

## Case Series

# Toronto extremity salvage score-patient reported outcome measures in upper extremity bone tumors treated with limb salvage surgery

Subbiah Shanmugam\*, Sandhya P. A.

Department of Surgical Oncology, Govt Royapettah Hospital, Chennai, Tamil Nadu, India

**Received:** 27 July 2023

**Accepted:** 06 September 2023

**\*Correspondence:**

Dr. Subbiah Shanmugam,

E-mail: [subbiahshanmugam67@gmail.com](mailto:subbiahshanmugam67@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

### ABSTRACT

Bone and soft tissue tumors of upper extremity are relatively uncommon than those of lower limb. Treating these patients while retaining a functional limb is quite a challenge. Along with musculoskeletal tumor society score, Toronto extremity salvage score (TESS) is most widely used patient-reported outcome measure for sarcomas of upper extremity. Retrospective analysis of patients with upper extremity bone tumors (24) treated with limb salvage surgery (20) from 2014 to 2022 was undertaken. Mean follow-up period was 26 months and mean age was 30.2 years. Out of 20, 11 humerus cases were of tumors arising from humerus, 5 in radius and 3 in ulna. 9 patients were treated with custom mega prosthesis reconstruction, 6 with fibular free flap, 6 radius underwent simple resection and 1 curettage. Majority of the cases were giant cell tumors (8) followed by osteosarcoma (3), fibromatosis (3), aneurysmal bone cyst (2), simple bone cyst (2), 1 Ewing sarcoma and 1 metastatic bone disease. The mean TESS score of the sample population was 69.7. Most of the patients (11) rated their disability to be of moderate degree and considered themselves to be moderately disabled. The mean TESS score for CMP group was 71.1, while that of autograft reconstruction was 68.3. Despite only half the population having received CMP as a reconstructive option, nearly 40% patients with disease of forearm where the results are not so great, our study population reported a reasonably good patient reported outcome score. A dedicated physiotherapy team with tailor made exercise protocol for each patient depending on their needs can help in improving the quality of life.

**Keywords:** TESS score, Patient reported outcome measures, MSTs score, Bone tumours of upper limb

### INTRODUCTION

Primary bone tumors though uncommon are major cause of not only mortality but also significant morbidity especially in young patients. These tumors are more common in lower extremities in comparison to upper extremities. The morbidity profile of upper limb is distinctly different from that of lower limbs owing to the intricate movements required of the former.<sup>1</sup> Over the last few decades, we have moved on from debilitating surgeries like amputation to limb salvage surgeries for extremity bone tumors.<sup>1</sup> Traditionally studies have concentrated on the oncological outcomes of these procedures. But in the recent years the functional outcomes measured in terms of impairment and disability have emerged as a major factor in assessing the outcomes.<sup>2</sup> The present study is an institutional experience in limb

salvage surgeries for upper extremity bone tumors and the functional outcomes measured in the form of TESS.

Aim of the study was to calculate TESS score and measure the functional outcome in patients with bone tumors of upper limb treated with limb salvage surgery

Data on patients with upper extremity tumors operated in our institute from 2014 to 2022 was collected. The patients we contacted and were requested to review. The patients were requested to fill the TESS questionnaire.

### CASE SERIES

We collected data on 24 patients of upper extremity bone tumors operated in our institute between 2014 and 2022. Among these 20 were treated with limb salvage surgery.

Out of 20, 12 cases were of tumors arising from humerus, 6 in radius and 3 in ulna. Nine patients were treated with custom mega prosthesis reconstruction, 6 with fibular free flap, 4 underwent simple resection and 1 curettage. Majority of the cases were Giant cell tumors (8) followed by osteosarcoma (3), fibromatosis (3), aneurysmal bone cyst (2), 1 Ewing sarcoma and 1 metastatic bone disease (Tables 1 and 2, Figure 1) Out of 20, 13 patients were able to fill up TESS questionnaire and the mean TESS score of the was 69.7 (Table 3). Most of the patients (11) rated their disability to be of moderate degree and considered themselves to be moderately disabled. The mean TESS score for CMP group was 71.1, while that of autograft reconstruction was 68.3 (Figure 2-4). The mean follow-up period was 26 months and mean age was 30.2 years.

