

# Improving Wound Hygiene Through Fluorescence Imaging: A Focus on Spatial Patterns in Diabetic and Venous Leg Ulcers

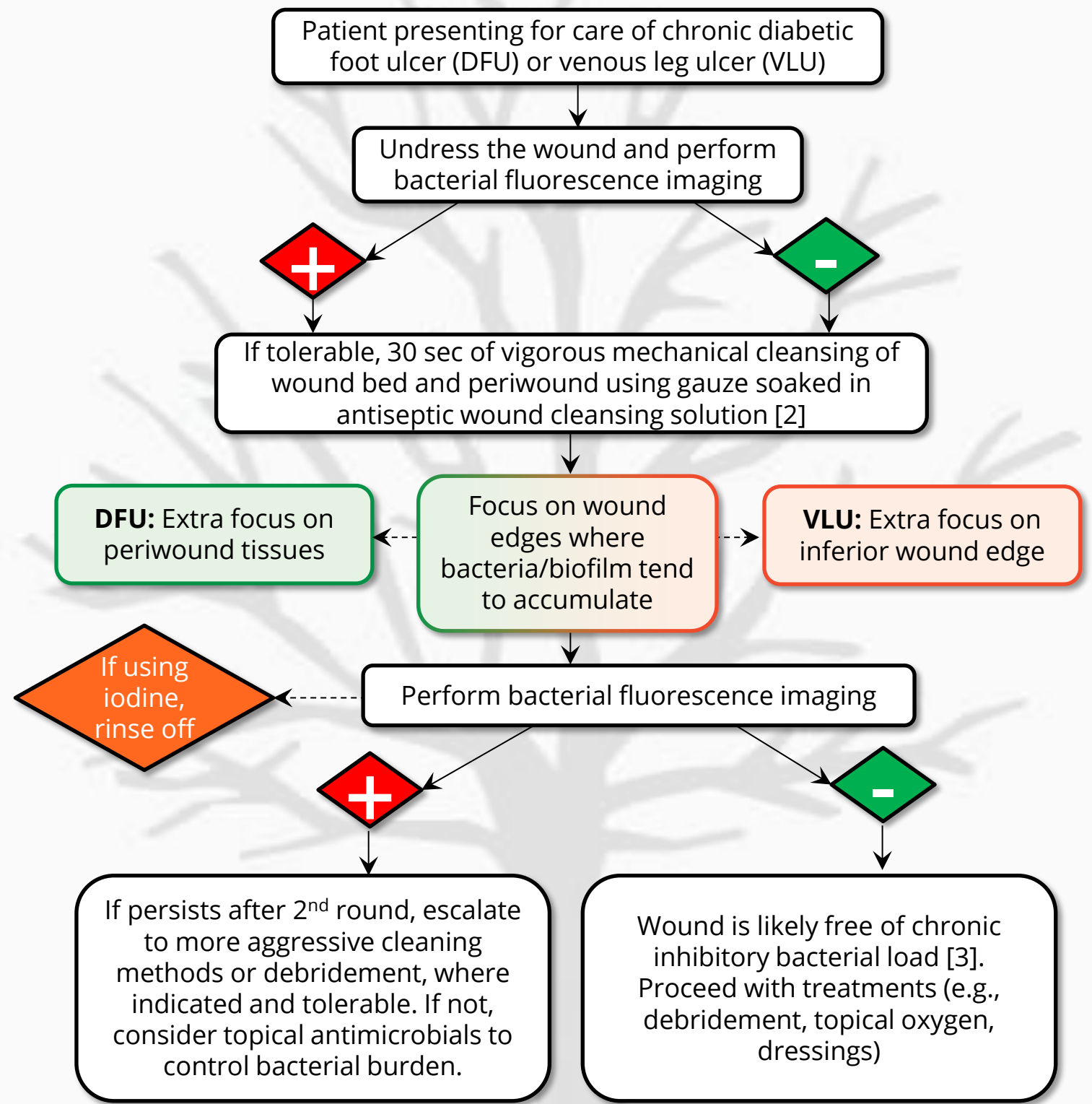
Alisha Oropallo, MD<sup>1,2</sup>; Amit Rao, MD<sup>1</sup>; Farisha Baksh MD<sup>1</sup>, Sally Kaplan MD<sup>1</sup>

