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# Successful Hand Replantation Augmented by Delayed Pedicled Fascio-Cutaneous Groin Flap in an Adult Laborer: A Case Report and Literature Review

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**Patient:** Male, 44-year-old  
**Final Diagnosis:** Amputated left hand distal to the wrist joint  
**Symptoms:** Amputated left hand distal to the wrist joint  
**Medication:** —  
**Clinical Procedure:** Replantation of amputated hand augmented with fasciocutaneous left groin flap  
**Specialty:** Orthopedics and Traumatology • Plastic Surgery • Rehabilitation • Surgery

**Objective:** Management of emergency care

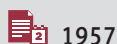
**Background:** Upper limb replantation has become an almost routine procedure, with digital and hand reattachments being the most commonly performed. These remain challenging procedures to reconstructive surgeons, especially when there is trauma to the detached limb. Injury to the overlying skin and soft tissue can lead to tissue necrosis, sepsis, and loss of the replanted limb. The use of skin grafts as well as a wide variety of muscular, musculo-cutaneous, fascio-cutaneous flaps, and free-transfer grafts has significantly diminished limb loss. We report on the use of a delayed fascio-cutaneous, pedicled groin flap to cover a defect on the dorsum of a hand replanted 6 weeks earlier.

**Case Report:** A right-hand-dominant male laborer had his left hand completely severed by a sharpened machete. This was surgically replanted with limb salvage but there was an area of denuded tissue on the dorsum, devoid of epidermal coverage. A fascio-cutaneous, pedicled rotational flap arising from the left groin was used as definitive cover for the defect. This flap augmented the replantation process by producing a functional and visually acceptable replant, allowing the patient to undergo rehabilitation and eventually return to the workforce.

**Conclusions:** The fascio-cutaneous, pedicled, rotational groin flap is a thin, pliable, but robust flap which covered the defect created by the initial injury with a protective tissue layer. It allowed free movement of the extensor tendons by creating a smooth surface over which they could easily glide with retention of near-normal, functional hand movement.

**Keywords:** Replantation • Soft Tissue Injuries • Surgical Flaps

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## Background

Successful hand replantation has been previously reported in the Caribbean by Naraynsingh and Moze [1] and there are anecdotal single-case reports from smaller islands in the region. Generally, these are complex procedures requiring meticulous techniques, especially if there is tissue loss during the injury. Small skin defects can be closed by split skin grafts or allowed to heal by secondary intention, but contracture formation can lead to unwanted scarring with compromised function. Failure to adequately cover exposed underlying tissue can lead to necrosis, sepsis, and, ultimately, limb loss [2].

With the underlying extensor tendons exposed, there was the need for skin cover as well as soft tissue cover to allow the extensor tendons to function unhindered. A split skin graft would have been insufficient functionally, so a flap was essential. A variety of flaps, such as muscular, musculo-cutaneous, adipofascial, fascio-cutaneous, or free (transfer) flaps, are universally available. Commonly used flaps are the radial artery perforator flap [3], the ulna artery perforator flap [4], the posterior interosseous flap [5,6], and adipofascial and fascio-cutaneous flaps [7]. The desired features would be the use of a flap that would be pliable, well-vascularized, non-bulky, but robust [8].

A fascio-cutaneous flap was considered, with the groin being chosen as the donor site, since, with the elbow flexed while sitting, the patient would replicate a common resting position without strain to shoulder or elbow. We herein present the use of a fascio-cutaneous pedicled groin flap for covering tissue defects such as denuded areas on the dorsum of the hand. We advocate its use as an effective method for skin and soft-tissue cover to complement hand replantation.

## Case Report

A 44-year-old right-hand-dominant male laborer was attacked by a known assailant who used a sharpened machete to completely sever his non-dominant (left) hand. He was taken to the local district health facility for immediate medical attention and the severed hand was located, placed in ice, and transferred with him to the nearest trauma hospital (Figure 1). Despite being placed in ice and not as per protocol in a bag “on ice”, the hand appeared grossly intact without ice crystal formation, so a decision was taken to replant. He underwent surgical resuscitation at the Emergency Department and had imaging of the residual right upper limb (Figure 2).

Four and a half (4.5) hours had elapsed since the incident. The cut was clean, but there was an injury noted on the dorsum of the hand (where the machete came in contact with the hand), and a decision to replant hand was taken. The surgical procedure was explained to the patient and relatives, with the possibility of failure to replant and, if replanted successfully, further surgery to allow for tissue coverage and to ensure maximum limb function. The patient consented to surgical repair and its consequences.

### Surgical Replantation and Wound Closure

After patient consent, the vessels were thoroughly flushed with heparinized saline to ensure they were patent and to avoid thrombus formation. Surgical replantation took the expected course of orthopedic stabilization first, followed by venous and arterial repair to allow perfusion to the now reattached hand. Nerve and tendon repair were performed and skin closure was done to complete the replantation process. There



Figure 1. Amputated left hand in ice bowl (A) palmar view (B) dorsal view.



**Figure 2.** X-ray of left forearm (A) lateral and (B) AP views showing amputation of hand distal to proximal rows of carpal bone.

was an area of denuded tissue on the dorsum, which was debrided and thus was devoid of epidermal coverage (**Figure 3**).

