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ORIGINAL ARTICLE

Activity Levels among Filipino Sarcoma Patients: A Philippine Musculoskeletal Tumor Society (PMTS) Collaborative Study*

Abigail R. Tud, MD-MBA,[1] Edward HM Wang, MD, MSc,[2] Czar Louie L. Gaston, MD,[2] Charles A. C. Villamin, MD,[3] Mamer S. Rosario, MD, MPA[4]

[1]*Philippine Orthopedic Center, Banawe Street, Quezon City, Philippines*
[2]*University of the Philippines - Philippine General Hospital, Taft Avenue, City of Manila, Philippines*
[3]*University of Santo Tomas Hospital, España Boulevard, City of Manila, Philippines*
[4]*East Avenue Medical Center, Quezon City, Philippines*

ABSTRACT

Objectives. Osteosarcoma and soft tissue sarcomas are the most common sarcomas in the Philippines, often resulting in disability and decreased productivity. We sought to answer the following question: Are Filipino sarcoma survivors able to return to baseline and/or sports activities after treatment?

Methodology. Post-treatment patients with sarcomas of the extremities with a follow-up period of at least one year were included in this retrospective, multi-center study. Outcome measures included the modified Musculoskeletal Tumor Society (MSTS, 1993) score and the University of California, Los Angeles (UCLA) activity score.

Results. Fifty-eight patients with extremity sarcomas were followed for an average of 4.5 years. Osteosarcoma was the most common diagnosis, with most at Enneking Stage IIB. MSTS scores among limb salvage surgery patients (LSS) were significantly higher compared to amputees (79% ± 9 vs. 51% ± 9, $p = 0.000057$). Baseline activity post-LSS was higher (7.1 ± 1.3) compared to amputees (5.8 ± 0.9). At one year post-surgery, overall activity for both groups decreased (4.0 ± 0.65 for LSS, 4.1 ± 0.6 for amputees), then increased at their latest follow-up (6.9 ± 1.4 for LSS, 4.9 ± 0.86 for amputees). Analysis of UCLA scores showed no interaction with the type of surgery performed ($p = 0.7$).

Conclusion. This is the first report comparing physical activity levels among Filipino sarcoma patients. Returning to baseline and high-impact activities is possible after sarcoma treatment, which may improve quality of life.

Keywords. extremity sarcoma, MSTS score, physical activity, return to sports, sports, UCLA score

INTRODUCTION

Sarcomas comprise a heterogeneous group of malignant tumors arising from mesenchymal cells. These tumors can occur at any age, affecting various anatomic sites, and account for approximately 1% of all newly diagnosed cancers. Bone and soft tissue sarcomas represent the two major subgroups, with over 50 distinct histological subtypes.[1-3]

In the Philippines, osteosarcoma and soft tissue sarcomas are the most common sarcomas in clinical practice. While considered rare, the burden of disease is significant for patients with sarcoma of the extremities, many of whom are diagnosed in the second to sixth decades of life, often resulting in disability and decreased productivity. In our socio-cultural context, where a second family member is tasked with caregiving, this additional loss in productivity contributes to the hidden costs of sarcoma care.[4-10]

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Corresponding author: Abigail R. Tud, MD, MBA
Tumor Clinic, Philippine Orthopedic Center,
Banawe St., Quezon City, Philippines
Tel. No.: (+632) 87114276 local 291
E-mail: poc.mtu@gmail.com
ORCiD: https://orcid.org/0000-0001-9106-4760

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Advancements in chemotherapy, radiation therapy, and surgical techniques over the last four decades have made limb-sparing surgery (LSS) the current standard of care for resectable extremity sarcomas. A significant number of patients still require amputation, however, particularly in low-resource settings.[11-13]

Cancer patients often experience chronic physical and psycho-emotional changes that impact their quality of life (QoL) long after treatment is completed. Among long-term survivors, physical activity can improve overall function, mental health, social engagement, and outlook on daily life. While authors have studied factors affecting the quality of life for Filipino carcinoma patients, none have thus far focused on sarcoma survivors, their return to physical activity, and the effect on their physiologic and psycho-emotional well-being.[4-10,14-16]

