Abstract: Lower extremity ulcers affect 8%–10% of individuals with sickle cell disease. The pathogenesis of this condition is poorly understood, and a good option for the long-term management of these lesions does not exist. Skin grafting and local wound care remain the mainstay of treatment; however, even short-term success often leads to long-term failure, as the wound might once again breakdown. The authors postulated that successful long-term healing of a chronic sickle cell leg ulcer would require a permanent alteration of the wound bed with recruitment of a new cell population. To this end, a skin graft, in conjunction with fat grafting, was performed for the treatment of a chronic sickle cell ulcer that had previously failed under local wound care and skin grafting treatments.

Sickle cell disease affects 1 in 5000 people in the United States, and is the most prevalent genetic condition in certain populations of Africa and South America. While they are not pathognomonic to the condition, lower extremity ulcers are a common manifestation of the disease. For reasons that remain unclear, these wounds tend to develop in areas with minimal subcutaneous fat, such as the ankles. The result is a lesion similar on exam to a venous stasis ulcer, with varying stages of breakdown. These lesions are known to heal slowly, responding unpredictably to treatment. Even once well healed, they often recur, becoming a difficult and chronic problem.

While vasculopathy is likely a factor, the mechanism of sickle cell ulceration is poorly understood. Limited evidence regarding sickle cell wounds suggests that arteriovenous shunting, rather than lack of perfusion, is responsible. While local trauma may be inciting, there is no clear link between injury and the development of these wounds. With little insight into the mechanism of this symptom, there are few good options for therapy. Local wound care remains the mainstay of treatment, as surgical management often fails in the long term. Effective therapy for these chronic wounds likely requires a change in the wound bed itself. Specifically, improved vascularity and a bulky soft tissue platform would help prevent wound breakdown, and would serve as an optimal bed for skin graft take.

Fat grafting is increasingly being recognized as a viable method of alter-
ing soft tissue quality and vascularity.\textsuperscript{4–6} Easily accessible through minimally invasive means, adipose tissue has been used to restore tissue bulk in congenital facial anomalies, fill in chronic open wounds, improve the texture and appearance of burn scars, produce neovascularization, and restore tissue quality to radiated skin.\textsuperscript{7–9} The authors hypothesized that subcutaneous fat grafting could improve the quality of a chronic wound bed associated with sickle cell ulceration, allowing good long-term skin graft healing where skin grafting alone had previously failed.

**Case Report**

The patient is a 34-year-old woman with sickle cell disease. Her prior medical history was significant for hepatitis C, contracted from a blood transfusion she received as a child. She has no allergies and takes no daily medications. The patient presented to the authors’ clinic with a 1-year history of a nonhealing 3 cm × 6 cm ulcer on her right medial ankle, with no exposed tendon or bone. The wound demonstrated no evidence of infection, and she had no other signs of vasculopathy on either lower extremity. She did not recall any incident of trauma to the site, and had no associated fevers. She did report that the wound was very painful, and that it had occurred independently of a sickle cell crisis.

As a first stage of treatment, the wound was debrided in preparation for skin grafting. Local wound care continued weekly until the wound demonstrated a healthy, granulating bed. Three months after initial presentation, a split-thickness skin graft was performed. Postoperatively, the wound was dressed with a V.A.C. dressing (KCI, San Antonio, TX) and then managed weekly with Unna boot dressing changes. At 4 weeks postoperatively, the patient presented with breakdown at the wound site and partial loss of the skin graft. Local wound care continued, but ultimately, the graft was lost. The patient continued to report severe pain at the site of the ulcer, and was prescribed narcotic medication as part of her treatment.

For the next 6 months, the wound was managed with daily wet-to-dry dressings and light compression. Although the wound bed was clean and granulating, there was no evidence of wound contraction or re-epithelialization at the site of graft loss. The patient began experiencing depression over the situation, and she requested another attempt at surgical management. At this time, the wound was 3 cm × 7 cm in diameter.