<sup>1</sup>Northwell Health System, Department of Surgery, Comprehensive Wound Care Healing and Hyperbaric, Lake Success, NY; <sup>2</sup>Donald & Barbara Zucker School of Medicine at Hofstra/Northwell, Hempstead, NY

## The Modern Era of Wound Hygiene:

- Wound cleansing is necessary to put stalled wounds back onto a healing trajectory and to prevent infection and its complications.
- The advent of bacterial fluorescence imaging technology (MolecuLight®) for wound care has changed our understanding of bacterial distribution in wounds and allows us to evaluate wound hygiene efficacy in real-time.
- Clinical studies show that significant bacterial colonization is frequently left behind following standard cleansing practices [1], highlighting the potential for improvement.
- 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.**

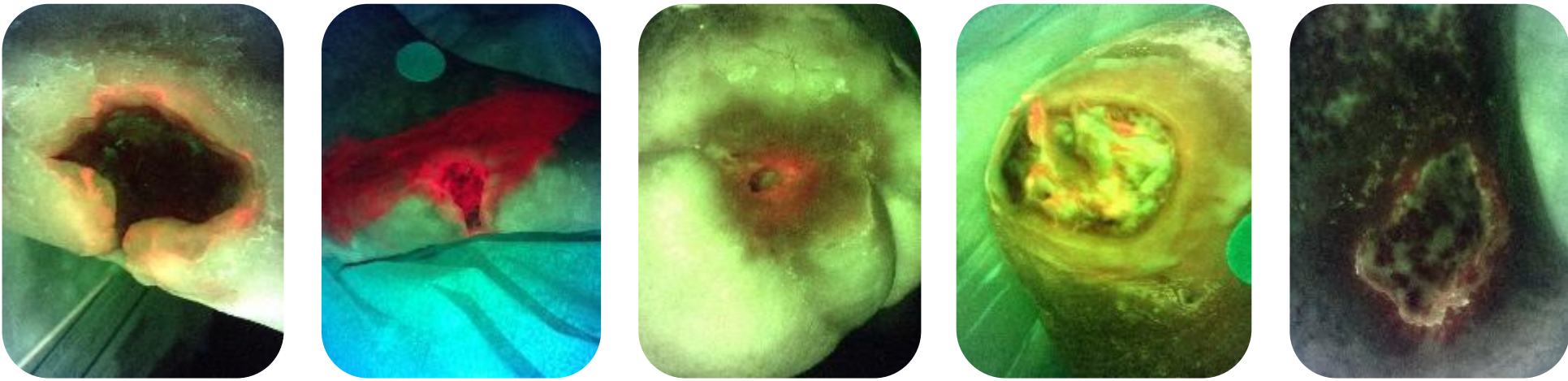
### Clinical Decision Tree for Fluorescence Guided Wound Cleansing of DFU and VLU



