

Ethical approval

The study was approved by the Institutional Review Board of Yonsei University Medical Center (IRB No. 4-2017-0259) and performed in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained.

Patient consent

The patient provided written informed consent for the publication and the use of his image.

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Versatility of the reverse sural fasciocutaneous flap for the reconstruction of lower leg defects caused by chronic osteomyelitis

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Recently, many studies have shown no difference in efficacy between musculocutaneous and fasciocutaneous flaps in the treatment of osteomyelitis [1]. The aim of this study was to examine the efficacy of the reverse sural fasciocutaneous flap for the reconstruction of chronic osteomyelitis defects on the distal lower leg. Between March 2013 and March 2018, five adult patients aged 38 to 85 years who underwent reconstruction with a reverse sural fasciocutaneous flap were included in this study (Table 1). These patients were diagnosed with chronic osteomyelitis at the Department of Orthopedic Surgery of Myongji Hospital and were referred to the Department of Plastic and Reconstructive Surgery for reconstruction of the soft tissue defects. Delayed distally-based fasciocutaneous reverse sural flaps were used in a 2-step procedure [2]. The patients were followed in our outpatient clinic and their healing status was quantitatively compared with previous findings by 3-phase bone scans, which all patients agreed to have performed for postoperative follow-up. Four of the five patients recovered progressively from osteomyelitis without complications, such as necrosis of the distal aspect of the flap or marginal dehiscence. These patients showed clinical resolution at the time of the last

Images

Patient no.	Age (yr)/sex	Diagnosis	Risk factors	Delay period (day)	Size of the flap (cm ²)	Complications	Duration of follow-up (mo)
1	68/male	Chronic osteomyelitis on the lateral malleolus caused by abscess formation	None	11	9 × 3	None	6
2	38/male	Chronic osteomyelitis on the calcaneus caused by surgical site infection	Smoker	10	14.5 × 4	None	7
3	62/male	Chronic osteomyelitis on the first metatarsal bone caused by diabetic foot	Diabetes mellitus, smoker	14	5 × 4	None	18
4	85/male	Chronic osteomyelitis on the tibia caused by an open tibiofibular fracture	Old cerebral infarction, peripheral arterial occlusive disease	15	12.5 × 5	None	6
5	65/male	Chronic osteomyelitis on the calcaneus caused by diabetic foot	Diabetes mellitus	14	15 × 6.5	Bone necrosis	12

follow-up examination (Figs. 1-4). Complications such as necrosis and marginal dehiscence in the distal area often occur in reconstruction using a reverse sural flap. The authors performed a delayed procedure to overcome this and superficially undermined the proximal portion of the pedicle to protect the pedicle from twisting or kinking. However, in one case, chronic osteomyelitis had already progressed to bone

necrosis and the patient underwent antebread insertion and a planned reoperation. The mean duration of follow-up for these patients was 9 months. During the follow-up of patients with 3-phase bone scans, the significant soft tissue uptake and increased blood flow due to the inflammatory reaction subsided gradually, and in cases with good results, these results disappeared completely. A reverse sural flap can be

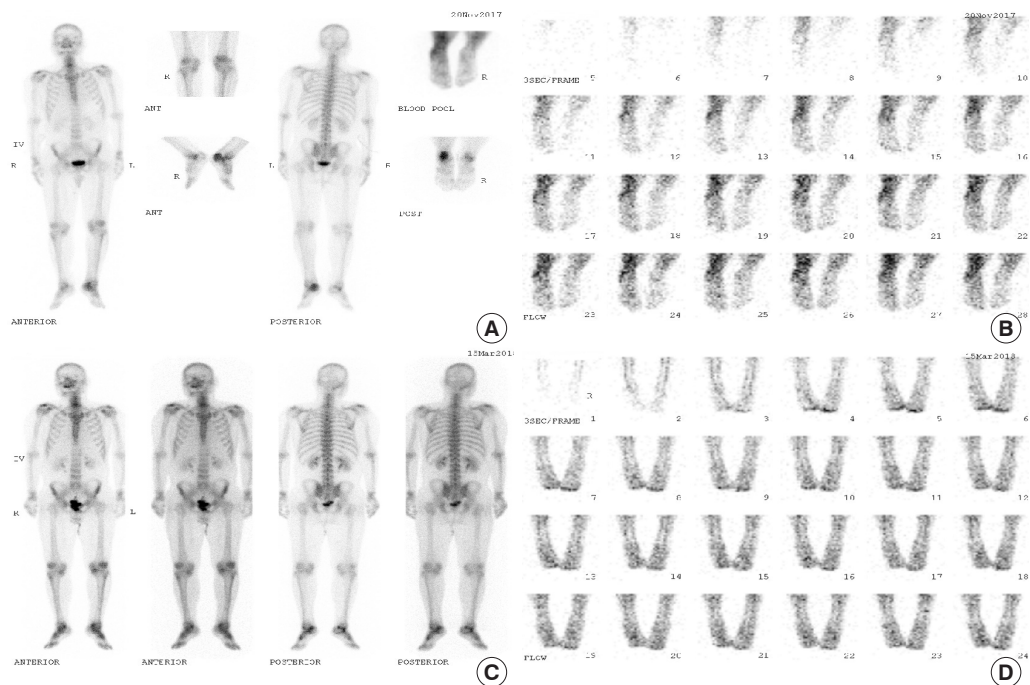


Fig. 1.

