The Use of Meshed Porcine Dermal Matrix Xenograft in the Recreation of Plantar Soft Tissue Scaffold Following Limb Salvage Surgery Secondary to a Rare Case of Necrotizing Fasciitis Caused by Prevotella bivia: A Case Report.

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Abstract

In a transmetatarsal amputation, the forefoot is removed across the metatarsal shafts. While this amputation aims to preserve as much limb length as possible, it can disrupt the plantar architecture which is comprised of the plantar fascia, fat pad, dermis, and associated musculature. Necrotizing fasciitis is a rapidly progressing, aggressive soft tissue infection that causes widespread necrosis to fascia and subcutaneous tissues, including the plantar architecture of the foot. It is frequently associated with septic shock and can be lethal if not quickly recognized and aggressively treated. This case report presents a compelling example of limb salvage in a high-risk patient with necrotizing fasciitis caused by Prevotella bivia—a rare but increasingly recognized anaerobic pathogen, and our use of a multi-layered meshed porcine dermal matrix xenograft (Strattice™) for the recreation of the plantar soft tissue scaffold to achieve healing and restoration of limb function.

Introduction

Necrotizing fasciitis involves the fascia and subcutaneous tissues, leading to severe tissue destruction, systemic toxicity, and often requires surgical debridement or amputation (1-2). Prompt diagnosis and treatment with broad-spectrum antibiotics and surgical intervention are critical to improving outcomes (3).

Prevotella bivia is an anaerobic, gram-negative bacterium commonly found in the female genital tract and is most often associated with pelvic infections. There are however documented cased where P. bivia, either alone or as part of polymicrobial infection, has contributed to necrotizing fasciitis, particularly in immunocompromised patients or in infections originating near the perineal or lower extremity areas (4). P. bivia infections tend to be polymicrobial and may be recognized via blood cultures, wound cultures, or tissue biopsy (5-9). Soft tissue emphysema may be present; however, it is less common in anaerobic infections (6). Antibiotic treatment for P. bivia generally involves metronidazole or amoxicillin-clavulanate (8).

Strattice™ Reconstructive Tissue Matrix is an acellular dermal matrix (ADM) derived from porcine dermis (10-12). It is processed to remove cells while preserving the extracellular matrix, which provides a structural scaffold to support tissue regeneration and host cell integration (10-12). Strattice™ is commonly used in reconstructive surgeries, such as abdominal wall repair, breast reconstruction, and hernia repair, particularly when native tissue compromised or at risk for infection (10-12). It maintains better biocompatibility and flexibility, which leads to better tissue incorporation and reduced inflammatory response compared to crosslinked grafts (10-12). It is also considered more resistant to infection than systemic meshes, making is ideal for contaminated surgical fields (10-12).

The plantar soft tissue scaffold includes the thick, fibrous structures on the bottom of the foot, particularly the plantar fascia, fat pad, dermis, and associated musculature. These tissues are essential for shock absorption, weight distribution, and pressure protection during gait.

In a transmetatarsal amputation, the forefoot is removed across the metatarsal shafts. While this amputation aims to preserve as much limb length as possible, it can disrupt the plantar architecture. Debridement of necrotic tissue further complicates the surgical outcome.

The aim of this case study was to highlight a rare case of necrotizing fasciitis stemming from a foot ulceration infected with Prevotella bivia and our use of a meshed porcine dermal matrix xenograft for the recreation of the plantar soft tissue scaffold after limb salvage surgery to achieve healing and restoration of limb function.

Case Report

We present the case of a 64-year-old male patient with past medical history of type 2 diabetes mellitus with peripheral neuropathy, peripheral vascular disease, chronic kidney disease, and prior contralateral Charcot neuropathy. The patient presented to the emergency department with a necrotic, dusky second digit, ascending cellulitis to the anterior leg, abscesses in multiple foot compartments, and a wound to his distal second toe which had appeared within a week prior. He was seen by his regular podiatrist in the community who recommended an incision and drainage of that digit and for the patient to start oral antibiotics. At his post operative follow up appointment two days later the community surgeon recommended he go directly to the VA emergency department with the expectation of amputation.

After chart review and during his initial bedside evaluation a thorough history was obtained. A lower extremity focused exam was performed which included vascular, dermatologic, neurologic, and musculoskeletal exams. Lab work and imaging was ordered including radiographs and CT of the lower extremity and Complete blood Count, Basic Metabolic Panel, Erythrocyte Sedimentation Rate, C-reactive protein. Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) Score was 10 indicating the patient was high risk for necrotizing fasciitis. An Ankle Brachial Index obtained a week prior demonstrated a toe pressure of 78. A wound culture was obtained and sent for culture and sensitivity testing which ultimately cultured P. bivia.

