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Original Article

Comparative Study of Functional Outcomes in Limb Salvage versus Amputation in Osteosarcoma Patients.

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Abstract

Background:

Osteosarcoma is the most common primary malignant bone tumor among adolescents and young adults. Advances in chemotherapy and reconstructive techniques have increased the use of limb salvage surgery as an alternative to amputation. However, comparative data regarding functional outcomes in resource-limited settings remain limited.

Aim:

To compare the functional outcomes of limb salvage surgery and amputation in osteosarcoma patients attending a tertiary care hospital.

Methods:

This retrospective observational study was conducted over two years at a tertiary care hospital and included 35 histopathologically confirmed osteosarcoma patients who underwent either limb salvage surgery or amputation. Demographic details, treatment modality, postoperative complications, mobility, and functional outcomes were collected from hospital records. Functional outcome was assessed using the Musculoskeletal Tumor Society (MSTS) scoring system. Statistical analysis was performed using Student's *t*-test and Chi-square test.

Results:

The mean age of participants was 18.4 years, with males constituting 62.9% (n=22) of the study population. Limb salvage surgery was performed in 22 (62.9%) patients, while 13 (37.1%) underwent amputation. The mean MSTS score was significantly higher in the limb salvage group compared with the amputation group (25.6 vs. 18.2; p=0.01). Patients undergoing limb salvage demonstrated better mobility and overall satisfaction. Postoperative complications included infection (17.1%), phantom limb pain (14.3%), local recurrence (11.4%), and implant failure (8.6%).

Conclusion:

Limb salvage surgery provides superior functional outcomes and improved quality of life compared with amputation despite a higher risk of postoperative complications.

Recommendation:

Limb salvage surgery should be considered whenever oncologically feasible, while ensuring careful patient selection, multidisciplinary care, and long-term follow-up.

Keywords: Osteosarcoma; Limb salvage surgery; Amputation; Functional outcome; Musculoskeletal Tumor Society score.

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Introduction

The most prevalent primary malignant bone tumour that affects teenagers and young adults is osteosarcoma. The tumour typically affects the metaphyseal areas of long bones, especially those at the knee joint, and is derived from primitive mesenchymal cells that can produce osteoid matrix. Because there were few therapy alternatives and a high likelihood of local recurrence, amputation was once thought to be the conventional treatment for osteosarcoma(1). For some patients with osteosarcoma, limb salvage surgery has become the preferred course of treatment due to advancements in imaging tools, neoadjuvant chemotherapy, surgical planning, and reconstructive operations. The goal of limb salvage is to improve quality of life and preserve limb function while achieving full tumour removal with sufficient oncological margins(2).

Effective chemotherapy regimens have greatly enhanced survival rates and made limb salvage treatments more feasible. Following limb preservation surgery, improved surgical methods such as vascularized grafting, biological reconstruction, and endoprosthetic reconstruction have further improved functional outcomes. Despite these developments, problems with limb salvage surgery include non-union, infection, implant failure, local recurrence, and the need for further procedures. Even though it limits function, amputation is still a viable choice in situations where there is significant neurovascular involvement, pathological fractures, infection, or a poor response to treatment. For some patients, prosthetic rehabilitation after amputation can result in a satisfactory functional recovery.(3).

When managing osteosarcoma, functional outcome and quality of life are crucial factors, especially for young people and adolescents. Maintaining limb function may have a major impact on long-term rehabilitation, social integration, psychological health, and physical mobility. The survival and recurrence rates of limb salvage and amputation have been compared in a number of studies. However, there is still a dearth of information about functional outcomes in environments with low resources. Treatment choices and results may be impacted in underdeveloped nations by delayed presentation, limited availability to cutting-edge reconstructive facilities, and financial limitations.(4).

Despite advances in osteosarcoma management, information regarding comparative functional

outcomes between limb salvage surgery and amputation in resource-constrained settings remains limited. Therefore, the present study aimed to compare functional outcomes, postoperative complications, mobility, and patient satisfaction between limb salvage surgery and amputation among osteosarcoma patients treated at a tertiary care hospital(5).

Materials and Methods

Study Design

This retrospective observational study was conducted to compare functional outcomes between limb salvage surgery and amputation among patients with osteosarcoma.

Study Setting

The study was conducted at Mahavir Cancer Sansthan, Patna, Bihar, India, a tertiary care oncology center providing specialized cancer services including orthopedic oncology, medical oncology, radiation oncology, pathology, radiology, chemotherapy, rehabilitation, and supportive care services. The study was conducted over two years from January 2023 to December 2024.

Study Population

The study population comprised patients with histopathologically confirmed osteosarcoma who underwent either limb salvage surgery or amputation during the study period. A total of 35 eligible patients were included in the analysis.

