Nepal Orthopedic Association Journal
https://doi.org/10.59173/noaj.20251103c

ORIGINAL ARTICLE

Identifying Oncoplastic Reconstructive Procedures for Musculoskeletal Tumours in Nepal: A Cross-Sectional Study

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ABSTRACT

BACKGROUND
Oncoplastic reconstruction is a critical component in musculoskeletal oncology, aiming to restore form and function following tumour resections. In Nepal, where specialized musculoskeletal oncology services are evolving, this study aims to identify the patterns and types of oncoplastic reconstruction performed after tumour resection across four major tertiary centers.

METHODS
This was a multicentric observational study conducted at KIST Medical College and Teaching Hospital, National Trauma Centre, Bhaktapur Cancer Hospital and Nepal Cancer Hospital and Research Centre. Patients with benign or malignant musculoskeletal tumours who underwent resection and oncoplastic reconstruction between January 2021 and May 2024 were included. Data on demographics, tumour sites and types, reconstructive techniques, and postoperative complications were collected and analysed using descriptive statistics.

RESULTS
This study included 141 patients with a mean age of 39.96 ± 14.04 years. Tumours were most frequently located in the lower limb, accounting for 84 (59.58%) cases. Soft tissue reconstruction was undertaken in 122 (86.52%) cases, predominantly utilizing loco-regional flaps in 103 (84.43%) patients. Functional reconstruction comprising tendon transfers and nerve grafts was performed in 19 (13.48%) cases. The mean duration of surgery was 6.32 ± 3.16 hours. Notably, 51 (36.17%) patients had previously undergone unplanned excisions before specialist referral. Postoperative complications were observed in 35 (24.83%) cases with 17 (12.05%) requiring secondary surgical intervention.

CONCLUSION
This study outlines the current landscape of oncoplastic reconstruction in musculoskeletal tumour surgery in Nepal, highlighting the importance of team work and early specialist referral.

KEYWORDS
functional reconstruction; tumours; oncoplastic reconstruction; soft tissue reconstruction

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INTRODUCTION

Wide resection remains the cornerstone of curative treatment in musculoskeletal tumours; however, such oncologically sound

resections often result in substantial soft tissue defects and loss of function.[1] To mitigate these consequences and enable limb preservation, onco-plastic reconstructive strategies must be planned concurrently with tumour resection. Soft tissue reconstruction using skin grafts or flaps provides durable coverage, protects vital structures and reduces postoperative complications.[2] Functional reconstruction such as tendon transfers or nerve procedures or free tissue transfers is essential to restore mobility and optimize limb function, particularly when nerve and motor units are sacrificed during tumour clearance.[3] A multidisciplinary approach combining oncologic and reconstructive expertise is essential to achieve effective local tumour control while restoring both function and appearance.

This cross-sectional study investigates oncoplastic reconstructive procedures to generate insights into surgical oncology practice in resource-limited settings like Nepal and contribute to the growing body of knowledge in musculoskeletal tumour management.

METHODS

This multicentric, retrospective observational study was conducted at four tertiary care centres in Nepal: KIST Medical College and Teaching Hospital, National Trauma Centre, Bhaktapur Cancer Hospital, and Nepal Cancer Hospital and Research Centre where musculoskeletal tumour surgeries are routinely performed. Ethical approval was obtained from the Nepal Health Research Council (Reference number: 1182).

The study population included all patients with histologically confirmed benign or malignant musculoskeletal tumours (both soft tissue and bone tumours) who underwent oncoplastic reconstructive procedures following wide resection in the single setting between January 2021 and May 2024. Both primary and recurrent tumours were considered. Cases with incomplete records or insufficient follow-up were excluded.

Data were extracted through comprehensive review of institutional surgical logs, operative notes, inpatient records, and outpatient charts between December 2024 and March 2025. Variables collected included demographic details, tumour types and sites, techniques of reconstruction and postoperative complications. Reconstruction was classified as either soft tissue or functional. Soft tissue reconstruction included skin grafts and flaps, further categorized into free or loco-regional flaps. Loco-regional flaps consisted of pedicled myo-cutaneous, muscle-only, fascio-cutaneous flaps, or combinations of muscle flaps with skin grafting. Functional reconstruction involved tendon transfers and nerve grafting. Additionally, vascular reconstructions performed for limb salvage and any secondary surgeries undertaken were recorded.

