Supercharging Extra-Large Anterolateral Thigh Flaps for Single-Stage Resurfacing of Massive Burn Defects Over Upper Extremity Elbow Joints

Shao-Yu Hung, MD,* Charles Yuen Yung Loh, MBBS, MSc, MS, MRCS,*,† Hung-Chang Chen, MD*,‡

The resurfacing of soft tissue over extensor side of elbow joint after a full thickness burn injury is challenging due to greater amount of soft tissue needed. Local or regional flaps in the upper limb are not readily available and the use of free flap is the consensus. We want to present the first report of an extra-large anterolateral thigh (ALT) flap for a 1-stage coverage of an extensive elbow defect. The versatility of the ALT flap in design offers the surgeon the added option of supercharging the flap for increased survival when using a large flap for extensive wound coverage in the elbow. A 36-year-old male was admitted due to full thickness contact thermal burn over extensor side of left elbow. After debridement, we applied a 1-stage reconstruction with an extra-large ALT flap for the wound coverage and a supercharging design was made for the better perfusion for the flap. The flap was well perfused and the patient was discharged under stable wound condition as well as a fair functional outcome. The ALT flap is ideal for resurfacing large defects over the elbow and its anatomy and multiple source perforators allow the use of supercharging to enhance flap survival in the upper limb. (J Burn Care Res 2018;39:831–834)

The resurfacing of soft tissue over a joint can present a reconstructive conundrum, especially postburns injury. The elbow in particular is a hinge joint that has a large range of movement with multiple crucial structures located over the joint. Adequate reconstruction of the soft tissues would consist of ample soft-tissue cover to allow a good range of movement at the elbow joint. The ideal flap would also consist of a thin enough flap that is able to protect the underlying structures at the elbow joint and allowing even distribution of soft tissues. Local or regional flaps in the upper limb are not readily available, especially when large defects around the elbow are required. In this instance, free flaps are required. Reconstruction of defects around the elbow can be divided into the cubital or flexor surface and the extensor surface of the elbow. The latter requires a greater amount of tissue due to the mobility of the joint. The flaps reported in the literature for similar burns injuries of the extensor surface of the elbow are often the use of a myocutaneous flap such as the latissimus dorsi flap.[1] Local propeller flaps have also been described in the literature for elbow reconstruction postburns.[2] However, extensive injuries are often inadequately covered. Muscle flaps are also often subject to wound contracture and shrinkage, which then restricts elbow movement.

This article represents the first report of an extra-large anterolateral thigh (ALT) flap for a 1-stage coverage of an extensive elbow defect. The versatility of the ALT flap in design offers the surgeon the added option of supercharging the flap for increased survival when using a large flap for extensive wound coverage in the elbow.

CASE REPORT

A 36-year-old male was admitted to our burns unit having sustained contact thermal full-thickness burns over his left arm and back. He had attempted suicide by burning charcoal in a closed room but passed out over the embers, resulting in extensor surface full-thickness burns from the mid-humerus level to just proximal to the distal wrist crease. The full-thickness burn was almost circumferential around the elbow joint itself. A fasciotomy of his arm and hand was performed after the primary survey. When his condition was stabilized, debridement and evaluation of his wounds was performed 4 days after his initial injury. A full-thickness defect down to muscle was observed intraoperatively after debridement. While his elbow extensor mechanism was preserved, his ulna nerve was found to be damaged (Figure 1).

*From the *Department of Plastic and Reconstructive Surgery, Chang Gung Memorial Hospital, Linkou, Taiwan; †St Andrew's Center for Plastic and Reconstructive Surgery, Broomfield Hospital, Court Road, Chelmsford, United Kingdom; and ‡Chang Gung University, College of Medicine, Taoyuan, Taiwan.*

Address correspondence to Hung-Chang Chen, MD, Department of Plastic Surgery, Chang Gung Memorial Hospital and Chang Gung University, No. 5 Fu-Hsing St. Kwei-Shan, Taoyuan, Taiwan, 333. Email: Firepigtw@gmail.com.

