



ORIGINAL ARTICLE

Functional outcome of limb sparing surgery of shoulder girdle tumors after free vascularized fibular flap.

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Article Citation: Shah SA, Hayat W, Khan Z. Functional outcome of limb sparing surgery of shoulder girdle tumors after free vascularized fibular flap. Professional Med J 2025; 32(01):49-53. <https://doi.org/10.29309/TPMJ/2025.32.01.8191>

ABSTRACT... Objective: To share the functional outcome of free vascularized fibular flap for shoulder reconstruction using Toronto Extremity Salvage Score (TESS). **Study Design:** Descriptive Cross-sectional study. **Setting:** Burns and Plastic Surgery Center, Peshawar. **Period:** January 2019 to December 2023. **Methods:** All the patients presented with biopsy proven sarcoma involving proximal humerus were included in this study. Informed consent for data collection was obtained. Patient data regarding demographics, tumor location, extent of lesion, reconstruction and complications was collected from patient records. Six month follow up was done to assess functional recovery of the patient. Toronto Extremity Salvage Score (TESS) was used 6 months post-operatively to assess recovery of the patient using TESS questionnaire. Patient data was analyzed in using an open source software, GNU PSP version 2.0.0. **Results:** A total of 11 patients were included in this study. Mean age of the patients was 15 ± 3.5 years. Eight patients (72.7%) were male while 3 (27.3%) were female. Two patients has post-operative bleeding and 1 patient had fracture of fibula. Average TESS score was 61 ± 7.71 years. Eight patients (72.7%) reported a good TESS score while 4 (27.3%) patients scored poor on TESS Questionnaire. **Conclusion:** Reconstruction of shoulder in sarcoma patients is a complex problem. Both prosthetic and biological reconstructive options present their own set of issues. In our experience, the use of free vascularized fibular flap (FVFF) presents a much better option with lower rate of infection and on average good Toronto Extremity Salvage Score (TESS) Scores.

Keywords: Free Tissue Flaps, Free Vascularized Fibular Flap, Limb Salvage, Sarcoma Surgery, Sarcoma.

INTRODUCTION

Shoulder girdle allows seamless movements of the upper limbs. The intricate mechanics of the shoulder girdle depends on the harmonious movements of bone, muscles, tendons and joint capsule. The reconstructive challenges that a surgeon faces is restoration of bony support, integration of tendons and joint capsule with the new bony scaffold and restoration of shoulder function depending on the available muscle mass.¹⁻³

Defect secondary to osteosarcoma of the proximal humerus requires complex reconstruction techniques in order to achieve shoulder mobility.^{4,5} Several reconstructive methods are described in the literature for shoulder reconstruction. These include both biologic and prosthetic reconstructive options. Each technique has its

own set of problems. Prosthetic reconstruction has the risk of infection, tissue adherence, lax joint capsule and loosening of the joint.⁵ On the other hand, autologous bone grafts can have bone resorption and infection.⁶

Limb preservation is important for post-surgery quality of life of the patient because it can give some degree of functionality. A free vascularized fibular flap (FVFF) can also be used for shoulder reconstruction.⁷ This study focuses on the use of free vascularized fibular flaps for the use of shoulder reconstruction. Due to the robust blood supply of the flap, it provides a much reliable option as compared to the autologous tissue graft. In this study we aim to share the functional outcome of free vascularized fibular flap for shoulder reconstruction using Toronto Extremity Salvage Score (TESS).

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Article received on: 19/03/2024
Accepted for publication: 07/11/2024

METHODS

This study was performed from January 2019 to December 2023 in the department of Plastic & Reconstructive Surgery after approval from ethical committee (05/REB/B&PSC/23). All the patients presented with biopsy proven sarcoma involving proximal humerus. Informed consent for data collection was obtained. First the tumor was excised by the Onco-surgery team, after excision, the defect was measured and the required length of fibula harvested from the leg. Proximally, fibula-glenoid arthrodesis was done to fuse the joint. Distally the fibula was plated with the humerus. If the tumor size was large, Cappanna technique was employed. After excising the humerus, it was autoclaved for 12 minutes at 132 degree Celsius. After autoclaving, remnant muscle was removed and antibiotic (Vancomycin) wash was done to prevent infection. Free vascularized fibula flap was placed in the intramedullary canal of the humerus. A window was cut in the humerus at one side to allow for anastomosis.

Patient data regarding demographics, tumor location, extent of lesion, reconstruction and complications was collected from patient records. Six month follow up was done to assess functional recovery of the patient. Toronto Extremity Salvage Score (TESS) was used 6 months post-operatively to assess recovery of the patient using TESS questionnaire. Patient scores were classified into 3 categories, excellent score (80-100), good (60-79), and poor (0-39). Patient data was analyzed in using an open source software, GNU PSPP version 2.0.0.

