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TIPS, QUIPS, AND PEARLS

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Use of a Hybrid "Kickstand" External Fixator for Pressure Relief After Soft-Tissue Reconstruction of Heel Defects

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The surgical treatment of large posterior-plantar soft-tissue defects of the heel with underlying calcaneal osteomyelitis presents a significant reconstructive challenge because of the immobile adjacent soft tissues, fragile vascular supply, close proximity to neurovascular and tendinous structures, and significant weightbearing pressure and shear forces during stance and ambulation (1–3). Partial calcanectomy with primary closure or healing by secondary intent continues to be a viable alternative to below-knee amputation. However, the resultant soft-tissue contour defect and gait changes resulting from resection of the Achilles tendon are of significant cosmetic and functional concern (4–7).

Although several regional pedicled cutaneous and intrinsic muscle flaps are available, the neuroadipofasciocutaneous sural island turndown flap has become a true workhorse in the treatment of soft-tissue defects of the posterior-plantar heel secondary to ulceration or traumatic injuries. Since first being described by Masquelet et al (8) in 1992, the safety, ease of dissection, efficacy, and durability have been established (9–16) (Fig. 1). Additionally, it has been shown to be efficacious in resolving calcaneal osteomyelitis when the deep portion of the flap is packed within the osseous defect (17).

However, according to the published literature, and our own experience, a common problem during the postoperative recovery period for neuroadipofasciocutaneous sural island turndown flaps has been preventing pressure over the flap, pedicle, and donor site that come in direct contact with the splint, pillows, and bedding (8–16). Techniques used to decrease pressure over the flap, pedicle, and donor site have included maintaining a prone position until fully healed (8, 10,13,14), using a posterior splint with a flare built into the heel and lower leg portion (18), using pillows arranged as a box around the proximal limb (19), and using a surgical glove filled with water as a mini–water mattress (20). Although ingenious, we have used each of these techniques and, unfortunately, none of them provide complete pressure relief and elevation of the heel. Several publications describe the use of external fixation to immobilize the ankle and to elevate the heel after free-tissue transfer for coverage of lower-leg defects as a result of chronic ulceration or traumatic injuries (21–24). We have used a simple hybrid

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FIGURE 1 Photograph of the final appearance of a reconstructed heel defect with a neuroadipofasciocutaneous sural island turndown flap. Note the size and location of the cutaneous portion of the flap and the length and location of the donor site along the posterior-lateral aspect of the leg.

kickstand external fixator to provide complete pressure relief and elevation of the lower limb during the postoperative period for the treatment of posterior-plantar heel defects after soft-tissue debridement, resection of any associated calcaneal osteomyelitis, and immediate coverage of the resultant soft-tissue and osseous defects with a neuroadipofasciocutaneous sural island turndown flap (Fig. 2).

The hybrid "kickstand" external fixator is constructed from a Synthes (Paoli, PA) large external-fixator system because of its simplicity, versatility, durability, and convenience. The hybrid kickstand external fixator consists of an 11-mm diameter carbon-fiber rod, which is usually 400 mm in length (component 394.87), oriented along the anterior-medial aspect of the distal tibial and foot. This rod is connected to the medial face of the distal tibia and the foot by using four 5.0-mm diameter, 50-mm thread length, 200-mm length, blunted trocar point, self-tapping Schanz screws (component 294.56) and adjustable clamps (component 393.64). Two of these pins are placed in the tibia, 1 in the first and second metatarsals, and the 1 in the first cuneiform. Using tube-to-tube clamps (component 393.361), 2 additional 11-mm diameter carbon-fiber rods, usually 350 mm in length (component 394.86), are attached to the first carbon-fiber rod just distal to the tibial-pin attachment sites and are aligned in the shape of a triangle, angled medially and laterally away from the lower leg, to contact the weightbearing support surface beneath. Finally, a single 11-mm carbon-fiber rod, usually measuring 400 mm in length, is connected across the weightbearing support surface to the medial and lateral angled carbon-fiber rods using tube-to-tube clamps. Once completed, the limb remains hovering above the weightbearing support surface in the upper section of the triangular frame (Fig. 2).

The moderate cost (approximately $1,000) involved is easily accepted because this device completely relieves pressure from the entire lower leg, ankle, and heel, and allows easy access to the flap, pedicle, and donor site for frequent monitoring and dressing changes without the repeated trauma of reapplying a splint or the need to remain prone for several weeks until full soft-tissue healing and maturation has occurred. To the creative foot and ankle surgeon, the use of the hybrid kickstand external fixator after soft-tissue coverage of heel defects is a new technique based on time-honored principles available for planning and executing complex reconstruction of posterior-plantar heel defects with underlying calcaneal osteomyelitis.

