Flexor Hallucis Brevis Muscle Flap over Exposed Tibialis Posterior Tendon in Necrotizing Soft Tissue Infection

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Statement of Purpose

Wound defects of the foot and ankle are a challenge to heal given the proximity of tendons/bone and other avascular structures to the skin. Necrotizing soft tissue infections in patients with diabetes can be devastating due to the depth and location of debridement in these regions. This case study demonstrates how the flexor hallucis brevis muscle flap can be used to cover exposed tibialis posterior tendon and preserve foot and ankle function after a severe infection.

Literature Review

Aggressive surgical management may be imperative for reducing morbidity and mortality in the high-risk group of necrotizing soft tissue infections in the context of diabetic foot infections. Muscle flaps were first introduced by Ger in the 1960s and gained popularity/utility due to their low donor site morbidity and durability to fill dead spaces and defects (1). Muscle flaps may be elevated based on their individual pattern of perfusion, based on the Mathes and Nahai classification (2). The role of muscle flaps in covering exposed tendons is to provide well-vascularized tissue that promotes healing, protects underlying structures, fills dead space, and enables tendon gliding, especially when local soft tissue is insufficient or when there's risk of infection or poor wound healing (3, 4). Local muscle flaps are preferred for small, accessible defects, as they offer reliable coverage with minimal donor site morbidity and do not require microsurgical expertise (5). The flexor hallucis brevis is an uncommon intrinsic muscle used for local muscle flaps. However, a study by Masadeh et al aimed to demonstrate that the distally-based reverse medial hemi-flexor hallucis brevis muscle flap serves as an option for distal first ray soft-tissue defects especially when local flap coverage is needed for exposed deep or avascular structures not amenable to skin grafting or conservative wound care techniques. All patients ambulated in shoes with custom molded inserts without complication postoperatively and no ulceration recurrence was encountered at the 12-month follow-up (6).

Case Study

A 57-year-old male with diabetes and kidney transplant initially presented with a necrotizing soft tissue infection of the left foot. CT imaging showed soft tissue gas in the medial hindfoot/ankle. The patient underwent serial debridements resulting in a large soft tissue deficit with exposed tibialis posterior tendon near the insertion. The foot was successfully salvaged after serial debridements and ultimately a flexor hallucis brevis muscle flap was utilized to cover the exposed posterior tibial tendon. The patient has resumed normal activities and remained healed at a follow up of 13 months.

Case Study Continued

After multiple serial debridements to salvage the left foot, control of the infection was achieved and the flexor hallucis brevis (FHB) muscle flap was elevated. The medial head of the muscle was transected distally and the flap elevated to its proximal most perforator. This was identified on doppler examination and preserved so as to serve as the rotation point for the muscle. The FHB was then rotated in a retrograde fashion and transferred to a point with minimal tension on the muscle. The flap inset was determined to be delayed given the extent of rotation required. Several days later a return to the operating room was scheduled for advancement and final inset of the flap. Final inset was performed with 3-0 monocryl and complete coverage of the exposed posterior tibial tendon was achieved. Strong doppler signals remained present at the completion of the inset with bleeding noted from the proximal portion of the muscle at the inset location. A synthetic skin substitute and wound VAC were then applied.

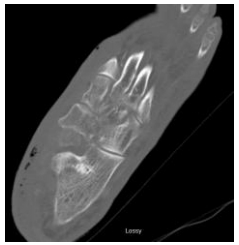

Figure 1: Pre-op CT image, axial view

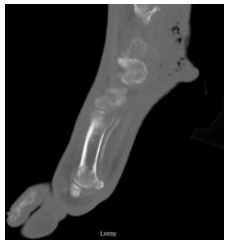

Figure 2: Pre-op CT image, sagittal view

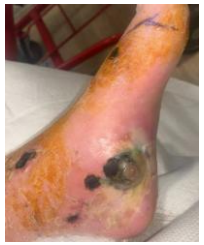

Figure 3: Pre-op clinical image

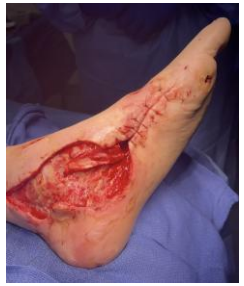

Figure 4: Post-op day 2

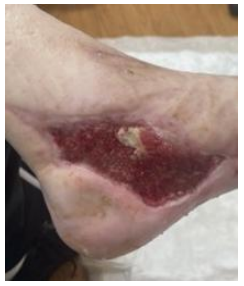

Figure 5: Post-op day 90

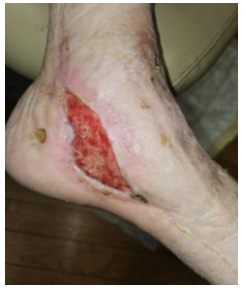

Figure 6: Post-op month 11

Analysis and Discussion

Early recognition and aggressive surgical management are imperative for reducing morbidity and mortality in the high-risk group of necrotizing soft tissue infections in the context of diabetic foot infections. Patients with diabetic foot ulcers have more than double the mortality risk compared to diabetic patients without ulcers. The presence of infection substantially increases the risk of amputation. Approximately 50-60% of diabetic foot ulcers become infected while about 20% of moderate to severe infections lead to lower extremity amputation. The 5-year mortality rate following major amputation for diabetic foot infections exceeds 70% which is worse than most cancers (7). Intrinsic muscle flaps provide definitive coverage for exposed bone, tendon, and joint following aggressive debridement of necrotizing infections. These local flaps demonstrate a success rate of 87-96% in diabetic patients with exposed vital structures. The limb salvage rate with intrinsic muscle flaps ranges from 91-94% in diabetic patients, even in the presence of osteomyelitis (8). The flexor hallucis brevis is an uncommon intrinsic muscle used for local muscle flaps, but it can be successfully utilized for coverage of an exposed tendon in a soft tissue deficit at the medial aspect of the foot. When this muscle is used, it is often rotated in an antegrade fashion, but our case presents the alternative option of use in retrograde so as to provide soft tissue coverage of the medial foot/ankle.

References

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