Innovative Combination Therapy with Novel Allograft Tissue in Aiding Natural Wound Closure of Complex Wounds

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ABSTRACT

Complex wounds are difficult to heal since they can be deep and further challenged with co-morbidities (diabetes, vascular disease, obesity). In the United States, over 6.5 million individuals have unhealed complex wounds[1]. This study examines a combination treatment of human allograft tissue (dermal, amniotic, adipose) to support various stages of treatment and aid natural closure[2].

A 53-year old diabetic male (with hypertension, hyperlipidemia, hypothyroidism) developed gas gangrene on his left plantar foot (open over a year). The necrotizing infection initiated at the 4th metatarsal head and tracked to the 3rd toe, the metatarsal phalangeal joint, and the flexor tendons to the plantar medial arch. Decompression of the infection involved debridement and removal of the soft tissue including the plantar fascia. The wound was packed twice daily with 0.25% Dakin's for 3 days followed by debridement of the non-viable skin edges and amputation of the 3rd toe in the OR. Pre-meshed, human reticular acellular dermal matrix (HR-ADM) was applied in a single layer and contoured to the wound bed. The graft was secured with nylon sutures, dressed with oil emulsion dressing along with negative pressure wound therapy (NPWT). The patient was off-loaded with a knee-walker and the NPWT was changed weekly. This strategy facilitated granulation-angiogenesis to rebuild tissue. To support further granulation and epithelialization, aseptically processed viable human amnion (week 6.7) and dehydrated human amnion and chorion allograft (dHACA) (week 11), were applied, casted and changed biweekly. The subcutaneous tissue of a small open region (below the 4th metatarsal) received adipose allograft matrix (AAM) to supplement the atrophic fat pad. The patient was non-weight bearing with a knee walker for 3 weeks and reached natural wound closure at week 15.

This unique case demonstrates that complex wounds may require a combination of allograft treatment to support natural wound closure depending on the depth and type of wound.

MATERIALS AND METHODS

Human dermal tissue, human placental tissue and human adipose tissue were recovered from donors with research consent, and the tissues were aseptically processed at the Musculoskeletal Transplant Foundation (Edison, NJ) according to Good Tissue Practices.

Case study involves a 53 year old male who had developed gas gangrene on his left plantar foot and has been open for over a year. To treat this complex wound, a combination of advanced wound therapies were selected to treat the open wound. Negative pressure wound treatment (NPWT) was used at 125mmHg and off-loading options utilized were total contact casting (TCC) and a knee walker.

CONCLUSION

This complex, deep wound was treated with a combination of advanced wound care treatment and off-loading. With the staged treatment of pre-meshed human reticular dermis with NPWT, cryopreserved viable human amnion (with TCC), dehydrated human amnion/chorion membrane (with TCC) and human adipose allograft matrix (with a knee walker), the patient achieved natural wound closure within 15 weeks.

REFERENCES

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RESULTS

Patient Information: 53 yr male with Insulin Dependent Diabetes– Mellitus and hypertenstion. Hba1c is 9.1.

Wound History: Patient presented with low grade fever and grossly infected wound on the left foot 3rd metatarsal head. Wound present for 1.5 years and patient had a previous 5th metatarsal resected. Fever started 5 days prior to hospital admission.

Wound Size: DFU is 1cm x 0.8cm x 1cm with positive probe to the bone. Base was fibronecrotic with active purulence and malodor. The wound tracked and undermined towards the medial arch.

Initial Examination:

- Initial surgery consisted of incision and drainage of left foot into the plantar arch and extending from the 3rd toe to the 1st metatarsal phalangeal joint
- Deep wound cultures isolated methicillin sensitive *Staphylococcus aureus*
- Started IV vancomycin
- Wound packed with 0.25% sodium hypochlorite twice daily until second surgical debridement in the operating room (Day 4)
- Patient switched to IV UNASYN

Treatment:

- Resection of the 3rd metatarsal head and amputation of the 3rd toe
- Following debridement on Day 4, pre-meshed reticular acellular dermis* ($6x8cm^2$) was applied with sutures and NPWT at 125mmHg, continuous, changed biweekly for 3 weeks
- The pre-meshed dermal graft covered the bone to facilitate granulation
- Day 50, cryopreserved viable human amnion** ($3x4cm^2$) was applied with NPWT changed biweekly
- Day 64, cryopreserved viable human amnion ($3x4cm^2$) was applied, NPWT was discontinued and WBAT was placed in total contact casting
- Day 71, dehydrated human amnion/chorion membrane*** ($3x4cm^2$) was applied WBAT in total contact cast
- Day 81, dehydrated human amnion/chorion membrane (18mm disk) graft was applied in total contact cast
- Day 99, dehydrated human amnion/chorion membrane (18mm disk) was applied. 5mL adipose allograft matrix**** was injected into the 4th metatarsal head to support the atrophic fat pad
- The patient was non-weight bearing with a knee walker

Outcomes:

- Complete closure in 112 days
- Total number of grafts:
  - 1 human pre-meshed reticular acellular dermis
  - 2 cryopreserved viable human amnion grafts
  - 3 dehydrated human amnion/chorion membranes
  - 1 human adipose allograft matrix injection

Transition of a Deep, Open Complex Wound through to Wound Closure

Day 0 - Initial Consultation

Day 4 - Incision & Drainage

Day 4 - Placement of pre-meshed reticular dermis

Day 4 - Sutured pre-meshed reticular dermis

Day 8

Day 50 - Viable amnion applied

Day 64 - Viable amnion applied

Day 99 - Dehydrated amnion/chorion membrane applied

Day 99 - Adipose allograft matrix injected

Day 102

Day 105

Day 112 - Wound closed