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Case Report

Sequential chimeric free deep circumflex iliac artery bone flap and superficial circumflex iliac artery perforator flap from the same site for one-stage reconstructions of severe hand injury: A report of two cases[☆]

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ARTICLE INFO

Article history:

Received 17 May 2020

Accepted 27 September 2020

Available online 2 October 2020

Keywords:

Bone loss

Complex tissue defects

Osteomyelitis

Skin defect coverage

Superficial circumflex iliac artery

Vascularized iliac bone graft

ABSTRACT

Two flaps, namely the free vascularized iliac bone graft supplied by the deep circumflex iliac artery (DCIA) and the superficial circumflex iliac artery perforator flap supplied by the superficial circumflex iliac artery (SCIA), can be individually harvested from a single surgical field. We report two cases treated by these free flaps for severe hand injury with large skin defect and osteomyelitis. Sequential chimeric flaps were anastomosed between the ascending branch of the DCIA and the SCIA. The advantage of this method is more freedom in the flap inset for complex tissue defects. For this reason, this method is also excellent for cosmetic appearance. Furthermore, donor site morbidity can be minimized because the flaps are harvested from the same site.

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[☆] Part of this work was announced in an oral presentation at the 20th Federation of European Societies for the Surgery of the Hand Congress in Milan, Italy, June 19, 2015.

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Introduction

When it is necessary to reconstruct skin and bone simultaneously, flexibility is required in terms of placement and direction of the skin and bone. Moreover, free movement can improve cosmetic appearance. The vascularized iliac bone graft supplied by the deep circumflex iliac artery (DCIA) and the superficial circumflex iliac artery (SCIA) perforator flap can be elevated individually from the ipsilateral side. We applied this chimeric flap to reconstruct skin and bone defects with osteomyelitis. The purpose of this article is to explain the usefulness of this method.

Case 1

A 34-year-old female experienced third-degree burn wounds on her right dorsal wrist from an electric heater while asleep (Figure 1). One month later, she was referred to our hospital. At the initial visit, these wounds were associated with the exposure of the ulnar head and the carpal bones with severe infection. Furthermore, her tendons became necrotic as a result of infection. The infection was initially controlled by frequent surgical debridement and antibiotic cement bead treatment.

We designed a large superficial circumflex iliac artery perforator (SCIP) flap that extends from the inside the groin to the outside of the iliac crest. The free vascularized iliac bone graft (FVIBG) and the SCIP flap, based on the medial superficial branch of the SCIA, were individually elevated from the same field, and they were applied as the chimeric one-pedicle-artery flap. The skin defect was covered by the SCIP flap, the osteomyelitis of the carpal bones was curetted, and the patient's wrist was fused using the FVIBG. The DCIA was not dissected far medially, maintaining the minimum