## What Does Fluorescence Imaging Tell Us About Bacteria in DFU and VLU?

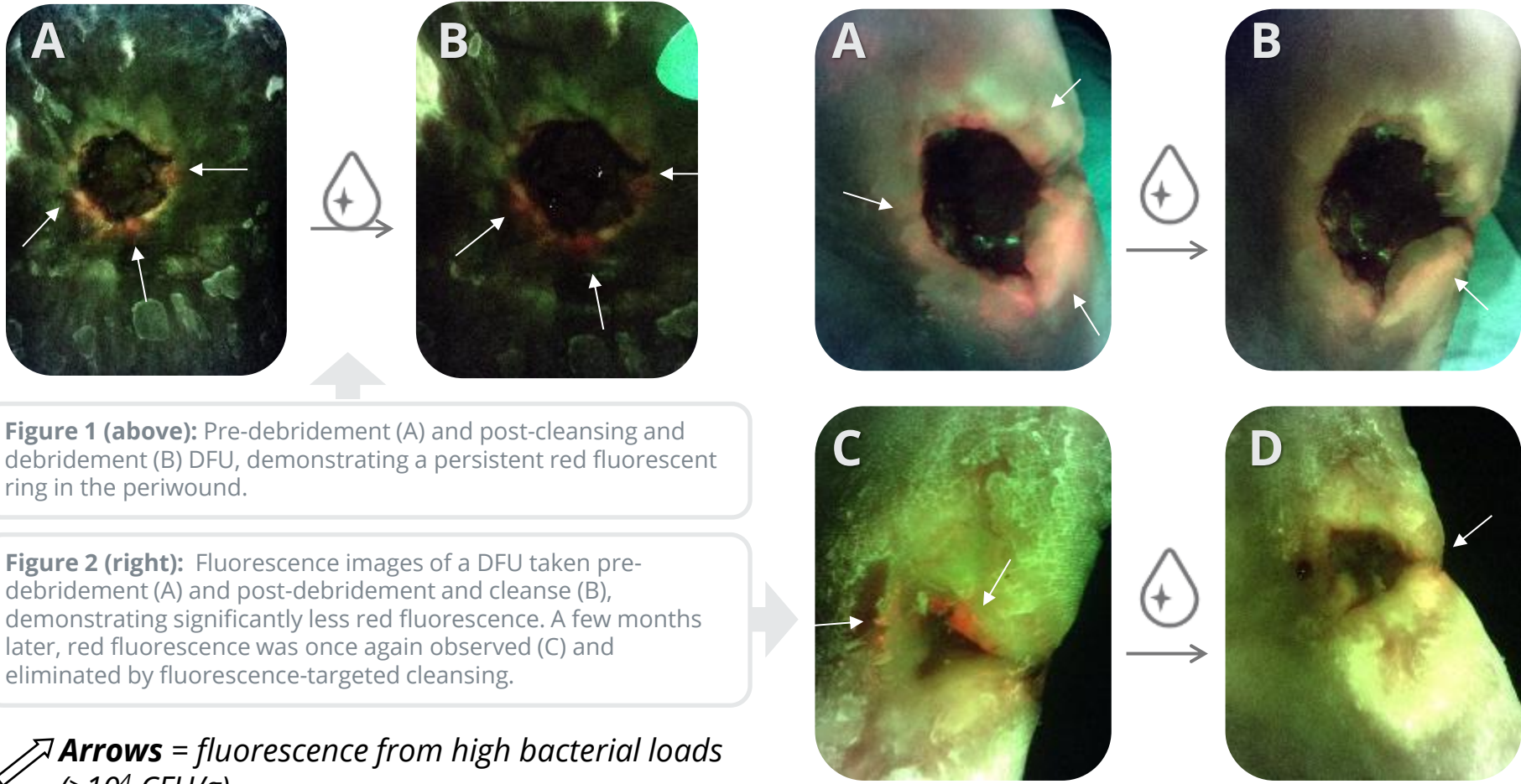
- Chronic VLUs and DFUs frequently display fluorescence signals indicating high levels of bacterial colonization that impede healing and increase infection risk [3].
- For **VLUs**, cyan fluorescence indicating *Pseudomonas aeruginosa* seems to be more common than red fluorescence. It is often clustered along the wound edge, especially inferiorly, possibly due to gravity.
- Red fluorescence indicating a mixture of bacterial species is more common in **DFUs**, usually forming a “ring” around the wound edge that often extends into the periwound.

