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CASE REPORT
Reconstructive

Autologous Cell Harvesting System as Adjunct for Soft-tissue Reconstruction of Necrotizing Soft Tissue Infection

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Summary: Necrotizing soft tissue infections (NSTIs) cause rapidly progressing destruction of skin and soft tissue, leaving large soft tissue defects and necessitating complex reconstruction. RECELL, an autologous cell harvesting device, provides a regenerative epidermal suspension (RES) from a small split-thickness skin biopsy for the substitution of (or in addition to) split-thickness skin grafting (STSG). We present a case of a 56-year-old man with extensive NSTI managed by serial debridement, leading to a degloving injury to the right upper extremity, axilla, flank and back, which was later reconstructed using RES application in conjunction with STSG and Integra placement. At his 2-week hospital follow-up, the patient was healing well with limited right upper extremity range of motion, but continued improvement seen with physical and occupational therapy. Due to the patient's significant soft tissue defect, a unique reconstructive plan was required using both Integra and RECELL in conjunction with STSG. RECELL, in conjunction with STSG, should be considered for the treatment of significant soft tissue defects such as those found in NSTI. *(Plast Reconstr Surg Glob Open 2022;10:e4197; doi: 10.1097/GOX.0000000000004197; Published online 18 March 2022.)*

Necrotizing soft tissue infections (NSTIs) are rapidly-spreading, aggressive soft tissue infections. NSTIs have an incidence of 0.3–15 per 100,000 and a mortality rate of 25%, thus requiring emergent surgical debridement and antibiotic therapy.[1–6] Meshed split-thickness skin grafting (STSG) usually addresses large soft tissue deficits, but reconstruction is challenging depending upon the size and location of the defect.[3,6]

Autologous cell harvesting devices, including RECELL, provide an array of epithelial cells, including keratinocytes, melanocytes, fibroblasts, and Langerhans cells from a small split-thickness skin biopsy. Although traditionally used to treat burns, regenerative epidermal suspension (RES) is also effective in management of trauma, cancer excision sites, and diabetic ulcers.[7–12] When full thickness wounds require coverage, RES is used in conjunction with STSG to provide the above-mentioned benefits. This is the first reported case of RES use, in conjunction with STSG and Integra, in a patient with major tissue loss due to NSTI. While Integra was used in specific areas over exposed tendons and crevices of the axilla for dermal regeneration, STSG and RES provided assistance with epithelial coverage and allowed use of meshed skin graft.

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Received for publication August 27, 2021; accepted January 25, 2022.

DOI: 10.1097/GOX.0000000000004197

CASE REPORT

A 56-year-old man was transferred to our facility for a higher level of care for extensive NSTI involvement of the right upper extremity (RUE), axilla, contiguous chest, and flank. He was taken to the operating room for emergent debridement after being started on vasopressors and other supportive treatment. His wound bed at the end of serial debridement consisted of a cadaveric-appearing extremity, including exposed muscles, soft tissues, and tendons (Fig. 1). Positive wound cultures for methicillin-resistant *Staphylococcus aureus* (MRSA), and carbapenem-resistant *Acinetobacter* respiratory cultures complicated recovery.

Upon recovery from his systemic illness, wound reconstruction was initiated after periods of local wound care until healthy granulation tissue was present. On postadmission day (PAD) 29, he underwent debridement of the right flank, chest (59 cm x 20 cm), and RUE wound (70 cm x 20 cm). On PAD 34, the patient returned to the operating room for debridement along with STSG to the right chest, flank, and shoulder. RES was applied over the graft

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

Fig. 1. Wound consisting of exposed muscles, soft tissues, and tendons of right upper extremity, axilla, flank, and back following serial debridement.

Fig. 2. Post admission day 62 (postoperative day 11 after reconstruction of right upper extremity with STSG and RES, and Integra to dorsum of hand and axilla).

and donor site of the right lower extremity, with Integra placement over the exposed hand extensor tendons and crevices of the axilla due to concern for increased shear forces (Fig. 2). During the earlier part of his care, he was largely unable to participate in occupational therapy due to significant pain; however, by PAD 50, the patient was ambulating without pain.