In relation to this, the authors sought to evaluate post-treatment function and recreational activities among patients with extremity sarcomas, to determine the following:

- The effect of surgical intervention on post-treatment physical activity level
- Changes in physical activity level pre- and post-treatment
- The effect of surgical and/or oncologic complications on physical activity level

METHODOLOGY

Patients with biopsy-proven extremity bone or soft tissue sarcoma who completed surgical and/or systemic treatment where applicable, with a follow-up period of at least one year, and who were able to respond to physician-administered functional and activity scoring tools were included in this retrospective, multi-institutional study. Demographic information and various disease- and treatment-related variables were recorded in a single electronic database with access restricted to authors. The main outcome measures were the modified Musculoskeletal Tumor Society (MSTS) score and the University of California, Los Angeles (UCLA) activity score.

The modified 1993 version of the Musculoskeletal Tumor Society (MSTS) score (Appendix A) is a widely recognized, physician-administered tool that emphasizes limb-specific outcomes and considers the use of assistive devices. Scores of 23 or higher are considered Excellent, 15 to 22 are deemed Good, 8-14 are considered Fair, and less than 8 are considered Poor. Scores are expressed as a percentage of the maximum to facilitate statistical analysis. This tool was validated and adopted by the MSS and the International Society of Limb Salvage in 1993 to facilitate studies comparing outcomes of musculoskeletal tumor surgeries, using a standard set of questions with low interobserver variability.[17]

There is currently no gold standard for assessing physical activity levels among cancer patients. The UCLA activity score (Appendix B) was used to collect information about general activity level as it is license-free and minimizes confusion for both patients and doctors. It categorizes the intensity and frequency of physical activity, ranging from a score of 10 (the highest) to 1 (the lowest), for those dependent on caregivers. It has also been shown to have excellent reliability and a strong correlation with other activity scales, such as the WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) and IPAQ (International Physical Activity Questionnaire), among patients who have undergone joint replacement surgery.[18,19]

Frequency of participation was based on physical activity recommendations for cancer patients set by the American College of Sports Medicine (ACSM), with 15 minutes a day, three times a week considered as the minimum level of acceptable physical activity.[20]

Surgical outcomes, complications, and pre- and post-treatment physical activity levels were recorded. MSTS scores were compared using a T-test, while two-way ANOVA was used to determine differences between UCLA activity scores at three time points: one year post-treatment,[14] three years post-treatment, and on the latest long-term follow-up.

Ethical consideration

Approval to conduct the records review was granted by the Ethics Review Board of the Philippine Orthopedic Center (Certificate No. POCERB-2022-04-007).

RESULTS

Fifty-eight patients diagnosed with extremity bone or soft tissue sarcomas who had completed treatment and a minimum follow-up time were included. All sarcomas were located on the lower extremities (Table 1).

The group consisted of 34 males and 24 females, with a mean age of 24 years and an average follow-up period of 4.5 years. Osteosarcoma was the most common histologic diagnosis for both groups, and the most common diagnosis for which chemotherapy was received. Patients were most often diagnosed at Enneking St. IIB. Thirty-nine patients underwent amputation, while 19 underwent limb salvage surgery (LSS). Infection was the most common complication among the patients undergoing ablative surgery. Of 19 patients who underwent LSS, one patient developed a surgical site infection, one underwent revision due to implant failure, and one underwent metastasectomy for solitary lung metastases. Endoprosthetic reconstruction (EPR) and rotationplasty were the two most frequently performed reconstructions, with four EPRs performed for osteosarcomas of the distal femur and two for the proximal tibia. All six rotationplasties were done for distal femur osteosarcomas. The most common ablative procedures were above-knee amputation (AKA), followed by hip disarticulation. Debridement for surgical site infection was the most frequently performed additional procedure in this group.