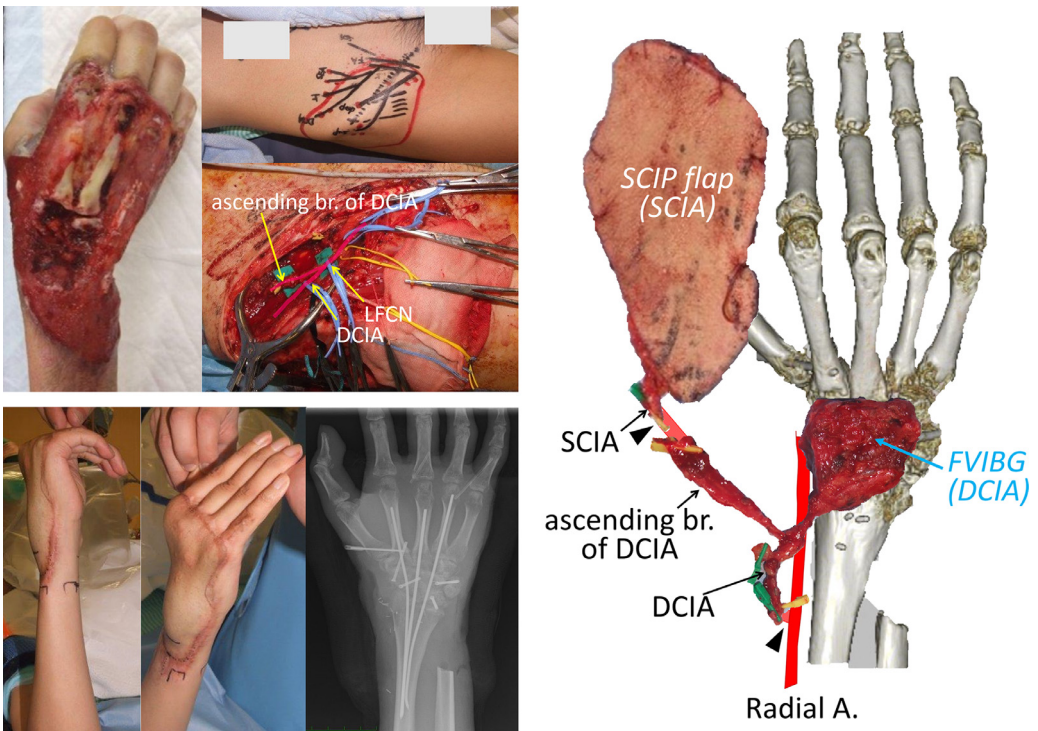


Figure 1. Case 1 was a 34-year-old female. The patient had osteomyelitis of her carpal bone and a large skin defect (upper left). The chimeric one-pedicle-artery flap consisting of the SCIP flap (13 × 9 cm) and the FVIBG (3.5 × 2 cm) were harvested from the same field (right). Black arrowhead indicates the arterial anastomosis site. LFCN, lateral femoral cutaneous nerve; FVIBG, free vascularized iliac bone graft.