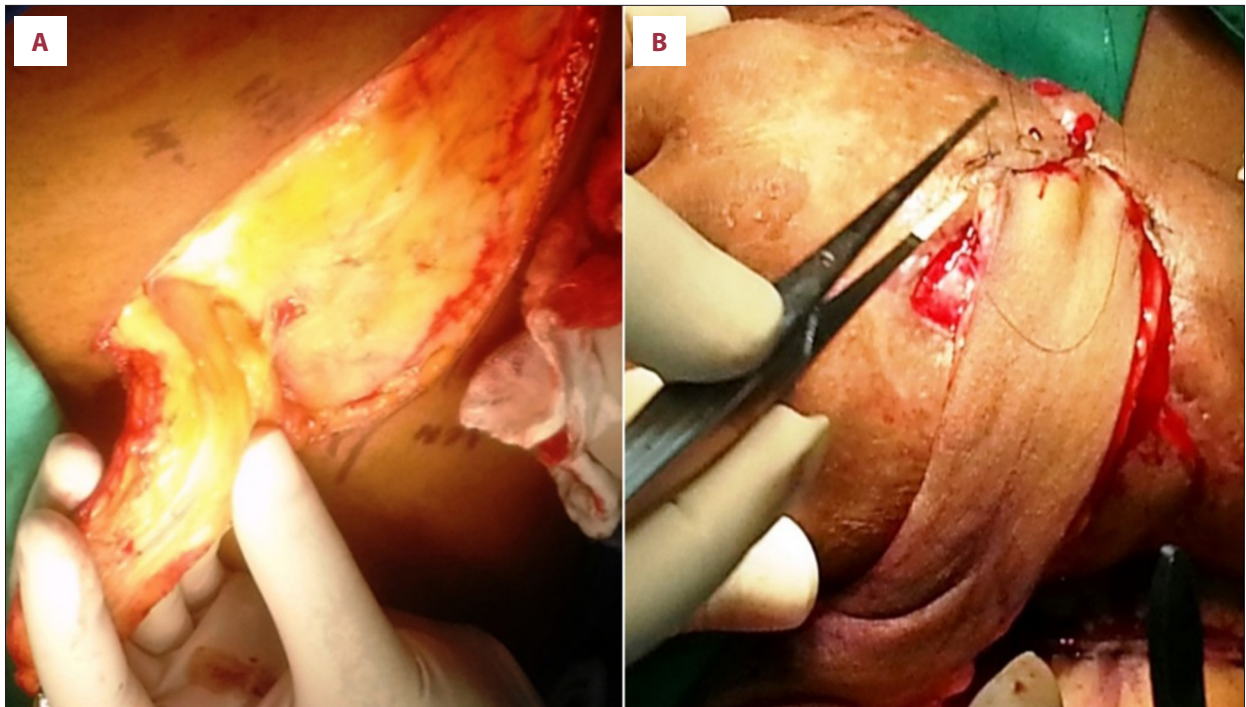
The hand appeared well perfused at 6, 12, and 18 h postoperatively, with good capillary refill and good Doppler signals over the radial and ulna arteries. Pulse oximetry saturation of all fingers ranged from 90% to 95% postoperatively, but this increased to 98% to 100% at 8 h as the hand became warmer.

The area of denuded tissue was a potential source of infection where the “dirty” machete came into contact with the skin. A wound swab was taken of the area and a split skin graft was used as a temporary cover to this area by the plastic surgery team. Several debridements were necessary before the wound



**Figure 3.** Photograph of left hand showing exposed extensor tendons.





**Figure 4.** Intraoperative photos showing (A) Raising of fascio-cutaneous left groin flap (B) Application of left groin flap over dorsum of left hand to cover the exposed tendons.

swab became negative for bacterial colonization (43 days after replantation). The wound looked clean and formal closure was considered. A fascio-cutaneous flap would be used as a rotational pedicled flap from his (ipsilateral) left groin, which would be applied to the denuded area and left in place for 2 weeks. An adequate blood supply would be provided to the area by the superficial circumflex iliac artery and veins.

#### **Surgical Technique: The Fascio-Cutaneous Fflap**

The pedicled groin flap based on the superficial circumflex iliac artery (SCIA) was harvested in standard fashion from lateral to medial, using the linear vascular axis of the flap approximately 1-2 cm below and parallel to the inguinal ligament. The length of the pedicled flap is estimated by taking into account the arc of rotation and distance from the source of its blood supply.

The oval shape of the flap was designed symmetrically and incised sharply down to the fascia over the sartorius muscle and this fascia was included in the flap (Figure 4). The vascular pedicle was mobilized as dissection proceeded from lateral to medial, with the visualized superficial inferior epigastric artery and vein. This fascio-cutaneous graft was then applied to the denuded area of the left hand and sutured in place, ensuring that the entire wound was covered (Figure 4). The pedicled flap was closed as a “tube” so that the pedicle from the groin was attached to the hand in close proximity, with the hand resting on the groin as it would in a normal posture. The

anatomical area of the groin was chosen as this would allow the patient, with elbow flexed, to be in a naturally relaxed position allowing close proximity of left hand to left groin (albeit for 14 days) while allowing patient mobility.

