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RECONSTRUCTION OF COMPLEX AXILLARY DEFECT WITH FREE TISSUE TRANSFER – FROM INTRAOPERATIVE EXECUTION TO POST-OPERATIVE FOLLOWUP: CASE REPORT AND REVIEW OF LITERATURE

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SUMMARY

We present a SCARE (Surgical Case Report) guidelines-compliant case describing the staged reconstruction of a complex traumatic axillary defect in a 19-year-old man following a high-energy road traffic injury. The patient sustained a deep degloving wound of the axilla with exposure of the humeral head and open shoulder joint, partial loss of the latissimus dorsi and biceps muscles, and an associated lower-limb degloving injury. After initial resuscitation, serial debridement, and infection control, definitive reconstruction was performed one month later using a free anterolateral thigh (ALT) flap with split-thickness skin grafting. Because the usual thoracodorsal recipient vessels were affected by the injury, the flap was anastomosed to the pectoral branch of the thoracoacromial artery and vein, with additional venous drainage through the cephalic vein. The flap survived, graft take was largely successful. Physiotherapy was initiated at 2 weeks postoperatively and sustained upon discharge. At 6 months the patient had preserved shoulder range of motion, though with some difficulty initiating abduction, likely related to associated rotator cuff injury. The case highlights important considerations when reconstructing axillary defects with emphasis not only on defect closure, but also functional preservation and/or restoration.

INTRODUCTION

The axilla, a nexus of neurovascular structures and dynamic musculoskeletal function, presents a reconstructive challenge when devastated by high-energy trauma. In this anatomical region, soft tissue loss exposes not only vital structures but also the patient to long-term morbidity from contracture, instability, and sensory deficits(1–4). While local and regional flaps offer reliable solutions for moderate defects, extensive axillary injuries particularly those involving joint exposure or compromised recipient vessels demand microsurgical tissue transfer (2,5,6).

This case report details the staged reconstruction of a complex axillary defect in a young trauma patient, where conventional thoracodorsal recipient vessels were rendered unusable. Instead, the thoracoacromial system provided a viable alternative for microvascular anastomosis (2,7), enabling the successful inset of a free ALT flap. We highlight the technical nuances of thoracoacromial vessel use, the versatility of the ALT flap (3,6,8)in contouring and coverage, and the importance of early rehabilitation(1,5,9) in preserving shoulder function. In doing so, we contribute to the growing body of evidence supporting thoracoacromial-based reconstruction as a salvage strategy in anatomically hostile or vessel-depleted axillae—broadening the reconstructive armamentarium for trauma surgeons and microsurgeons alike (4,8,10).