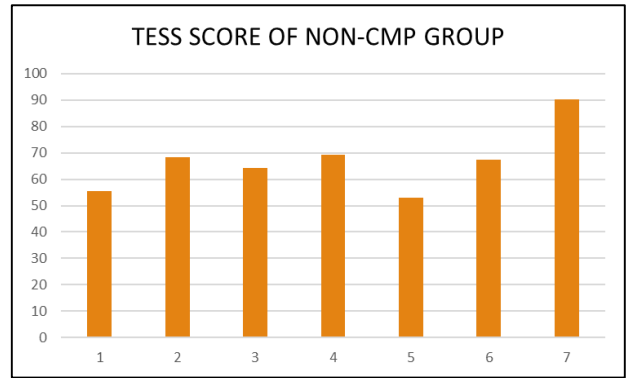


Figure 3: TESS score in non-CMP group.

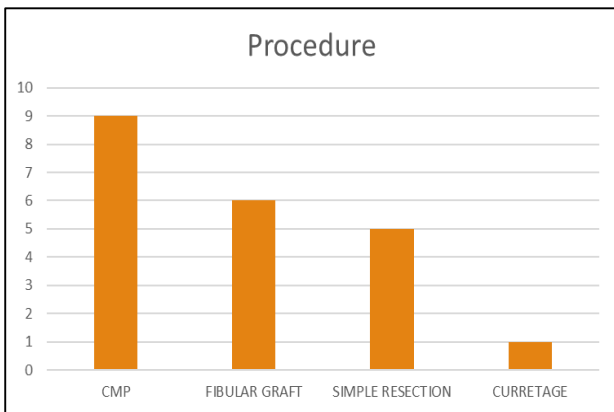


Figure 1: Procedure.

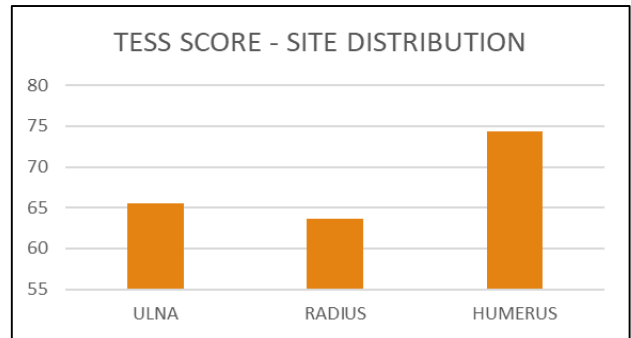


Figure 4: TESS score according to site.

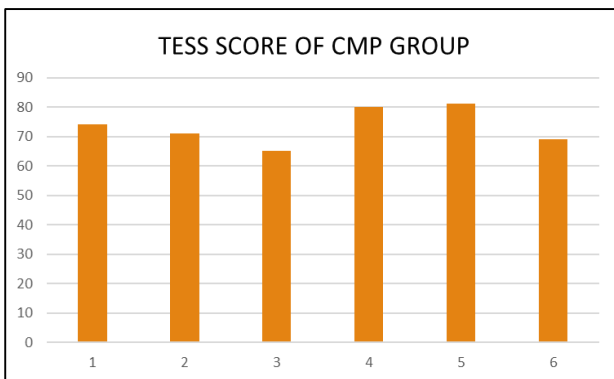


Figure 2: TESS score in CMP group.

Table 1: Age distribution.

Age (In years)	N
10-20	8
20-30	5
30-40	1
40-50	4
50-60	2

Table 2: Diagnosis.

Diagnosis	N
Osteosarcoma	3
GCT	8
Ewing's sarcoma	1
Fibromatosis	3
Others	5

Table 3: Score.

Age (years)	Sex	Diagnosis	Side	Location	Score
20	M	GCT	L	Distal radius	55.5
26	F	GCT	L	Distal radius	68.2
12	F	Fibrous dysplasia	R	Proximal humerus	64.3
15	F	Ewings sarcoma	L	Ulna	69.2
26	M	Recurrent fibromatosis	L	Ulna	53.1
52	M	Recurrent gct	R	Proximal radius	67.3
14	M	Simple bone cyst	L	Proximal humerus	90.1
13	M	Aneurysmal bone cyst	R	Proximal ulna	74.2
47	M	GCT	R	Proximal humerus	71.1

Continued.