Data Collection Methods

Hospital medical records were reviewed retrospectively to obtain demographic characteristics, tumor site, treatment modality, postoperative complications, recurrence status, rehabilitation outcomes, and follow-up information. Functional outcomes were assessed during follow-up visits using the Musculoskeletal Tumor Society (MSTS) scoring system. Patient mobility and satisfaction were also documented from follow-up records.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 25.0. Continuous variables were expressed as mean \pm standard deviation, while categorical variables were presented as frequencies and



percentages. Student's *t*-test was used to compare mean functional scores between treatment groups, whereas the Chi-square test was used to compare categorical variables. A *p*-value <0.05 was considered statistically significant.

Results

Table 1 presents the demographic profile of study participants. The mean age of patients was 18.4 years, and males constituted the majority of the study population (62.9%), indicating a predominance of osteosarcoma among young male patients.

Table 1. Demographic Distribution

Variable	Frequency	p-value
Male	22.0	0.03*
Female	13.0	0.03*
Mean Age	18.4	0.21

Table 2 shows the distribution of treatment modalities. Limb salvage surgery was performed in 62.9% of patients, whereas 37.1% underwent amputation. Limb salvage was the preferred treatment modality whenever oncologically feasible.

Table 2. Treatment Modality

Treatment	Frequency	Percentage	p-value
Limb Salvage	22	62.9	0.02*
Amputation	13	37.1	0.02*

Table 3 compares functional outcomes between treatment groups. The mean MSTS score was significantly higher among patients undergoing limb salvage surgery than among those undergoing

amputation (25.6 vs. 18.2; *p*=0.01), indicating superior postoperative functional status in the limb salvage group

Table 3. Functional Outcomes (MSTS Score)

Group	Mean MSTS Score	p-value
Limb Salvage	25.6	0.01*
Amputation	18.2	0.01*

Table 4 summarizes postoperative complications observed among study participants. Infection was the most frequently reported complication, followed by phantom limb pain, local recurrence, and implant failure

Table 4. Postoperative Complications

Complication	Frequency	p-value
Infection	6	0.04*
Implant Failure	3	0.05*
Local Recurrence	4	0.03*
Phantom Pain	5	0.02*