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After debridement, reconstruction for wound coverage was performed. A large 40 × 25 cm ALT flap from his left thigh was selected as a 1-stage procedure for coverage of his elbow defect (Figure 2). During harvesting, only 2 perforators were identified, 1 from oblique branch and another from descending branch of the lateral circumflex femoral artery.The oblique and descending branch merged together proximal to the division of the branch to rectus femoris (RF) muscle so if we harvest the flap base on the main pedicle, we have to sacrifice the branch to RF muscle (Figure 3). In order to enhance the blood supply and venous drainage of this extra-large flap and also to preserve the blood supply of RF muscle, a decision was made to supercharge the flap based on the separate main trunks that led to different perforators. The oblique branch was anastomosed to the proximal radial artery stump and its corresponding veins to the cephalic vein and the concomitant veins of the radial artery. The descending branch of the

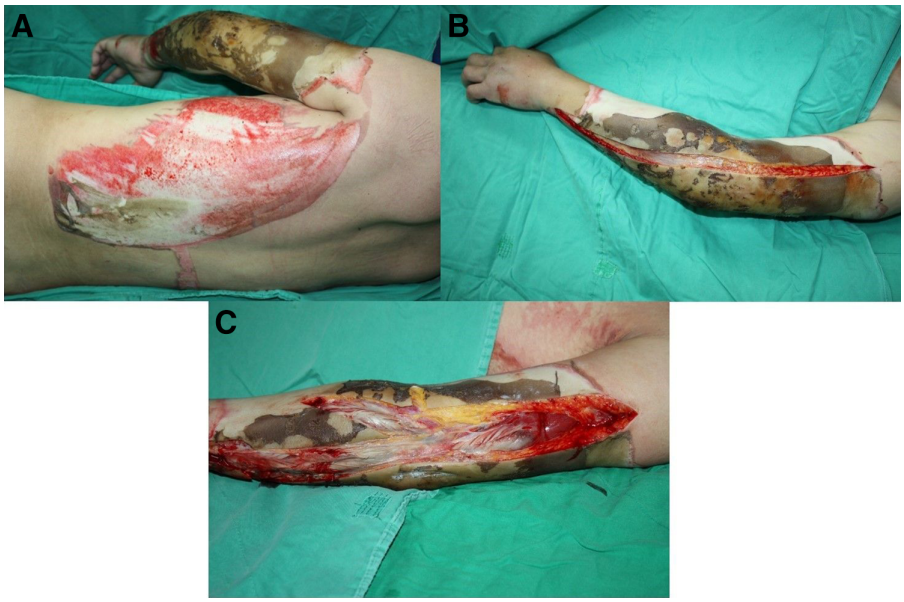

Figure 1. Photographs depicting the initial burn injury. A. Full thickness and mixed depth burns of the left arm and left back. B. Initial fasciotomy performed on his left arm. C. Debridement of devitalized tissue revealing depth of burn down to muscle.