Age (years)	Sex	Diagnosis	Side	Location	Score
15	F	Osteosarcoma	R	Distal humerus	65.2
45	M	GCT	R	Proximal humerus	78.2
40	F	GCT	L	Proximal humerus	81.2
52	M	Solitary bone metastasis	R	Proximal humerus	69.2

## DISCUSSION

Till 1980, the treatment of choice for bone and soft tissue sarcomas of upper limb was amputation. This highly debilitating surgery remained as standard of care for quite a long time due to many reasons like absence of efficient chemotherapeutic drugs, fear of recurrence due inadequate margin, scarcity of reconstruction options.<sup>1</sup> This was more relevant for upper extremity tumors where multiple neurovascular bundles run in small volume of soft tissue resulting in difficulty in reconstruction and increased risk of margin positivity after limb salvage. With the emergence of newer efficient chemotherapeutic drugs and advances in the field of prosthesis reconstruction, limb salvage surgeries became the management of choice. The amputation is reserved for those patients in whom limb salvage is not an option either due to non reconstructable neurovascular involvement or extensive soft tissue disease leading to inadequate cover.<sup>1</sup>

With the growing body of evidence in favour of oncological safety of limb salvage surgery the researchers have turned their attention toward quality of life (QOL) after limb salvage surgery. The initial studies measuring overall quality of life showed no significant difference while the recent studies with musculoskeletal specific questionnaire data have shown superior QOL with limb salvage surgery.<sup>2,3</sup> Three most used functional assessment instruments in literature are musculoskeletal tumor society score (MSTS), TESS and SF-36. The MSTS is most validated and commonly used because of the simplicity and brevity of the scoring system. But this is developed to be completed by the clinician, instead of measuring the function as perceived by the patient. The studies have shown that the clinician's MSTS score overestimates the physical function as compared to patient completed score with largest discrepancy in the assessment of function and emotional acceptance domains.<sup>4</sup> SF-36 is an overall QOL index neither specific to extremities nor to bone tumors. The TESS is a patient reported outcome measurement instrument with 29 questions specific to upper or lower extremities. The questions range from fine actions of fingers to crude movements of shoulders with emphasis on daily activities and socialisation.

Measurement of functional outcome after limb salvage for upper limb is different from that of lower limb for quite a few reasons. A patient is more likely to expect to recover the dexterity of upper limb with all fine intricate movements of the fingers while a minimal limp after lower limb salvage is quite acceptable for many. The literature is scarce in functional outcomes in upper extremity limb salvage in comparison to lower extremity owing to lower incidence of the former. In our own institutional

experience of 15 years published in 2016, only 17% of the patients who had undergone CMP reconstructions had upper extremity tumors.<sup>5</sup>

In the present study 40% (8) belonged to age 10-20 years, which is in accordance with literature where the malignant bone tumors like osteosarcoma peak in this age group. But if we look at the overall histopathological characteristics of patients in our study, GCT and fibromatosis took lead at 63%. In our own demographic data published in 2022, we noticed that 50% of upper extremity tumors turned out to be giant cell tumors.<sup>5</sup> Among the upper extremity tumors in our study humerus was involved in 55% (11) cases followed by radius (6) and ulna (3). Similar data was published in an epidemiological survey conducted in 2015 by Marko et al where humerus (11%) was found to be most affected followed by radius and ulna (4%). In the same study 70% tumors were found to be benign, similar to our own findings.<sup>7</sup> The mean TESS score of our study group at mean follow up of 26 months was 69.7. A multicentre study conducted in Finland on soft tissue sarcoma of upper extremity by Helena et al reported a TESS score of 88%, which was expected as these cases did not involve bone. In 30 months follow up data of proximal humeral resection with prosthesis reconstruction, the authors reported a TESS score of 80%.<sup>6</sup> Maurizio et al conducted 28 years follow up of patients who had undergone limb salvage for shoulder girdle resections and reported a TESS score of 85% at median follow up of 28 years. In their study they proved that the functional outcomes do tend to improve over time.<sup>9</sup> This we could not appreciate as ours was a short term follow up study. We could not appreciate much difference in TESS score between patients who had undergone CMP reconstruction and those who were treated with autograft/simple resection (71.2% v/s 68.7%), which was in concordance with results of Maurizio et al. As expected, the score after forearm bone surgery was significantly low (64%) compared to surgery involving the humerus (74.7%). The relatively low TESS score in our study population can be attributed to absence of dedicated physiotherapy department for limb rehabilitation in our centre. But despite of that all patients reported their disability to be of moderate degree which is subjected to recall bias of some degree.