Table 1. Patient demographics

	Total	Lower extremity		Chemotherapy
Number of patients	58	Limb Salvage: 19 (33%)	Amputation: 39 (67%)	40 (69%)
Gender (M[1]/ F[2])	34/24	9/10	25/14	24/16
Mean age at surgery (range)	24 years (6-70 yo)	21 years (7-56 yo)	25 years (6-70 yo)	16 years (6-35 yo)
Enneking stage	IIA IIB III	2 16 1	3 26 10	- 32 8
Mean years of follow-up	4.5 years (1-21)	3.5 years (1-17)	6 years (1-21)	5 years (1-19)
Histologic diagnosis Osteosarcoma Chondrosarcoma Ewing's sarcoma UPS[3] Synovial sarcoma Other STS[4]		 15 1 - - - 3	 30 - 1 3 2 3	 38 - 1 - - 1
Type of surgery		EPR[5] (6) Fusion (2) Rotationplasty (6) Excision (5)	Hemipelvectomy (2) Hip disarticulation (16) AKA[6] (18) BKA[7] (2) Syme (1)	
Additional intervention for complications		3 Debridement (1) Implant revision (1) Metastasectomy (1)	5 Debridement (4) Metastasectomy (1)	

[1] Male; [2] Female; [3] Undifferentiated Pleomorphic Sarcoma; [4] Soft Tissue Sarcoma; [5] Endoprosthetic reconstruction; [6] Above-knee amputation; [7] Below-knee amputation

Table 2. Tabulated Modified Musculoskeletal Tumor Society (MSTS) scores

MSTS Rating	Limb Salvage	Amputation
Excellent (≤23)	14	11
Good (15-22)	3	9
Fair (8-14)	2	12
Poor (<8)	-	7

Table 3. Overall MSTS Scores

Type of surgery	Modified MSTS score (expressed as percent of total score)
Limb salvage (n = 19)	79% ± SD 9
Amputation (n = 39)	51% ± SD 7

Table 4. Sports activity levels (UCLA score) for sarcomas of the lower extremity according to the type of surgery (limb salvage vs amputation)

Type of surgery	Time	UCLA activity score
Limb salvage (n = 19)	Prior to surgery 1 year post-op Latest follow-up	7.1 ± SD 1.3 4 ± SD 0.65 6.9 ± SD 1.4
Amputation (n = 39)	Prior to surgery 1 year post-op Latest follow-up	5.8 ± SD 0.9 4.1 ± SD 0.6 4.9375 ±0.858

Regarding outcome measures, the raw MSTS scores appeared to be better for the LSS group compared to the amputation group. While none of the limb salvage patients scored poorly in the MSTS, seven amputees (18% of the amputation group) did (Table 2). Statistical analysis confirmed higher overall MSTS scores among LSS patients at 79% ± 9, significantly better compared to amputees' 51% ± 9, ($p = 0.000057$) (Table 3).

Analysis of UCLA scores was conducted within each group at three time points: before treatment to establish baseline activity, at one year post-treatment, and at the latest follow-up (Table 4). Mean activity before treatment was found to be higher for LSS patients (7.1 ± 1.3) compared to amputees (5.8 ± 0.9). Further assessment showed that 26% of LSS patients ($n = 10$ out of 19) were regularly engaged in high-impact activities before treatment, compared to 21% in the amputation group ($n = 8$ out of 39). At one year post-treatment, overall activity for both groups decreased (4.0 ± 0.65 for LSS patients and 4.1 ± 0.6 for amputees), but this was subsequently followed by an increase across the board on the latest follow-up (6.9 ± 1.4 for the LSS group and 4.9 ± 0.86 for the amputation group). Two of five LSS patients and two of eight amputees who had already been engaging in high-impact activities were able to return to their baseline, pre-diagnosis level.

There was no evidence of interaction between the type of surgery and UCLA scores at any point ($p = 0.7$). However, mean scores were significantly lower for LSS patients who developed complications requiring additional surgery ($n = 3$) compared to those who did not ($n = 16$, $p = 0.02$). This contrasts with the amputation group, where no significant difference was noted between those with complications ($n = 5$) versus those without ($n = 34$, $p = 0.41$). These findings can account for the statistically significant results comparing UCLA scores across the three time points ($p = 0.02$).

