Advanced Wound Care Of Pyoderma Gangrenosum Through Fluorescence-guided Debridement

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Introduction and Background

Wound care plays a key role in the management of Pyoderma Gangrenosum (PG) cases[1]. Characterized by cyclical inflammatory and healing phases, which result in fluctuation of the wound's depth and exudate level, **PG requires careful and specialized attention to optimize healing outcomes[2-3]**. Customized wound care strategies are vital for symptom control, tissue regeneration, and complication prevention.

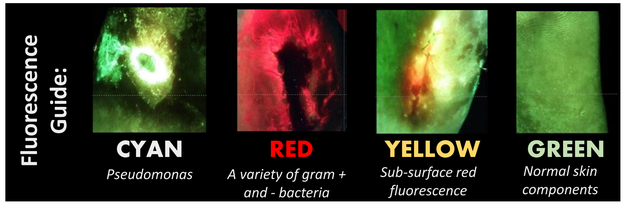
The recent adoption of the TIME wound management algorithm for managing PG emphasizes the importance of debridement within this strategy[2-3]. **However, effective debridement necessitates careful immunomodulation and inflammation control to prevent pathergy[4]**. The regulation of inflammation and bacterial control are closely linked, with debridement playing a key role in both. Point-of-care bacterial location aids in strategic debridement, benefiting our practices.

Aim

To depict the real-life application and utility of targeted debridement and other therapeutic decisions at the bedside for effective PG management, as informed by fluorescence imaging.

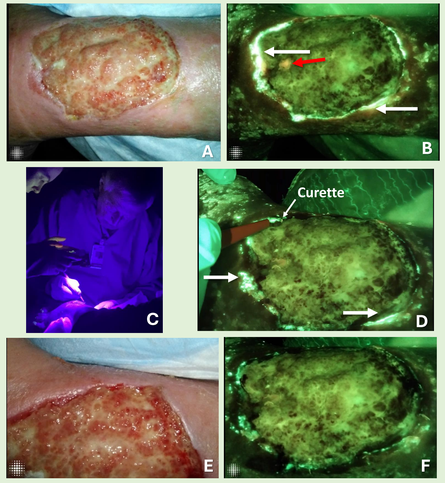
Materials and Methods

A fluorescence imaging device (MolecuLight ***i:X***, **DX**) was utilized for cases of PG attending 2 specialized wound care centers in the US. Debridement was limited to areas showing positive fluorescence (red or cyan, see image below) which indicated the presence of bacterial loads >10^4 CFU/g (pathogenic), and extended until the signal was removed, when possible. This indicates optimal debridement in PG cases, where debridement is used effectively to minimize trauma while maximizing bacterial removal.



1. Strunck J, et.al. J Am Acad Dermatol. 2022. **2.** Croitoru D, et.al. Adv Wound Care (New Rochelle). 2020. **3.** Janowska A, et.al. Dermatol Ther. 2020 **5.** Eisendle K, et.al. Adv Wound Care (New Rochelle). 2020 **6.** Rahma S, et.al. Diabetes Care, July 2022. **7.** Price N. Diagnostics (Basel). 2020 **8.** Kelso M et.al, Adv Skin and Wound Care, 2024

Case 1



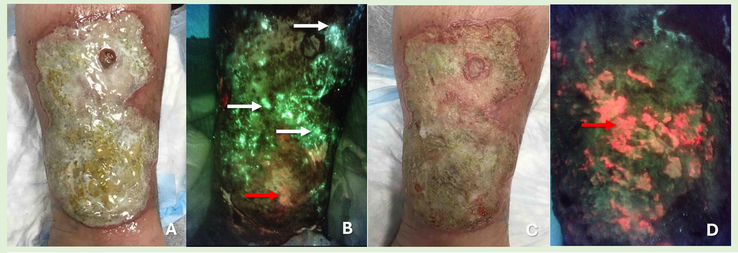
A 72-year-old female with severe kyphosis underwent multiple surgeries, leading to difficult-to-heal wounds. Due to malposition, she often slept sitting down, causing pressure ulcers on her lower back. All her wounds were infection-prone. Additionally, her history of poor healing complicates the PG in her right ankle herein.

Standard assessment (A) reveals signs of infection like slough and exudate. Fluorescence imaging (B) indicates a mix of Pseudomonas (cyan, white arrows) and gram +/- pathogens (blush fluorescence, red arrow). Targeted debridement is guided solely by fluorescence imaging (C,D) to focus on affected areas. Post-debridement, the wound looks better (E), but fluorescence reveals objectively the absence of bacteria (E).

