Correlation Between MSTS, TESS and QOL-CSV Scores in Patients With Soft Tissue and Bone Tumors

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Abstract

Purpose:

Limb salvage surgery (LSS) is the preferred treatment when compared to amputation. Although LSS provides a desirable outcome, it still presents with some functional limitation. The quality of life (QOL) amongst patients with musculoskeletal sarcomas is an important factor to consider in the management. This study investigates the correlation between MSTS and TESS score versus QOL for musculoskeletal cancer survivors.

Methods:

Patients with musculoskeletal tumors on follow up were recruited. Any age, gender and race were included provided they had completed surgical treatment. The functional scores were evaluated using MSTS and TESS tools while QOL was determined with QOL-CSV tool. Their correlation was compared.

Results:

The study involved 96 patients, 54.2% were females and 45.8% were males. The highest range of age was 21-30 years old (27.1%). Majority had bone sarcoma (63.3%). The mean MSTS score was $71.32\% \pm 23.34$ (0-100), TESS was $78.92\% \pm 17.38$ (0-100) and QOL-CSV was $71.51\% \pm 12.05$ (0-100). Both MSTS (49.0%) and TESS (54.2%) scores had a good response. However, only 25% had a good QOL-CSV. All the tools had a positive correlation. Multiple linear regression model demonstrated that the effect of TESS on QOL was significant but the effect of MSTS was insignificant. The R-squared value of MSTS (0.073) and TESS (0.013) combined was 0.17.

Conclusion:

A single tool is not a good predictor therefore all 3 tools should be taken into consideration when assessing the QOL of those undergone musculoskeletal tumor surgery.

Introduction

Diagnosing a musculoskeletal tumor is a life-changing event for patients. Even with recent advancement in imaging, chemotherapy, radiation therapy and surgical reconstruction options to improve the quality of life, we still fail to reach an ideal goal for disease free survival and good quality of life. Limb salvage surgery is currently the most sought treatment option as they have functional and physiological benefits over amputation (2, 3). When considering limb salvage surgery four issues should be considered (4). Firstly, would survival be affected by the treatment choice? Secondly, how do the short term and long term morbidity compare. Thirdly, how would the function of a salvaged limb compare with that of prosthesis and lastly, will it impose any psychosocial consequences. Different outcome measurements are proposed to identify outcome after the musculoskeletal tumor surgery either in the form of limb salvage or amputation. One of the most commonly used is the Musculoskeletal Tumor Society Score

(MSTS) (5), where a physician or clinician completes a questionnaire with seven parameters. These parameters are pain, strength, joint stability, deformity, functional activity and emotional acceptance. Each item is a score from 0–5 with total possible score of 30. Nearer the total score towards highest possible score is considered better. It is widely recognized and utilized to evaluate physical function. The main drawback of using this score is that, it is based on physician's evaluation and does not include the patient's perception of function. Also there is no psychometric data included in this scoring system. Another score known as Toronto Extremity Salvage Score (TESS) (6) is used to monitor and evaluate the physical function of individual and group of patients over time. It also consists of specific question sets designed with possible score of 1–5 for each question. It is a self-scoring functional instrument. Basically MSTS is a measurement of impairment while TESS is of disability. However with increased survival rates of patients with malignant musculoskeletal tumors, evaluating only the physical and psychological well-being was not sufficient. There was suggestion to include the social aspect of well being (family, friendship and work) and spiritual to evaluate a comprehensive quality of life (7). Generalized short-form 36 (SF-36) was developed to assess the general well being of the patient but was not specific to post musculoskeletal tumor surgery. Therefore, it was modified to Quality of Life (QOL) questionnaire and further upgraded to a more specific Quality of Life in Cancer Survivor (QOL-CSV) for long term cancer surviving patients after treatment. Health care providers evaluated QOL tools and most of the items were derived from clinical experience and literature review. The new QOL-CSV was based on interview with cancer patients and is considered to be more specific for evaluating cancer patients.

Question arises about the relationship between these scoring systems and the need for more than one tool. There are a few literatures pertaining to the correlation between MSTS, TESS and QOL-CSV score. There are several studies that compare the outcome between limb sparing surgeries, rotationplasty and amputations in patients with lower limb sarcoma using above score. In one of the study, results show that amputees have lower MSTS score compared to limb sparing surgery but the author could not find the difference in TESS (8). In addition there was also no difference in quality of life (QOL) between the amputees and limb sparing surgery except for their physical function. This shows that the score used to evaluate the outcome of a surgery should be evaluated with caution; a lower MSTS score does not always equate to a lower quality of life. Another study on predicting the functional outcome following limb salvage surgery for lower extremity soft tissue sarcoma mentioned large tumor size, bone resection, motor nerve resection and complications as a predictor of lower MSTS while a lower TESS only depended on large or high grade tumors that required motor nerve resection. In the same study, quality of life was evaluated using SF-36 (Short Form Survey) form that considered age and prior surgeries (9). The author concluded that different factors were predictive for different patient outcome, meaning each scoring system looked at a different perspective and they need not always correlate. Similarly in an attempt on evaluating a quality of life in children following treatment for a malignant primary bone tumor around the knee, authors found that patients rate their mobility and satisfaction with the treatment lower than the surgeons (10). So there is always a chance of patient having higher score in MSTS while their quality of life may not be high. Therefore, in this study we want to identify how these different scoring systems (MSTS, TESS and QOL-CSV) correlate with each other.

