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Case Report

Ten-year outcome of unilateral leg replantation after bilateral lower leg amputation following traumatic injury: A case report

Ryo Fujimura^{*}, Keisuke Adachi, Hisakazu Shitozawa, Masahiro Kiyono, Yosuke Fujii, Yasuyuki Shiozaki, Ryozo Sato

Department of Orthopedic Surgery, Mitoyo General Hospital, Kagawa, Japan

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ABSTRACT

The absolute indications for lower limb replantation are not unequivocally established; rather, this procedure is still challenging and controversial. We report a case of a young male who underwent bilateral leg amputation, followed by unilateral replantation. The patient demonstrated good 10-year outcomes. A 23-year-old man had both of his lower legs crushed by heavy machinery that fell from the back of a truck, leading to amputation of bilateral lower limbs. Although bilateral amputation was recommended due to severe contusion on both sides, the patient and his family strongly requested replantation of the right leg, and surgery was started approximately 3 h after the injury. In addition to the emergency replantation, six surgeries were performed thereafter. Five months after the first surgery, the patient was fitted with a left lower leg prosthesis and started gait training. He was discharged 8 months later. Ten years after the replantation, the patient is satisfied with his leg. He has a normal gait with a prosthesis and has integrated into society with no functional deficit. There are still no clear standards for replantation after leg amputation, and individual decisions must be made based on the severity of the injury and the patient's general condition. In this case, we respected the patient's strong will to preserve the right leg and decided on the treatment plan. As a result, the patient was highly satisfied, and the spared right leg facilitated the patient's physical and mental recovery.

Introduction

The indications for lower limb replantation are still controversial. This is due to the complexity and difficulty of the replantation procedure and its various complications, as well as the improvements in prosthetic limbs in recent decades. The absolute indications for replantation are not unequivocally established; thus, patients must be carefully selected. According to the literature, the main criteria that should be met to decide on replantation of an amputated lower limb are the patient's age, general condition, ischemia time, type and extent of tissue damage, and requirement for bilateral amputation [1]. However, the most important consideration is the will of the patient and their family. They must be made aware of the treatment options, surgical complications, and postoperative outcomes to make informed decisions regarding replantation. There are few reports in the literature regarding the long-term outcomes of replantation after leg amputation in adults. Herein, we report a case of bilateral leg amputation in a young male who underwent left-sided replantation. The patient experienced good 10-year outcomes.

^{*} Corresponding author at: Department of Orthopedic Surgery, Mitoyo General Hospital, 708 Himehama, Toyohama, Kanonji, Kagawa 769-1695, Japan.

E-mail address: rfjmr.ortho@gmail.com (R. Fujimura).

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Fig. 1. Injury to the right lower leg. Traumatic amputation at the ankle joint.

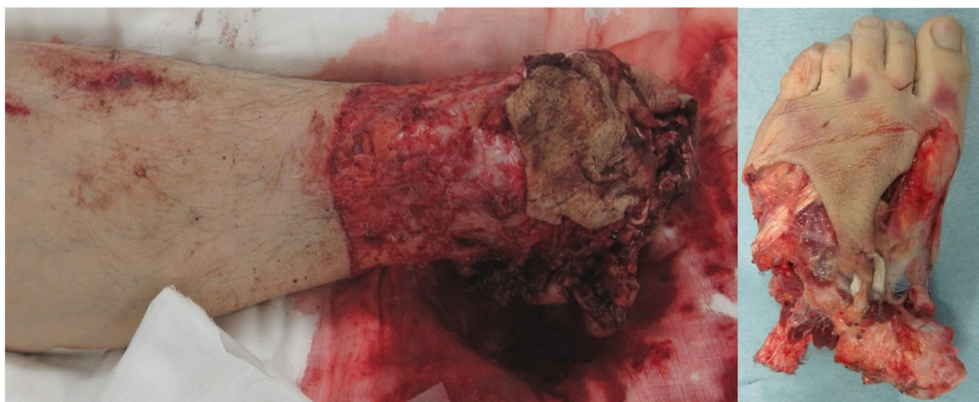


Fig. 2. Injury to the left lower leg. The left leg was more severely crushed than the right leg.

Case presentation

A 23-year-old man had both of his lower legs crushed by heavy machinery that fell from the back of a truck, leading to amputation of the bilateral lower limbs. The patient arrived at the hospital about 50 min after the injury. On arrival, he was awake (Glasgow Coma Scale score = 15). He was transiently hypotensive, but he responded to crystalloid and blood products. The right leg was amputated ankle joint with severe soft tissue damage and distal 1/3 of the tibial diaphysis was open fracture (Fig. 1). There was no strong contusion of the foot. The left lower limb was even more severely crushed than the right (Fig. 2). The Mangled Extremity Severity Score (MESS) was 7 (skeletal/soft tissue = 3; ischemia = 3; shock = 1; age = 0). There were no other associated injuries. The patient was advised to undergo a below-knee amputation based on clinical judgment, functional prognosis, and expected need for multiple surgeries. However, the patient and his family did not agree and requested that we proceed with a trial of right leg replantation.

