The Journal of Foot & Ankle Surgery 54 (2015) 994–1000

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Reconstruction of the Pediatric Lateral Malleolus and Physis by Free Microvascular Transfer of the Proximal Fibular Physis

Christopher Bibbo, DO, DPM, FACFAS [1], David A. Ehrlich, MD [2], Stephen J. Kovach III, MD [3]

[1] *Chief, Foot and Ankle, Limb Preservation/Microsurgery, Department of Orthopaedics, Marshfield Clinic, Marshfield, WI*
[2] *Clinical Assistant Professor, Department of Surgery, Division of Plastic Surgery, Thomas Jefferson University Hospital, Philadelphia, PA*
[3] *Associate Professor, Department of General Surgery, Division of Plastic Surgery and Department of Orthopedic Surgery, Hospital of the University of Pennsylvania, Philadelphia, PA*

ARTICLE INFO

Level of Clinical Evidence: 4

Keywords:
free flap
free physis transfer
microsurgery
pediatric ankle valgus
sural flap
trauma

ABSTRACT

Traumatic injury to the pediatric growth plate can result in growth disturbances, late angular deformity, and limb length inequalities. Complete traumatic loss the entire growth plate complex (physis, epiphysis, and distal metaphysis) of the ankle can lead to severe joint instability and loss of function. In the growing child, physeal preservation is paramount; however, the reconstructive options are limited. We report a case of post-traumatic loss of the distal fibular physis resulting in severe ankle valgus in a pediatric patient after a Gustilo grade 3B open injury. Ankle valgus secondary to post-traumatic necrosis of the lateral ankle physeal complex was successfully managed by microvascular free transfer of the ipsilateral proximal fibula physis. The 24-month follow-up examination demonstrated continued growth of the free vascularized physeal graft and a stable ankle. The donor site had healed without incident. The patient was able to return to age-appropriate play, sports, and social integration.

Traumatic growth plate injuries often pose problematic sequelae in the form of angular deformity and limb length inequality. Depending on the child's age, growth plate disturbances can be mitigated using epiphysiodesis, serial casting, or bracing or allowing the growth disturbance to take its course, with the resulting angular deformity compensated by adjacent joint segment motion. Corrective osteotomies can also be performed when the patient is a young adult. However, in young children, the complete loss of the physis can become more problematic, because the years of continued growth and development without a growth plate will result in significant loss of limb length and severe joint angulation or even complete subluxation within a very short period. Thus, preservation of the physeal complex in young children becomes a priority that is difficult to achieve. We report the case of a 6-year-old male with early, symptomatic ankle valgus due to post-traumatic avascular necrosis of the distal fibular component of the ankle joint that was successfully managed (by the senior author [C.B.]) with a free microvascular transfer of the ipsilateral proximal fibular growth plate complex and soft tissue coverage with a supercharged reverse sural flap. At the 24-month follow-up point, the patient continued to have a stable ankle with a growing distal fibula. The investigation was performed at Marshfield Clinic, in Marshfield, Wisconsin.

Case Report

A 6-year-old male experienced Gustilo grade 3B open fractures of the tibial shaft, ankle growth plates, and Lisfranc complex of the foot (Fig. 1) from a riding lawn mower accident. He also had significant tissue loss over the anterior and lateral ankle and foot (Fig. 2). After serial irrigation and debridement, osseous fixation of the Lisfranc injuries was accomplished using bioabsorbable screws and pins. An Ilizarov external fixator was used to stabilize the distal tibia, and an axial pin was used to stabilize the ankle and prevent subtalar subluxation (Fig. 3). Loss of the long toe extensor muscles required tenodesis of the toe extensor tendons to the tibialis anterior tendon. Immediate mobilization of the patient was permitted in the external fixator. Serial subatmospheric dressings promoted a granulation base over the areas of soft tissue loss, which were subsequently covered with a split-thickness skin graft (Fig. 3). At 4 weeks, radiographic healing of the tibial shaft fracture was demonstrated, and the external fixator was removed. Gentle joint range of motion and tendon gliding exercises were initiated, and full weightbearing was begun at approximately 2 months. However, at 4.5 months, the patient presented with a clinically tender and unstable ankle. Radiographs demonstrated progressive avascular necrosis of the distal fibular physis, epiphysis, metaphysis, and distal diaphysis, resulting in a valgus ankle deformity (Fig. 4).

Financial Disclosure: None reported.
Conflict of Interest: None reported.
Address correspondence to: Christopher Bibbo, DO, DPM, FACFAS, Department of Orthopaedics, Marshfield Clinic, 1000 North Oak Avenue, Marshfield, WI 54449.
E-mail addresses: bibbo.christopher@marshfieldclinic.org, cbibbo@charter.net (C. Bibbo).

