Using Bacterial Fluorescence Imaging to Evaluate & Improve the Effectiveness of Wound Hygiene

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Effective Wound Hygiene is Fundamental to Favorable Wound Healing Outcomes

The first line of defense is cleansing the wound bed and periwound area. However, without a means to visualize bacterial location, presence, and extent, cleansing can leave behind bacterial burden which puts the wound at risk for delayed healing, infection, and ultimately poor outcomes.

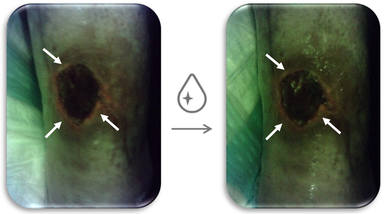
Objective, reliable methods to improve wound hygiene are much needed. This leads us to present practical guidance on using fluorescence-imaging to accomplish more effective hygiene.

Practice Points

- Fluorescence-imaging is a useful technology that can improve the effectiveness of routine wound hygiene at the bedside and supports an objective approach to bacterial-infection management.
- It can also alert to any remaining bacterial burden, possibly prompting iterative rounds of hygiene and fluorescence-imaging, or additional interventions including debridement and topical antimicrobials.

Bacterial Loads are Routinely Missed Without Fluorescence Imaging Guidance

Moellekin et al. [1] found that a single round of mechanical debridement left behind 29% of bacterial fluorescence areas across the wound bed and periwound. We have found this also to be true following traditional, unguided cleansing, where significant bacterial burden was often left behind, regardless of the cleanser used.

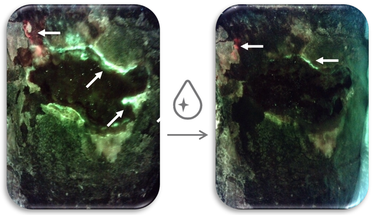


Arrows = *fluorescence from high bacterial loads (>10^4 CFU/g)*

Case 1: Fluorescence images were blindly captured before and after 30 sec of vigorous mechanical cleansing of the wound bed and periwound with moistened gauze and soap. Blush red fluorescence (indicative of high bacterial load & denoted by white arrows) was present at the wound edges prior to intervention and persisted following routine hygiene.

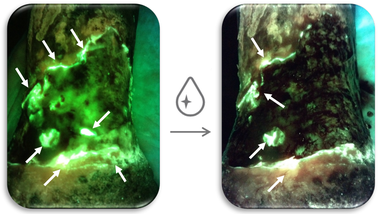
There is opportunity for improvement with fluorescence guidance.

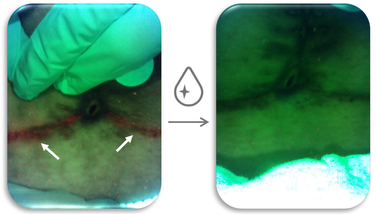
Bedside Fluorescence Imaging Targets & Improves Bacterial Removal During Hygiene



Case 1: A 50-year-old man presented for chronic wound care with a venous leg ulcer measuring 10.62 cm² in area. Cyan and red fluorescence were apparent at the wound edges, indicating elevated bacterial load, including *Pseudomonas*. After undressing the wound, 30 sec of vigorous mechanical cleansing was performed using 5% acetic acid-soaked gauze. By targeting cleansing to fluorescence positive areas, bacterial burden was significantly reduced. In this case, oral antibiotics (Augmentin™) were prescribed to manage the residual bacterial burden.

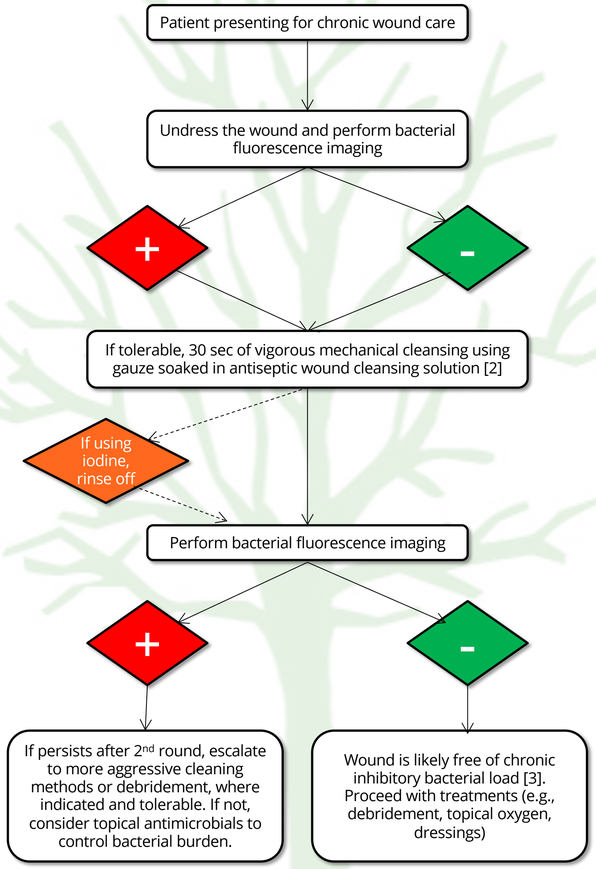
Case 2: A 94-year-old woman presented with a venous lymphedema ulcer measuring 54.49 cm² in area. Cyan fluorescence indicative of *Pseudomonas* was apparent throughout the wound bed and periwound. After 30 sec of vigorous mechanical cleansing using 5% acetic acid, bacterial fluorescence was significantly reduced – however some did remain, prompting another round of cleansing followed by curettage debridement. The patient was prescribed antimicrobial foam dressings (IoPlex®) to control the persistent bacterial fluorescence that could not be removed via debridement or cleansing.





Case 3: A 19-year-old woman presented with a surgical wound 0.42 cm² in area midline on her abdomen following an OBS-GYN procedure. Red bacterial fluorescence was apparent along the incision line, prompting targeted hygiene with Vashe cleanser that led to complete removal of the red fluorescence. Proper wound hygiene was discussed with patient as there was concern of possible infection due heavy amount of biofilm under the panus, and the wound was repacked with iodoform. The patient's last visit occurred 2 months later during which her wound had healed.

Clinical Decision Tree for Fluorescence Guided Wound Cleansing



References: [1] Moelleken M, Jockenhöfer F, Benson S, Dissemond J. Prospective clinical study on the efficacy of bacterial removal with mechanical debridement in and around chronic leg ulcers assessed with fluorescence imaging. Int Wound J. 2020 Aug;17(4):1011-1018. [2] Oropallo A, Rao AS, Del Pin C, Ranire-Maguire M, Mathew A. An objective comparative study of non-surgical cleansing techniques and cleanser types in bacterial burden management. [3] Armstrong DG, Edmonds ME, Serena TE. Point-of-care fluorescence imaging reveals extent of bacterial load in diabetic foot ulcers. Int Wound J. 2023 Feb;20(2):554-566.