The patient was immediately transferred to the operating room and put under general anesthesia. Surgery was performed 3 h after the injury. Stabilization of the ankle joint was performed first, using two Kirschner wires inserted from the calcaneus to the tibia. The



Fig. 3. Real-life images and X-ray images after the primary surgery.

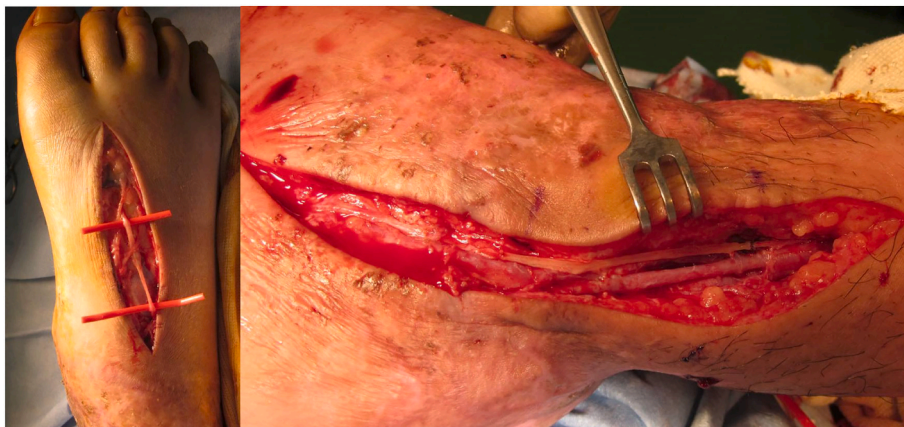


Fig. 4. Grafting of the peroneal nerve to the tibial nerve.

Table 1

Seven surgeries were performed after the injury.

Surgery no.	Length of time after first surgery	Surgical procedure
1	0	Amputation
2	1 month	Debridement
3	2 months	Split-thickness skin graft
4	5 months	Tibial nonunion surgery (debridement + intramedullary nail)
5	7 months	Nerve grafting (peroneal nerve to tibial nerve defect)
6	4 years	Arthroplasty of hallux interphalangeal joint
7	6 years	Mobilization of the proximal interphalangeal joint

