

Successful Treatment of Wounds from Nonuremic Calciphylaxis with Acellular Piscine Dermis

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Summary: In this report, we present a 57-year-old man with chronic bilateral lower extremity wounds from nonuremic calciphylaxis, which were successfully reconstructed using a piscine-derived acellular dermal matrix. The acellular dermal matrix incorporated quickly, providing a wound bed that was amenable to skin grafting. We demonstrate that this is an effective off-the-shelf solution for these chronic wounds, resulting in pain reduction and complete closure of the wounds, allowing the patient to return to his previous baseline activities, and improving his quality of life. (*Plast Reconstr Surg Glob Open* 2023; 11:e5120; doi: [10.1097/GOX.00000000000005120](https://doi.org/10.1097/GOX.00000000000005120); Published online 12 July 2023.)

Cutaneous calciphylaxis is a debilitating condition caused by calcification of cutaneous blood vessels within the dermis and subcutis, leading to progressive narrowing and eventual occlusion of the vessel lumen and ischemic infarction of supplied tissue.¹ Clinical presentation includes livedo reticularis, plaques, nodules, and ulceration.¹

Treatment is targeted toward preventing calcification, decalcifying affected vessels, pain management, and wound care.¹ Preventing further calcification requires correcting metabolic derangements when present.^{1,2}

Although correcting the underlying problem is essential, this does not address the wounds. Infected or highly exudative wounds are typically treated surgically, whereas dry, uninfected wounds are treated enzymatically.^{2,3} Aggressive debridement has been associated with worsening ulceration.³ Once the underlying disease is controlled, successful cases have described debridement of deep ulcers, followed by skin grafting.⁴

Kerecis omega-3 (Kerecis, Isafjordur, Iceland) is a cod-derived acellular dermal matrix (ADM). It has grown in popularity in wounds secondary to diabetes, vascular insufficiency, and burns.^{5–8} There are also reports of its use in mucogingival procedures and in a critical upper extremity wound.^{9,10} In vivo, this ADM promotes angiogenesis and

collagen synthesis, functioning as an antiinflammatory agent that increases the speed of wound healing.¹¹ There is a paucity of literature regarding the use of this ADM in patients with cutaneous calcific lesions, with a single report of iatrogenic neonatal calcinosis cutis.¹² In this report, we describe the use of Kerecis in reconstruction of bilateral lower extremity wounds in a patient with nonuremic calciphylaxis.

CASE DESCRIPTION

An otherwise healthy 57-year-old man presented with bilateral lower extremity ulcerations. He had an extensive workup before presentation, including evaluations by dermatology, nephrology, and rheumatology. He was initially thought to have pyoderma gangrenosum and was started on prednisone. Doppler ultrasonography of his lower extremities ruled out venous insufficiency. Lower extremity imaging demonstrated superficial subcutaneous vascular calcification, consistent with dermatopathological evaluation of tissue samples from his wounds, demonstrating idiopathic nonuremic calcinosis cutis.

The wounds grew larger after multiple bouts of cellulitis requiring inpatient antibiotics. Wound treatment included hyperbaric oxygen, silver sulfadiazine, and negative pressure wound therapy (NPWT).

After a year of local wound care, healing stagnated. His quality-of-life significantly deteriorated, with the exudative wounds becoming his main source of stress and pain, requiring consultation with pain management. The patient was not forced to retire due to the demands of

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Fig. 1. Preoperative photograph: anterior left lower extremity.

wound care. He no longer enjoyed his hobbies and lost hope for any solution.

The patient had wounds on his bilateral legs, right measuring 100cm² and left with two wounds measuring 96 and 120cm² (Fig. 1). (See figure 1, Supplemental Digital Content 1, which shows a preoperative photograph of the posterior right lower extremity. <http://links.lww.com/PRSGO/C662>.) Wounds were to the deep dermis without muscle or critical structure exposure. There were no signs of infection. His pain was at a six on the visual analog pain scale. We decided to reconstruct the wounds using a staged approach, given the chronicity of the wounds and the extensive workup consistent with idiopathic calcinosis cutis.

First, he underwent superficial debridement, and Kerecis was applied to the wounds (Fig. 2). NPWT was applied for 1 week, and subsequently changed every 3–5 days (standard at our institution). The wounds were reevaluated at each dressing change for granulation tissue formation.



Fig. 2. Intraoperative view of the left lower extremity with Kerecis applied.

On postoperative day 20, the wound bases were noted to have healthy granulation tissue throughout (Fig. 3). The patient was then taken for second-stage reconstruction with split-thickness skin grafting to resurface the wounds.

Two months after grafting, the patient's wounds had complete, stable epithelialization. His pain was significantly improved, recorded as a two on the visual analog pain scale, down from six. The patient was participating in his hobbies, and his quality of life had improved significantly when compared with initial presentation. At 1-year postoperative, he had stable, pain-free coverage of his legs (Fig. 4). (See figure 2, Supplemental Digital Content 2, which shows a 1-year postoperative photograph of the posterior view of bilateral lower extremities. <http://links.lww.com/PRSGO/C663>.)

DISCUSSION

Calciophylaxis is a systemic disease process seen in patients with end-stage renal disease, disequilibrium of calcium and phosphate levels, or vitamin K deficiency.¹ Nonulcerating cutaneous calciophylaxis is often representative of early disease progression, whereas ulcerating lesions indicate more severe disease and are associated with high mortality.¹³

When addressing these wounds, treating the underlying metabolic derangement is essential. A multidisciplinary approach should be used, with the goal of



Fig. 3. Left lower extremity wound bed before definitive skin grafting, postoperative day 20 after Kerecis placement.

preventing progression of vascular calcification, decalcifying affected vessels, preventing infection, and limiting morbidity. Therefore, it necessitates involvement of various specialties, including nephrology, dermatology, plastic surgery, and nutrition.²

Wound management includes necrotic tissue removal, infection prevention, and wound healing promotion.¹ Surgical and nonsurgical approaches have been used to debride these wounds, although concerns about further wound complications (ie, pathergy) have been described.¹⁴ This underscores the importance of two key points. First, the underlying condition must be addressed. Second, the wounds must be stable and/or healing. Nonsurgical treatments described include maggot therapy, NPWT, and hyperbaric oxygen.^{2,15–19}

When considering ADMs, it is essential to choose the product that best aligns with the goals of the reconstruction.¹⁰ Kerecis has become a useful tool. Unlike bovine and porcine products, there are no known pathogens that are transferred between North Atlantic cod and humans.²⁰ This allows for a gentler processing of the fish skin so it retains more of the native structure and components, including omega-3s.^{21,22} These properties allow for rapid incorporation and granulation tissue formation, which allowed us to achieve definitive closure of these chronic, painful wounds. Previous studies have evaluated the structure of Kerecis under electron microscopy, demonstrating less unintentional cross-linking of the ADM when compared with human amnion/chorionic membrane allograft, allowing for easier migration of the native fibroblasts through the structure.²³ Additionally, Kerecis is less susceptible to infection compared with human amnion or chorion.²⁴



Fig. 4. One-year postoperative photograph: anterior view of bilateral lower extremities.

CONCLUSIONS

In this case report, we describe the successful application of Kerecis to help convert wounds associated with idiopathic nonuremic cutaneous calciphylaxis into wound beds amenable to skin grafting. Three months after the initial presentation, our patient reported improvements in pain, cosmesis, and quality of life. As our experience with Kerecis grows and the body of literature expands, we will have a much better understanding of the limitations and indications of this ADM. In the interim, we have included this in our treatment algorithm as a simple solution for many different problems.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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