93%) versus 71% (range, 50%–87%), respectively.<sup>3</sup>

### MATERIALS & METHODS

The oncological follow up was assessed at 2 year retrospectively using Musculoskeletal

Tumour Society Score (MSTS), Toronto Extremity Salvage Scoring System (TESS) and Short Form-36 (SF-36) Questionnaire.

Musculoskeletal Tumour Society Score (MSTS) evaluates the functional impairment after tumour treatment. It is calculated on the basis of standard physical examination by the physician. It is a measure of physical function across 7 items. The 7 items are pain, range of motion, strength, joint stability, joint deformity, emotional acceptance and overall function.

Each item is scored 0-5 with a maximum possible score of 35.<sup>4</sup> The Toronto Salvage Score (TESS), was developed to record the physical and functional impairment in daily life (disability). It comprises restriction in mobility, in personal care, and carrying out daily activities of life. This self administered questionnaire allows participants to indicate the level of difficulty experienced in dressing grooming, mobility, sports, leisure etc. Each question is a measure of the difficulty that the individual has while performing the task. The potential for an item is a perfect performance score is 5.<sup>5</sup>

Short Form-36 (SF-36) questionnaire measures Health related quality of life (HRLQ) and is completed by study participants. The questionnaire consists of 36 items combined into 8 subscales that include physical functioning, role limitation due to physical health, pain, general health, energy, social functioning, role limitation due to emotional health, emotional well being and health change.<sup>6</sup>

### STATISTICAL ANALYSIS

Patients were assessed according to all three questionnaires and criteria described earlier. Data was described by using percentages and proportions. Functional outcome was compared. Quantitative outcome parameters were compared during the course of follow up by using the Wilcoxon Signed rank test. Factors affecting outcome measure in terms of restoration to normality was assessed by using Chi Square Test.

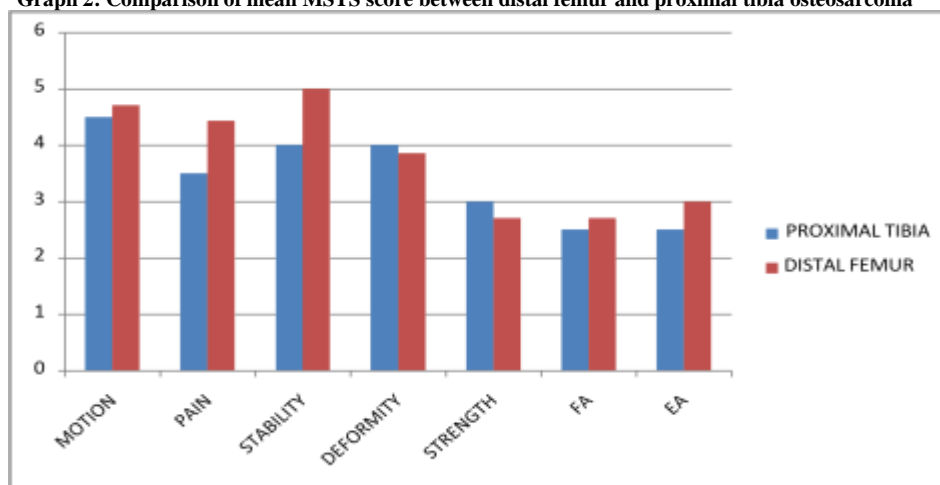
## RESULT

Site	Limb Salvage Surgery	Amputation	Total
1.Proximal tibia	5	4	9
2.Distal femur	8	1	9

Table 1. Comparison of individual MSTS score parameter between distal femur and proximal tibia osteosarcoma

	PROXIMAL TIBIA		DISTAL FEMUR		P VALUE
	MEAN SCORE	STANDARD DEVIATION	MEAN SCORE	STANDARD DEVIATION	
MOTION	4.5	1.00	4.71	0.756	0.695
PAIN	3.5	1.00	4.43	0.976	0.166
STABILITY	4	1.155	5	0.00	0.040
DEFORMITY	4	1.155	3.86	1.069	0.840
STRENGTH	3	0.00	2.71	0.756	0.479
FA	2.5	1.00	2.71	0.756	0.695
EA	2.5	1.00	3	0.00	0.200
MSTS	24	3.464	26.43	3.599	0.304

Graph 2: Comparison of mean MSTS score between distal femur and proximal tibia osteosarcoma