### Spatial Patterns of Bacterial Fluorescence in DFU



### Clinical Case: Fluorescence “ring” in DFU persists after routine hygiene

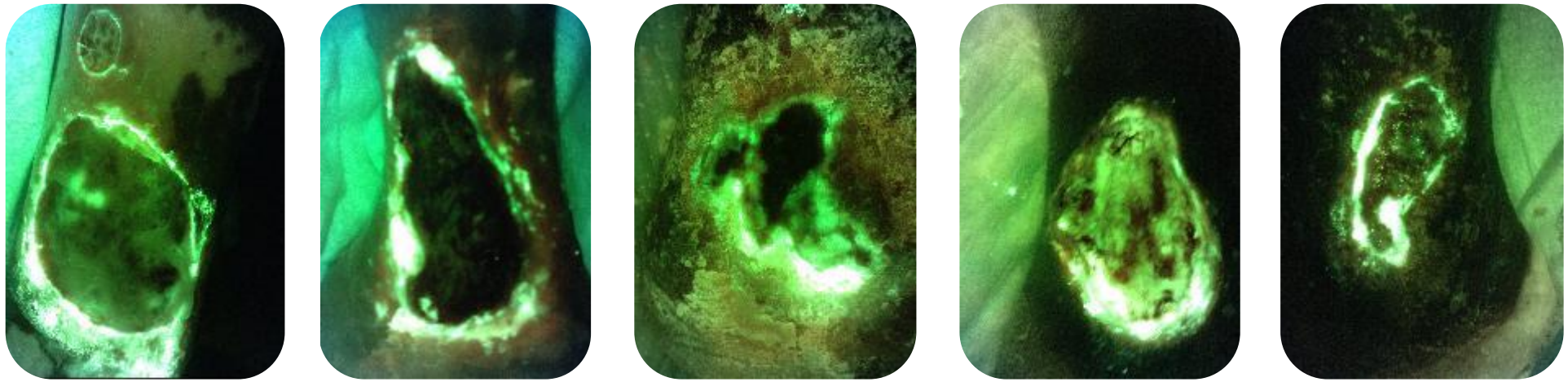
- Red fluorescence indicates a mixture of Gram +/- bacterial species at loads  $>10^4$  CFU/g. In DFUs, red fluorescence is often observed, usually forming a “ring of fire” around the ulcer that extends a few centimeters from the wound edge (Figure 1A and Figure 2A).
- In some cases, cleansing and debridement are insufficient, leaving significant bacterial burden (Figure 1B). It is also not uncommon for debridement to uncover deeper bacterial affection. Fluorescence-guided cleansing towards bacterial-laden regions improves wound hygiene (Figure 2B). However, additional rounds and/or measures may be recommended if bacterial fluorescence persists.



## Conclusions:

- 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.
- Clinically unremarkable VLUs and DFUs display consistent spatial patterns of bacterial fluorescence that can be identified and targeted with fluorescence-guided cleansing.**
- When bacterial fluorescence persists after iterative rounds of fluorescence-guided hygiene, additional interventions including debridement and topical antimicrobials may be required. This approach aligns with published guidelines for fluorescence imaging [4].

### Spatial Patterns of Bacterial Fluorescence in VLU



### Clinical Case: *Pseudomonas* clusters along inferior edge of VLU

- Cyan fluorescent signals indicates the presence of *P. aeruginosa*, which is frequently observed VLUs and often clusters along the wound edge (Figure 3 A and Figure 4 A). Cyan fluorescence is also often further concentrated to the inferior wound edge, possibly due to pooling of exudate.
- Wound care providers should exercise a high index of suspicion for bacterial colonization in asymptomatic VLUs, particularly for *P. aeruginosa*.
- Following a single round of fluorescence-guided wound cleansing, the presence of cyan fluorescence greatly decreased (Figure 3B and Figure 4B).
- This highlights the efficacy of fluorescence imaging as a tool to manage bacterial loads with proper cleansing.