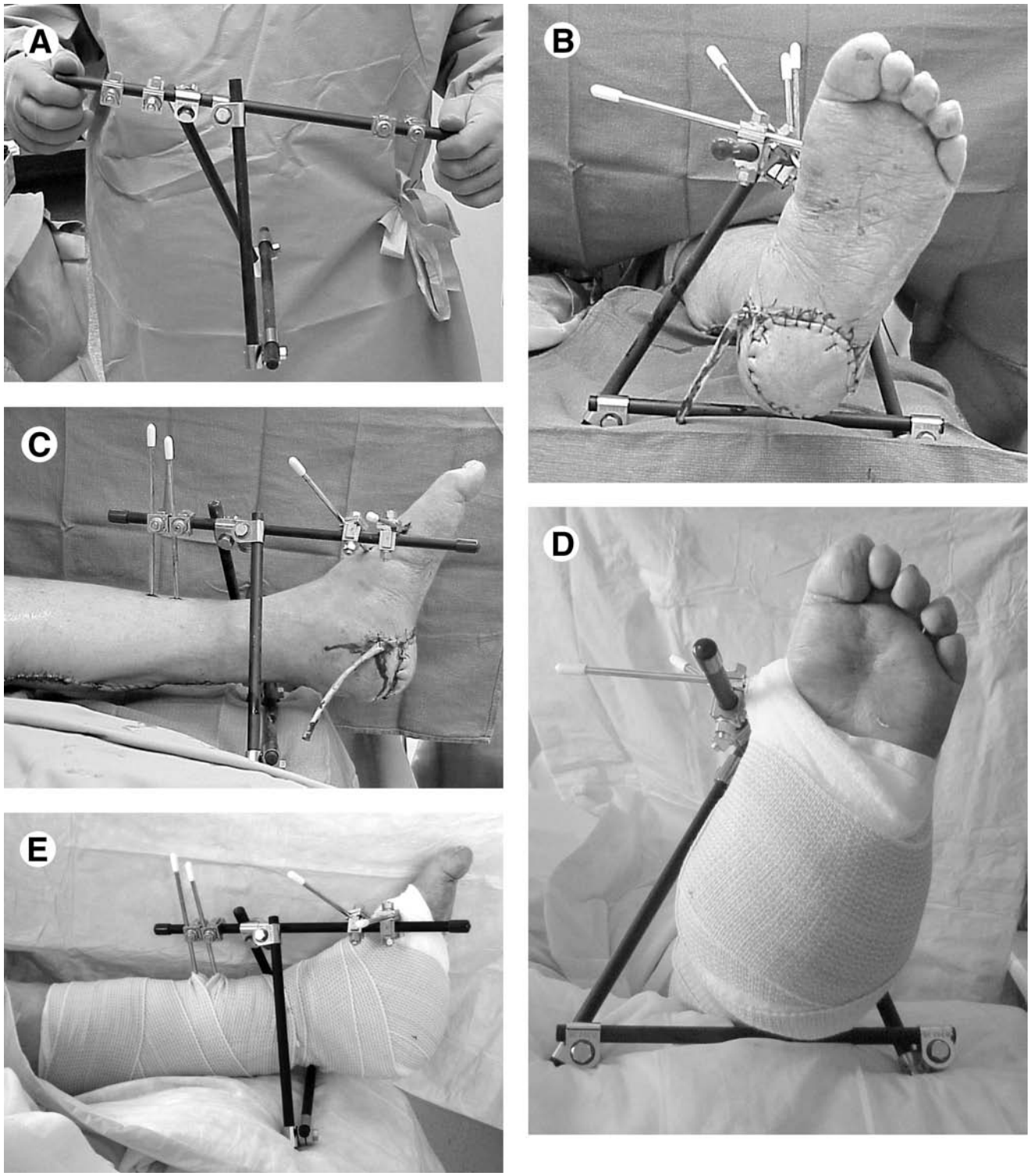

FIGURE 2 (*A*) Photograph of the preconstructed hybrid kickstand external fixator. (*B*) En fass view showing the reconstructed heel within the upper segment of the triangular portion of the frame. (*C*) Medial view showing how the lower leg, ankle, and heel are hovering completely off of the underlying weightbearing support surface even after application of (*D* and *E*) a bulky postoperative surgical dressing.

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