Micronized, Particulate Dermal Matrix to Manage a Non-healing Pressure Ulcer with Undermined Wound Edges: A Case Report

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Pressure ulcers with undermined edges are generally hard to treat and may require surgical debridement and flap coverage. A woman with a 5-month history of a non-healing, undermined, sacro-coccygeal pressure ulcer presented for care at the author’s wound care center. Because traditional wound care had failed and surgical debridement and repair was contraindicated due to her overall poor general health and malnutrition, an injectable dermal filler was applied inside the wound. The matrix filler was covered with secondary and tertiary dressings and the wound healed after 8 weeks with no adverse effects or infection. The results of this and previously published case studies suggest that injectable dermal matrix may be a viable option for non-surgical treatment of difficult-to-heal pressure ulcers with undermining. Additional safety, efficacy, and cost-effectiveness studies seem warranted.

KEYWORDS: pressure ulcer, undermining, dermal filler

Case Report

History. Ms. K, a 58-year-old Caucasian, presented to the wound care center with a chronic non-healing sacro-coccygeal pressure ulcer. Her past medical history included advanced rheumatoid arthritis, severe gastroesophageal reflux disease (GERD), and depression. Her medications included levothyroxine sodium, prednisone, infliximab, pamidronate disodium, buproprion, mirtazapine, vitamin C, and Ultracal (Novartis Nutrition, St. Louis Park, Minn) via percutaneous endoscopic gastrostomy tube (PEG).

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Ms. K was admitted to the hospital 5 months previously for removal of an infected PICC line placed for malnutrition secondary to severe erosive gastritis. During her admission, she developed a sacral pressure ulcer initially noted in the chart as Stage III with a surface diameter of 7.5 mm, depth measuring 1 cm, and “undermining noted as 1.5 cm to 2 cm circumferentially,” according to the plastic surgery consult notes. During her hospital stay, Ms. K was evaluated for surgical treatment for flap coverage by both general and plastic surgery but due to her malnutrition and overall poor medical condition surgery was not advised. She received conservative treatment: wound cleansing with saline, followed by Aquacel-Ag (ConvaTec, a Bristol-Myers Squibb Company, Princeton, NJ) packed gently to the undermined areas with secondary gauze dressing and changed on a daily basis as ordered by the attending physician. She continued with this regimen after discharge — first at a rehabilitation facility and subsequently through home health care.

After 4 to 5 months of treatment, Ms. K presented to the wound care center with persistent undermining. Her height and weight were 157 cm and 41 kg, respectively (body mass index = 16.6). Relevant physical exam by an MD revealed a thin, cachectic female with obvious rheumatoid deformities and limited range-of-motion of the joints in the hands and feet. A PEG tube was in place. She had a small, midline opening over the sacrum measuring approximately 2 mm in diameter. Probing revealed a depth of about 1 cm and undermining of the tissue in the 11 to 1 o’clock and 5 to 7 o’clock positions of about 1.5 cm. Serosanguineous drainage and crepitus were significant but no cellulitis, palpable abscess, or other fluctuance was noted.

Relevant laboratory values for Ms. K included an albumin of 2.4 g/dL (3-5); pre-albumin, 27 mg/dL (20-40); and Hgb, 11.9 g/dL (11.5-16). Her bone scan showed no evidence of osteomyelitis.

Treatment

Treatment as ordered by the wound care center physician and provided by the home health care agency consisted of an offloading cushion, education about the need for frequent repositioning, serial curette debridement (performed in clinic through the surface opening) to remove the pseudo-capsule, and collagen/alginate packing (Fibracol, Johnson and Johnson, New Brunswick, NJ) with secondary border foam (Mepilex, Molnlycke Health Care, Norcross, Ga.). Vitamin A, vitamin C, and zinc sulfate supplements were prescribed to supplement PEG feeding.

Three months after presentation to the center, Ms. K’s wound had not progressed toward healing. Undermining increased to 3 cm in the same positions as previously noted. She was referred again to plastic surgery but was told she still was not a candidate for surgery. The physician made the decision to use a micronized, particulate dermal matrix (Cymetra [Lifecell Corp, The Woodlands, NJ]) in an attempt to repair the undermined tissue, given its use as a dermal filler. Three weeks later, 2 mL of the product was injected directly into the depth of the wound and the undermined areas via the surface opening using an 18-gauge angiocath. Promogran (Johnson and Johnson, New Brunswick, NJ) then was packed to the surface as a “plug” and a tertiary foam border dressing (Mepilex) was placed. The tertiary dressing was replaced every 5 to 7 days with no further packing performed.

KEY POINTS

- Despite careful monitoring and the use of wound care products to fill the defect and protect the wound, pressure ulcers with undermined wound edges are often difficult to heal and may require surgical debridement and closure.
- In this case study, the author used an injectable dermal matrix material, developed for use in minimally invasive repairs, to treat a non-healing, undermined pressure ulcer.
- Based on the results of this and other case studies, the author concludes that this product may provide an alternative to surgical repair in a select group of pressure ulcer patients.
- Controlled clinical studies to evaluate the safety, outcomes and cost-effectiveness of this treatment are needed.
In 4 weeks, the undermining in Ms. K’s wound decreased to 2 cm and no residual dermal matrix was noted. By the 8-week post injection visit, the tunneling, undermining, and superficial wound had sealed, with no crepitus, movement of tissue, or fluid collection appreciated. The wound was healed and remained so at 6 month follow-up.

