

Dehydrated human amnion/chorion membrane allograft as an aid for wound healing in patients with full-thickness scalp defects after Mohs micrographic surgery



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INTRODUCTION

Large surgical defects after Mohs micrographic surgeries (MMS) often require rotation or advancement flaps, skin grafts, or delayed reconstruction after use of tissue expanders. For patients with limited tissue redundancy, wounds may also heal by secondary intention. Elderly patients undergoing MMS with full-thickness defects exposing bone pose a unique set of healing barriers, such as immunosuppression, increased infection risk, poor tolerance to bone chiseling for exposing pinpoint bleeding, and difficulty in reaching wounds to apply dressings successfully. Dehydrated human amnion/chorion membrane (dHACM) allografts are skin substitutes that can be placed in wound beds to accelerate wound healing and decrease pain without the need for meticulous wound care. These grafts are placed directly on bone weekly, integrate into the wound beds, and encourage rapid granulation without the need for dressing changes. We describe a case series of 5 elderly patients with large, full-thickness, surgical defects to the bone on the scalp/forehead after MMS who were treated with dHACM allografts (Epifix; MiMedx Group Inc, Marietta, GA) to facilitate timely wound bed granulation.

CASE SERIES

Five elderly patients with full-thickness MMS defects to bone received weekly dHACM grafts to facilitate wound healing. Time until wound bed granulation was chosen as an endpoint, as patients

Abbreviations used:

dHACM: dehydrated human amnion/chorion membrane
MMS: Mohs micrographic surgeries

were often released back to their referring provider at that time. For the patients who had complete epithelialization while under our care, we have included these times. After wound bed granulation, the wounds were allowed to heal via secondary intention. While using the dHACM, the graft was applied to the wound bed followed by petroleum jelly. Then, a nonstick dressing was applied with tape to cover the wound. The dressing was left in place for 1 week, and patients were instructed to keep the dressing dry during that period.

Patient demographics, wound sizes, graft application numbers, time until wound bed granulation, time until epithelialization (if known), and average reported pain over the course of treatment are delineated in [Table I](#) and [Figs 1](#) and [2](#). None of the patients received preoperative or postoperative antibiotics or prescription pain medication. Patients 1, 2, 4, and 5 all had difficulty reaching their wounds and could not easily see the wound bed because of the location of the defect. Patient 2 subsequently had many squamous cell carcinomas of the scalp and is currently undergoing radiation therapy, which has slowed the healing of his wound. At the time of

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Table I. Patient demographics

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
Gender	M	M	F	M	M
Age	72	90	92	98	77
Comorbidities	CLL	None	HTN	Afib, CAD, HTN, CVA	Esophageal cancer, DM
MMS defect (cm ²)	10.26	33.6	15.75	13.3	25
No. of weekly applications	4	6	4	9	7
Time until wound bed granulation (wks)	5	7	5	12	8
Time until epithelialization	7 wks	Still healing	11 wks	Still healing	21 wks
Reported pain	None	None	None	None	None

Afib, Atrial fibrillation; *CAD*, coronary artery disease; *CLL*, chronic lymphocytic leukemia; *CVA*, cerebrovascular accident; *HTN*, hypertension.

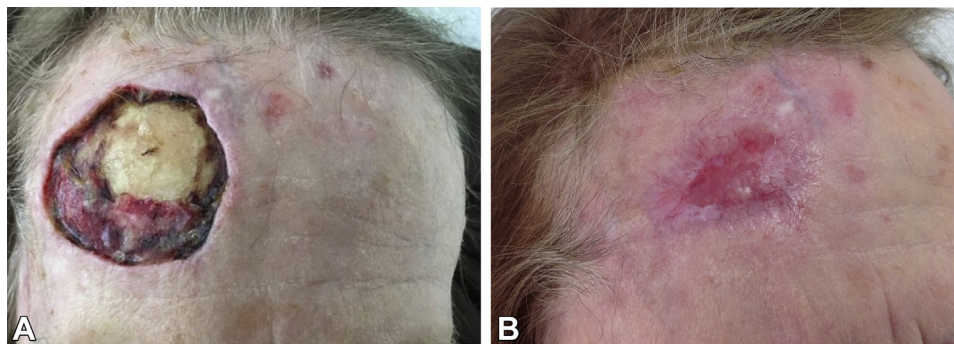


Fig 1. **A**, Patient 3 with MMS defect down to the bone. **B**, Patient 3 after 4 applications of dHACM allograft with complete healing at 2.5 months. Wound bed granulation occurred at 5 weeks.

submission of this report, his wound was still not epithelialized after 11 months.