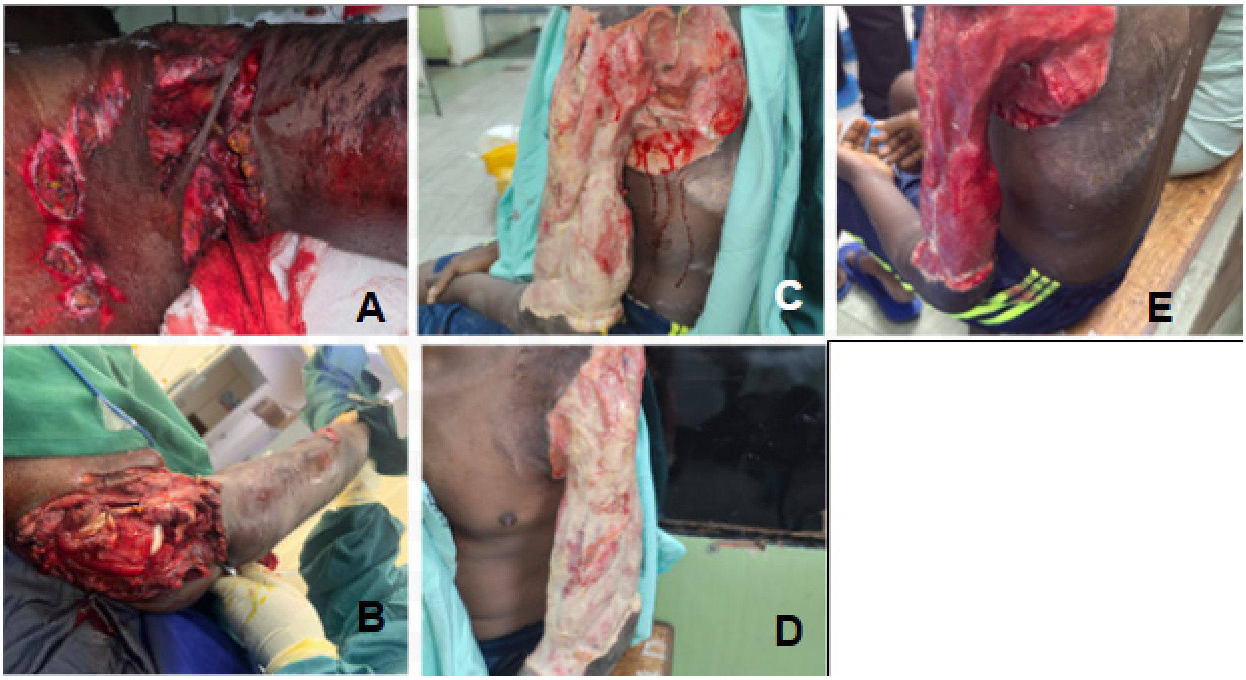
CASE PRESENTATION

A 19-year-old male with right hand dominance and a barista by profession was admitted to our level six referral facility following a high-energy road traffic accident in which he was struck by a speeding minibus while intoxicated. He presented in hypovolemic shock with extensive soft tissue injuries, including a deep degloving wound of the left axilla exposing the humeral head and open shoulder joint, with partial loss of the latissimus dorsi and biceps muscles. The brachial artery and brachial plexus were preserved. He also sustained a degloving injury of the left lower limb.

Initial imaging with FAST and chest radiography excluded intra-abdominal or thoracic injury. Regional imaging of the axilla was not done in an attempt to reduce time to operative surgery.

He initially underwent debridement, hemostasis and exploration of the axilla and lower limb with the following findings: Deep degloving wound of left axilla exposing the humeral head and shoulder joint, partial loss of Latissimus Dorsi and Biceps Muscles, preservation of brachial artery and major brachial plexus branches(Radial nerve, median nerve, ulnar nerve, musculocutaneous nerves)

Figure 1: Perioperative findings: Before debridement[A,B] showing open joint capsule with exposed humeral head, severed medial and long head of the triceps, latissimus dorsi and rotator cuff muscles. Wound was finally debrided serially and left to granulate before reconstruction [C,D,E]



Later a second debridement for wound sepsis control and finally definitive reconstruction one month later with a free anterolateral thigh flap to the axilla and split-thickness skin grafts from left thigh. The Flap was initially harvested as a sensate flap (based on lateral femoral cutaneous nerve of thigh), septocutaneous perforator (double perforators) and anastomosed to the pectoral branch of Thoracoacromial artery and vein and the cephalic vein. No suitable sensory nerve recipient was found.

Both the debridement and reconstruction were done under General Anaesthesia, supine positioning with 10% povidone iodine for skin preparation with routine plastic surgery and microvascular instruments. There was a significant delay between the decision on intervention, e.g. repeat debridement, and its actualisation because of limited theatre space in the Level 6 facility serving the entire East and Central African region. Perioperatively antibiotics, analgesia, transfusion and prophylactic anticoagulation were given.

Postoperatively flap monitoring was undertaken using our institution's standard including 2 hourly monitoring for 24 hours, followed by 4 hourly for the next 24 hours and 6 hours in the next 24 hours. We made sure there was no pressure on the flap and there was cessation of shoulder range of motion for two weeks. The patient was followed up in an HDU setup for 1 week then transferred to the general ward. Structured rehabilitation was started after two weeks involving shoulder range of motion and strengthening exercises. Range of motion exercises was started gradually with passive range of motion then active range of motion and degrees increased as tolerated for two weeks before discharge and continued 3 times a week as outpatient. The flap survived, and graft take was largely successful, though some areas required regrafting. On 6 month follow up, the patient had preservation of shoulder range of motion although had difficulty initiating abduction probably due to the rotator cuff injury. This case highlights the challenges of axillary reconstruction after high-energy trauma in a young patient including rehabilitation to retain and restore function.