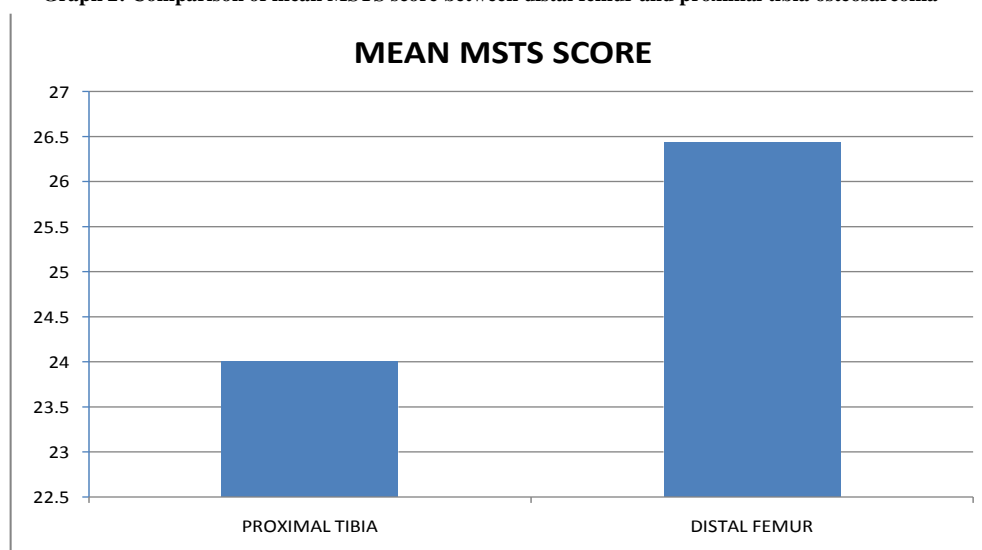


Comparison of mean MSTS score between proximal tibia and distal femur osteosarcoma, was not found to be significantly different (p value=0.304). (Table 2 and Graph 2)

Table 2: Comparison of mean MSTS score between distal femur and proximal tibia osteosarcoma

	PROXIMAL TIBIA		DISTAL FEMUR		P VALUE
	MEAN SCORE	STANDARD DEVIATION	MEAN SCORE	STANDARD DEVIATION	
MSTS	24	3.464	26.43	3.599	0.304

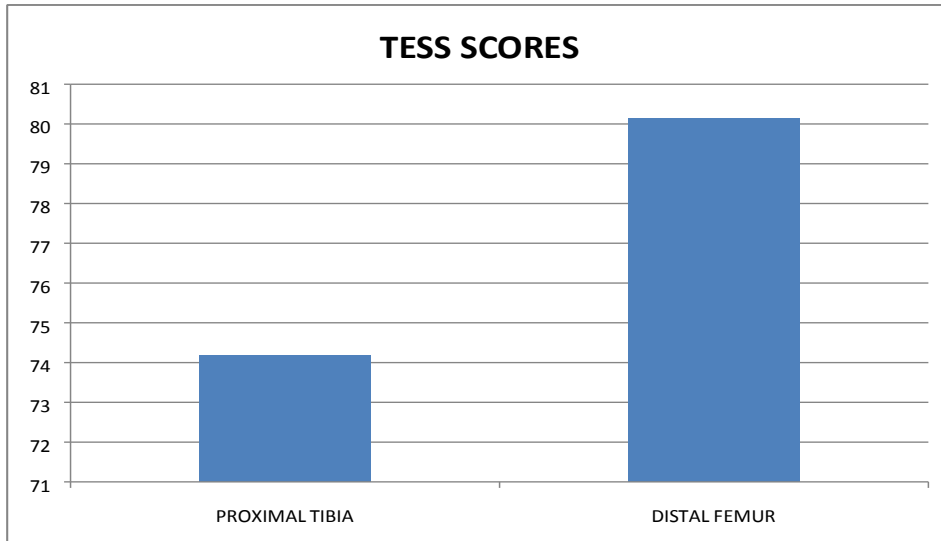
Graph 2: Comparison of mean MSTS score between distal femur and proximal tibia osteosarcoma



**Table 3: Comparison of mean TESS score between distal femur and proximal tibia osteosarcoma**

	PROXIMAL TIBIA		DISTAL FEMUR		P VALUE
	MEAN	STANDARD DEVIATION	MEAN	STANDARD DEVIATION	
<b>TESS SCORES</b>	74.17	14.233	80.14	13.993	0.462