RESULTS

A total of 11 patients were included in this study. Mean age of the patients was 15 ± 3.5 years. Eight patients (72.7%) were male while 3 (27.3%) were female. Proximally the fibula was either arthrodesed with the glenoid fosa or suspensory arthroplasty was done using a dental wire (Figure-1 and 2). In two patients, recycled bone was used as a scaffold to house the free fibula after autoclaving (Figure-2). Two patients has post-operative bleeding which was managed conservatively. One patient had fracture of fibula which required a secondary procedure for

replanting the fibula. Average TESS score was 61 ± 7.71 years. Eight patients (72.7%) reported a good TESS score while 4 (27.3%) patients scored poor on TESS Questionnaire. Figure 3 shows movements of the patient 6 months after the surgery.



Figure-1. A, Sarcoma involving proximal humerus. Biopsy scar visible. B, Radiograph showing the lesion. C, Harvesting the fibula from leg. The forceps point towards the pedicle about to be divided. D, Radiograph shows inset of free vascularized fibular flap which is arthrodesed proximally to the glenoid fossa and plated to the humerus.

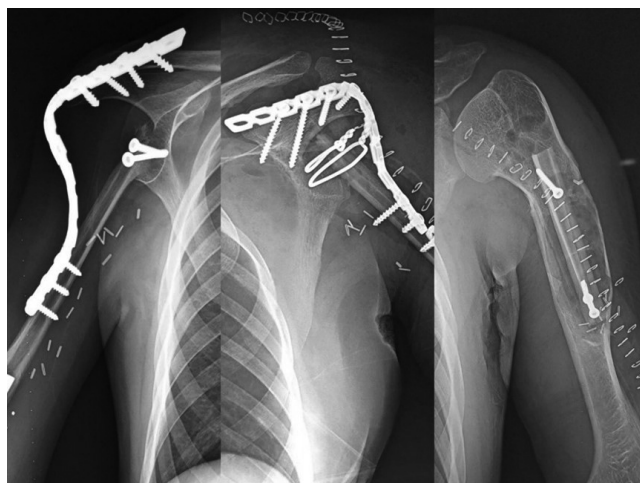


Figure-2. A, Shows arthrodesis of free vascularized fibular flap to the glenoid fossa. B, Metal wire used for suspensory arthroplasty. C, Tumor involving proximal 2/3rd humerus. Humerus was autoclaved to kill all the tumor cells. This process also kills normal cells. The recycled tissue is used to house the FVFF in the intermedullary cavity. A window is made in the bone to provide passage for the artery and veins to allow microsurgical anastomosis.



Figure-3. Showing 6 month follow-up of a patient. Patient has undergone fibuloglcnoid arthrodesis. Pictures showing good functional recovery of the patient with shoulder abduction, flexion, extension and bringing the hand to the mouth.

DISCUSSION

Reconstruction of shoulder is a complex process. Each of the available reconstructive option has its own set of problems. Most common methods employed for reconstruction are with prosthetics. These include Nail-cement spacers, modular and custom made prosthesis and reverse polarity prosthesis.⁸⁻¹¹ These options are useful and are quick to reconstruct, but they are expensive. Custom made prosthesis can cost the patient valuable time and in the mean time if the tumor spreads further, it can render the prosthesis inadequate. Another issue that is commonly encountered is poor integration of the deltoid and rotator cuff muscles with the prosthesis.¹²

Common biological options include fibular graft, use of clavicle for reconstruction, allograft, using the recycled humerus after autoclaving or radiation and use of free vascularized tissue. Integration and cost is not an issue for the biological reconstructive options, but they have their own set of problems. The common issues with biological reconstruction is strength and infection. In case of fibular graft, allograft and recycled autoclaved bone, blood supply to the bone is not present. The recovery time is very long and the bone is prone to infections, non-union and fractures.^{6,13-15} The recovery time is very long and the bone is prone

to infections, non-union and fractures. In case of clavicle, the clavicle retains its blood supply, but is too weak to support the upper limb and is at risk of fractures.^{16,17} Another problem with the use of recycled autoclaved bone is that the specimen cannot be sent for histopathology and margin clearance cannot be determined. The use of Free Vascularized fibular flap (FVFF) decreases the risk of infection as it maintains a blood supply. Another advantage is the relatively early recovery, again due to its robust blood supply.^{7,18,19} The risk of fracture is also low in vascularized fibular flap as compared to fibular grafts.

LIMITATIONS

The limitation of this study is that it is a retrospective study. The data was recorded from patient records and many variables that the authors wanted to obtain were not available. Another limitation is less number of cases. A larger sample size would have given us more data that would be generalizable to the population of patients presenting with sarcoma involving proximal humerus.

CONCLUSION

Reconstruction of shoulder in sarcoma patients is a complex problem. Both prosthetic and biological reconstructive options present their own set of issues. In our experience, the use of free vascularized fibular flap (FVFF) presents a much better option with lower rate of infection and on average good Toronto Extremity Salvage Score (TESS) Scores.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.




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AUTHORSHIP AND CONTRIBUTION DECLARATION

| No. | Author(s) Full Name | Contribution to the paper | Author(s) Signature |
|-----|---------------------|--|---|
| 1 | Syed Asif Shah | Conception, Design, Data collection, writing, analysis responsibility for content of this article. |  |
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