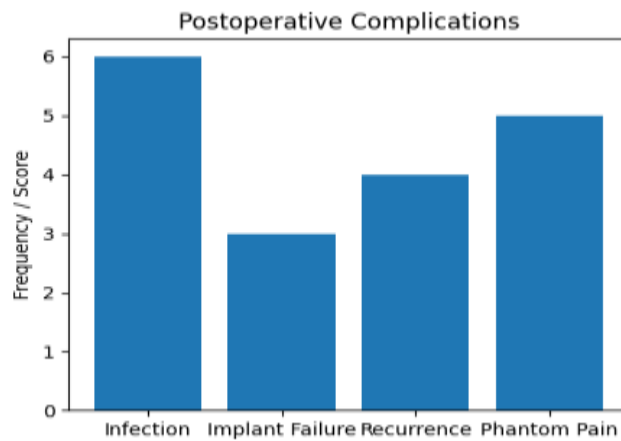


Figure 1: Postoperative complication

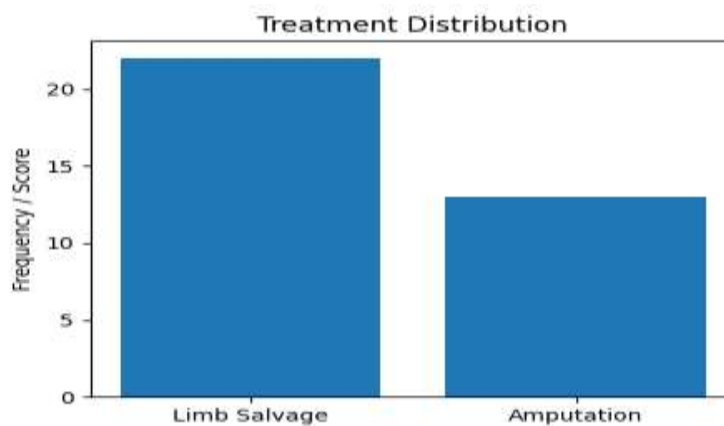


Figure 2: Treatment distribution

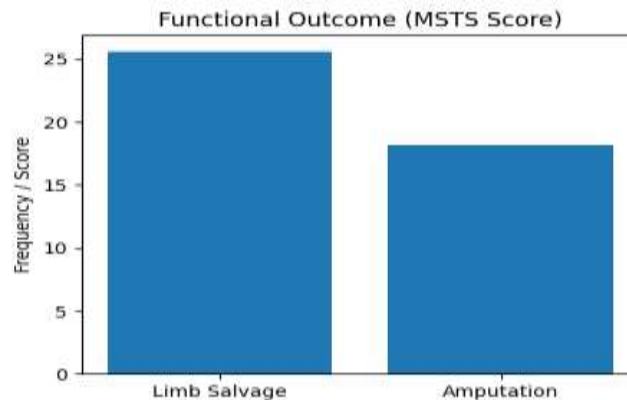


Figure 3: Functional outcomes

Discussion

The present study compared the functional outcomes of limb salvage surgery and amputation among patients with osteosarcoma treated at a tertiary care center. Among the 35 patients included in the study, limb salvage surgery was performed in 62.9% (22/35) of patients, whereas 37.1% (13/35) underwent amputation. This finding reflects the growing preference for limb-preserving procedures whenever adequate oncological clearance can be achieved. Advances in neoadjuvant chemotherapy, imaging modalities, and reconstructive surgical techniques have substantially increased the feasibility of limb salvage procedures in osteosarcoma patients.

A major finding of the present study was that patients undergoing limb salvage surgery demonstrated significantly superior functional outcomes compared with those undergoing amputation. The mean MSTS functional score was significantly higher in the limb salvage group (25.6) than in the amputation group (18.2) ($p=0.01$). These findings are consistent with previous studies reporting improved mobility, better gait mechanics, and enhanced functional independence following limb salvage procedures. Preservation of the native limb anatomy contributes to improved physical functioning and facilitates better social and psychological adjustment, particularly among adolescents and young adults who constitute the majority of osteosarcoma patients.

The present study also demonstrated that patients who underwent limb salvage surgery experienced better overall mobility and patient satisfaction than those who underwent amputation. Improved functional performance following limb salvage may be attributed to preservation of joint function, maintenance of proprioception, and avoidance of dependence on external prosthetic devices. Similar observations have been reported in previous studies, which have shown that limb preservation is associated with superior quality of life and psychosocial outcomes compared with amputation.

Despite the favorable functional outcomes, limb salvage surgery was associated with a greater burden of postoperative complications. In the present study, postoperative complications included infection in 17.1% of patients, implant failure in 8.6%, and local recurrence in 11.4% of patients. These complications are well-recognized challenges associated with limb salvage procedures and may necessitate additional surgical interventions. Adequate surgical margins, meticulous operative techniques, strict infection control measures, and careful postoperative surveillance are therefore essential to optimize outcomes following limb salvage surgery.

Amputation, although associated with lower functional scores, remains an important treatment option in selected patients. Extensive neurovascular involvement, poor response to chemotherapy, uncontrolled infection, and extensive local disease may preclude limb



preservation. In the present study, phantom limb pain was observed in 14.3% of patients undergoing amputation, highlighting the need for comprehensive postoperative rehabilitation and psychological support. Modern prosthetic rehabilitation, however, can still provide satisfactory functional recovery and acceptable quality of life in appropriately selected patients.

The findings of this study emphasize the importance of a multidisciplinary approach in the management of osteosarcoma. Collaboration among orthopedic oncologists, medical oncologists, radiologists, pathologists, physiotherapists, and psychologists is crucial for optimizing treatment outcomes. Early rehabilitation, structured physiotherapy programs, and regular follow-up play significant roles in improving long-term functional recovery regardless of the surgical modality employed. Socioeconomic factors, access to reconstructive facilities, and availability of rehabilitation services may also influence treatment decisions, particularly in resource-constrained settings. Overall, the present study suggests that limb salvage surgery offers superior functional outcomes and improved patient satisfaction compared with amputation in carefully selected osteosarcoma patients. However, the increased risk of postoperative complications underscores the need for meticulous patient selection, multidisciplinary care, and long-term follow-up to ensure optimal clinical outcomes.(6-10).

Generalizability

Since this study was conducted in a tertiary care oncology center managing patients from diverse geographic regions, the findings may apply to similar tertiary oncology institutions in resource-limited settings. However, caution should be exercised while extrapolating the findings to primary healthcare settings or specialized international cancer centers.

Conclusion

According to the current study, patients with osteosarcoma who have limb salvage surgery had much better functional outcomes and a higher quality of life than those who undergo amputation. Patients who had limb salvage showed improved mobility, higher MSTs functional scores, and higher levels of overall satisfaction. Even though limb salvage treatments were more likely to result in postoperative problems such as infection, implant failure, and local recurrence, these

issues were controllable with the right multidisciplinary care and follow-up.

