



Current Trends and Clinical Outcomes in Orthopedic Oncology: A Multicenter Retrospective Study

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Received: 20 June, 2025 | Accepted: 22 June, 2025 | Published: 02 July, 2025

Citation: John M. Carter, Meera V. Nair, Luis A. Gomez, Hana Takahashi (2025) Advances and Clinical Outcomes in the Surgical Management of Spine Disorders: A Retrospective Cohort Study J. Orthopedic Practice and Techniques1(1): dx.doi.org/OPT/PP.0003

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Abstract

Background: Orthopedic oncology is a subspecialty that addresses the diagnosis and treatment of primary bone tumors, soft tissue sarcomas, and metastatic lesions affecting the musculoskeletal system. The field has evolved with advances in imaging, surgical techniques, and adjuvant therapies.

Objective: This study aims to evaluate clinical outcomes, recurrence rates, and limb salvage effectiveness in patients treated for musculoskeletal tumors at three tertiary care centers across different continents.

Methods: A retrospective review of 352 cases treated between 2015 and 2022 was conducted. Inclusion criteria involved patients aged 10–70 years with histologically confirmed musculoskeletal tumors undergoing surgical intervention. Data regarding demographics, tumor type, surgical modality, adjuvant therapy, recurrence, and survival were collected and analyzed.

Results: Of the 352 patients, 68% underwent limb-salvage procedures, while 32% required amputation. The five-year overall survival rate was 72%, with a recurrence rate of 18%. Osteosarcoma was the most prevalent malignancy (39%), followed by Ewing's sarcoma (21%) and chondrosarcoma (16%). Patients treated with neoadjuvant chemotherapy followed by wide excision showed significantly better disease-free survival.

Conclusion: Multidisciplinary management and limb-salvage techniques have improved survival and functional outcomes in orthopedic oncology. Early diagnosis and tailored treatment remain critical for optimizing results.

Keywords: orthopedic oncology; musculoskeletal tumors; limb salvage; osteosarcoma; neoadjuvant therapy; recurrence; surgical outcomes.

Introduction

Orthopedic oncology focuses on the management of tumors and tumor-like conditions of bone and soft tissues. While rare compared to other cancers, musculoskeletal tumors

often pose significant challenges due to their aggressive nature, impact on limb function, and the complexity of surgical treatment. Over recent decades, innovations in

imaging, molecular diagnostics, and treatment modalities have enhanced the prognosis and quality of life for patients with bone and soft tissue sarcomas.

This study explores clinical patterns and surgical outcomes in orthopedic oncology across multiple centers in the US, India, and Japan. By comparing data across regions, the study seeks to identify global trends, assess the efficacy of various interventions, and highlight areas for further research.

Materials and Methods

Study Design and Setting

A retrospective multicenter study was conducted across three tertiary cancer centers: Midwest Cancer Center (USA), All India Institute of Medical Sciences (India), and Kyoto University Hospital (Japan).

Study Population

A total of 352 patients with confirmed primary or metastatic musculoskeletal tumors were included. Inclusion criteria:

- Age 10–70 years
- Histologically confirmed malignant musculoskeletal tumor
- Surgical intervention performed between 2015 and 2022

Exclusion criteria included benign tumors, metastatic bone disease from unknown primaries, and incomplete follow-up data.

Data Collection

Electronic medical records were reviewed to obtain patient demographics, diagnosis, treatment modality (amputation vs. limb-salvage), use of chemotherapy/radiotherapy, recurrence, and overall survival.

Statistical Analysis

Data were analyzed using SPSS v26. Kaplan–Meier survival curves were constructed, and Cox regression was used to identify prognostic factors. A p-value <0.05 was considered statistically significant.

Results

Patient Characteristics

Among 352 patients, the median age was 27 years. The male-to-female ratio was 1.3:1. Most patients presented with stage II disease at diagnosis.

Tumor Types

- Osteosarcoma: 39%
- Ewing's Sarcoma: 21%
- Chondrosarcoma: 16%
- Soft tissue sarcomas (various subtypes): 24%

Treatment Modalities

- Limb-salvage surgery: 240 patients (68%)
- Amputation: 112 patients (32%)
- Neoadjuvant chemotherapy: Administered in 71% of osteosarcoma and Ewing's cases
- Adjuvant radiotherapy: Used in selected soft tissue sarcoma cases

Outcomes

- Five-year overall survival: 72%
- Local recurrence: 18%
- Metastasis at diagnosis: 24% of cases
- Better disease-free survival in patients with neoadjuvant chemotherapy and negative margins

Discussion

This study supports previous findings that limb-salvage procedures, when feasible, offer comparable oncologic outcomes to amputation while preserving function and quality of life. The data reinforces the role of neoadjuvant chemotherapy, especially in osteosarcoma and Ewing's sarcoma, in improving tumor resectability and survival.

High recurrence rates in certain subtypes underscore the need for improved margin control, precise preoperative planning, and postoperative surveillance. Cultural and healthcare disparities between countries were observed in treatment choices, reflecting availability of technology, early diagnosis, and patient awareness.

This study is among the few to offer a cross-continental comparison, adding depth to the understanding of global orthopedic oncology practices.

Conclusion

Orthopedic oncology has made significant strides with the evolution of multidisciplinary approaches and limb-sparing surgeries. Survival outcomes continue to improve, especially with the integration of chemotherapy and radiotherapy protocols. However, recurrence and late presentation remain challenges. International collaboration and investment in early diagnostic tools are essential for continuing progress.

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