There are few limitations associated with our study, first being low number of patients. Because of many reasons quite a few number of patients were lost to follow up. The study is an assessment of functional outcome at one point in the timeline rather than over a time period. Following these patients up and calculating the scores down the timeline would give better assessment of outcomes. Since the reconstructions in the study population included both upper arm and forearm, assessment of functional outcome

at any subsite was not possible. The last but not the least is short term follow up.

## CONCLUSION

Despite only half the population having received CMP as a reconstructive option, nearly 40% patients with disease of forearm where the results are not so great, our study population reported a reasonably good patient reported outcome score. A dedicated physiotherapy team with tailor made exercise protocol for each patient depending on their needs can help in improving the quality of life.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: Not required*

## REFERENCES

1. Wright EH, Gwilym S, Gibbons CL, Critchley P, Giele HP. Functional and oncological outcomes after limb-salvage surgery for primary sarcomas of the upper limb. *J Plast Reconstr Aesthet Surg.* 2008;61(4):382-7.
2. Qadir I, Umer M, Baloch N. Functional outcome of limb salvage surgery with mega-endoprosthesis reconstruction for bone tumors. *Arch Orthop Trauma Surg.* 2012;132(9):1227-32.
3. Malek F, Somerson JS, Mitchel S, Williams RP. Does limb-salvage surgery offer patients better quality of life and functional capacity than amputation? *Clin Orthop Relat Res.* 2012;470(7):2000-6.
4. Janssen SJ, Van Rein EAJ, Pereira NRP, Raskin KA, Ferrone ML, Hornicek FJ et al. The Discrepancy between Patient and Clinician Reported Function in Extremity Bone Metastases. *Sarcoma.* 2016;1014248:6.
5. Shanmugam S, Susikar S, Bharanidharan T, Victor A, Shanmugam SJ. Demographic, Clinico-pathological features and management pattern of primary bone tumors in a tertiary care hospital of South India. *Int J Res Orthop.* 2022;8(1):60-63
6. Ketola H, Kask G, Barner-Rasmussen I, Tukiainen E, Blomqvist C, Laitinen MK et al. Measuring functional outcome in upper extremity soft-tissue sarcoma: Validation of the Toronto extremity salvage score and the Quick DASH patient-reported outcome instruments. *J Plast Reconstr Aesthet Surg.* 2022;75(5):1543-50.
7. Bergovec M, Kubat O, Smerdelj M, Seiwerth S, Bonevski A, Orlic D. Epidemiology of musculoskeletal tumors in a national referral orthopedic department. A study of 3482 cases. *Cancer Epidemiol.* 2015;39(3):298-302.
8. Ellerbrock M, Theil C, Gosheger G. Function and return to sports after proximal humeral replacement in patients with primary bone sarcoma. *J Orthop Traumatol.* 2022;23:59.
9. Maurizio S, Matthew HT, Courtney SE, Franklin SH, O'Connor MI. Survival, Tumor Recurrence, and Function Following Shoulder Girdle Limb Salvage at 24 to 35 Years of Follow-up. *Orthopedics.* 2019;42(6):e514-20.

**Cite this article as:** Shanmugam S, Sandhya PA. Toronto extremity salvage score-patient reported outcome measures in upper extremity bone tumors treated with limb salvage surgery. *Int J Res Orthop* 2023;9:1257-60.