Physical exam demonstrated palpable pedal pulses, diminished protective sensation, and no gross deformity of the right foot, the left foot showed bony prominences and midfoot collapse secondary to a history of Charcot arthropathy. The right second digit demonstrated a distal ulceration with necrosis and duskiness with ascending cellulitis to the mid anterior leg. On imaging, cortical erosions were appreciated to the distal second phalanx with extensive soft tissue edema and emphysema throughout the second toe.

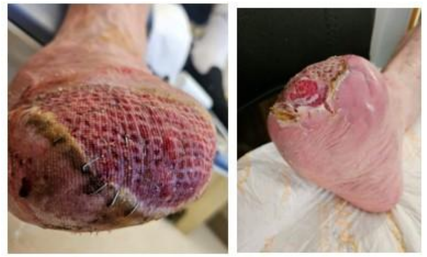
The patient was admitted for necrotizing fasciitis with gas gangrene. A right second toe amputation was performed for source control. Vascular surgery was consulted with recommendation of below the knee amputation which the patient refused. The patient went into septic shock and was admitted to the ICU.

Over the following days the patient was taken for multiple toe and metatarsal amputations with serial debridement ultimately leading to a transmetatarsal amputation (TMA) with noted complications of extensive plantar soft tissue necrosis. One week later a revisional transmetatarsal amputation was performed with removal of all nonviable soft tissue and bone. Extensive damage was noted to the skin, tendons, muscles, and other soft tissues. The patient again declined consent for a below the knee amputation. The remaining transmetatarsal stump was left with minimal plantar and intermetatarsal soft tissues and inadequate skin for closure.

During the TMA revision a single layer thickness of meshed pericardium allograft was wrapped over the distal metatarsal shafts. Three layers of porcine dermal xenograft was sutured together and to the soft tissues surrounding the metatarsal bases for plantar padding along the metatarsal remnants

A single-layer of the porcine dermal graft was then meshed and placed within the open wound to cover the exposed area. It was sutured to the deep aspect of the skin flaps to act as a basement layer. Two retention type sutures were used to approximate the skin flaps to secure and protect the newly placed grafts. Negative pressure wound therapy (NPWT) was initiated and continued over the following two months.

After significant granulation of the wound bed the patient was scheduled for a split thickness skin graft (STSG). The patient began wearing a prior diabetic shoe with a built-in metatarsal pad which led to failure of the central plantar portion of the split thickness skin graft. He was placed back onto an offloading shoe and local wound care was continued.



Epithelialization of the central plantar portion of the TMA stump was not achieved over the course of a six-month period with local wound care efforts. He was scheduled for an Achilles tendon lengthening to address the adductovarus deformity leading to increased pressure along the distal stump as well as a second split thickness skin graft.

Discussion

The infection originated from a seemingly minor foot ulcer and quickly progressed, necessitating a transmetatarsal amputation. The infection's severity, compounded by the patient's diabetes, peripheral vascular disease, and septic shock, left the surgical team with extensive plantar soft tissue loss, presenting a major reconstructive challenge. The authors highlight the use of a multi-layered meshed porcine dermal matrix xenograft (Strattice™) to recreate the plantar soft tissue scaffold, a critical component for foot function and protection post-TMA. Their approach demonstrates the potential of biologic matrices to support tissue regeneration and avoid more proximal amputations, even in severely compromised patients.
Longitudinal follow-up showed initial granulation, but epithelialization remained incomplete after the first autograft due to mechanical stress from improper footwear. This underscores the importance of post-operative care and offloading strategies. Ultimately, a second split-thickness skin graft (STSG) and Achilles tendon lengthening achieved full wound closure and functional preservation at one year. The case reinforces the biomechanical importance of the plantar soft tissue scaffold, and the versatility of biologic grafts like Strattice™ in complex, contaminated wounds. It also highlights the interplay between surgical technique, patient compliance, and biomechanical management in long-term limb salvage outcomes.
It is important to note that this case was performed at the Southern Arizona Veteran Affairs Health Care System, therefore cost and reimbursement were not factors in determining treatment. All wound care products used all reimbursable through Medicare and private insurance and have their own designated HCPCS codes. The cost to benefit ratio would need to be assessed on an individual provider and patient basis. All pricing of the wound care products used in this case are available to the public through the Department of Veteran Affairs Federal Supply Schedule.

Conclusion

When presented with this case our goals of therapy were to prevent a more proximal amputation, eradicate the infection, minimize patient discomfort, restore function of the limb, and achieve complete wound closure. The wound achieved complete closure after one year of advanced wound care including xenografting and autografting. Proximal amputation was prevented and restoration of full function to the limb was attained.

Conflict of Interest Statement

The authors of this article declare no conflict of interest. The companies involved had no role in the design of the study; in the collection, analyses, or interpretation of date; in the writing of the manuscript, or in the decision to publish the results.

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