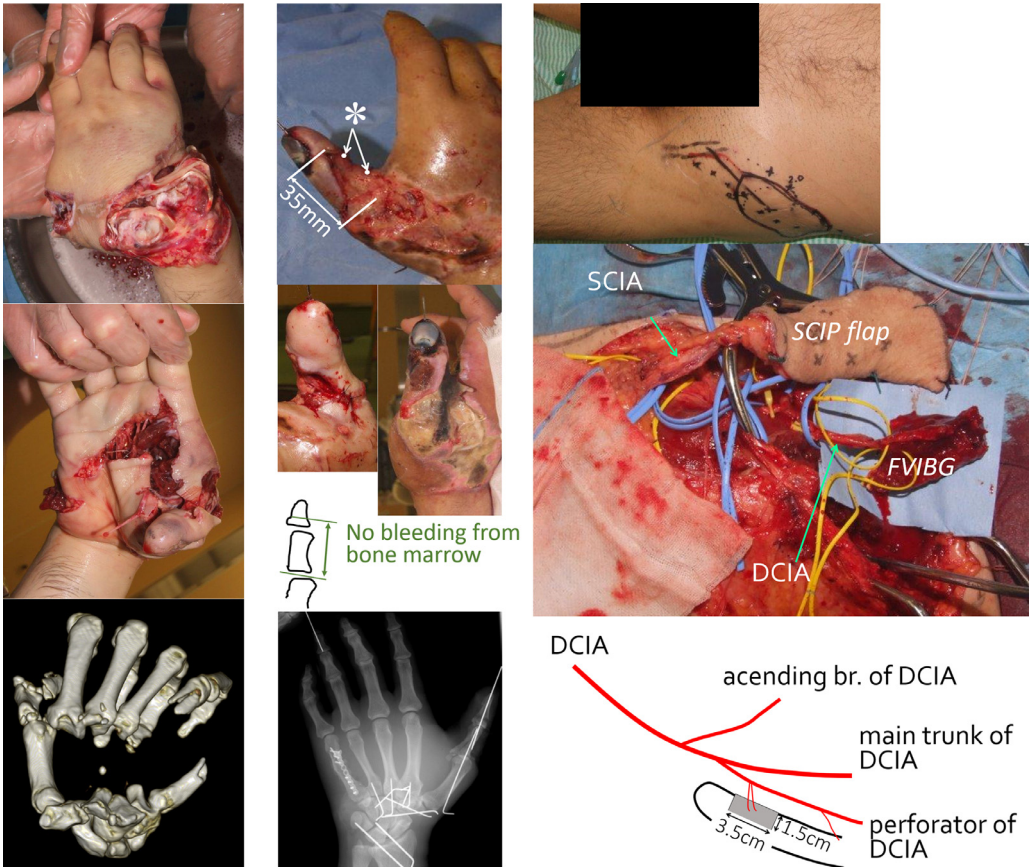


Figure 2. Case 2 was a 41-year-old male. This patient presented with severe trauma of the skin, bones, nerves, and vessels as a result of a degloving injury (left column). The proximal phalanx and skin around the thumb necrosed (middle column). * indicates where the ulnar digital artery of thumb was reconstructed with a vein graft. The chimeric one-pedicle-artery flap consisting of the SCIP flap (10 × 5 cm) and the FVIBG (3.5 × 1.5 cm) were harvested from the same field (right column). We harvested this FVIBG supplied by the perforator from main trunk of the DCIA. DCIA, deep circumflex iliac artery; FVIBG, free vascularized iliac bone graft.

exposure of the femoral nerve, and the inguinal canal was preserved. Only the inner table of the ilium was harvested. We performed end-to-side anastomosis between the radial artery and the DCIA, and end-to-end anastomosis between the ascending branch of the DCIA and the SCIA. The deep circumflex iliac and the superficial circumflex iliac vein were anastomosed to the dorsal forearm cutaneous veins, respectively, by use of end-to-end anastomosis. The procedure took approximately 12 h. The flaps of the skin and the bone survived. The patient started walking two weeks after surgery. At that time, she complained of a little tightness in the hip joint on the donor side of the graft, but could walk without pain. Subsequently, we performed a two-stage extensor tendon reconstruction using a silicone rod, and the extensor digitorum communis and extensor pollicis longus were reconstructed by tendon transfer using the flexor carpi radialis and palmaris longus respectively at the second stage.

Case 2

A 41-year-old male experienced a degloving injury on his right hand from a press machine. His injuries involved the fracture and dislocation of the carpus and phalanges, rupture of the radial artery