**Discussion**

Pressure ulceration is a major problem that consumes a significant amount of resources. The pathophysiology is well documented — pressure that causes soft tissue compression between bone and a rigid support surface has been found to be the main culprit in the development of full-thickness wounds. This mechanism induces ischemia in the tissues. Deep muscle is significantly more at risk for ischemia than superficial skin and leads to a cone-shaped, or “tip of the iceberg” type injury. Histopathologic studies have confirmed this pattern of injury and explain why many patients present with fairly small superficial wounds that exhibit considerable undermining of the edges and tunneling secondary to deeper tissue necrosis.

Undermining is differentiated from tunneling by a more extensive involvement of the wound edges with overhanging margins. In a study of quantitative cultures, Sapico et al examined the microbiological characteristics of decubitus ulcers in 25 spinal cord injury patients and found that ulcers with no necrotic tissue and no undermining were almost sterile; whereas, ulcers with no necrotic tissue but with undermining grew anaerobic and aerobic bacteria in significant quantities. In addition, histologic studies involving pressure ulcers have shown that undermined tissue has a propensity to develop a dense, poorly vascular fibrotic collagen network. This reduces the likelihood of granulation tissue formation, rendering conventional packing materials ineffective. Recent reviews and national guidelines have emphasized the need for extensive debridement to remove the undermined edges and all necrotic tissue to facilitate proper assessment of depth/stage and the ability to implement an appropriate topical treatment/dressing within the overall treatment plan.

The treatment of advanced Stage III or Stage IV pressure ulcers may involve surgery. Debridement, comprising removal of all necrotic tissue and undermining as well as overhang, is the norm. This usually is followed by myocutaneous flap coverage, either in one or two stages, as described in multiple case series and literature reviews. However, due to a high recurrence rate, most surgeons are selective about patients chosen for these procedures, with strict requirements for nutritional status, use of postsurgical pressure-relief surfaces, and lack of concomitant significant comorbidities. In the case described here, the patient was rejected for flap coverage surgery by the consulting surgeons on three separate occasions due to her immunosuppression and borderline nutritional status.

The micronized, acellular, dermal matrix product used in this case study is derived from human tissue. The sheet form (Alloderm, Lifecell, NJ) is indicated for use in soft tissue reconstructions such as abdominal wall repair, post-mastectomy breast reconstruction, and ear-nose-throat/plastics repair; the micronized form was developed for injectable use in minimally invasive repairs such as injection laryngoplasty and facial cosmetic procedures. Controlled clinical studies and case series have shown the effectiveness of these products when used in the above mentioned indications compared to bovine collagen. In one controlled study, Sclafani examined soft tissue augmentation in 25 patients treated with the sheet matrix product subdermally behind one ear and bovine collagen intradermally behind the other. Another group was treated with the sheet matrix, both intradermally and subdermally behind one ear and in similar fashion behind the other ear using bovine collagen. All patients were studied with digital photography to document soft tissue volume and biopsied after 12 weeks. Implanted and micronized intradermal and subdermal sheet matrix volume persisted significantly longer than bovine collagen. In addition, biopsy studies showed extensive fibroblast invasion of the sheet matrix but no foreign body inflammatory reaction.

The advantage of the matrix products is that they allow for soft tissue reconstruction with tissue integration and repopulation with native fibroblasts. In a
review, Homicz hypothesized that these products provide a matrix scaffold over which tissue integration is achieved. This occurs with little or no inflammatory response; the products are human-derived but completely acellular. In addition, unlike other forms of collagen, the newer injectable matrix has the ability to be placed in wounds where surface size limits packing. Finally, the fact that the matrix comprises human tissue may explain its greater incorporation as compared to bovine or other animal derived collagen, where hypersensitivity is seen in approximately 5% of patients.

Although used extensively in soft tissue surgical repairs and cosmetic procedures, such as neurosurgical resections, abdominal wall hernia repairs, and soft tissue augmentation, matrix use in chronic wounds has been limited. Reports in the literature of its use include only three pressure ulcer patients. In one case series where the product was used in 13 refractory wounds, only two were pressure ulcers. These studies do not mention wound undermining or tunneling in study participants and the patients did not heal despite two injections of matrix; however, a significant increase in granulation tissue was noted. Another paper describing use of the matrix for persistent sinus tracts in two patients included a sacral pressure ulcer patient with a persistent sinus tract but no undermining. This patient healed with two injections, administered 4 weeks apart. Despite the lack of undermining in the three patients with pressure ulcers in the aforementioned case series, the author surmised that the dermal matrix, with its ability to act as a filler and stimulate cell migration and tissue integration, might be beneficial in patients with undermined wounds.

Although the possibility exists for post-injection infection due to the higher bacterial burden of undermined ulcers and the possibility of “dead space” (ie, superficial closure without deep tissue repair), this was not a problem in this patient and no adverse effects were observed. Infection was probably avoided by ensuring the deep undermined recess was filled properly by using a long angiocath for injection and avoiding placement of the product near the skin opening.

Conclusion

Based on the results of this case and other case studies, the injectable dermal matrix seems to be a viable treatment option when other more conservative methods have failed to heal an undermined pressure ulcer and the patient is not considered a good candidate for surgical debridement and closure. Clearly, more research is necessary to evaluate the safety and effectiveness of using dermal fillers in chronic wounds, particularly in the context of pressure ulcers with substantial soft tissue loss. - OVM

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