(A) Preoperative findings of case 1. Defect wound caused by chronic osteomyelitis on left heel. (B) Flap migration by minimizing twisting and kinking of the pedicle. (C) Inset of the flap. (D) Six months after surgery.

Fig. 2.

(A, B) Preoperative 3-phase bone scan findings of case 1. Increased blood flow and soft tissue uptake in left foot. Focal increased uptake in left calcaneus on delayed bone scan. Suggestive of osteomyelitis (a 68-year-old male patient, there was an sprain on left ankle 1 month before flap surgery, after that I&D was performed due to abscess formation, and thereafter, about 3 cm sized soft tissue defect had remained). (C, D) Three-phase bone scan findings of 4 months after surgery. No significant increased blood flow or soft tissue uptake in left foot. No significant uptake on delayed bone scan. Resolved state of previous inflammation in left calcaneus.



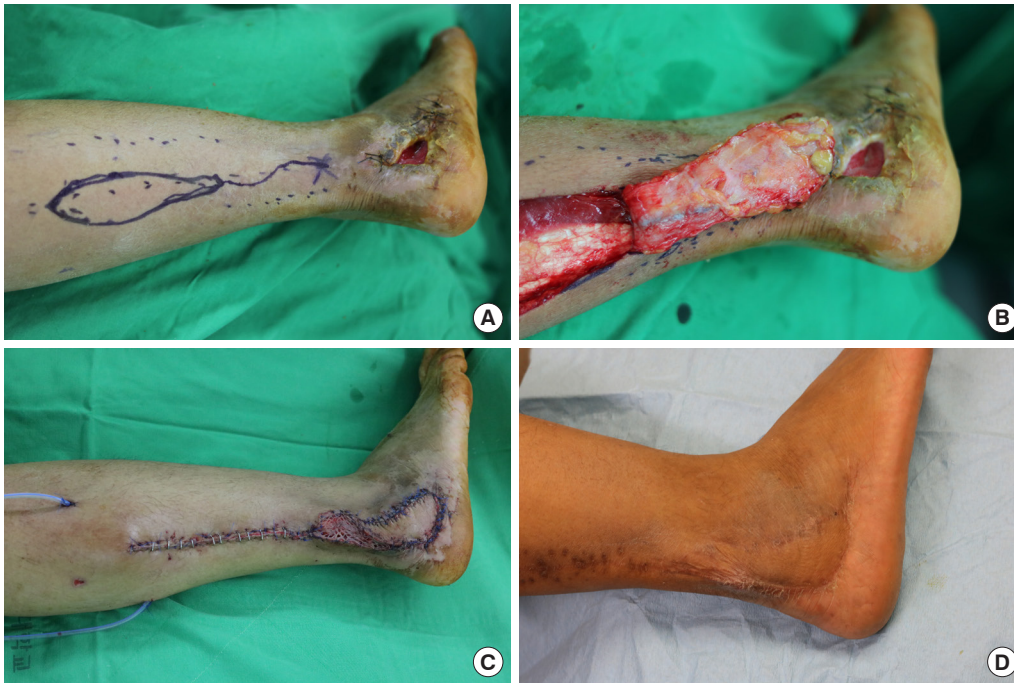


Fig. 3. (A) Preoperative findings of case 2. Wound dehiscence after internal device removal surgery and defect wound caused by chronic osteomyelitis on right heel. (B) Lesser saphenous vein and sural nerve was included in the pedicle. (C) Inset of the flap with minimizing twisting and kinking of the pedicle. (D) Six months after surgery.