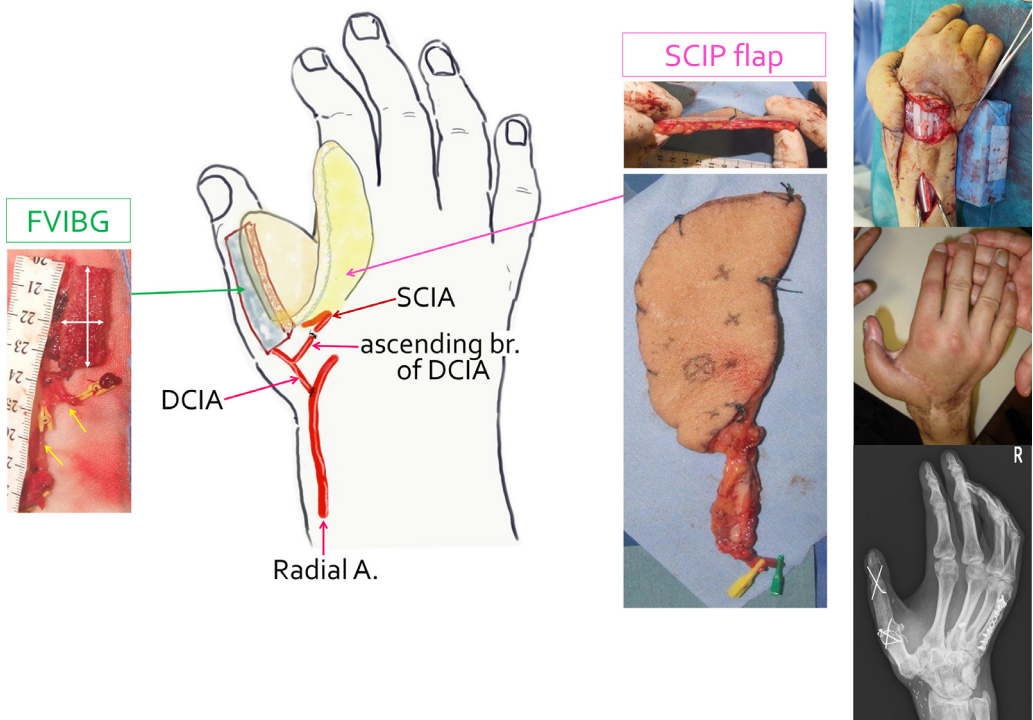


Figure 3. Case 2. We performed end-to-side anastomosis of the radial artery and the DCIA, and end-to-end anastomosis between the ascending branch of the DCIA and the SCIA. Two-stage extensor tendon reconstruction using a silicone rod and sheet (right column). DCIA, deep circumflex iliac artery; FVIBG, free vascularized iliac bone graft.

in the snuffbox, disturbance of blood flow, digital nerve injury of the thumb and index finger, and avulsion of the extensor tendons (Figure 2).

On the day of this accident, after debridement and osteosynthesis, the terminal branch of the radial artery was reconstructed using a vein graft between the snuffbox and the princeps pollicis artery, two dorsal veins were anastomosed using vein grafts, digital nerves were sutured, and the compartment of the forearm and intrinsic muscle of the hand were opened. Later, the skin defect was reconstructed using the SCIP flap, based on the medial superficial branch of the SCIA, and the proximal phalanx of the thumb was removed and reconstructed using the FVIBG because the skin damage was severe and no blood was being supplied to the proximal phalanx of the thumb except the distal phalanx. These two flaps were elevated individually from a single field to fabricate the chimeric flap supplied by one pedicle. We performed the same sequence of vascular anastomoses as described for case 1. The procedure took approximately 10 h. The patient started walking two weeks after surgery with the help of a walker and did not experience pain. Finally, we performed a two-stage extensor tendon reconstruction using a silicone rod and sheet, and the flexor carpi radialis was used as a motor with a plantaris tendon bridge graft at the second stage (Figure 3). After another 4 months, a lipectomy was performed.

Discussion

The vascularized iliac bone and skin supplied by the pedicled DCIA can be elevated en bloc. There have been some reports, however, indicating that when the perforator blood flow from the bone to the skin is insufficient, the skin flap causes necrosis but the iliac bone survives.^{1–6} Koshima et al., therefore, first reported that the vascularized iliac bone graft supplied by the DCIA and the groin

flap supplied by the perforator of SCIA were elevated en bloc, then the SCIA was supercharged by the ascending branch of the DCIA.⁶ The importance of microsurgical chimeric flap fabrication with a higher degree of freedom has been reported for the coverage of complex wounds in recent studies.⁷⁻⁸

In the present cases, it was very difficult to position them in the intended place when elevating the DCIA osteocutaneous flap as a unit because there was no freedom possible in the orientation of flap inseting and performance of the vascular anastomoses. Therefore, we first replaced the vascularized iliac bone to cover the curretted bone affected by osteomyelitis or no blood supply. We then covered the skin defect of the dorsal hand with the SCIP flap. The bone flap and the skin flap were independent, so we were able to arrange them as needed. The freedom of inseting the position and direction of the bone and skin flaps are increased, and the versatility is expanded, making this method cosmetically superior. The donor site scar was made less conspicuous by the use of underwear. Furthermore, donor site morbidity can be minimized because the flaps are harvested from the same site. Moreover, it is possible to elevate the two flaps safely as one pedicle artery by anastomosing the SCIA to the ascending branch of the DCIA. As alternatives to this method, the scapular osteocutaneous (OC) flap,⁹ fibula OC,⁹ and osteo-periosteal-cutaneous flap of the medial femoral condyle¹⁰ can elevate the bone and skin flaps separately as one feeding artery. However, it is important to use them according to the amount, shape, and size of bone or skin required. Thus, our method is superior when sufficient cancellous bone is required or when flat bone with the exposure of one-sided cancellous bone is required. The disadvantages of this method are a slight extension of operation time as a result of harvesting the two flaps and an increase in the number of anastomoses required. We believe, however, that the extended time can be minimized by harvesting from the same site.

Funding

None

Declaration of Competing Interest

None declared.

Ethical approval

Not required.

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