Promising Healing Outcomes With Cryopreserved Umbilical Skin Substitute Grafts: A 10-Case Evaluation

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Background

- **The use of umbilical skin substitute grafts has gained attention for their potential in wound healing, offering a novel approach to tissue regeneration.**
- **Cryopreservation enhances the shelf-life and application of these grafts.**
- **This case series examines the clinical outcomes of 10 patients who received cryo-preserved umbilical skin substitute grafts for wound treatment at a single institution performed by faculty of the Department of Podiatry and residents at Cape Fear Valley Health.**

Methods

- A total of 10 patients with chronic wounds of varying etiologies were treated with cryopreserved umbilical skin substitute grafts following failure of conventional wound care therapies.
- Patient demographics, wound characteristics (including wound type and baseline size), and comorbid conditions were recorded. Glycemic control was assessed using average hemoglobin A1C values.
- Clinical outcomes were evaluated using percentage wound size reduction over the treatment period, hospital length of stay, and 30-day readmission rates. These measures were used to assess both the effectiveness of the grafts in promoting wound healing and their impact on short-term clinical outcomes in a high-risk patient population.

Results

The application of cryopreserved umbilical skin substitute grafts led to an overall average wound reduction of 62.68% across all patients.

The average hospital stay was 5.6 days, indicating a relatively short recovery period.

Additionally, the average readmission rate was 20%, reflecting a low incidence of complications or the need for further intervention.

Cryopreserved Umbilical Cord Allograft

Commercial placental tissue grafts have emerged as a treatment option for complex wounds due to their anti-inflammatory, antioxidant, antimicrobial, and angiogenic properties that support tissue repair and regeneration.

Cryopreserved umbilical tissue is derived from placental tissue and consists of an outer amnion layer and an inner stromal layer known as Wharton's jelly.

This graft preserves a native extracellular matrix rich in collagen and hyaluronic acid, along with growth factors, cytokines, and viable epithelial cells, fibroblasts, and mesenchymal stem cells found in fresh umbilical tissue.

The material is a soft, conformable, and durable graft approximately 1–3 mm thick, making it suitable for coverage of large, complex wounds.

Available sizes:
2 x 4 cm
3 x 6 cm
3 x 8 cm

Discussion

Cryopreserved umbilical skin substitute grafts demonstrated significant potential in promoting wound healing, with favorable outcomes in terms of wound reduction, hospital stay, and readmission rates. These results suggest that this treatment modality could be a promising alternative for managing complex wounds, offering a combination of efficacy and efficiency in clinical settings. Further studies with larger sample sizes and longer follow-up periods are needed to confirm these findings and explore the long-term benefits of this approach.

Complex wounds of multiple etiologies like shown on this case series have shown clinical difficulty with closure and many lead to higher level amputation. Especially in high-risk patients with comorbidities who may not tolerate traditional options like skin grafts or flap surgery. In this case series, after a single application of viable cryopreserved umbilical tissue, we see multiple cases of recalcitrant ulcers leading to 100% wound closure or a significant reduction in wound size which in return prevented higher level amputations and led to a decrease in re-admission rate with close and frequent clinic outpatient follow up.

References

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Case Series

Case 1

- 29 year old male presenting to the ED with worsening chronic ankle wound. Extremely tender to palpation and history of multiple debridements with multiple negative biopsies.
- PMH: Type 1 Diabetes Mellitus.
- Patient initially underwent sharp excisional debridement of wound with application of 3 cm x 6 cm cryo-umbilical graft application. Subsequently discharged on PO Augmentin and weekly clinic OP follow up.

Week 0
4 cm x 3 cm x 0.5 cm

No cortical erosion on X-ray

Intraoperative application of cryopreserved umbilical skin substitute graft

Week 2
3.6 cm x 2.9 cm x 0.4 cm
We can start seeing clinical integration of graft with resolution of skin epiboly and early granular tissue formation

Week 6
1.6 cm x 1 cm x 0.2 cm
We can start seeing decreased in wound size and complete resolution of epiboly and inflammatory border with an almost entirely granular wound bed

Week 8
Complete resolution of recalcitrant wound

Case 2

- 76 year old female presenting to the ED with painful ulceration to the left ankle with exposed hardware. Patient had a prior trimalleolar ankle fracture which was repaired via ORIF one year prior to presentation.
- PMH: Hypertension, Hx of AKI, Hx of tri-malleolar ankle fracture, Non-smoker, Hx of OM.
- Patient initially underwent hardware removal without residual bone instability, with debridement of wound and bone, after negative bone pathology patient underwent second debridement with graft application.

Pre-op hardware removal. Healed trimalleolar fracture

ED presentation–Exposed hardware with subsequent peri-wound cellulitis

Post-op hardware removal, no bone instability

3 cm x 2.5 cm x 0.4 cm
Week 0
Pre-op

2.4 cm x 2 cm x 0.2 cm
Week 4
Granular wound bed and cessation of inflammatory phase of wound

Week 8
Complete resolution of ulceration

Case 3

- 43 year old male presenting to ED due to 3 week old crush injury to dorsal right foot secondary to trailer falling on foot. Main complaint of pain and redness with drainage.
- PMH: Uncontrolled T2DM (A1C 12), Tobacco Use (Daily)
- Patient started initially on Bactrim and NWB in post-op shoe. Formal OR debridement scheduled due to extent of tissue necrosis and abscess formation.
- Intraoperatively hydrosurgery system was used with placement of 3.0X6.0CM umbilical graft.
- Patient followed up weekly in clinic for dressing changes until resolution of wound.

Initial ED Presentation

XR Right FOOT AP: Displaced fracture through the distal 2nd metatarsal shaft. Nondisplaced fracture through the distal 3rd metatarsal shaft.

4.7 x 2.6 x 0.6 cm
Pre-Op

6.0 x 3.4 x 0.9 cm
Intra-op

2.5 x 1.7 x 0.3 cm
Week 5 Post-op

Week 8 Post-op

Case 4

- 64 year old male presenting to ED originally due to gangrenous changes to right foot.
- PMH significant for uncontrolled T2DM (A1C 10), PVD, substance abuse, tobacco abuse (daily), osteomyelitis right foot.
- Patient initially underwent right foot TMA. He was followed by vascular surgery and infectious disease while inpatient. Underwent RLE angiography and angioplasty with PT and DP on doppler post intervention. Discharged on IV vancomycin and IV cefepime for 6 weeks after initial surgery.
- Presented back to ED 2 months after initial TMA due to concern of dehiscence to site. Underwent repeat debridement with hydrosurgery system and placement of 3.0X6.0CM umbilical graft.
- Routine weekly follow-up in wound care until wound closure.

Initial ED Presentation

Successful balloon angioplasty of right superficial femoral popliteal anterior tibial and tibial peroneal trunk stenoses with in-line flow to the foot via the posterior tibial and anterior tibial arteries.

2 Months s/p initial Right foot TMA

Intra-op
Intraregional application of cryo-preserved graft to fill soft tissue deficit

4.9 cm x 1.1 x 0.2 cm
Week 3 Post-op
We can start seeing a completely granular wound bed with early migration of soft tissue

Week 8 Post-op

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