DISCUSSION

The American College of Sports Medicine (ACSM) defines sufficient physical activity as "150 minutes of moderate intensity exercise per week.[20]" Approximately 25% of patients in the study regularly participated in high-impact activities

before surgery. This baseline is lower than reports from two similar Western studies despite a comparable mean age.[14,16]

Looking through the activities of our Filipino patients, a key difference lies in the options available to patients on a day-to-day basis. Among the sports reported in these Western studies were skiing, snowboarding, squash, tennis, inline skating, and more. As a corollary, a paper published by Reyes et al. in 2016 on sociodemographic indicators of health among Filipinos found that it is more common for our patients to use their "free time" to make extra income, to make ends meet.[21] With over 26.14 million Filipinos living below the poverty line in 2021, this constitutes a significant barrier and avenue for development.[8,21-23] In contrast, patients from affluent countries tend to have sufficient minimum wage, a well-functioning healthcare system, and more leisure time, allowing better access to more diverse forms of recreation. This high-lights the sociocultural and geopolitical role that society plays in improving the overall fitness of its citizens.

At one year, a general decrease in overall UCLA scores was observed, consistent with the early course of recovery from surgery and adjuvant chemotherapy. Interestingly, six patients who underwent amputation reported improved scores at one year post-surgery. These included three teenagers who had undergone above-knee amputation, and three who had undergone hip disarticulation. Upon further investigation, the patients attributed their increased levels of activity to physiotherapy after surgery, the regular use of assistive devices, being assigned household chores, and finding online support groups that encouraged them to be more active. While 37% of our patients were regularly participating in moderate to high-impact activities on the latest follow-up, this is lower compared to 91% at three years for Hobusch et al., and 89% at five years for Lang et al.[14,16] Aside from the longer follow-up period, there are several reasons that may account for this. In the 2019 study by Hobusch, all 32 patients with extremity soft tissue sarcomas underwent limb salvage regardless of tumor size and location.[14] In the 2015 study by Lang, all 27 patients with lower extremity osteosarcoma underwent endoprosthetic replacement, but had very high baseline levels of activity, and this was subsequently found to be predictive of higher UCLA scores.[16] Quarantine mobility restrictions and slow vaccine rollout were also cited by several of our patients as factors that made an impact on their previous lifestyles. These are key points for further research and reference when monitoring our post-operative patients.

In terms of the effect of surgery on postoperative activity levels, our analysis showed that the mean UCLA scores were not significantly different across all time points between the two groups. At first, this may seem counterintuitive: in principle, limb and joint salvage procedures are considered functionally superior to all forms of ablative surgery, especially when using physician-rated outcome measures like the MSTS. Our study population exhibited this same trend. Several authors have pointed out, however, that when using more objective outcome measures, particularly for tumors around the knee, the theoretical advantage of limb-sparing procedures over ablative procedures may not be as distinct as expected.[24-27] The perception of joint salvage's superiority may be related not to physiologic function, but rather to biologic tolerability, or the capacity of patients to adapt to their post-surgical limitations.[24,27,28] Finally, we looked at the possible effect of complications on activity levels. Mean UCLA scores between limb salvage patients with complications versus those without were significantly different, probably due to the need for revision surgery for endoprosthetic failure in one LSS patient. Mean UCLA scores were not significantly different within the ablative surgery group regardless of complications, consistent with previous reports.

Study limitations include a small and relatively heterogenous sample size, selection bias, and recall bias regarding activities before diagnosis. Sarcomas themselves are heterogenous and rare, both inherent non-modifiable features that add to the difficulty of recruiting more patients. Nevertheless, the incidence of osteosarcomas and soft tissue sarcomas continues to increase among Filipinos. The lack of published literature focused on sarcoma survivors' return to physical activity after treatment partly mitigates the small sample size. The authors also recommend better representation from other regions of the Philippines, which may significantly increase the sample size and its homogeneity.

