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Utilization of polyhexamethylene biguanide hydrochloride (PHMB) embedded collagen matrix to heal a chronic stage 4 sacral pressure injury



Fareea Khaliq, MD^{1,2}, Erin Osullivan, MSN, APRN-BC, CWS¹, Darlene Hanley RN, WWC¹, and James Doan, MD^{1,2,3}



¹VA Boston Healthcare System, Boston Massachusetts, ²Harvard Medical School Department of PM&R, Boston, Massachusetts, ³Tufts Univ. School of Medicine, Department of PM&R, Boston, Massachusetts

Introduction

- Stages of pressure injuries classified by NPIAP:
 - Stage I: Nonblanchable erythema, intact skin
 - Stage II: Partial thickness loss of dermis, no subq fat or underlying tissue exposed
 - Stage III: Exposed subq fat
 - Stage IV: Full thickness with exposed fascia, muscle, tendon, bone
 - Unstageable: Slough or eschar occluding the wound
 - Deep Tissue Injury: Localized area of discolored intact skin or blood-filled blister, intact skin
- Polyhexamethylene biguanide (PHMB) embedded collagen skin graft is an antimicrobial barrier that has been implemented to increase epithelization and regeneration of damaged tissue. There is a cross-linked extracellular matrix as part of the graft that inhibits inflammatory cytokines and promotes resistance of degradation.

Clinical Case

75-year-old T6 AIS A male with a chronic and recurrent stage 4 sacral pressure injury presented with sepsis from the infected sacral wound. He underwent surgical debridement in the operating room twice and was placed on 6 weeks of intravenous antibiotics before being sent to a Veterans Affairs (VA) hospital with a vacuum assisted closure (VAC) device for further management and care.

Results

At the VA facility, the wound initially measured 9.5 cm in length, 9cm in width with a depth of 3cm. The patient was limited to 2 hours out of bed (OOB) time with VAC changes three times a week. A PMHB infused collagen skin graft was then applied to the wound bed. The graft was reapplied twice a week. Once there was full granulation tissue over the wound bed, the VAC was discontinued, and the patient continued with the skin graft covered with a silicone foam dressing. His OOB time was gradually increased to 8 hours and five months after initiation, his wound measured 1.5x1x1cm.



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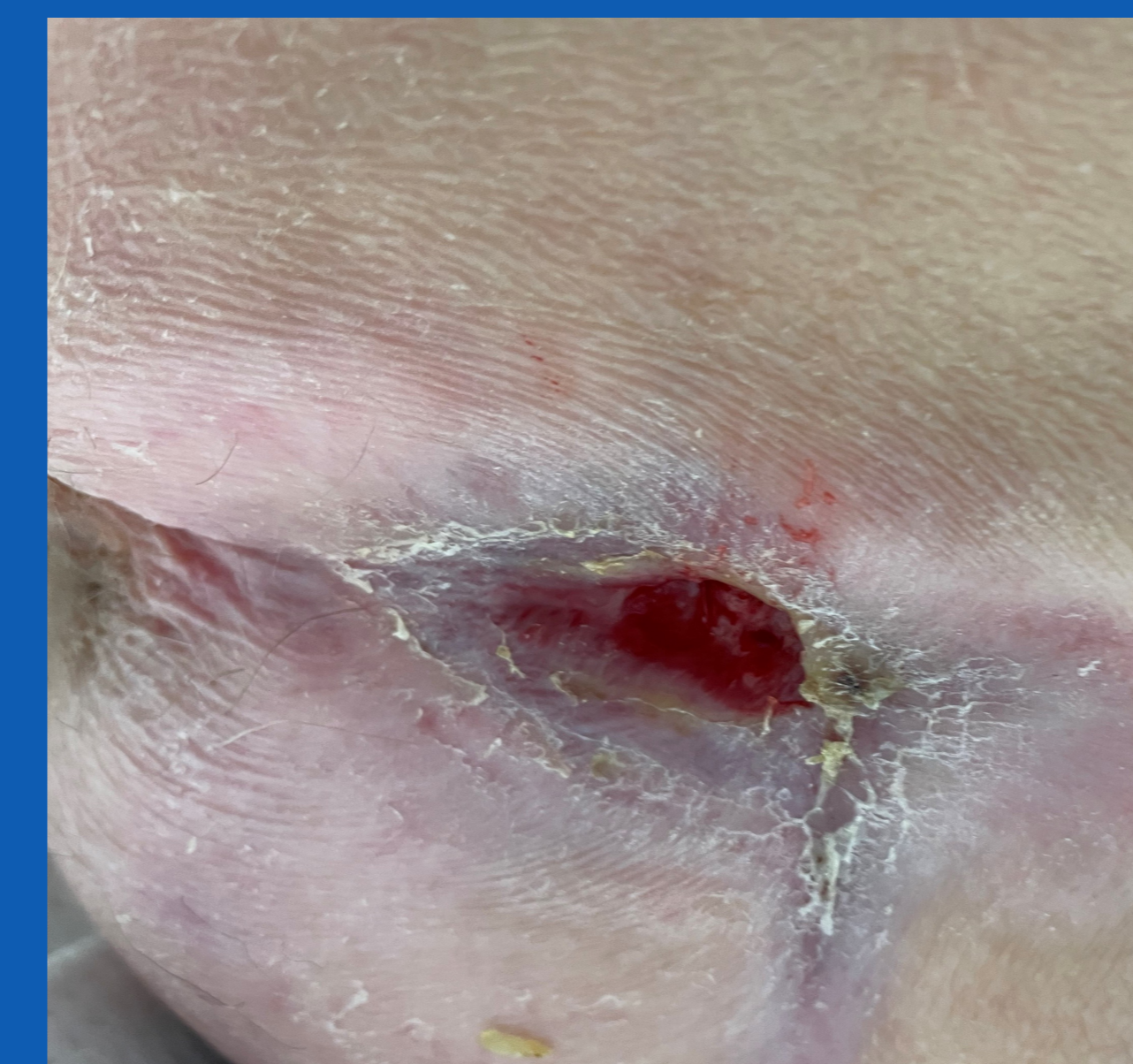
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Discussion

- There are five phases of wound healing:
 - The Hemostasis phase occurs immediately after injury to the skin causing vasoconstriction of small vessels within the damaged tissue along with activating the clotting cascade pathways to prevent further bleeding and damage
 - In the Inflammation phase, there is recruitment of macrophages, mast cells, and other vasoactive substances to promote edema and vasodilation. Many chronic wounds do not progress past this stage.
 - In the Epithelization phase, there is epithelial cell migration along with proliferation of these cells until they reach the dermis layer. In chronic wounds, the physical distance of epithelial migration is increased resulting in limited closure.
 - Fibroblasts are produced in the Fibroplasia phase aiding in pulling together the edges of the wound as well as creating collagen.
 - In the Maturation phase, there is collagen cross-linking, collagen remodeling, wound contraction and regimentation. The more collagen that is present, the stronger the tensile strength of the wound.

Conclusion

While the wound VAC aided in increasing granulation tissue at the wound bed, there was limited epithelization, which halted the recovery process and left the wound as a residual open stage 4 wound. Utilizing the antimicrobial PMHB embedded collagen skin graft not only allowed for substantial healing and epithelialization of the wound, but further stimulated the process in an otherwise non-healing wound. More data and research is necessary to further augment use of these types of skin grafts for patients with chronic pressure injuries.

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