Method

This is a cross sectional study. Patients with bone and soft tissue tumors (malignant/ benign) on follow up at the Orthopaedic Oncology Clinic at our Centre were considered for the study. Patients chosen consisted of various age, sex, and race. Patients must have had completed the surgical treatment. The functional scores were evaluated using MSTS and TESS tools while quality of life was determined with QOL-CSV tool. The research was conducted according to the principles of Declaration of Helsinki. IBM SPSS Statistics Version 21 was used to analyze the data obtained. Correlational coefficient was calculated considering the Quality of life in cancer survivors (QOL-CSV) as dependent variable while MSTS and TESS as independent variables. The distribution graph of the dependent variable, QOL-CSV was normally distributed, thus parametric tests were used in this study (Fig. 1).

Results

The study involved 96 patients, 54.2% were females and 45.8% were males. The Malay race constituted the highest percentage (44.8%), followed by Chinese (36.5%), Indians (17.7%), and others (1.0%). The highest range of age was 21–30 years old (27.1%) with a mean of 35.57 ± 16.47 . Most of the patients were diagnosed with giant cell tumor (30.2%), followed by osteosarcoma (27.1%), chondrosarcoma (6.3%), soft tissue sarcomas (5.2%), pleomorphic sarcoma (5.2%) and all others (26.0%) (Table 1). The mean for MSTS score was 21.18 ± 6.94 (range 3–30), TESS was 106.29 ± 24.98 (range 39–145) and QOL_CSV was 278.38 ± 59.92 (range 84–400). Both MSTS and TESS scores (Table 2) had a good response, 49.0% and 54.2% respectively. However, most of the patients gave an average response to QOL_CSV, where only 25.0% of the patients have a good quality of life, while a majority of 69.8% patients agreed on having an average quality of life. All the tools have a positive correlation (Table 3) with significant p values < 0.05 . Multiple linear regression models demonstrated that the effect of TESS on QOL_CSV was significant but the effect of MSTS on QOL_CSV was insignificant (Table 4). The R-squared value of both MSTS and TESS was 0.17. The R-squared values of MSTS and TESS scores individually were 0.073 and 0.103 respectively (Table 5).

Table 1
Demographic data

Gender	Females = 54% Males = 46%
Race	Malay = 44% Chinese = 38% Indians = 17% Others = 1%
Age distribution	Highest range = 21–30 years old (27.1%) Mean age = 35.57 ± 16.47
Diagnoses	Bone Sarcomas (75%): GCT (40%) Osteosarcoma (36%) Chondrosarcoma (8%) Ewing's sarcoma (2.67%) Others (13.30%) <hr/> Soft tissue sarcomas (25%)
Anatomical Distribution	Upper limb = 20 Lower limb = 80
Total number of patients	100

Table 2
Distribution of patients for MSTs, TESS and QOL_CSV based on score range

Score Range (%)	MSTs (%)	TESS (%)	QOL_CSV (%)
Good (80–100)	47	56	0
Average (50–79)	37	37	18
Unsatisfactory (< 50)	16	7	82

Table 3
Correlation between MSTS/ TESS/
QOL_CSV

	t-test	p-value
MSTS- TESS	0.571	< 0.01
TESS- QOL_CSV	0.335	< 0.01
MSTS- QOL_CSV	0.287	< 0.01

Table 4
Multiple Linear Regression table between different
independent variable with dependent variable.

	(Coefficient, β)	p-value
TESS – QOL_CSV	0.254	< 0.05
MSTS – QOL_CSV	0.142	> 0.05

Table 5
R-Squared Variation

		Variation %	p-value
TESS, QOL_CSV	0.103	10.3	< 0.05
MSTS, QOL_CSV	0.073	7.3	< 0.05
Combined	0.176	17.6	< 0.05

Discussion

MSTS and TESS scores are commonly used functional outcome measurement tools after limb salvage surgery. MSTS looks into impairment while TESS measures the disability. Long term cancer survivors following major limb salvage surgeries have escalated with improved chemotherapy and radiotherapy protocols. Measuring the quality of life in these individuals would be an ideal indicator of functional, psychological, social and spiritual well-being. Most of our patients who underwent limb salvage surgery were for primary bone tumors. Giant cell tumors, osteosarcoma and chondrosarcoma were the commonest tumors requiring the limb salvage surgery. Pleomorphic sarcoma was the commonest pathology among the soft tissue sarcomas. In our study, mean MSTS percentage was 71.32 ± 23.34 and TESS score was 78.92 ± 17.38 . This is similar to studies done by Rougraff et al (11), Ham et al(12) and Aksnes et al (8). The above studies were done following limb salvage surgery on patients with osteosarcoma and their mean MSTS score were 76.66%, 73.33% and 70% respectively. Aksnes et al also compared the mean MSTS score between limb salvage and amputation patients and confirmed that patients following amputation had lower MSTS compared to limb salvage procedures (13). A higher

