Case Study

The patient is a 20-year-old female presenting to clinic with symptoms involving the foot and ankle of children under age fifteen. These injuries are some of the most devastating and disabling injuries treated by reconstructive surgeons. Successful management of these injuries requires a wide array of soft tissue reconstructive procedures and different offloading options. Traditionally, treatment for lower extremity wounds with extensive soft tissue damage was amputation, however this increases energy expenditure, decreases life expectancy, and increases risk of amputation to the contralateral leg. Due to the complexity of these injuries multiple operations are typically required by different specialties. Extensive soft tissue defects to the weight-bearing surface of the foot often require coverage with free flaps, muscle flaps, local flaps, or pedicle flaps in order to obtain durable long-standing wound closure.

Vascular surgery should be consulted to ensure blood flow to the dominant arterial branch of the flap is present. Pedicle flaps are defined as an isolation of an identifiable named neurovascular bundle supplying the block of tissue intended to be transferred. Pedicle flaps can be fasciocutaneous, adipofascial, or musculocutaneous with either an arterial or venous pedicle. Internal fixation was placed to cover the proximal cutaneous artery as it courses anterior to the calcaneus. Pedicle flaps are used for offloading of pedicle flaps located on weight-bearing surfaces to allow maximum healing potential.

Innovative techniques to prevent or salvage compromised pedicle flaps are essential to long-standing wound closure. The offloading the pedicle flap is a critical part in the patient’s postoperative healing period. Numerous techniques have been used to limit pressure over pedicle flaps including; awkward positions in bed with pillows, modified posterior splints, and casting. Casting the knees in a fixed position prevents weight-bearing but does not allow observation of the flap and cannot cause a partial knee flexion contracture and bearing forces at the flap. External fixation provides the surgeon with a means to elevate and offload the leg, increase stability, allow for osseous procedures, easy flap monitoring, and relieves pressure on the flap.

Two types have frequently been used: the “kickstand” external fixator and the Taylor spatial frame. The use of external fixation to offload pediatric flaps allows for quick and repeated evaluation of the flap, while maintaining alignment of the foot and ankle to prevent kinking and avoid tension at the pedicle flap. The primary task was to assess the validity of external fixation with soft tissue healing of pedicle flaps, through a case review.

Conclusions

The lateral calcaneal artery flap is an excellent surgical technique for posterior heel defects that have shown improved healing potential with the use of external fixation due to immobilization and offloading of the surgical sites. Both studies cited on the lateral calcaneal artery flap did not use external fixation and showed favorable results, our patient had an unusual presentation.

References

4. Clemens et al. 12 patients who underwent the lateral calcaneal artery flap. The authors used external fixation techniques to stabilize immobilization, positioning, or the ability for direct visualization of the site, to allow maximum healing potential.
9. Literature Review

Recent literature has seen the use of external fixation solely to protect soft tissue flaps. Clemens et al. described 12 patients that were unable to heal a weight-bearing soft tissue flap. All patients had failed to heal after flap harvest, despite adequate technical flap harvest, axial blood flow, and early removal of the external fixation frame application, mean healing time was 128 days, with an overall limb salvage rate of 83%. Literature has shown diabetic patient’s compliance to be successful in offloading boot, meaning the patient walks without protection to the extremity 72% of the time. External fixation immobility and offloading of the affected limb.

Another study by Baumeister et al. conducted a retrospective review detailing complication rates associated with sural artery flaps in a multimorbid patient population. The authors used external fixation techniques in 28 of 70 flaps. The rate of necrosis in this group was 39%. 33% in patients without the device; the groups were too different to allow a statistical analysis. Regardless of this result, the authors recommend the application of an external fixation device in all patients except those with known peripheral arterial disease, with resting pain, as this device facilitates post-operative care while increasing patient mobility. Other authors have shown unfavorable outcomes in flap surgeries with morbidities including diabetes mellitus, PAD, vasculitis, and an age > 40 years old. Patient selection for these surgical interventions is important, and an emphasis with mandatory preoperative and postoperative immobilization and attention to the integrity of the artery in question is essential.

External fixation has been shown to be advantageous to postoperative soft-tissue flap healing. Patients with co-morbidities above have shown improved healing potential with the use of external fixation due to immobilization and offloading of the surgical sites. While both studies cited on the lateral calcaneal artery flap did not use external fixation and showed favorable results, our patient had an unusual presentation. Due to the complexity of the patient’s previous ten surgeries, the external fixation device was paramount for complete wound healing.

Conclusions

- Traditional offloading techniques are inadequate for healing of pedicle flaps located on weight-bearing surfaces.
- External fixation can be used to immobilize the lower extremity, and is an adequate method for offloading and observation of pedicle flaps.

The lateral calcaneal artery flap is an excellent surgical technique for posterior heel defects that allows long-term durability because it does not sacrifice a major artery to the foot or ankle.