DISCUSSION

Elderly patients undergoing MMS with full-thickness defects exposing bone pose a unique set of healing barriers, such as increased infection risk, poor tolerance to bone chiseling for exposing pinpoint bleeding, and difficulty in reaching wounds to apply dressings successfully. The use of dHACM in patients with full-thickness MMS defects has several advantageous benefits compared with current standard of care of healing by secondary intention or methods to stimulate pinpoint bleeding like bone chiseling. One advantage is the ease of postprocedure wound care, which was appreciated by our cohort and their families. The use of dHACM allows for patients to come into the office only once per week for a dressing change with application of a new graft at that time compared with traditional healing by secondary intention, in which the wound would require daily cleansing and dressing changes and consistent attention by a caregiver or necessitates setting up home health. Another major advantage of using dHACM grafts to stimulate healing was the

paucity of postprocedure pain reported by our patients. Compared with frequent cleansing and dressing changes, which can be uncomfortable, none of our patients reported pain after dHACM allograft applications. None of our patients required narcotics, and fewer than 50% reported taking acetaminophen that we recommend to all of our post-Mohs surgery patients without contraindications. This absence of pain may be caused by the graft's anti-inflammatory properties as well as the physical barrier covering nerve endings.¹ Third, the use of the dHACM also helps avoid invasive bone chiseling to stimulate pinpoint bleeding and subsequent granulation, as the graft contains cytokines and growth factors to facilitate healing less traumatically. In previous studies for full-thickness MMS wounds, chiseling, fenestration, or decortication of exposed bone was performed to promote granulation and allow for healing by secondary intention,^{2,3} but this technique can be challenging for patients to tolerate.

The dHACM allograft is one of many treatment options available for full-thickness wounds. Human amniotic membrane with both amnion and chorion has been used for more than a century and has been found to promote healing, reduce localized pain,



Fig 2. **A**, Patient 5 with exposed periosteum and bone after MMS. **B**, Patient 5 after 7 applications of dHACM allograft with subsequent appropriate granulation tissue development.

provide a matrix for cellular migration and proliferation, and reduce inflammation; the dHACM also has antibacterial properties.⁴⁻⁷ These allografts contain more than 50 cytokines and growth factors, which promote angiogenesis and specifically have been found to promote wound healing through the induction of fibroblast proliferation and upregulation of basic fibroblast growth factor, granulocyte stimulating factor, and placental growth factor biosynthesis.^{8,9} The amnion is harvested from the placenta of healthy patients after cesarean sections and is cleaned and then dehydrated with a resultant allograft having a 5-year shelf-life.¹⁰

In several observational and randomized controlled trials, dHACM allografts were found to be superior when compared with standard wound care.¹⁰⁻¹² Most studies examined dHACM allografts primarily for the treatment of diabetic foot ulcers and venous stasis ulcers, whereas the literature for use after MMS is scant.¹¹⁻¹³ One prospective, randomized trial by Zelen et al¹¹ compared dHACM against the standard care for the treatment of diabetic foot ulcers and found that the overall healing rates at 6 weeks for dHACM allograft vs standard treatments were 92% and 8%, respectively.¹¹ Another study examining dHACM allograft with compression therapy against compression therapy alone for the treatment of venous leg ulcers found that 62% of the dHACM allograft group achieved 40% wound closure at 4 weeks, whereas only 32% of the control group achieved the same amount of closure.¹² These allografts have also been used successfully in one study in the treatment of intractable pyoderma gangrenosum in which the application resulted in pain resolution and a decrease in the wound size of greater than 50% after three applications.¹⁴

In this case series, dHACM allografts were safe and well tolerated with no complications in elderly patients with full-thickness MMS defects for whom surgical repairs were declined or not possible and for whom daily or twice-daily wound care was challenging. All of our patients reported no pain after dHACM allograft application. Further studies are needed to compare the length of time for total resolution of full-thickness MMS defects to the bone using dHACM allografts versus secondary intention alone to determine if their use results in a significantly decreased healing time.

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