mean MSTS score was reported following limb salvage surgery of soft tissue sarcoma. Rivard et al (14) and Schreiber et al (15) showed 93.3% and 87.26% mean MSTS scores respectively in their study following soft tissue sarcoma resection. TESS score in their study had no difference between limb salvage surgery and amputation as shown in the study done by Aksnes et al (8) with median TESS score of 89%. Higher TESS score was also recorded in a similar study by Robert et al (16). In this study also there was no difference in TESS score between amputation and limb salvage surgery with mean TESS score of 78.7% and 78.2% respectively. TESS score was also in good range following limb salvage surgery for soft tissue sarcoma. Rivard et al (14), Schreiber et al (15) and Davidge et al (17) reported mean TESS score of 93%, 88.38% and 83.3% respectively after limb salvage surgery for soft tissue sarcoma. Few studies were identified using QOL-CS questionnaire for measuring quality of life in patients following surgical treatment of bone and soft tissue tumors. Most of the studies used SF-36 measure for quality of life and none of the studies found a significant difference between quality of life in subgroups of amputation, endoprosthesis and rotationplasty. Studies by Nagaraja et al (18) and Robert et al (16) using QOL-CS also found no difference in quality of life between limb salvage surgery and amputation.

Correlation of different Scores

Moderate correlation ($R = 0.50-0.75$) was found between MSTS and TESS score ($R = 0.57, p < 0.01$) and fair correlation ($R = 0.25-0.50$) was found between TESS and QOL-CS ($R = 0.34, p < 0.01$) and MSTS and QOL-CS ($R = 0.29, p < 0.01$). The correlation between MSTS and TESS was similar to the study by Davis et al (6). They also had moderate correlation between MSTS and TESS ($R = 0.48$) however they did not use quality of life outcome in their study. In another study by Marchese et al (19), during validating a new tool to assess the functional mobility in patients, they performed multiple linear regression analysis to determine if Functional Mobility Assessment (FMA), MSTS and/or TESS could predict the SF-36v2 scores. Their result showed that all the above variables were significant predictor of Health Related Quality of Life (HRQOL) measured by SF-36v2. However in our study, TESS score was the only significant predictor of Quality of Life in Cancer Survivors (QOL-CSV). This can be due to the difference in the basic concept of the two indicators of quality of life. SF-36 v2 is a generalized questionnaire with 36 questions with three or five options looking at general health, physical health and emotional problem while QOL-CSV is specific for cancer survivors and has added survivor specific component (spiritual) apart from physical, psychological and social aspects. MSTS is also a physician based scoring system and looks more at physical impairment, hence less likely being an accurate predictor of quality of life in cancer survivors. While TESS is a patient based scoring system focusing more on disability. Therefore, patient scoring tools like TESS are a better predictor for quality of life in cancer surviving patients. Different studies compared different functional outcome studies between the limb salvage and amputation. MSTS scores were better in studies by Aksnes et al (8) but the TESS score and Quality of life were similar. This study implies that MSTS might not be a good predictor for quality of life as compared to TESS. Other studies by Dam et al, Ginsberg et al, Hopyan et al also did not show any difference between TESS score and quality of life amongst limb salvage surgery and amputation patients. An exception for rotationplasty was observed, which had better functional outcome compared to limb salvage but no difference in the

quality of life (13). It can safely be explained that though TESS is better in predicting quality of life, it may not be the sole indicator predicting the quality of life. The R –squared value in this study for MSTS was 0.073 and TESS was 0.103. It means only 7.3% variation in quality of life can be explained by MSTS while 10.3% by TESS ($p < 0.05$). The combination of both MSTS/TESS is able to explain 17% ($r^2 = 0.17$) on the variation of QOL-CS. This proves that a single functional tool does not accurately reflect quality of life.

Conclusion

Every patient undergoing limb salvage surgery is different. Each has a different expectation in life depending on several factors. Therefore, a single tool may not be the best predictor to evaluate quality of life. We suggest the use of more than one functional outcome measure tools to accurately predict outcomes of patients following treatment of bone and soft tissue sarcoma.

Abbreviations

1. LSS - Limb salvage surgery
2. QOL – Quality of life
3. MSTS - Musculoskeletal Tumor Society Score
4. TESS - Toronto Extremity Salvage Score
5. QOL-CS – Quality of life in cancer survivor
6. SF-36 – Short Form – 36
7. HRQOL - Health Related Quality of Life
8. FMA - Functional Mobility Assessment

Declarations

Ethics approval and consent to participate

This study was approved by Meical Research Ethics Committee, University Malaya Medical Centre.

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Consent for publication

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Figures

Figure 1

Distribution curve of Dependent Variable, Qol-CS