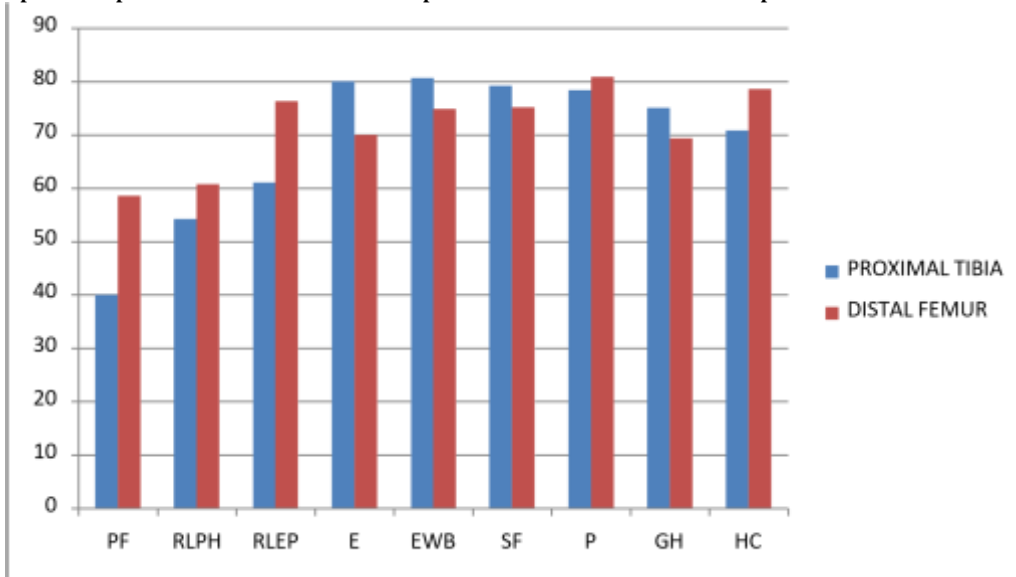
**Graph 3: Comparison of mean TESS score between distal femur and proximal tibia osteosarcoma**



**Table 4: Comparison of individual SF-36 score parameter between distal femur and proximal tibia osteosarcoma**

	PROXIMAL TIBIA		DISTAL FEMUR		P VALUE
	MEAN	STANDARD DEVIATION	MEAN	STANDARD DEVIATION	
<b>PF</b>	40	28.81	58.57	24.446	0.234
<b>RLPH</b>	54.17	45.871	60.71	42.956	0.795
<b>RLEP</b>	61	32.955	76.29	25.23	0.364
<b>E</b>	80	8.367	70	16.330	0.204
<b>EWB</b>	80.67	13.003	74.86	23.519	0.602
<b>SF</b>	79.17	15.471	75.14	14.724	0.641
<b>P</b>	78.33	11.690	80.86	21.027	0.799
<b>GH</b>	75	5.477	69.29	22.991	0.566
<b>HC</b>	70.83	36.799	78.57	30.375	0.686

**Graph 4: Comparison of individual SF-36 score parameter between distal femur and proximal tibia osteosarcoma**



## DISCUSSION

The use of a medial gastrocnemius flap dramatically lowers the infection rate due to adequate soft tissue coverage of the prosthesis and improves resultant knee extension<sup>7</sup>, but the outcome is still poor when compared to distal femur procedures, as the patellar tendon is sewed into the gastrocnemius and anchored to the prosthesis and surrounding soft tissue which is not biological and hence there is tendency for slip or avulsion and an extensor lag. Furthermore, late rehabilitation and extensive surgical procedures associated with the flap lead to fibrosis that limits knee range of motion. At our institution, we used medial gastrocnemius flap for extensor mechanism reconstruction and prosthesis coverage for all cases of proximal tibia reconstruction. Patients were given above-knee slab in full extension for 2 weeks till suture removal and later above knee plaster of paris cast was given in full extension for 4 weeks and patients were made to walk non weight bearing with the help of a walker and static quadriceps strengthening exercises were started from post operative day 2. Whereas, for distal femur endoprosthesis reconstructions knee range of motion exercises along with quadriceps strengthening were started on post operative day 2 after drain removal and dressing, and patients were made to walk full weight bearing with long knee brace. It is because of these differences in post operative physiotherapy protocol and management of proximal tibia and distal femur endoprosthesis, there are poorer results in MSTS scores and even TESS scores between the two anatomic locations of endoprosthesis. The mean MSTS score of distal femur and proximal tibia osteosarcoma are 26.43 and 24 respectively. The p value was found to be significant for stability (p value=0.04). The mean TESS score for distal femur and proximal tibia osteosarcoma are 80.14 and 74.17 respectively. No significant difference was

found between the SF-36 scores of both the groups.

Similar results on comparing the MSTS score in patients with distal femur replacement and proximal tibia replacement were obtained by Ritschl et al.<sup>8</sup>, Wittig et al.<sup>9</sup>, Kawai et al.<sup>10</sup>, Gerrand et al.<sup>11</sup> and Rompen et al.<sup>12</sup>. Only Fabroni et al.<sup>13</sup> reported that patients with a proximal tibia replacement have a better functional outcome compared to distal femur replacement. Malo et al.<sup>14</sup> showed that the MSTS score was 80.4% and the TESS was 81.4% in 56 patients with a distal femur replacement.