The flap was therefore created from the left groin and applied to the dorsum of the left hand and left in place for 2 weeks. The flap was viewed regularly and subsequently disconnected from the tubular pedicle, trimmed and shaped, and the groin wound closed.

The pedicled flap had 100% “take” and the patient suffered no untoward effects due to body positioning with the rotational flap. The long-term results were both functionally acceptable and aesthetically pleasing to the patient (Figure 5) since he was able to hold objects (Figure 6) and form a fist with his replanted hand.

#### **Postoperative Care**

The wound was dressed every 2 days after pedicle disconnection from the groin, with passive and active physiotherapy and the patient was kept in hospital to ensure the flap was viable, that the wounds healed well, and that active physiotherapy was performed. He was only allowed to go home after the donor site had fully healed and the flap viability ensured with an out-patient appointment for physiotherapy.



**Figure 5.** Post of photos of replanted left hand (A) palmar view (B) dorsal view.



**Figure 6.** Photo of the replanted left hand showing the patient's ability to hold a water bottle.

## Discussion

An amputation of the upper limb is a devastating injury and the subsequent replantation is a serious challenge to the reconstructive surgeon, with a range of difficulties greater than that encountered in replanting digits [9]. With modern surgical techniques, better outcomes are obtained, with even elderly patients having as good a chance of replantation as younger individuals [10]. Traumatic amputation may be accompanied

by mutilating injuries to soft tissue of the severed part, which leads to tissue necrosis and sepsis, and this is the most common cause of limb loss following replantation [2]. However, attention must be also paid to the existing residual 'stump' since its evaluation and treatment are also crucial to replant survival [11].

Wounds arising from traumatic injuries usually require surgical debridement, and after 2-3 procedures most wounds are ready for covering. Temporary covering can sometimes be achieved by split-thickness skin grafts (STSG), which can be taken up by the tissue as well as by vessels and nerves, even if wound is not quite clean [2].

There are a variety of grafts and flaps available as permanent cover for defects of the upper limb and the surgeon must weigh the benefits against disadvantages that can be predicted for any one procedure. Flaps can anatomically originate from the latissimus dorsi or scapular area, the lateral or medial arm, the forearm, or the groin [12]. Perforator flaps, musculo-cutaneous rotational flaps, fascial, adipofascial and fascio-cutaneous pedicled flaps, as well as free-transfer flaps can all be used to close these tissue defects [13].

Perforator forearm flaps such as the radial artery perforator flap [3] and the ulnar artery perforator flap [4] depend on perforators from the radial and ulna arteries, which work well if the zone of injury is limited and the blood supply around the defect is intact [13]. The posterior interosseous artery (PIA) flap is described as versatile and does not require sacrifice of any major artery [5,6], but these flaps would, by necessity,



arise from a limb just recovering from a traumatic injury. For a recently replanted limb, a flap taken from a distant source will have less effect on vascular supply than one that is taken from the injured limb itself.

Pedicled flaps are quite common, with those arising from the groin and abdomen considered the primary flaps [14]. Disadvantages include stiffness, patient discomfort, the need to divide flap, and the inability to elevate the limb after acute trauma [14]. Free flaps have now taken over the work once done by the pedicled flaps and are universally acceptable. However, where the free flaps are not possible or whenever they fail, the pedicled flaps are considered essential [15]. They are good at stump-coverage prior to transplant and can cover defects in digits, hands, or forearm [14]. These flaps are very versatile and although they require microsurgical technique, they do not require microsurgical sutures [16], and are quick and easy to “raise” [13]. Like the adipofascial flap, the soft tissue also adds to the vascularity of the area [7].

Since a good vascularized area tends to be more resilient to local bacterial colonization, a pedicled flap can provide permanent cover and can be used immediately or for up to 2-3 weeks after replantation. Fascial flaps can also be used as emergency free flaps to cover “vital” structures with good tissue cover and reduced chance of postoperative infection [17]. Some flaps, such as the temporo-parietal fascial free-flap, provide cover with flow-through revascularization even in wounds that are suppurative and necrotic [18]. In the presence of mild necrosis, after serial debridements, flap cover with either the latissimus dorsi or scapular muscles can prove effective, with full flap and replant survival without infection [19].

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Fascial flaps have the advantage of being robust but not bulky, as well as having a low incidence of donor-site complications [20]. The fascio-cutaneous flap created in our patient was thin and pliable, being able to cover the tissue defect on the dorsum of the left hand as well as the exposed tendons. It provided a friction-free surface over which the extensor tendons glided smoothly, enabling near-normal functioning of the replanted hand.

## Conclusions

We report on a technique that was used for tissue cover in a recently replanted limb by modifying the procedure to suit the patient's injury. The tissue defect on the dorsum of the hand was covered using a pedicled flap originating from a site distant from the zone of injury. This provided not only adequate skin and soft-tissue cover, but also a smooth surface for a good functional outcome. This procedure can be used universally for tissue cover in any recently replanted limb.

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## Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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