CONCLUSION

This study is the first local attempt to compare activity levels among sarcoma survivors who have undergone different surgical interventions, including amputation. Cancer patients have long been encouraged to engage in regular physical activity because of proven positive effects on quality of life, but few studies have focused on sarcoma survivors. Return to baseline activities and regular high-impact sports is possible after sarcoma treatment. By demonstrating the benefits of physical activity on sarcoma survivors, we may better educate our colleagues and patients about small but impactful changes they can make to improve overall health and quality of life. A larger sample size with a longer follow-up is recommended to determine whether complications and the type of surgery affect long-term function.

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STATEMENT OF AUTHORSHIP

All authors certified fulfillment of ICMJE authorship criteria.

CREDIT AUTHOR STATEMENT

ART: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Data Curation, Writing – original draft preparation, Visualization, Project administration; **EHMW:** Conceptualization, Methodology, Formal analysis, Investigation, Resources, Writing – review and editing, Supervision, Project administration; **CLLG:** Conceptualization, Validation, Investigation, Resources, Writing – review and editing, Project administration; **CACV:** Validation, Investigation, Resources, Writing – review and editing; **MSR:** Validation, Writing – review and editing.

DATA AVAILABILITY STATEMENT

Datasets generated and analyzed are included in the published article.

AUTHOR DISCLOSURE

Dr. Gaston is an Editorial Board member of the Philippine Journal of Orthopaedics (PJO). The other authors have no conflicts of interest to declare.

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APPENDICES

Appendix A. Modified MSTS 1993 Scoring Tool adapted for the paper, Sports and Activities After Sarcoma Treatment Among Filipinos

Tud A, MD-MBA, FPOA, Wang EHM, MD, MSc (epi), FPOA Gaston CL, MD, FPOA, Rosario M, MD, MPA FPOA, Villamin C, MD, FPOA
Philippine Musculoskeletal Tumor Society Research Committee (PMTS-R)

Institution :
Date of survey :
Representative PMTS Member :
Hospital number :

Lower Extremity

Pain	Function	Emotional Acceptance	Supports	Walking Ability	Gait	Total score
5: No pain	5: No restriction	Enthused, would recommend to others	5: None	5: Unlimited	5: Normal	
			4: Occasional use of brace			
3: Modest	3: Recreational restriction	Satisfied	3: Mostly brace	3: Limited (<1000 steps)	3: Minor cosmetic	
1: Moderate	1: Partial disability	Accepts	1: One cane or crutch	1: Inside only (<200 steps)	1: Major cosmetic, minor handicap/ functional deficit	
0: Severe	0: total disability	Dislikes	0: Two canes or crutches	0: Unable unaided	0: Major handicap/ functional deficit	

Scores with indeterminate definition or value such as "intermediate" corresponding to scores of 4 and 2 under "Pain" and "Function" have been removed to avoid confusion, as part of the 1993 modifications[17]

Appendix B. University of California, Los Angeles (UCLA) activity score.

UCLA Activity Score

Hip ID:
Study Hip: ☐ Left ☐ Right
Examination Date (MM/DD/YY): / /
Subject Initials: |____|____|____|
Medical Record Number:

Interval: _____

Check one box that best describes current activity level.

☐ 1: Wholly Inactive, dependent on others, and can not leave residence

☐ 2: Mostly Inactive or restricted to minimum activities of daily living

☐ 3: Sometimes participates in mild activities, such as walking, limited housework and limited shopping

☐ 4: Regularly Participates in mild activities

☐ 5: Sometimes participates in moderate activities such as swimming or could do unlimited housework or shopping

☐ 6: Regularly participates in moderate activities

☐ 7: Regularly participates in active events such as bicycling

☐ 8: Regularly participates in active events, such as golf or bowling

☐ 9: Sometimes participates in impact sports such as jogging, tennis, skiing, acrobatics, ballet, heavy labor or backpacking

☐ 10: Regularly participates in impact sports