**Methods**

Tumescent solution (500 mL) was infiltrated into the subcutaneous fat of the patient’s lower abdomen. A total volume of 200 mL of lipoaspirate was obtained by hand held suction. It was decanted into multiple 20 cc syringes that were capped and positioned upside down in a tall container. The lipoaspirate was allowed to separate by gravity sedimentation over a period of 30 minutes. This helped to remove the liquid component and isolate the fat cells in the lower portion of the syringe. The liquid layer was aspirated from the surface of the lipoaspirate, and 30 mL of crude adipose tissue resultant from this process was transferred to 3-mL syringes. This concentrated fat was then injected in droplet fashion into the wound bed using an 18-gauge needle. A total of 9 mL of fat was transferred to the ulcer site.

The patient had a prior cesarean section scar, which she desired to have revised, therefore the authors planned to excise an ellipse of skin from her lower abdomen for use as the skin portion of the graft. The pre-marked area was incised and the skin was harvested for transfer. The full-thickness skin graft was pie-crusted and inset using 4-0 chromic suture. The wound was dressed with Bacitracin ointment and Vaseline impregnated gauze. A bolster was fashioned to secure the graft in place, and the patient remained with a compressive dressing in place and her leg elevated for several weeks postoperatively.

**Results**

During the first few postoperative weeks, the grafted skin demonstrated some epithelial slough with no skin loss. The wound was re-dressed weekly with antibiotic ointment and an Unna boot. At 3 weeks postoperatively, the sloughed area demonstrated good re-epithelialization, and the graft had good take. Over the next few weeks, the wound bed continued to heal well, with increased soft tissue bulk under the graft. The patient returned to her usual

**Key Points**

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daily activities within 6 weeks, with no further incidence of wound problems. The wound remained closed, with complete resolution of pain at 2 months postoperatively.

Discussion

Chronic wounds are difficult to treat without addressing their underlying cause. For patients with vasculopathy, this involves restoring adequate perfusion to the compromised area. For patients with skin breakdown secondary to pressure or infection, this involves frequent repositioning and mechanical/medical debridement. For patients with ulcers associated with sickle cell disease, the undefined cause of the problem means that treatment is empiric rather than targeted. The relapsing chronicity of the condition also means that short-term successes can ultimately translate into long-term failures.

Sickle cell ulcers usually occur in areas with little subcutaneous bulk and complex vascular arcades. Many of them heal spontaneously within a few months with local wound care. For those that persist to become chronic wounds (ie, lasting longer than 6 months), more definitive intervention is needed. While the biologic effects of fat grafting have yet to be fully defined, it is accepted that grafted adipose tissue produces lasting changes in local tissues. Many of these changes involve increased bulk and improved vascularity—two elements crucial to improving sickle cell wounds.

Although patients with sickle cell disease do not generally demonstrate poor vascular perfusion, they exhibit vascular abnormalities that may contribute to wound pathogenesis. One would argue that recruitment of new blood vessels would ultimately not be beneficial if these vessels are similar to anomalous. However, if grafted fat can produce new and usual vascular structures, then this could be one simple way of maximizing a graft bed at a chronic wound site.

Early reports of fat grafting techniques have demonstrated a 30% loss of graft volume within 6 months. For those that persist to become chronic wounds (ie, lasting longer than 6 months), more definitive intervention is needed. While the biologic effects of fat grafting have yet to be fully defined, it is accepted that grafted adipose tissue produces lasting changes in local tissues. Many of these changes involve increased bulk and improved vascularity—two elements crucial to improving sickle cell wounds.

Authors’ patient, if grafted fat can produce new and usual vascular structures, then this could be one simple way of maximizing a graft bed at a chronic wound site. Early reports of fat grafting techniques have demonstrated a 30% loss of graft volume within 6 months.

Key points

- For the authors’ patient, the dermal component of the grafted skin served as an optimal structural matrix, and the wound bed itself provided the necessary biologic factors. New cell populations would be likely to recruit necessary growth factors, enhancing the general tissue quality and climate.

Conclusion

Chronic sickle cell ulcers are challenging wounds with an often relapsing course. Management and treatment are painstaking and often unsuccessful. The authors suggest that fat grafting at the site of the ulcer may permanently alter the wound bed, allowing for better skin graft take, and ultimately the prevention of further wound breakdown over the long term.
References