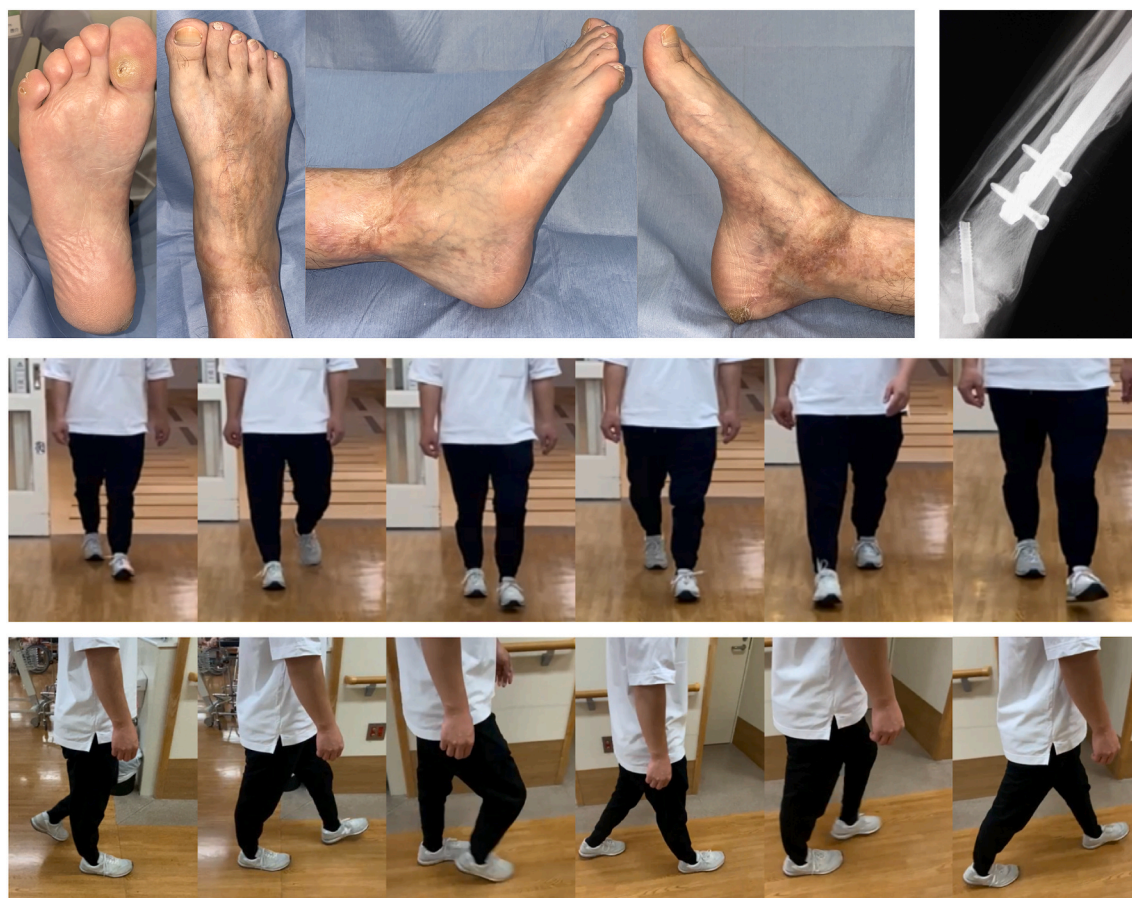


Fig. 5. Real-life images and X-ray images at the time of final observation.

blood vessels were then explored, and end-to-end anastomoses were performed for the posterior tibial artery, anterior tibial artery, posterior tibial vein, and great saphenous vein (Fig. 3). For the skin that could not be closed, a full-thickness skin graft was obtained from the left amputated limb. Revascularization was completed 6 h after the injury. The left leg was amputated simultaneously. To prevent thrombosis, heparin sodium and urokinase were used for 1 week after surgery. No complications, such as bleeding tendency or thrombus formation, were observed. After the first surgery, six further surgeries were performed (Fig. 4, Table 1). Five months after the first surgery, the patient was fitted with a left lower leg prosthesis, started gait training, and was discharged 8 months later. Although there were some sole callosities, he regained plantar sensation, and no ulcers or foot deformities occurred. Ten years after replantation, the patient was satisfied with his leg. He had a normal gait with a prosthesis and had integrated into society with no functional deficit (Fig. 5).

Discussion

Lower leg trauma requiring amputation is rare, but it continues to be a challenging condition to treat. The indications for replantation of the lower limb are not clearly defined. The most commonly used scores for severe limb trauma in the literature are the predictive salvage index (1987), the MESS (1990), and the limb salvage index (1991). However, all of these scores were developed more than 20 years ago [2]. In the present case, amputation was recommended because the MESS was >7 points, but the patient strongly requested at least one replantation, which resulted in a good outcome [3]. Recent reports have suggested that the sensitivity of the MESS is 46%, which is insufficient to predict amputation. Moreover, limb salvage is possible even with a MESS of ≥ 7 points [4,5]. An increasing number of reports have used the Ganga Hospital open injury score (2006) and the Orthopedic Trauma Association Open Fracture Classification (2010) as indicators of amputation or preservation. However, in any case, there is no clear evidence, and it is up to the physician to decide. The success rate and outcome of replantation after leg amputation have markedly improved [1,6,7]. For example, in their 2009 study, Cavadas et al. reported the outcomes of 13 amputations. They reported a survival rate of 100% and good or excellent clinical results in 92% of lower leg replantations. The conditions for replantation were that the sole of the foot was intact and the tibial nerve could be directly repaired. The tibial nerve is the most important nerve for lower leg function. The foot and the sole of the foot must give adequate sensory feedback to the patient, which is an important protective mechanism. In the present case, we

grafted the peroneal nerve to the tibial nerve defect within 8 months, and the patient achieved full sensory recovery, with adequate feedback. In most cases of limb salvage with standard tibial nerve repair, the chances of regaining plantar sensation are good [7]. Although there are only limited reports on the long-term postoperative course of adult patients, these reports show good outcomes [8,9]. However, replantation in patients aged >50 years is associated with many postoperative complications, but successful cases have been reported in children. In addition, it has been reported that bilateral amputation has a better outcome if one limb is salvaged [1,10].

Conclusion

There are still no clear indications for leg replantation. Rather, the decision must be made on a case-by-case basis according to the circumstances of the amputation and the patient's general condition. Replantation should be attempted whenever possible and feasible, especially in young people undergoing bilateral amputation. In this case, we respected the patient's strong will to preserve at least one leg. As a result, patient satisfaction was very high, and the spared right lower leg facilitated the patient's physical and mental recovery.

Patient consent

Consent to publish the case report was not obtained. This report does not contain any personal information that could lead to the identification of the patient.

Declaration of competing interest

None.

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