Figure 2: Wound state before start of reconstruction. Note the size extent and location of wound to involve the axilla. Wound is clean and axillary area should be covered by soft pliable tissue to prevent contracture. A(Anterior View), B (Dorsal view)

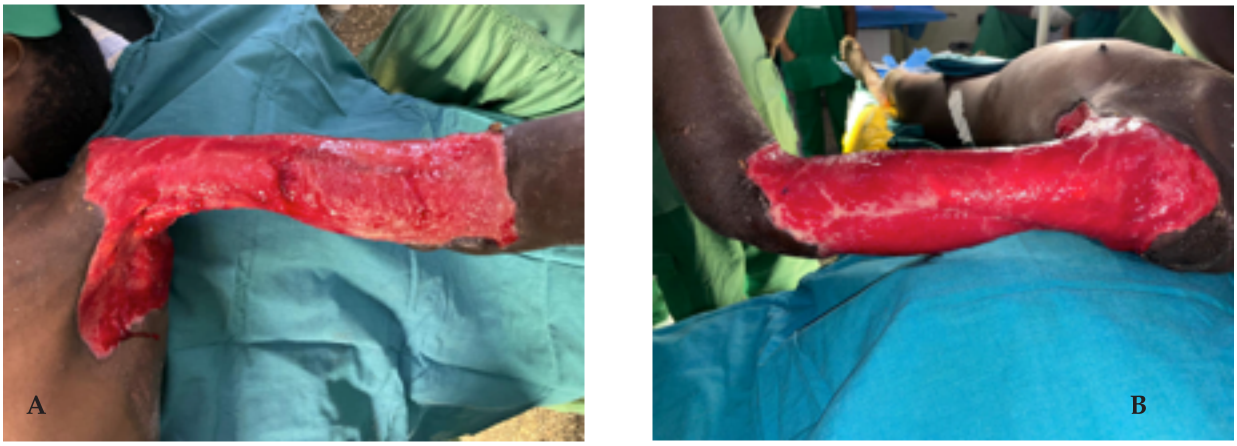


Figure 3: Intraoperative pictures during the reconstruction. ALT perforator flap is marked on an axis between ASIS and Lateral patella (A). The perforator is identified as septocutaneous and pointed with the surgical instrument(B,C). Flap dissection is complete, note the inclusion of two perforators in the flap and the lateral femoral cutaneous nerve of thigh(* asterix)(C,D,E) and inset (F).