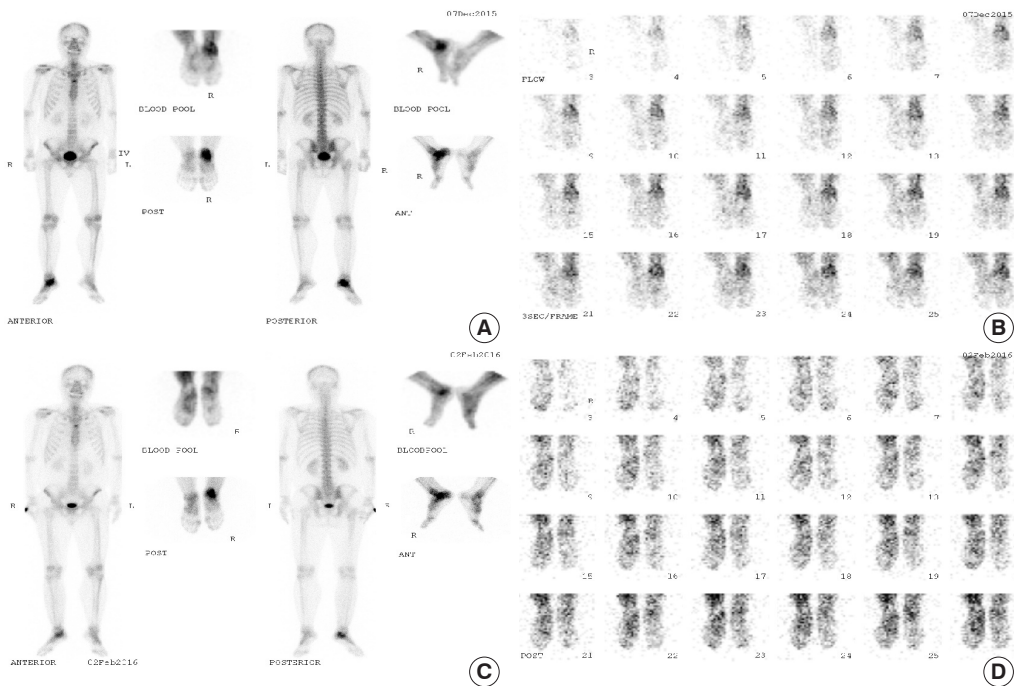


Fig. 4. (A, B) Preoperative 3-phase bone scan findings of case 2. Increased blood flow and soft tissue uptake in right heel with increased uptake on delayed bone scan, suggestive of osteomyelitis (a 38-year-old male patient underwent internal fixation of the calcaneus fracture 2 years before the flap surgery, and internal device removal 2 months before the flap surgery). (C, D) Three-phase bone scan findings of 1 month after flap surgery. Decreased blood flow in right foot, decreased extent of increased soft tissue uptake in right heel, suggestive of improving process of osteomyelitis.

used to effectively treat chronic osteomyelitis without significant donor site morbidity or the complications that may occur during the elevation of a muscle flap [3]. This widely known flap is much simpler, requires less anesthetic time, and poses less risk to the patient than free tissue transfer, including muscles. Therefore, this flap may be a good option for the reconstruction of chronic osteomyelitis wounds on the lower leg.

Notes

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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Patient consent

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Vastus intermedius–anterolateral thigh chimeric free flap for lower extremity reconstruction

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Generally, for the chimeric anterolateral thigh (ALT) flap, the vastus lateralis (VL) muscle is simultaneously harvested with a skin paddle [1,2]. However, it may be difficult to use an ALT chimeric flap including the VL if the distance between the defects is too great.

The vessels that flow into the VL are located near the perforator that runs from the descending branch of the lateral circumflex femoral artery (LCFA-db) to the skin paddle. On the other hand, the vastus

intermedius (VI) is a type II muscle, for which the dominant pedicle is supplied by the LCFA-db and the minor pedicle is supplied by the profunda femoris and superficial femoral arteries. Moreover, the main pedicle branches from a site approximately 7-cm distal to the site where the descending branch originates from the LCFA and enters the VI, while small vessels from a more distal descending branch supply blood to the muscle [3]; thus, a chimeric flap that includes the VI muscle can be an option in the reconstruction of two defects far from each other.

A 65-year-old man had two defects ($17 \times 8.5 \text{ cm}^2$, $7 \times 3.5 \text{ cm}^2$) on the distal tibia and lateral foot. The distance between the two defects was 9 cm (Fig. 1). We planned a chimeric free flap intraoperatively. After elevation of a fasciocutaneous flap, a branching point at approximately 3.5 cm distal to where the LCFA-db originated from the VI was identified, after which a muscle flap was elevated (Fig. 2). The pedicle was microanastomosed to the anterior tibial vessels. The muscle component was covered by skin grafting and the donor site was primarily closed. The patient was followed up for 6 months after surgery, during which time he showed good recovery with no wound problems or contour abnormalities (Fig. 1B).

The VI muscle–ALT chimeric free flap was able to achieve favorable outcomes with minimal donor site morbidity in the reconstruction of multiple defects that are far apart.



Fig. 1.

There were two defects on distal tibia and lateral foot, approximately 9 cm apart. (A) An open wound ($17 \times 8.5 \text{ cm}^2$) including necrotic tissue on the lateral side of foot, another open wound with bone exposure ($7 \times 3.5 \text{ cm}^2$) on the superomedial side of right distal pretibia. (B) Six months postoperatively after the vastus intermedius–anterolateral thigh chimeric free flap.