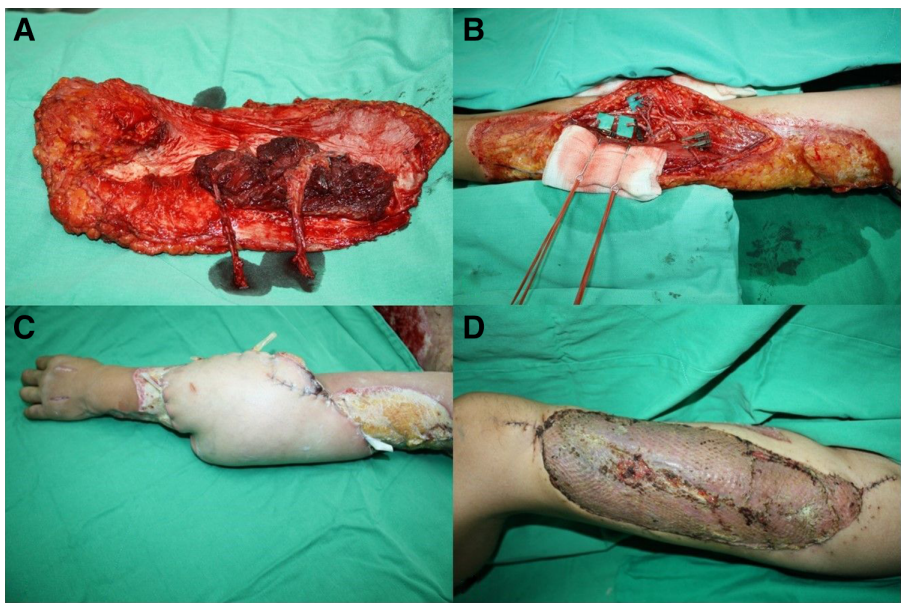

Figure 2. Intraoperative photographs of the extra-large ALT flap harvested with inset of flap in elbow. A. 40 × 25 cm ALT flap with 2 perforators based on 2 pedicles. B. Recipient vessel anastomoses. C. Final inset of ALT flap across elbow joint. D. Skin grafted donor site on left thigh. ALT, anterolateral thigh.

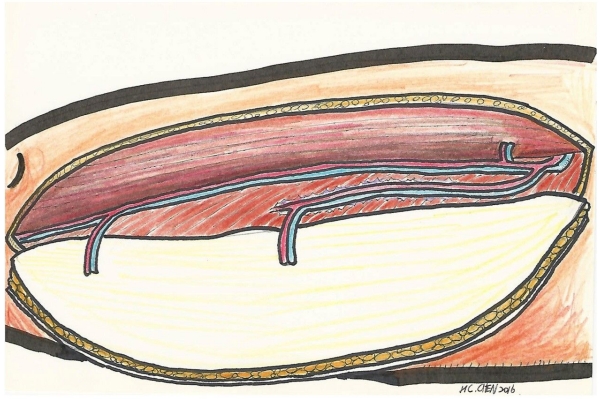

Figure 3. Diagram of the super big ALT harvesting. The oblique branch and descending branch of LCFA merged proximally to the branch to RF. Separate 2 branch as 2 pedicle can therefore preserve the branch to RF. ALT, anterolateral thigh; LCFA, lateral circumflex femoral artery; RF, rectus femoris.

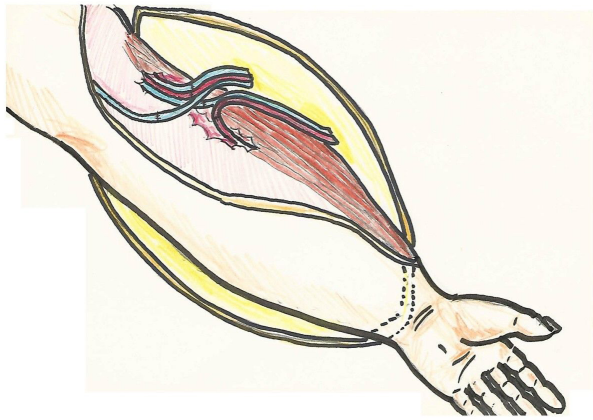

Figure 4. Diagram of the inset of the flap for the elbow coverage. The oblique branch was anastomosed to the proximal radial artery stump and its corresponding veins to the cephalic vein and the concomitant veins of the radial artery. The descending branch of the LCFA was anastomosed to the distal stump of the radial artery on the arm and its corresponding vein to the concomitant vein of the radial artery.

lateral circumflex femoral artery on the ALT flap was anastomosed to the distal stump of the radial artery on the arm and its corresponding vein to the concomitant vein of the radial artery (Figure 4). Both recipient vessels were found to be pulsing blood with enough force to power the flap before the anastomoses were performed.

RESULTS

The flap was well perfused postoperatively. Subsequent 2 episodes of skin grafting were performed for the residual wound at back and left arm. The patient was discharged after 35 days smoothly. A good range of elbow movement from 90 to 170 degrees was demonstrated at time of follow-up (Figure 5). Ulna nerve motor and sensory function remained compromised secondary to burns injury.