All procedures were performed by TeamSarc Nepal, a dedicated team of surgeons, specializing in musculoskeletal oncology and reconstructive surgery. The choice of reconstructive technique was tailored to the tumour location, defect size, and individual patient factors.

Descriptive statistics summarized demographic and clinical data, with categorical variables expressed as frequencies and percentages, and continuous variables presented as means with standard deviations.

RESULTS

A total of 141 patients who underwent oncoplastic reconstructive surgery following musculoskeletal tumor resections in the single setting between January 2021 and May 2024 were included in this study. The cohort had a mean age of 39.96 ±14.04 years. Male patients slightly predominated, comprising 75 (53.19%), while females accounted for 66 (46.81%) cases.

Tumour locations were predominantly in the lower limb, seen in 84 (59.58%) cases. The upper limb was involved in 42 (29.78%) cases, and the trunk in 15 (10.64%) cases. (Table 1).

Table 1 Tumor Location and types:

Location	**Frequency, n (%)**
Upper Limb	42 (29.78%)
Lower Limb	84 (59.58%)
Trunk	15 (10.64%)
Types	**Frequency, n (%)**
Soft tissue tumours	56 (39.72%)
Benign soft tissue tumours	6 (4.25%)
Soft tissue sarcomas	50 (35.47%)
Bone tumours	85 (60.28%)
Benign bone tumours	12 (8.51%)
Malignant bone tumours	73 (51.77%)

The majority of reconstructive procedures were for soft tissue defects, performed in 122 (86.52%) cases, while functional reconstructions accounted for 19 (13.48%). Combined reconstructions involving both soft tissue and functional components were needed in 13 (9.22%). (Table 2 and 3)

Table 2 Soft tissue reconstruction

Procedure	**Frequency, n (%)**
Free Flaps	7 (5.74%)
Free fillet flaps	2 (1.63%)
Anteriolateral thigh (ALT) flaps	5 (4.11%)
Loco-regional flaps	103 (84.43%)
Myocutaneous flaps	14 (11.48%)
Muscle only flaps	43 (35.25%)
Muscle flaps + Split-thickness skin grafts (STSG)	30 (24.59%)
Fasciocutaneous flaps	14 (11.48%)
VY advancement flaps	2 (1.64%)
STSG only	12 (9.84%)

Table 3 Pedicled Muscle based flaps distributions

Muscle pedicle	Myo-cutaneous flaps (n=14)	Muscle Flaps Only (n= 43)	Combined Muscle + STSG (n=30)
Latissimus dorsi	8 (57.14%)	6 (13.95%)	5 (16.67%)
Gastrocnemius	-	27 (62.79%)	23 (76.67%)
Vastus Lateralis	-	5 (11.63%)	1 (3.33%)
Rectus femoris	4 (28.57%)	3 (6.98%)	-
Gracilis	-	1 (2.33%)	-
Sartorius	-	1 (2.33%)	-
Pectoralis Major	-	-	1 (3.33%)
Vertical rectus abdominis	2 (14.29%)	-	-

In the pedicled fascio-cutaneous flap group, reverse radial forearm and propeller flaps were each performed in 3 (21.43%) cases, followed by reverse sural flaps in 2 (14.29%). Other flaps used less frequently (1 case each, 7.14%) included lateral arm, Quaba, dorsal ulnar artery, medial plantar, cross-finger, and posterior interosseous artery flaps.

A total of 43 (30.49%) patients underwent soft tissue flap reconstruction to provide coverage over orthopaedic implants or endoprostheses. The most common site was the proximal tibia, where 25 (17.73%) patients received flap coverage over an endoprosthesis. This was followed by the distal femur in 11 (7.80%) and the proximal humerus and distal humerus in 1 (0.70%) patient each. Flaps were also performed in 5 (3.54%) cases involving internal fixation with plates.

Functional reconstruction was performed in 19 (13.48%) patients. Tendon transfers were the most common technique, performed in 14 (73.68%) cases, while sural nerve cable grafting was done in 5 (26.32%) cases. Additionally, vascular reconstruction was required in 8 (5.67%) patients to preserve limb viability.