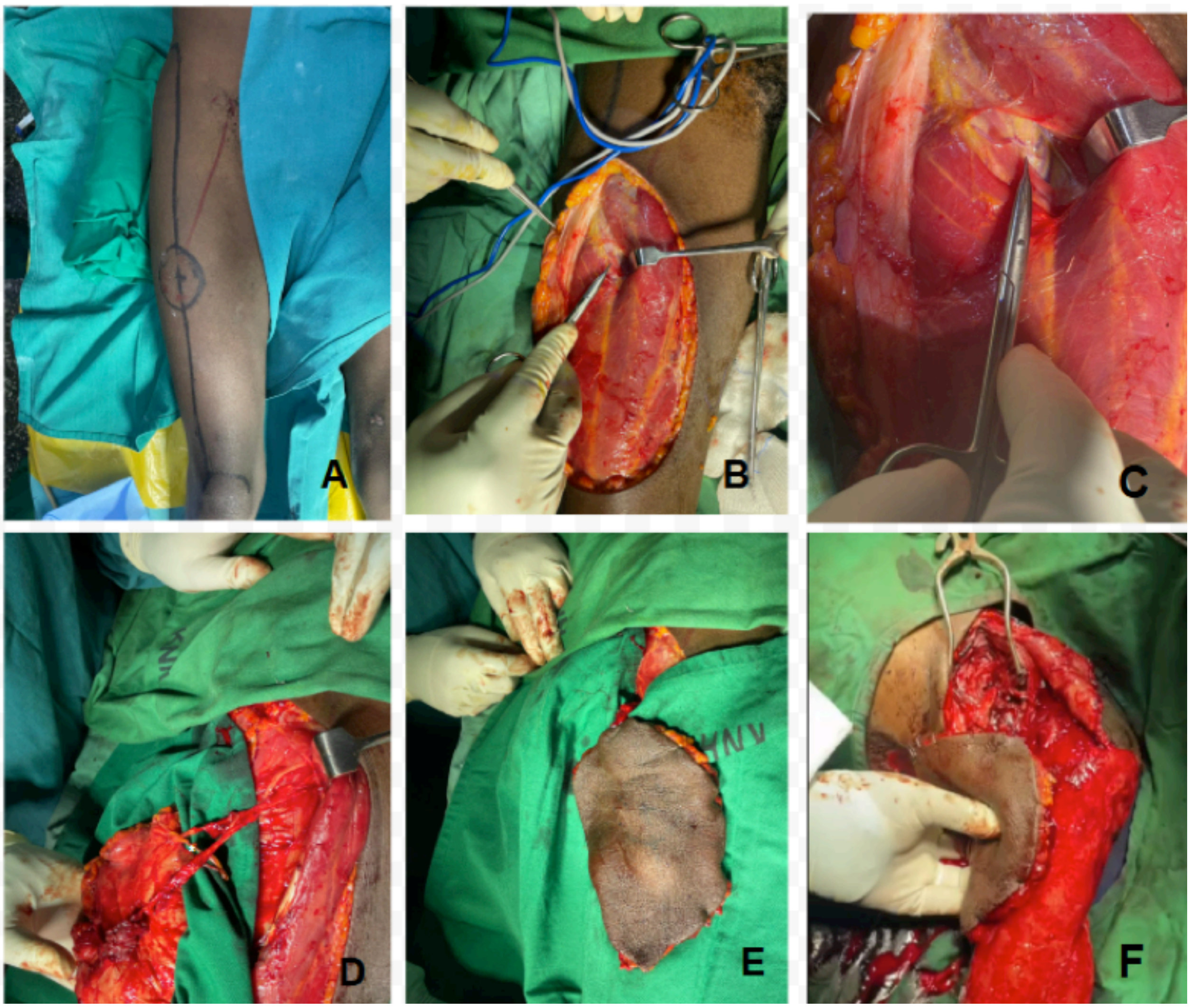


Figure 4: 3 and 6 months post operative photos showing a settled flap. >90% graft take at 3 months(A,B) and Full graft take after regrafting(C,D). Photos in adduction(A), abduction(B,C) and flexion (D) shows preservation of active shoulder range of motion.

Data for this case were obtained from the patient's clinical records, operative reports, and follow-up assessments documented at our institution.

DISCUSSION

Axillary soft tissue defects are a common challenge for reconstructive surgeons. They result from diverse etiologies such as trauma, burns, hidradenitis suppurativa, radiation injury, and oncologic resection. Each etiology poses distinct reconstructive challenges based on the depth of tissue loss, exposure or injury of vital structures, contamination and potential for contracture formation limiting function(1–4,7,10) .

Traumatic injuries, as in our case, often present with irregular wound edges, contamination, and devitalized tissue, making delayed reconstruction preferable after aggressive debridement. Burn-related axillary contractures, on the other hand, frequently result in fibrotic skin with poor elasticity that limits shoulder abduction and necessitates release and resurfacing with pliable tissue. Radiation-induced ulcers are often complicated by friable, poorly vascularized tissue, making local options unreliable and necessitating free tissue transfer to ensure vascularity and healing. Chronic inflammatory and infective etiologies such as hidradenitis suppurativa (HS) add a layer of complexity due to the high recurrence potential and the need for wide excision to remove all diseased tissue (3,7,8,11).

Various authors have demonstrated that durable reconstruction of such complex defects relies not only on mere wound coverage but coverage using reliable vascularized tissues to minimize recurrence, give stable coverage for future reconstructive surgeries, preserve shoulder mobility and prevent contracture.

RECONSTRUCTIVE OPTIONS

Selecting an appropriate reconstructive method for axillary defects requires a structured framework that integrates defect size, depth, neurovascular involvement, and local tissue availability. Sanz Aranda and colleagues (2022) proposed an algorithmic approach that remains highly applicable: local flaps for small defects (<30 cm²), regional flaps such as the thoracodorsal artery perforator (TDAP) or parascapular flaps for moderate defects (30–200 cm²), and microsurgical free flaps for extensive defects (>200 cm²) (12).