DISCUSSION

The use of free flap microsurgical reconstruction of elbow defects in burns is the accepted standard of reconstruction. Skin grafting is an option but when debrided down to bone, the denuded surfaces may not be an adequate vascular bed for skin graft take. The postoperative secondary contracture of split-thickness skin grafts also poses a problem functionally over the hinge joint of an elbow.[3] Reconstruction of the cubital area has been described using free rectus abdominis, latissimus dorsi, or ALTs.[4,5] Reconstruction of the extensor surface of the elbow can include other pedicled fasciocutaneous flaps such as the radial forearm flap, reverse lateral arm flap,[6,7] the antecubital fasciocutaneous flap,[8–10] ulnar forearm flap, and the posterior interosseous flap. The use of dermal matrices such as Alloderm and Integra for resurfacing of joints has been described in the literature.[11,12] It provides a thicker surface and improved skin quality. It however, may be insufficient in thickness over a pressure point such as the elbow and requires a 2-stage approach with skin grafting at a later date. The use of all of the above options are however inadequate for coverage in large elbow wound defects and require more than 1 stage procedures in achieving full coverage. A free flap reconstruction still provides the best coverage with most flexibility of inset, allowing a superior outcome in complex, large defects at the elbow.

The supercharging of free flaps in the upper extremity is rarely reported in the literature from our search. Supercharging of an ALT flap in the upper limb has not been described before. Supercharging of a free flap refers to the anastomosis of an extra artery, vein, or both in order to increase the survival of flaps transferred.[13] With small flaps, this is often not necessary but in large flaps such as the ALT flap in this case, added arterial input and venous drainage will add an extra supply of arterial blood and venous drainage to the flap. The ALT flap is varied in anatomy and both the descending branch of the circumflex artery and the oblique branch with their respective perforators can supply the overlying flap independently from each other.[14] This makes this flap versatile and optimal in the resurfacing of large elbow defects while supercharging it using the radial artery and concomitant vein as well as the cephalic vein in the upper limb. The decision to perform a supercharged flap also saved the branch to the RF muscle instead of sacrificing it and we divided the flap proximal to the merging of oblique and descending branch.

The ALT flap hence is ideal for resurfacing large defects over the elbow and its anatomy and multiple source perforators allow the use of supercharging to enhance flap survival in the upper limb.

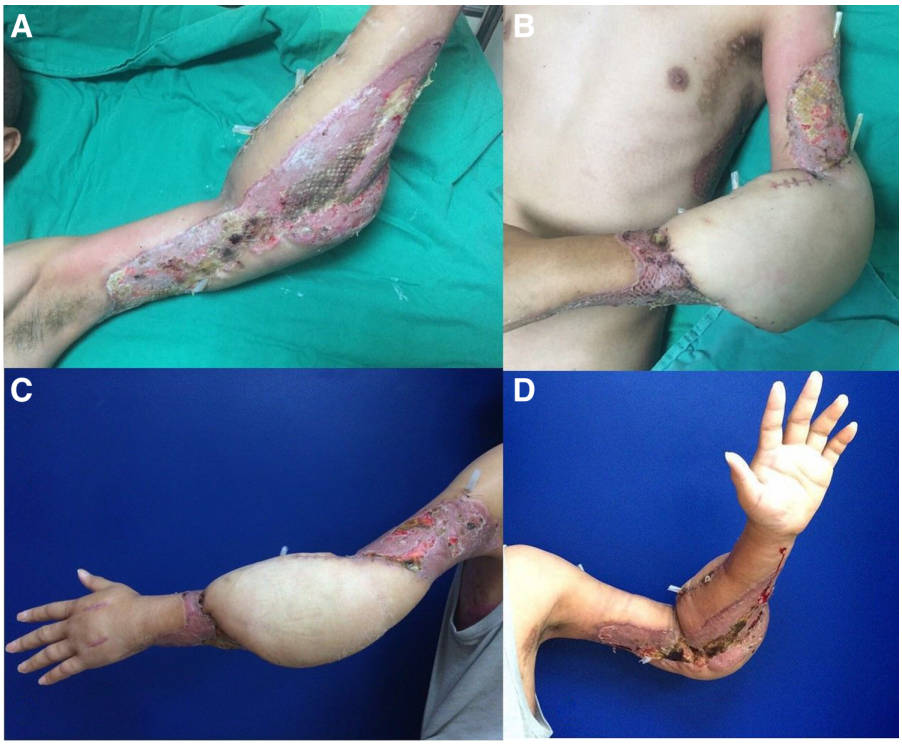

Figure 5. A, B. Reconstructed elbow in extension and flexion 5 days postreconstruction. C, D. Elbow extension and flexion 5 weeks postoperatively.

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