On PAD 51, he underwent debridement of the RUE (50 cm x 20 cm) and axilla (10 cm x 10 cm), STSG from the left thigh to RUE, RES application over the graft and donor site, and placement of Integra over the hand extensor tendons and axilla (Fig. 3). PAD 65, the patient underwent final debridement of the right dorsal hand (10 x 11 cm), axilla (13 x 11 cm), and RUE. A STSG from the right lower extremity was applied to the RUE and axilla with RES application over the graft and donor site (Fig. 3). The last graft takedown occurred on postoperative day 5 with 95% take. Involvement with physical/occupational therapy improved upon staged coverage of his wound and his pain remained well-controlled. He was able to move to/from supine to sitting, transfer to a bedside commode, and was progressing with grooming/dressing with both hands. At discharge, he was actively participating in RUE range of motion (shoulder abduction to 60 degrees, elbow flexion to 90 degrees) within limits of postoperative dressings. He was discharged to a rehabilitation facility without need for additional reconstruction and healing well with good graft take 2 weeks postdischarge (Fig. 4). He reported improved mobility in his hand and fingers, almost able to make a fist; however, his RUE range of motion remained limited due to poor compliance with therapy. Long-term evaluation of functional outcomes was unable to be obtained due to poor follow-up.

DISCUSSION

Wide debridement following NSTI leaves significant soft tissue deficits due to aggressive and rapid evolution of the disease process, requiring reconstruction often accomplished with autografting or flaps. In massive wounds, flaps lack sufficient coverage potential for wider areas of the body over contiguous anatomic sites. In these cases, STSG remains the only option for wound coverage. Dermal regenerative templates (DRT) such as Integra allow coverage of deeper tissue, tendons, nerves, and sometimes exposed bone before placement of STSG.

Literature regarding the reconstruction of NSTI wounds is limited. A study in 46 NSTI patients concluded that reconstruction with STSG was best.[13] While STSG may be the most viable option, drawbacks include

Fig. 3. Donor-site on postoperative day 28.

an additional wound, pain management, and significant scarring limiting functionality as well as poor cosmetic outcomes.

Autologous cell harvesting devices have been readily adopted by the burn community with satisfactory outcomes. RES, in combination with STSG or by itself, produced decreased donor site morbidity, donor site burden, and faster healing time in trauma patients with full-thickness soft tissue defects compared with those only receiving DRT and STSG.[14] Aesthetic benefits include improved re-pigmentation when used in conjunction with DRT and STSG. Similarly, RES with STSG may have an indication for use in NSTI reconstruction based on our patient experience.

Our patient had significant soft tissue defects requiring a unique reconstructive plan. Healing by secondary intention was impossible, and the surface area needing coverage was too significant for a flap. The patient underwent extensive serial debridement, RES with STSG, and Integra placement, which produced satisfactory outcomes in coverage, appearance, improvement in postoperative pain, and limited but still improved functional assessment.

Fig. 4. Two weeks postdischarge.

RES was used with STSG with improved graft appearance of supple tissue versus hypertrophic scarring, considering a 2:1 meshed skin graft was utilized. Integra was used for dermal substitution over the axilla and dorsum of the hand for concern of shear forces. Although the RES was not directly involved in the fasciitis management because it was used in combination with STSG, its use in relation to the soft tissue reconstruction is novel in an NSTI patient. In this case, combination of DRT with STSG and RES provided comprehensive coverage options. RES has already been widely used with beneficial impacts in burn patients despite its increased cost of care. Further prospective studies would help delineate its role in patients with large wounds following surgical treatment of NSTI. The major limitation of this study is the single case nature with lack of long-term follow-up.

CONCLUSIONS

The use of autologous cell harvesting systems can be beneficial in treating extensive soft tissue wounds like in the management of NSTI in conjunction with STSG with improved graft appearance. This case highlights an important modality to consider when reconstructing NSTI wounds.

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