

Statement of Purpose

This case series involves 21 patients sustaining diabetic or surgical wounds in the watershed area with tendon exposure that were healed with application of fish skin xenografts. The aim of this study is to exhibit success of the fish skin xenograft in healing large, complicated soft tissue deficits in the presence of multiple comorbidities.

Introduction

The Achilles tendon region is noted to be a historically complex area to heal wounds due to its known poor vascular supply.¹ Multiple different theories have been proposed of the exact angiosome supply to this region, most famously by Taylor and Attinger¹. Literature confirms significant risk factors predisposing individuals to wound complications such as current tobacco use, current steroid use, and female sex.² While there has been conflicting research in the exact distribution, the watershed area located 2-6 cm proximal to the insertion is undoubtedly a vexatious area to heal once a wound has formed due to its known avascularity.^{3,4,5,6}

Superimposed with poor subcutaneous tissue in the anatomic region, these wounds are often detrimental due to vast tendon exposure if not managed properly. Larger deficits commonly require negative pressure wound therapy in order to establish a granular and suitable base for skin epithelialization.⁷ Literature supports upwards of 12 weeks of continuous negative pressure therapy in cases where the Achilles tendon is exposed in order to obtain a suitable wound bed to incorporate a skin substitute or graft.

Increased healing of wounds with Omega-3 fatty acid skin substitutes have the potential to lead to less analgesic use due to their ability to minimize the inflammatory process of wound healing. This stage of wound progression is often known to be prolonged in most chronic, non-healing wounds.⁸

An additional potential complication associated with graft incorporation is the presence of latent or chronic infection. In many cases, the only way to obtain surgical cure for these aggressive infections in the lower extremity in the lower extremity is a proximal amputation. Previous studies have shown success in the use of Omega-3 xenografts being used in the setting of chronic osteomyelitis, which a patient in this case series suffered from, but fortunately progressed to full skin epithelialization.⁹



Results

All twenty-one patients have progressed to full healing of their respective wounds with fish skin grafts being used as the only skin substitute to facilitate tissue coverage. The average wound size was measured at 5.24 cm² (range 1.6 cm² – 10.2 cm²) upon initial presentation. Zero of the twenty-one patients undergoing complete skin epithelialization have undergone wound recurrence with an average follow up of 15.2 months. An average of 3.2 graft applications (range 1.0 – 5.0) were applied per patient with a direct correlation being observed with increase applications to larger wound measurements. Average time to complete healing was measured at 17 weeks (range 7 weeks - 28 weeks) for those undergoing complete healing. Both patients with PAD underwent angiograms with increased runoff following vascular intervention and an average of 0.22 improvement in ABI. One patient had re-ulceration at 8 months.



Achilles wound layered application

Methods

Twenty-one subjects were included in the case series with all possessing wounds to the Achilles tendon region following surgery or from a diabetic/pressure ulceration. Patients were selected from an initial presentation date of July 1, 2021 through February 28, 2024. Pertinent comorbidities included in the study included diabetes, peripheral artery disease, hypertension, hyperlipidemia, congestive heart failure, and tobacco used disorder. All surgical wounds were described as acute. Serial debridements with osseous and soft tissue resections, along with negative pressure wound therapy were implemented as deemed necessary for all patients. washouts were performed when necessary, in addition to negative pressure assisted therapy via wound vacuums. Grafts were cut and layered in areas where extensive deficits were present, and tunneling areas were filled with graft in granule form. When necessary, infectious disease consultations were placed for multi-drug resistant infections as well as for positive proximal margins for a microbiology and pathology standpoint. The subject pool for the aforementioned included two patients who both received a PICC line with a 6-week course of antibiotics guided by intraoperative cultures. Patients remained non-weight bearing to the affected limb in a CAM boot for the duration of graft applications to prevent failure of graft uptake during graft incorporation phases. Healing was qualified by healed with no recurrence for 3 months.

Discussion

This case series exhibits an excellent success rate in the healing of Achilles wounds with fish skin xenograft grafting. Although possessing a small sample size, the success rate exhibits promise for advanced limb salvage for wounds in extremely problematic areas, including those with multiple comorbidities inhibiting healing. Additional pitfalls of this case series include no randomization, no independent variables, and no comparative similar case series to extrapolate data from in terms of similar patient cohort and graft usage.

Further research is essential via randomized control trials and/or cohort studies to evaluate the efficacy of fish skin xenografts with obtainable statistical significance for variables such as optimal graft application timing for serial applications and the incorporation of NPWT in conjunction with grafting during the incorporation phase. All patients in this study undergoing NPWT had therapy completed prior to graft application and for no patients did simultaneous use occur. This case series lays the foundation for such further studies to take place and provides aspirations for those suffering extensive tissue loss that limb salvage is possible despite non-optimal and complicated healing conditions.

References

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