Utilizing Spare Part Technique to Aid in Complex Wound Reconstruction

University of Cincinnati
Department of
Orthopaedic Surgery

Zoe Dolcimascolo DPM, Bryce Yamat DPM, Suhail Masadeh DPM,
Michael Liette DPM
University of Cincinnati Medical Center Cincinnati, OH

Statement of Purpose

To present a case of limb salvage utilizing spare parts surgery to aid in coverage of a large soft tissue deficit after a necrotizing infection.

Literature Review

Necrotizing fasciitis is a serious, rapidly progressive infection involving the subcutaneous tissue and deep fascia. It's progression is driven by combination of bacterial virulence and the host immune response. A hallmark of this disease process is extensive necrosis which is caused by enzymes released from bacteria leading to necrosis of fascia and hypodermis as well as occlusion of vessels in these areas leading to thrombosis (1). Emergent surgical debridement followed by serial procedures until source control achieved is the highlight of treatment (5). As a consequence, patients are often left with extensive soft tissue defects which can be managed with local wound care, surgical salvage techniques or proximal amputation. Spare parts surgery is an innovative approach that involves repurposing viable tissue from non-salvageable areas to reconstruct soft tissue deficits. This concept has been utilized in both upper and lower extremity salvage procedures for a variety of reasons including oncologic reconstruction, infectious reconstruction and in the setting of trauma. Common "spare parts" options include digital fillet flaps, full thickness skin grafts, and free flaps.

When considering spare parts surgery, there are several requirements to consider. The idea of reconstructing or salvaging the area should have a greater overall benefit to the patient than primary amputation. Additionally, the "spare part" harvested from the unsalvageable area should have limited ischemia time and the tissue should have anatomical integrity (3). Contraindications for this procedure include local tumor or vascular invasion, prolonged ischemia time, concern for continued infection to host or donor site, or if the donor tissue would serve a greater purpose in its anatomical location (6, 3).

Case Study

A 42-year-old male with past medical history significant for type II diabetes mellitus, factor V leiden mutation, hereditary spherocytosis presents to the UCMC ED with chief complaint of left lower extremity pain and swelling. The pain had been ongoing for 5 days, and on the day of presentation, the patient observed a large blister and was unable to bear weight. Initial imaging significant for diffuse soft tissue edema, without evidence of cortical erosive changes or soft tissue emphysema. Lab work was significant for leukocytosis to 17.3, significantly elevated inflammatory markers with CRP of 363.5 and ESR of 32, as well as hyponatremia and significant hyperglycemia. The patient was tachycardic into the 120s and during evaluation in the emergency department became febrile. Clinical examination was significant for a large hemorrhagic bullae to the dorsum of the left foot with surrounding erythema, warmth and soft tissue edema. The left foot and lower leg were significantly tender to palpation although, no soft tissue crepitus was appreciated. A chronic ulceration sub-left hallux was noted.

Figure 1: initial plain film imaging

Figure 2: clinical photo of left foot

Surgical Procedure

First stage- Source control: An elliptical type incision was made overlying the bullae. This was excised in a full thickness layer. Sharp debridement of significant necrosis was extended until tissue planes no longer easily separated. The underlying dorsal foot musculature was noted to be viable. Sequential debridements were carried out until source control achieved, as evidenced by improvement in laboratory markers. In total, the patient underwent anterior and lateral compartment lower leg fasciotomies, hallux amputation with digital fillet flap and extensive skin and soft tissue debridement on the dorsum of the left foot.

Second stage- Wound Reconstruction: Upon final excisional wound debridement, the soft tissue deficit measured 27.1 cm x 9.3 cm x 2.0 cm and encompassed the dorsal foot and the anterior ankle. The hallux digital fillet flap from a prior surgery was harvested as a full thickness skin flap. The flap was debulked with a VERSAJET down to the level of dermis and inset over the anterior ankle joint with 3-0 Nylon. The remaining wound was healthy and a wound vac was applied. The graft demonstrated successful incorporation and take at the most recent follow up.

Analysis and Discussion

Necrotizing fasciitis is a rapidly progressive infection that often results in large soft tissue deficits, amputation, significant morbidity or mortality. This infection requires emergent surgical debridement and the end result of these surgeries often results in large soft tissue defects with complex wounds (5). "Spare parts" surgery utilizes viable tissue from non-salvageable areas of the extremity to reconstruct difficult-to-heal regions. (3). Because the thickness of the full thickness skin graft is critical, Bibbo et al (2) described a technique of preparing a full thickness skin graft by utilizing a VERSAJET to prepare the deep surface. The tool performs tangential hydrodissection which is the process of precise debridement of the tissue along with a vacuum effect to remove the tissue from the site. This process is called the venturi effect and is carried out on the grafts until adipose tissue is removed. The utilization of the VERSAJET has several advantages including the ability to precisely define different tissue types allowing the surgeon to preserve viable tissue, allows for a more uniform debridement and decreases debridement time (7).

References

1. Iacopi E, Coppelli A, Goretti C, Piaggesi A. Necrotizing Fasciitis and The Diabetic Foot. *International journal of lower extremity wounds*. Los Angeles, CA: SAGE Publications; 2015;14:316-327.
2. Bibbo C. VERSAJET™ hydrosurgery technique for the preparation of full thickness skin grafts and the creation of retrograde split thickness skin grafts. *The Journal of foot and ankle surgery*. 2010;49:404-407.
3. Peng YP, Lahiri A. Spare-Part Surgery. *Seminars in plastic surgery*. 2013;27:190-197.
4. Simman R, Zajac KK. "Spare Parts" for Foot Wound Reconstruction: A Report of 2 Cases. *Eplasty*. 2023;23:e77
5. Yoon J, Gebran S, Nam A, Brandao R, Wynes J. Necrotizing Fasciitis in Charcot-Marie-Tooth Treated with Debridement, Free Flap, and Extra-Articular Reconstruction. *Journal of the American Podiatric Medical Association*. 2023;113
6. Sánchez-García, A., Pérez-García, A., Salmerón-González, E., Thione, A., García-Villariño, E., Salom, M., Baixauli, F., & Simón-Sanz, E. (2019). The Spare Parts Concept in Sarcoma Surgery: A Systematic Review of Surgical Strategies. *International Journal of Orthoplastic Surgery*.
7. Choi SG, Shin HW, Yoon KC. Preparation of harvested skin using the Versajet Hydrosurgery System in full-thickness skin grafts. *Archives of plastic surgery*. 2019;46:603-607.