

Successful reconstruction of osteocutaneous defect of calcaneal area with allogeneic bone graft and anterolateral thigh flap

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ABSTRACT

Calcaneus is a unique-shaped hindbone, therefore the reconstruction of complex osteocutaneous defects of heel-calcaneal area remain challenging. Management of a complex defect in the complicated calcaneal area with allogenic tibia and free anterolateral thigh flap is presented. A 37-year-old male patient was presented with a heel defect after a mine injury. The patient underwent serial debridement, thereafter allogeneic proximal tibia defect was properly shaped, hammered and forged into the tibia medullary defect without any fixation material. The graft was covered with free sensate anterolateral thigh flap. The most important disadvantage of allogeneic bone grafts is the lack of blood supply. In the presented case, the blood supply of the bone graft was provided thanks to the blood supply from the medulla of the tibia. Therefore, it was possible to pass the blood inside the allograft. It can be predicted that this intramedullary vascularization also carries stem cells into the medium, further triggering recovery and regeneration.

Key words: *Anterolateral thigh flap, bone graft, calcaneus, defect, heel*

Introduction

Calcaneus is a load-bearing hindbone known for its unique shape. Therefore, the reconstruction of bone defects in the calcaneus presents quite a challenge for the orthopedic surgeon. Owing to the complexity of the heel-calcaneal area, both the bone and the skin need

to be repaired, while maintaining the gait function. It is therefore inevitable to lose the height of the foot, unless the bone defect in the calcaneal region is repaired. There is a lack of single and absolutely successful technique for calcaneus repairs [1]. For this reason, various techniques have been attempted in the research works

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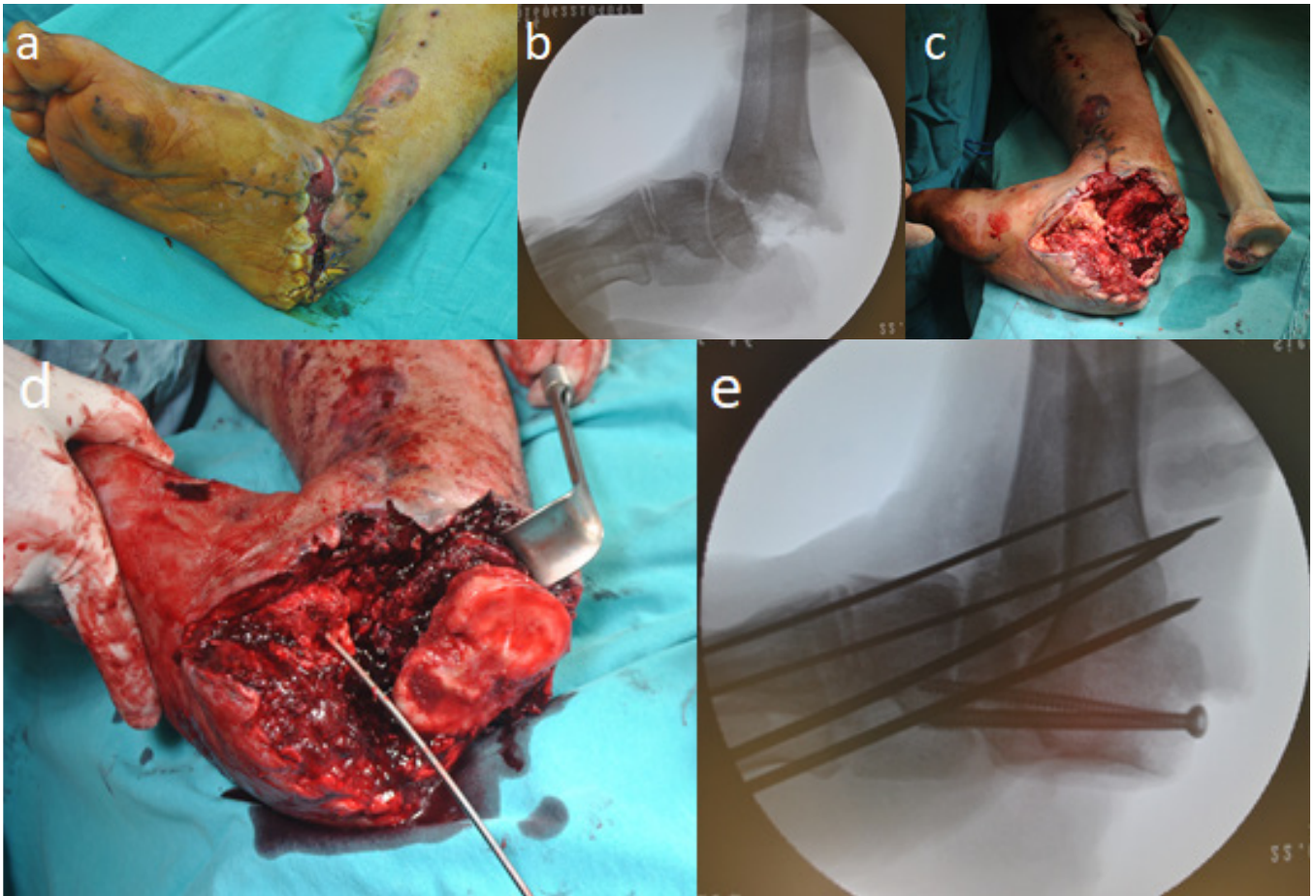


Figure 1. (A) The calcaneal region defect (B) Calcaneus defect (C) The blood supply from the medulla of the tibia and the nonshaped tibia allogeneic bone graft (D) The allograft is shaped and adapted to the defect (E) Postoperative calcaneal repair.

for the repair of calcaneal defects [2,3]. However, deficiency in the surrounding covering tissue has emerged as one of the difficulties during the repair of calcaneal defects. Complex defects in the calcaneal area, including bone and soft tissue, are often caused by traffic accidents, diabetes, or war injuries. Therefore, it is essential to overcome infection in the complex defects of the calcaneal area [4]. Infection, soft tissue defects, and bone defects complicate the repair of calcaneus, which has a unique shape and load-bearing ability.