Free flaps are particularly indicated when local tissues are inadequate due to scarring, previous surgery, or infection, as they provide ample, well-vascularized, and pliable coverage. Among free flaps, the anterolateral thigh (ALT) flap offers distinct advantages in axillary reconstruction. It provides a large, thin fasciocutaneous paddle that can be tailored to contour around the axillary fold with minimal donor-site morbidity and long pedicle. (4,10)

Alternative free flaps such as the scapular or parascapular flaps, circumflex scapular artery (CSA) system flaps, and latissimus dorsi musculocutaneous flaps have also demonstrated excellent outcomes, particularly in pediatric or post-burn settings due to their pliability and low donor morbidity (5,6)

FUNCTIONAL RECONSTRUCTION AND MICROVASCULAR RECONSTRUCTION

In extensive axillary trauma, functional reconstruction extends beyond soft-tissue coverage to the restoration of motion, protection of neurovascular structures, and, where feasible, reinnervation of the flap. Free flaps are attractive because they enable this complex reconstruction. ALT flap, for example, can be harvested as a sensate flap based on the Lateral Cutaneous Nerve of the Thigh and/or a functional musculocutaneous flap based on the vastus lateralis muscle (4,10).

The axilla's intricate anatomy, harboring the axillary artery and vein, brachial plexus cords, and multiple motor branches, demands careful recipient vessel and nerve planning. The thoracoacromial artery and vein, circumflex scapular vessels, or thoracodorsal pedicle are reliable recipient vessels due to their proximity, calibre match, and accessibility within unscarred planes. When these are compromised - such as after prior axillary dissection, radiation, or extensive burns and trauma transverse cervical, internal mammary, or subscapular system branches can serve as alternatives. Vascular anastomosis can be performed in an end-to-end or end-to-side configuration to the appropriately selected recipient vessel (2,5).

To enhance long-term sensibility and functional integration, sensory coaptation between the flap's lateral femoral cutaneous nerve and intercostobrachial or medial cutaneous nerve of the arm can restore protective sensation to the axillary skin, important in preventing secondary trauma and improving patient comfort. Where shoulder muscle injury coexists, motor neurotization to restore important shoulder movements and stability. Common choices of motor nerve recipients include branches from the musculocutaneous and thoracodorsal nerves (1).

REHABILITATION AND POSTOPERATIVE CARE AFTER MICROVASCULAR RECONSTRUCTION

The postoperative phase of axillary reconstruction is critical to ensuring long-term functional success. Close monitoring of flap perfusion in the first 72 hours remains essential and should be performed according to a peer-reviewed schedule and techniques. Documented schedules include 2 hourly clinical examinations of flap perfusion, vital signs, Doppler scanning, and infrared. Monitoring ensures that early complications of flaps are detected and the flap is salvaged (1,9).

Early physiotherapy focusing on shoulder abduction, flexion, and external rotation should begin as soon as the flap's vascularity is stable, typically after the first week. Immobilization beyond 10–14 days risks stiffness and recurrent contracture. Physiotherapy and occupational therapy should continue for at least 3 months. Rehabilitation must balance flap protection with the gradual restoration of mobility, emphasizing passive-to-active motion progression and regular scar massage once the wound is stable (1,3).

CONCLUSION

In conclusion, reconstruction of axillary soft tissue defects requires individualized planning that addresses both the anatomic and functional demands of the region. Aetiology-specific considerations, ranging from traumatic to radiation or inflammatory origins, inform the reconstructive approach. Using a framework enables exploration of all possible reconstructive options, with free tissue transfer becoming the optimal choice for extensive or complex defects where local and regional flaps are insufficient. The anterolateral thigh free flap, as used in our case, offers robust vascularity, pliability, and an excellent contour for restoring axillary mobility and can be utilised as a functional reconstructive option if required. Successful outcomes depend not only on meticulous flap selection and microsurgical technique but also on early and sustained rehabilitation aimed at preserving the range of motion and minimising contracture formation.

Ethical approval was not required for this case report in accordance with institutional guidelines, but a written informed consent was obtained from the patient for publication of this case report and accompanying images.

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