As expected for PG, cycles of improvement and exacerbation exist, requiring weekly treatment. Fluorescence imaging is pivotal in preventing complications and minimizing trauma.

Case 2

A 40-year-old female with morbid obesity, chronic venous insufficiency (CVI), and a 3-year history of pyoderma gangrenosum (PG) in the left lower extremity presents. She is undergoing treatment with monoclonal antibody medication (Spesolimab) and Remicade use.



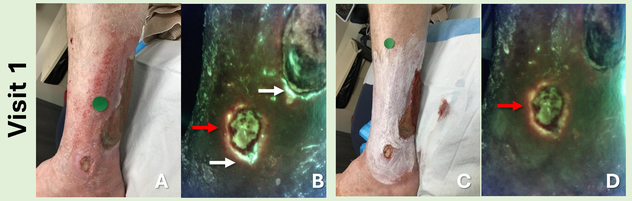
Past treatments include skin grafts and Zinc-impregnated compression bandages (Unna boot). The wound is malodorous and with heavy drainage, with the patient experiencing significant pain necessitating opioid therapy.

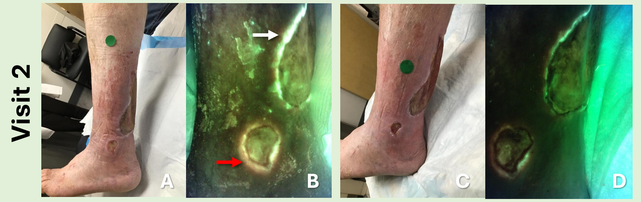
(A) Pre-debridement: Malodorous wound with abundant slough and purulent exudate. (B) Fluorescence imaging reveals widespread cyan fluorescence indicating Pseudomonas (white arrows) and red bacterial fluorescence in the bottom 2/3 (red arrows). (C) Post-debridement image of the wound. (D) Post-debridement, red signals persist under fluorescence, indicating deeper bacterial presence. Initial debridement often reveals hidden bacterial loads. In this case, clinical and fluorescence findings before and after debridement warrant aggressive systemic antibiotic therapy to alleviate symptoms. Microbiology confirms a polymicrobial infection.

Case 3

64 year-old male with a history of basal cell carcinoma, COPD, CAD, (has undergone multiple vascular surgeries-angioplasty and RFA), anemia, PAD, CVI, factor V Leiden deficiency, hyperlipidemia, hypertension, and current smoker with diagnosed with PG. The patient has chronic left lower extremity wounds of over 3 years duration Previous wound treatments included wound vac, CPT (Skin substitutes), and IM Biologics (Humira). The patient has refused to stop smoking throughout his treatment. He is relatively compliant with treatment, however, due to multiple comorbidities he is often hospitalized due to wound complications such as infection. **Fluorescence imaging is particularly useful in high-risk patients in targeting bacteria locally and proactively, supporting the decisions surrounding antibiotic treatments, and monitoring to avoid further complications.**

Visit 1: (A) Standard image of lower limb PG. (B) Corresponding pre-debridement fluorescence image. Cyan (white arrows) and red/yellow (red arrows) fluorescence signals are present. (C) Post-debridement standard image and (D) corresponding fluorescence image showing elimination of cyan (*Pseudomonas*) but persistence of red signal (gram +/-). Topical antibiotic was prescribed because of the bacterial findings seen with the fluorescence. **Visit 2**: (A) Standard image and (B) Corresponding pre-debridement fluorescence image. Cyan (white arrows) and red/yellow (red arrows) signals are still present. (C) Post-debridement standard image and (D) corresponding fluorescence image showing elimination of fluorescence or bacteria at problematic loads, reducing risk of PG infection.





PG cases can develop secondary infections that often go undetected with clinical assessment alone. The addition of fluorescence imaging enables bedside bacterial detection for optimization of the immediate treatment.

Conclusions

- **Focused, precise, and strategic debridement through fluorescence imaging (MolecuLight *i:X*, D:X) plays a pivotal role in reducing the inflammatory response.** Moreover, more effective debridement may facilitate surgical interventions in PG, such as split skin grafts, by optimizing wound bed preparation and enhancing postoperative bacterial control[5].
- Fluorescence imaging-guided debridement has proven to change the outcomes in other wound types by focusing on areas of high bacterial load and providing feedback on the extent and location of debridement[6-8]. This concept can be applied to the management of complex pyoderma gangrenosum.