Management of a complex defect in the complicated calcaneal area with allogeneic tibia and free anterolateral thigh (ALT) flap is presented.

Case Report

A 37-year-old male patient was presented with a heel defect after a mine injury. The patient underwent

serial debridement and, thereafter, the administration of broad-spectrum antibiotics was started. The calcaneal defect was 6x8 cm in size, and the soft tissue defect was 8x18 cm in size. Calcaneal reconstruction was planned after ruling out the possibility of infection. Allogeneic proximal tibia graft was prepared in the appropriate size, shape, and position as per the dimensions of defect. The graft was adapted to the tibia medullary defect via hammering and forging without the need of any fixation material. A second team planned a free sensate ALT flap for the soft tissue repair. The descending branch of the lateral femoral circumflex artery on the thigh was dissected in the suprafascial plane until the appropriate diameter was obtained and adapted to the recipient area. End-to-end neurotomy was performed for the lateral femoral cutaneous nerve and one of the branch-

es of the posterior tibial nerve. The administration of IV Heparin 5000 IU/ day was started postoperatively. Full weighting was achieved after ten weeks. Follow-up of the patient was done for four months. At the postoperative fourth month, the patient was able to put a load on his heel and walk without any problems or special shoes. The bone union was obtained, and the cosmetic result was satisfactory. The American Orthopedic Foot and Ankle Society Ankle-Hindfoot Scale showed a score of 85/100 (Pain:40/40, Function:35/50, Alignment:10/10). No complications, such as resorption, infection, or extrusion, were reported.

Discussion

Complex repairs of the calcaneal region require versatile thinking and successful planning. Controlling the infection needs to be the first step of this process. Gustilo-Anderson type 3B calcaneal fractures have the highest infection rates, and these rates can reach up to 60% [4]. Such an injury involves an open calcaneal fracture in which the periosteum is injured, along with the loss of the covering soft tissue. Calcaneal defect may occur as in the presented case. In the repair of these complex calcaneal defects, a simple closure is impossible because the bone needs to be shaped in the appropriate way as per the architecture of the bone. More importantly, the bone should be adapted to the foot area that had lost its projection and height. Moreover, this bone should be able to bear various loads. In the literature, free flaps such as free fibula flap and free iliac bone flap have been used for this purpose [4,5]. Allogeneic bone graft was employed in this case.

Historically, autogenic bone grafts are known as the gold standard for foot and ankle reconstruction surgeries [6]. Allogeneic bone grafts were then presented as a first-line alternative to the autogenic bone graft [7]. Allogeneic bone grafts are less cost-effective but are easily accessible and easy-to-use. In the literature, union rates are shown to be high [6]. Combinations with a vascularized bone, bone morphogenic protein

and mesenchymal stem cells have been performed in the research works in order to increase the success of allogeneic bone grafts [4,6]. However, it should never be used in the presence of an existing or potential infection. Infection must be ruled out in these cases. In this case report, after ruling out the infection with serial debridements and administration of broad-spectrum antibiotics, the definitive reconstruction procedure was performed.

The most crucial disadvantage of allogeneic bone graft is the lack of blood supply. In the literature, pedicle transfer methods have been introduced for the allogeneic bone graft in order to obtain a vascularized bone graft. In the presented case, the blood supply of the bone graft was provided thanks to the blood supply from the medulla of the tibia. Therefore, it was possible to pass the blood inside the allograft. It can be predicted that this intramedullary vascularization also carries stem cells into the medium, further triggering recovery and regeneration.

Reconstruction with a well-blooded tissue on the allograft is needed. ALT flap was preferred in the presented case. Various free flap recommendations for the reconstruction of heel have been presented and are still being presented in the literature, thereby indicating that the most reliable and most functional repair method for the complex repair of the calcaneus region has not been achieved yet [8]. In the literature, the muscle flaps combined with skin grafts and fasciocutaneous flaps are the two most commonly used reconstruction options [9-11]. The meta-analysis of Fox et al. found no difference among the parameters, such as revision, ulceration, and use of special shoes, for both flaps [11]. The reason for the choice of ALT flap in this study is the requirements of the defect and the experience of the surgeons. The ALT flap was not dissected subfascially, but it was dissected suprafascially in order to eliminate the slippery effect of the fascia on the heel. Free flap with sufficient skin and subcutaneous tissue to cover the allograft was thought to be the safer option to repair the defect.

Allogeneic bone graft vascularized with tibia nutrient artery and combined with free ALT flap has provided a safe, functional and load-bearing repair for the complex defect of the calcaneal area.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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