Postoperative complications occurred in 35 (24.83%) patients. (Table 4)

Table 4 Postoperative complications

Complication Type	Frequency, n (%)
Delayed Wound Healing	18 (12.77%)
Reoperation	17 (12.05%)
Infection	10 (7.09%)
Partial Flap Necrosis	4 (2.84%)
Complete Flap Necrosis	2 (1.42%)
Vascular Complications	1 (0.71%)

The mean duration of surgery was 6.32 ± 3.16 hours, reflecting the complex and meticulous nature of musculoskeletal tumour resections and reconstructions that require coordinated teamwork. 51 (36.17%) were whoops procedures, performed without adequate preoperative evaluation or oncologic planning. This indicates the ongoing challenges in early diagnosis and effective referral systems within the healthcare infrastructure.

DISCUSSION

This multicentric study from Nepal provides valuable insights into current oncoplastic reconstructive practices following musculoskeletal tumour resection in our settings. The predominance of lower limb tumours and high incidence of malignant bone sarcomas mirror global patterns observed in musculoskeletal oncology.[4] The mean patient age around 40 years highlights the impact of these diseases on a relatively young and economically productive population.[5]

In our study, soft tissue reconstruction was the cornerstone of our surgical strategy, with loco-regional flaps preferred for their reliability and less demanding technical requirements. This choice is particularly relevant in settings where microsurgical expertise and resources are limited, aligning with findings from studies at similar centers.[6,7] Muscle and myo-cutaneous flaps, especially gastrocnemius and latissimus dorsi, were frequently employed due to their robust vascularity, adaptability for covering large defects and relative ease of harvest and execution.[8] Fascio-cutaneous flaps and split thickness skin grafts supplemented coverage in smaller or more superficial defects, emphasizing the need for tailored approaches based on defect size and location.[9]

Similarly, our findings reflected the use of muscle flaps to ensure reliable soft tissue coverage of implants or prostheses in skeletal reconstruction after sarcoma resection. This approach aligns with established orthopaedic practices aimed at reducing complications and promoting optimal healing.[10]

In proximal tibial endo-prosthetic reconstructions, pedicled medial gastrocnemius muscle flap is considered the best choice for both covering the implant and reconstructing the extensor mechanism.[11] This has been our routine procedure while performing proximal tibial endoprosthesis.

Functional reconstruction, though less frequently performed, played a vital role in restoring function, particularly in cases that required sacrifice of critical nerves. Tendon transfers enable immediate restoration movements, facilitating quicker rehabilitation and significantly improving patients' quality of life: an advantage well documented in the literature.[12] On the other hand, nerve grafting provides a more biologically natural repair by promoting nerve regeneration, but it necessitates a longer recovery period and requires careful patient adherence to postoperative rehabilitation protocols.[13] Both techniques were selectively employed in our study based on the tumour's location and the extent of surgical resection to provide function. Our findings emphasize the importance of incorporating appropriate functional reconstruction strategies as essential elements of oncologic surgical planning.[14]

Postoperative complications, including infection and delayed wound healing, were consistent with data from other studies, and flap necrosis rates were low, reflecting surgical proficiency.[15] The need for secondary surgeries in our study showed the complexity of these reconstructions and the importance of close postoperative surveillance and multidisciplinary follow-up.[16]

The burden of unplanned excisions or whoops procedures remains a serious concern, particularly in our context. These inadvertent excisions often lead to more extensive surgeries and complex reconstructive strategies, and in some cases, limb salvage might not be possible.[17,18] Early identification and timely referral to specialized sarcoma centres are critical in preventing such outcomes.[19]

The efforts of TeamSarc Nepal in performing such complex oncologic and reconstructive surgeries illustrate the potential for multidisciplinary collaboration to elevate standards of sarcoma treatment in developing countries. Strengthening such teams, along with education and infrastructure development will be pivotal to improving outcomes and expanding limb salvage efforts.[20]

Limitations of this study include its retrospective nature and absence of long-term functional and oncologic follow-up. Prospective studies with patient-centred outcome measures will be crucial for future improvements.

CONCLUSION

This study identifies the spectrum of oncoplastic reconstructive procedures following musculoskeletal tumour resection in Nepal, underscoring the importance of early specialist referral, tailored surgical planning and multidisciplinary collaboration in achieving optimal limb salvage.

CONFLICT OF INTEREST None

ACKNOWLEDGEMENT

The authors would like to acknowledge Dr. Shefali Shrestha, for valuable suggestions and proof reading of the manuscript.

SOURCE OF FUNDING None

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