Novel Use of Microfluid Jet Therapy for Wound Bed Preparation and Facilitated Extraction of Calcinosis Cutis in Venous Ulcers

Vincent W. Li, MD, MBA*† § ; William Tsiaras, MD, PhD† § ; Noemi Y. Li*; William W. Li, MD*

Affiliations
*Angiogenesis Foundation;
†Angiogenesis & Wound Healing Center, Mass General Brigham Dermatology Dept;
§ Harvard Medical School

Background

Chronic venous leg ulcers are frequently complicated by lipodermatosclerosis and dystrophic calcinosis cutis, which create substantial barriers to wound healing. Calcinosis cutis produces firm, adherent calcium deposits within the wound bed and surrounding soft tissue, impairing granulation tissue formation, sustaining inflammation, and increasing the difficulty and pain of traditional sharp debridement. Management often requires repeated surgical extraction of calcific material and is associated with procedural pain and infection.

Microfluid jet therapy is an emerging wound bed preparation technology that delivers a precision high-velocity fluid stream capable of selectively removing slough, biofilm, and necrotic tissue while generating controlled microbleeding that stimulates angiogenesis and granulation tissue. Its ability to disrupt and mobilize calcific deposits within chronic wounds has not previously been reported.

Case

A 79-year-old woman presented with an 18-month nonhealing right pretibial ulcer associated with chronic venous stasis, lipodermatosclerosis, and dystrophic calcinosis cutis. Radiographs demonstrated extensive subcutaneous calcifications beneath the wound bed (**FIGURE 1**). The patient had a history of failed split-thickness skin grafts, recurrent soft-tissue infection, unsuccessful medical therapy with doxycycline and colchicine.
Prior treatment included repeated outpatient sharp debridement with surgical extraction of calcific deposits, which was associated with significant procedural pain requiring opioid analgesia. Microfluid jet therapy* was performed to the wound (**FIGURE 2, 3**) every few weeks in the outpatient setting using hypochlorous solution.

FIGURE 1. Radiograph demonstrating extensive subcutaneous calcinosis.

FIGURE 2. Wound appearance before microfluid jet therapy

Results

Following initiation of microfluid jet therapy the following were observed (**FIGURE 4**):

- Removal of devitalized tissue and debris
- Resolution of soft-tissue infection
- Controlled microbleeding
- Improvement in wound bed quality and development of granulation tissue

A notable finding was marked comminution and loosening of calcinosis cutis deposits. The high-velocity microfluid stream generated fluid shear forces and oscillatory mechanical energy, disrupting calcific aggregates embedded within the wound bed. After treatment, previously adherent calcium deposits were easily removed with forceps (**FIGURE 5**), contrasting with the prior need for surgical extraction. Procedures were well tolerated without use of additional opiods, and strikingly, the patient reported significantly reduced procedural pain *(rated 3 out of 10)* compared with prior sharp debridement sessions *(rated 10/10)*. Negative pressure wound therapy (NPWT)** was applied to the wound post-treatment (**FIGURE 6**).

Fluorescence imaging*** demonstrated a reduction in real-time microbial fluorescence following microfluid jet therapy, indicating effective bioburden control (**FIGURE 7,8**).

FIGURE 3. Microfluid jet therapy in use.

FIGURE 5. Loosened calcific deposits.

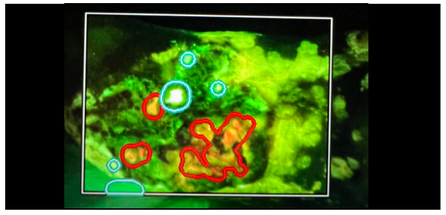

FIGURE 7. Bacterial fluorescent imaging before microfluid jet therapy

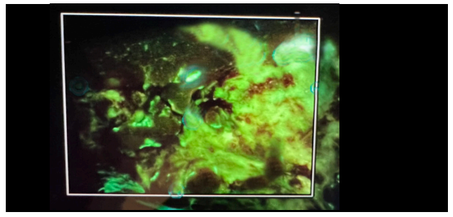

FIGURE 8. Bacterial fluorescent imaging after microfluid jet therapy

Conclusions

This case highlights a novel application of microfluid jet therapy in the management of chronic venous ulcers complicated by calcinosis cutis. Key observed benefits included:

- Selective removal of devitalized tissue and biofilm
- Antimicrobial wound cleansing
- Controlled microbleeding with wound bed activation
- Facilitated extraction of calcific deposits
- Improved procedural tolerability

The combination of precision fluid shear forces and oscillatory energy transfer may provide a previously unrecognized method for mobilizing calcific material within chronic wounds.

Microfluid jet therapy represents a valuable outpatient strategy for wound-bed optimization in calcific and refractory ulcers, warranting further investigation.

FIGURE 4. Wound bed preparation achieved with microfluid jet therapy.

FIGURE 6. NPWT utilized to continue wound healing progress.

References

1. Reiter N et al. Calcinosis cutis: pathophysiology and clinical management. *J Am Acad Dermatol 2011*
2. Kyoung J, et al. Dystrophic calcinosis cutis leading to nonhealing wound. *Plast Reconstr Surg Glob Open 2024.*
3. Goswami AG, et al. Biofilm and wound healing: from bench to bedside *Eur J Med Res 2023*
4. Serena TE, et al. Real-time bacterial fluorescence imaging. *J Wound Care 2019.*
5. Han D, et al. Models of shear-induced platelet activation and numerical implementation. *J Biomech Eng 2021.*

Footnotes: * HydroPrep™ Therapy, Medaxis
** Liberty™ NPWT Therapy Unit, Medaxis)
*** MolecuLight *i:X*™,MolecuLight Inc.)