1067-2516/$ - see front matter © 2015 by the American College of Foot and Ankle Surgeons. All rights reserved.
http://dx.doi.org/10.1053/j.jfas.2014.12.004

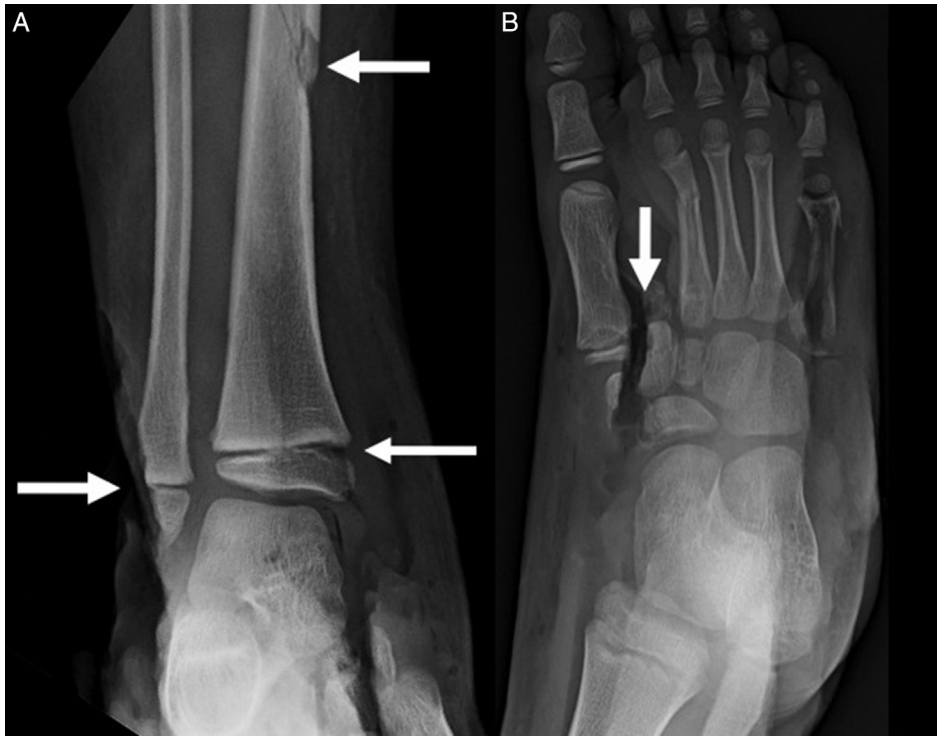

Fig. 1. Radiographs of fractures. (*A*) *Arrows* point to tibial shaft and ankle growth plate injuries. (*B*) *Arrow* points to Lisfranc injury.

Reconstruction of the distal fibular was performed by preparation of the recipient bed and microvascular reconstruction. Preparation of the recipient site included resection of the scar tissue and reconstruction of the scarred and/or torn peroneal tendons. The distal fibula required additional debridement to bleeding bone, and the atrophic soft tissue envelop was excised to a supple margin. The length of fibula needed was measured using a ruler and fluoroscopy. In the event of growth failure of the free physeal transfer, an extra length of the fibular diaphysis (1 cm) was incorporated into the free tissue graft.

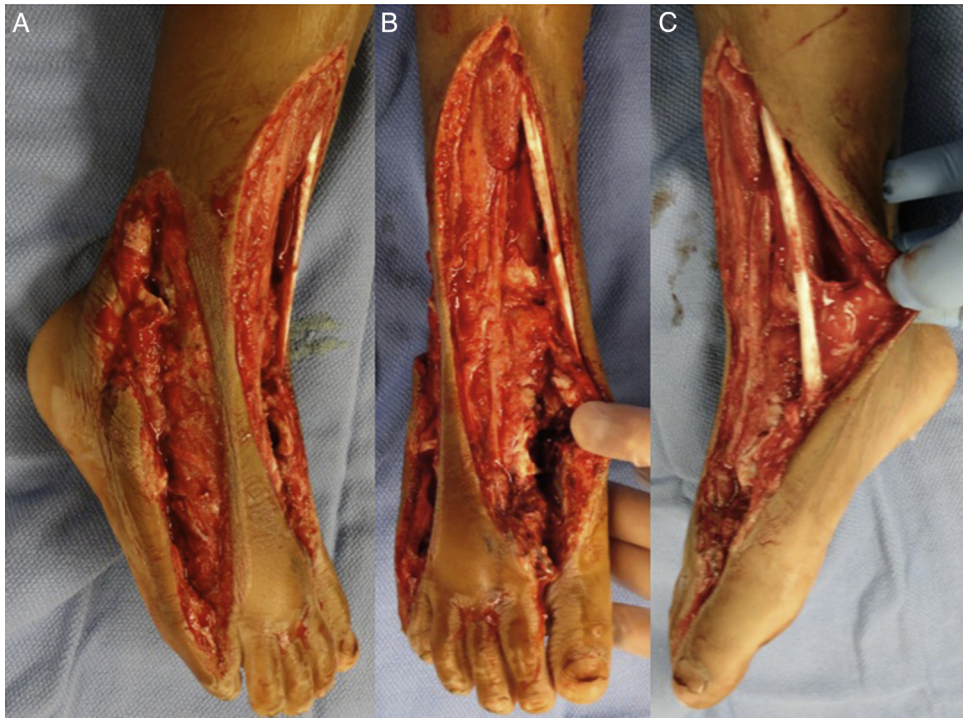

Fig. 2. Photograph of wounds from a riding mower accident (after debridement): (*A*) lateral, (*B*) anterior, and (*C*) medial aspects.