For patients with widespread illness, neurovascular involvement, or poor chemotherapy response, amputation is still a crucial treatment option. In certain situations, modern prosthetic therapy can result in a satisfactory functional recovery. Optimising treatment results for individuals with osteosarcoma requires careful patient selection, efficient chemotherapy, careful surgical planning, and thorough rehabilitation. To assess survival, quality of life, and functional outcomes in larger patient groups, more prospective multicenter trials with long-term follow-up are advised.

Limitations

The study had several limitations, including its retrospective design, relatively small sample size, and single-center setting, which may limit generalizability. Quality-of-life assessment and long-term survival analysis were not comprehensively evaluated. Additionally, variations in rehabilitation protocols could not be assessed because of the retrospective nature of the study.

Recommendations

Limb salvage surgery should be preferred whenever oncologically feasible because of its superior functional outcomes and improved quality of life. Careful patient selection, multidisciplinary management, early rehabilitation, and long-term follow-up are essential for optimizing outcomes. Future prospective multicenter studies involving larger populations are recommended.

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List of Abbreviations

- MSTs – Musculoskeletal Tumor Society
- LSS – Limb Salvage Surgery
- SPSS – Statistical Package for the Social Sciences
- SD – Standard Deviation



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No external funding was received for this study.

Conflict of Interest

The authors declare no conflict of interest.

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Author Contributions

- **RA:** Conceptualization, data collection, manuscript drafting.
- **SK:** Data analysis, interpretation, manuscript revision.
- **SP:** Supervision, critical review, final approval of manuscript.

References

1. Xu M, Tu J, Huang Y, Wang B, Zhao Z, Lin T. Comparison of oncological and functional outcomes in Lower-limb osteosarcoma pediatric patients: a large single-center retrospective cohort study. *Int J Surg*. 2024;(March):4208-20. <https://doi.org/10.1097/JS9.0000000000001340>
2. Rudyan J, Ige W, Astawa P. Comparison of Outcome Between Neoadjuvant Chemotherapy with Limb Salvage Surgery and Amputation with Chemotherapy in Osteosarcoma Patients: A Systematic Review. 2026;20(1):78-83. <https://doi.org/10.5704/MOJ.2603.009>
3. Saev S, Richardson CJ, Klueh ME, Tiesenga F. Long-Term Psychosocial and Functional Outcomes of Limb Salvage Surgery Versus Amputation: A Review Article. 2022;13(5):1-4. <https://doi.org/10.19080/OAJS.2022.13.555871>
4. Savio SD, Deslivia MF, Astawa P, Wiratnaya IGE. The Outcome Comparison of Limb Salvage Surgery versus Amputation for High - Grade Osteosarcoma : A Systematic Review and Meta - Analysis of the Last 7 - Year Studies. 2020;67-73. https://doi.org/10.4103/jotr.jotr_52_19
5. Ullah F, Altaf W, Khan D, Khan NA, Akbar S, Muhammad Z. Comparative Outcomes of Limb Salvage Surgery Versus Amputation in Osteosarcoma: A Five-Year Follow-Up Study From a Tertiary Care Center. 2025;17(10). <https://doi.org/10.7759/cureus.94881>
6. Zhu Y, Wu X, Zhang W, Zhang H. Limb-salvage surgery versus extremity amputation for early-stage bone cancer in the extremities: a population-based study. *Front Surg [Internet]*. 2023;10(May):1-11. <https://doi.org/10.3389/fsurg.2023.1147372>
7. Manandhar S, Li J, Zhang Y, Lu X, Zhang Y, Liu Y. A Comparative Study on the Clinical and Functional Outcome of Limb Salvage Surgery and Amputation in Tibial Osteosarcoma. *NORTH Am Acad Res J*. 2021;4(3):179-91.
8. Li X, Zhang Y, Wan S, Li H, Li D, Xia J. A comparative study between limb-salvage and amputation for treating osteosarcoma. *J Bone Oncol*. 2016;5:15-21. <https://doi.org/10.1016/j.jbo.2016.01.001>
9. Kaneuchi Y, Yoshida S, Fujiwara T, Evans S. Limb salvage surgery has a higher complication rate than amputation but is still beneficial for patients younger than 10 years old with osteosarcoma of an extremity. *J Pediatr Surg [Internet]*. 2022;57(11):702-9. <https://doi.org/10.1016/j.jpedsurg.2022.04.001>
10. Evans DR, Lazarides AL, Visgauss JD, Somarelli JA, Iii DGB, Brigman BE, et al. Limb salvage versus amputation in patients with osteosarcoma of the extremities: an update in the modern era using the National Cancer Database. *BMC Cancer*. 2020;20(995):1-11. <https://doi.org/10.1186/s12885-020-07502-z> <https://doi.org/10.21203/rs.3.rs-18262/v1>



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