National University Hospital

The use of Ultrasonic-Assisted Wound (UAW) debridement and novel antimicrobial foam dressing for effective management of venous leg ulceration

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Introduction: The polymicrobial complexity of biofilm has enabled them to evade host's immune system and antibiotics management. Their management rest on aggressive wound debridement and anti-biofilm activity exerted by antimicrobial agents. Ultrasonic-assisted wound debridement has shown to be an effective yet gentle form of debridement to achieve disruption of biofilms by inducing cavitation effects. Surfactant antimicrobial solution such as polyhexamethylene biguanide (PHMB) has shown to exhibit bactericidal effect, including planktonic and biofilm bacteria.

Case description: 55 years-old Chinese male presented with non-healing VLUs over 2 years at the bi-malleoli of the left lower limb despite SOC, including silver-based alginate dressing and multi-layered compression bandage. Pmhx includes young-onset of CVA, scar epilepsy, hypertension, CVI with residual DVT in bilateral LL. Patient is currently on long-term warfarin with target INR between 1.8-2.3. Initial wound presentation is thick adherent fibrinous slough overlying the entire wound bed. [Fig. 1] Wound edges is slightly rolled with thick callosity. No pus or serous discharge could be expressed. Thick callosity on wound edges. Quite painful to debridement and patient could only tolerate minimal office debridement.

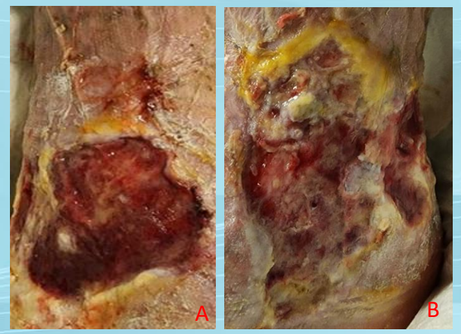

Fig. 1 Initial wound presentation of A) medial malleolus B) lateral malleolus

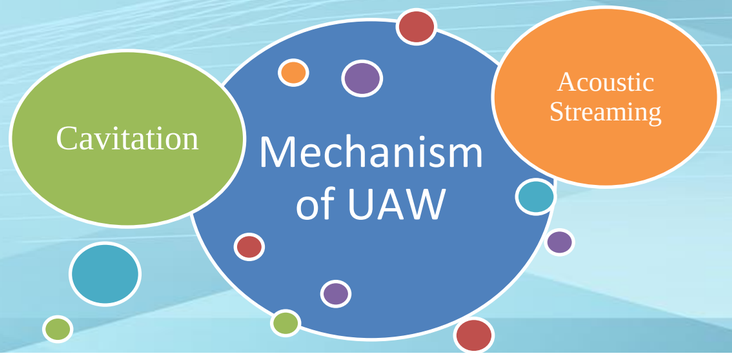

Fig. 2 Mechanism of UAW: 1) Cavitation – the formation of vibrating gas pubbles and subsequent implosions aids in the removal of non-viable tissue and biofilms; 2) Acoustic Streaming – interrupted flow of interstitial fluid by the ultrasonic energy , eventually leading to neo-angiogenesis and fibroblast stimulation and migration

Methods: UAW debridement was considered after inadequate sharp debridement due to pain intolerance. UAW debridement uses low frequency (25kHz) ultrasonic energy generated by SONOCA 185 device, through the sonotrode, deliver to the wound bed via direct contact. (Sörin GmbH, Germany). The irrigation solution used was polyhexamethylene biguanide (phmb) (Pronsan®, Bbraun) for enhanced antimicrobial effect. The UAW session was done once- weekly and wound was dressed with Algiante silver and multiple compression bandage

Results:
Optimal wound bed preparation was achieved with UAW debridement. Visual analogue score (VAS) for pain was significantly reduced from 6/10 to 2/10. However, 4- weeks after the initiation of UAW debridement, there were minimal progression in wound healing [Fig 3A & 4A]. This prompted us to review the wound dressing regimen. The attending podiatric physician decide to switch the primary dressing for medial malleolar wound from alginate silver to absorbent foam containing PHMB. The primary dressing for lateral malleolar wound remains the same as alginate silver. In comparison to medial malleolus, faster wound area reduction (more than 70% reduction) was observed progressively over the course of 12-weeks in the wound managed by PHMB foam dressing. [Fig 3 B-D; Fig 4 B-D]. In terms of exudate management, wound edge maceration was minimal which is comparable to alginate silver.

Conclusion
UAW debridement allowed aggressive debridement in shorter duration and pain-free manner. The addition of antimicrobial agent in both the UAW debridement and primary wound dressing may potentiate the disruption of biofilm and prevention of new biofilm formation. Future studies need to be conducted to evaluate their superiority over other wound dressing materials.

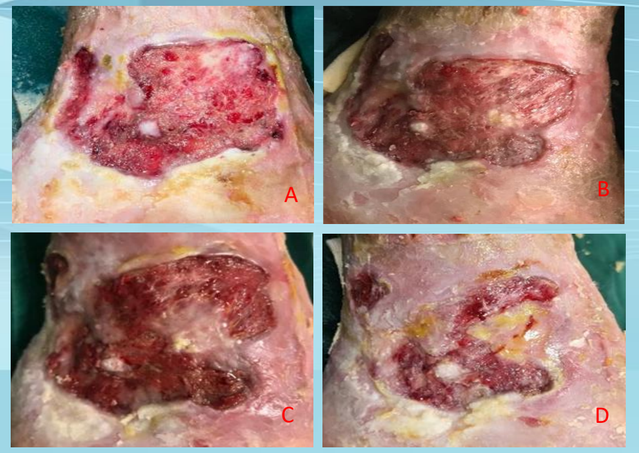

Figure 3 Presentation of medial malleolar wound after ultrasonic-assisted wound debridement at 4th week (A); 8th week (B); 12th week (C) 16th week (D)

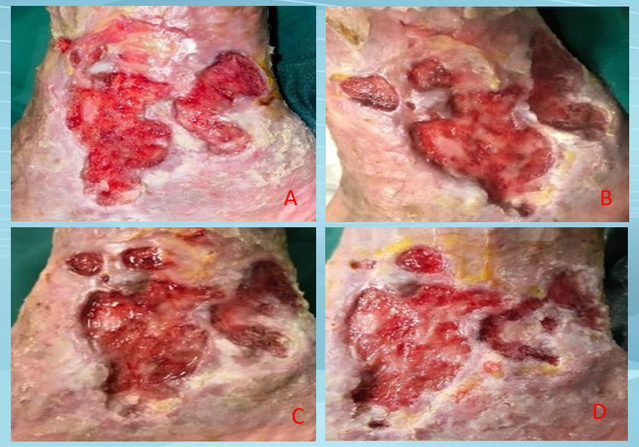

Figure 4. Presentation of lateral malleolar wound after ultrasonic-assisted wound debridement at 4th week (A); 8th week (B); 12th week (C); 16th week (D)