By using the combined MSTS score, TESS and SF-36 index, we could demonstrate that despite functional anatomical impairments after endoprosthesis management of bone tumours of the limbs, physical disability is perceived to only a small degree by the patients. Parallel recording of the MSTS score, the TESS and the SF-36 allows much better evaluation of the quality of life after limb-sparing surgery taking into account tumour site. Without the use of a self-rating scale of the patient, 'objective' measurements by the physician tend to overestimate anatomical impairment. Combining different tools for outcome assessment provides an improved understanding of the often complex post therapeutic situation of our patients.

## CONCLUSION

The subjective satisfaction and acceptance of physical impairment were significantly higher in patients with distal femur osteosarcoma. Distal femur osteosarcoma has higher functional MSTS and TESS scores as compared to proximal tibia. No significant difference was found between the SF-36 scores of both the groups.

### *Declaration by Authors*

**Ethical Approval:** Approved

**Acknowledgement:** None

**Source of Funding:** None

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

## REFERENCES

1. Tunn PU, Pomraenke D, Goerling U, Hohenberger P. Functional outcome after endoprosthetic limb salvage therapy of primary bone tumours--a comparative analysis using the MSTS score, the TESS and the RNL index. *Int Orthop.* 2008 Oct;32(5):619-25. doi: 10.1007/s00264-007-0388-8. Epub 2007 Aug 15.
2. Rougraff BT, Simon MA, Kneisl JS, Greenberg DB, Mankin HJ. Limb salvage compared with amputation for osteosarcoma of the distal end of the femur. A long-term oncological, functional, and quality-of-life study. *J Bone Joint Surg Am.* 1994 May;76(5):649-56. doi: 10.2106/00004623-199405000-00004. PMID: 8175811.
3. Mavrogenis AF, Abati CN, Romagnoli C, Ruggieri P. Similar survival but better function for patients after limb salvage versus amputation for distal tibia osteosarcoma. *Clin Orthop Relat Res.* 2012 Jun;470(6):1735-48. doi: 10.1007/s11999-011-2238-7. Epub 2012 Jan 24. PMID: 22270466; PMCID: PMC3348295.
4. Enneking WF, Dunham W, Gebhardt MC, Malawer M, Pritchard DJ. A system for the functional evaluation of reconstructive procedures after surgical treatment of tumors of the musculoskeletal system. *Clin Orthop.* 1993;286:241-246.
5. Davis AM, Wright JG, Williams JI, Bombardier C, Griffin A, Bell RS. Development of a measure of physical function for patients with bone and soft tissue sarcoma. *Qual Life Res.* 1996;5(5):508-516.
6. Ware JE Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36) Conceptual framework and item selection. *Med Care.* 1992;30(6):473-83.
7. Dubousset J, Missenard G. Reconstruction of quadriceps insertion by aponeurotic and muscular plastic after proximal tibial replacement in osteogenic sarcoma. Proceedings of the second international workshop on the design and application of tumour prostheses for bone and joint reconstruction. Vienna, Austria, Egermann.1983: 275- 77.
8. Ritschl P, Capanna R, Helwig U, Campanacci M, Kotz R. KMFTR (Kotz Modular Femur Tibia Reconstruction System) modular tumor endoprosthesis system for the lower extremity. *Z Orthop.* 1992;130(4):290-293. doi: 10.1055/s-2008-1039620.
9. Wittig JC, Bickels J, Kellar-Graney KL, Kim FH, Malawer MM. Osteosarcoma of the proximal humerus: long-term results with limb-sparing surgery. *Clin Orthop.* 2002;397:156-176.
10. Kawai A, Muschler GF, Lane JM, Otis JC, Healey JH. Prosthetic knee replacement after resection of a malignant tumor of the distal part of the femur. Medium to long-term results. *J Bone Joint Surg (Am)* 1998;80(5):636-647.
11. Gerrand CH, Currie D, Grigoris P, Reid R, Hamblen DL. Prosthetic reconstruction of the femur for primary bone sarcoma. *Int Orthop.* 1999;23(5):286-290.
12. Rompen JC, Ham JS, Halbertsma JP, Horn JR. Gait and function in patients with a femoral endoprosthesis after tumor resection: 18 patients evaluated 12 years after surgery. *Acta Orthop Scand.* 2002;73(4):439-446.
13. Fabroni RH, Castagno A, Aguilera AL, Steverlynck AM, Zeballos J. Long term results of limb salvage with the Fabroni custom made endoprosthesis. *Clin Orthop.* 1999;358:41-52.
14. Malo M, Davis AM, Wunder J, Masri BA, Bell RS, Isler MH, Turcotte RE. Functional evaluation in distal femoral endoprosthetic replacement for bone sarcoma. *Clin Orthop.* 2001;389:173-180.

How to cite this article: Varun Sachdeva, Richa Mehra. Comparison of functional outcome in osteosarcoma of distal femur and proximal tibia. *International Journal of Science & Healthcare Research.* 2023; 8(2): 301-306. DOI: <https://doi.org/10.52403/ijshr.20230238>

\*\*\*\*\*