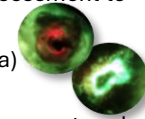


# Enabling Proactive Intervention: Understanding Chronic Inhibitory Bacterial Loads through Fluorescence Imaging and Why It Matters

Raymond J. Abdo, DPM<sup>1</sup>, Ashley Jacob, BSN, RN<sup>2</sup>  
<sup>1</sup>St. Louis Foot & Ankle, St. Louis, MO, <sup>2</sup>MolecuLight Corp, Pittsburgh, PA

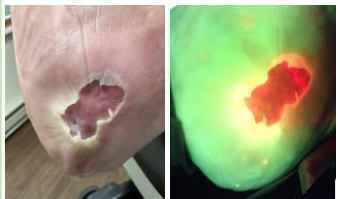
## Introduction

- A recently coined acronym, CIBL (chronic inhibitory bacterial load), refers to bacterial loads that stall healing and increase the risk of infection, complications, and hospitalization rate<sup>1</sup>.
- CIBL may not present with classic signs of inflammation and infection. Healing outcomes are shown to improve when these bacterial loads are removed.
- Irrespective of the clinical appearance, point-of-care fluorescence imaging\* can highlight the presence and location of CIBL, working with clinical assessment to inform treatment decisions<sup>1-3</sup>.
- In fluorescence images, CIBL is observed as either red (most bacteria) or cyan (*Pseudomonas*) fluorescence<sup>3,4</sup>.
- As wound care moves towards evidence-based practices, the assessment and management of CIBL calls for a robust treatment algorithm.



Here, we present a standardized framework developed and used in our practice with good results, that stages and addresses fluorescence signals of CIBL.

## Case Study: Stage II



A 71 year old Caucasian male, presented with a draining blister (rusty drainage) on the medial right heel, due to rubbing after excessive weight bearing in a work boot. They reported pain despite neuropathy. Patient had evidence of neuropathy, HTN and heart disease.

The wound was 4.56cm<sup>2</sup> with 0.1cm depth. Post incision and drainage, fluorescence imaging (MolecuLight) demonstrated high levels of red fluorescence indicating CIBL primarily in the wound bed.

Per our frame-work, a strong antiseptic was used, and the wound treated with an antimicrobial wound gel (Revyve). A tissue sample was obtained and imaging was planned for the following week.

At the next 1-week visit, the wound had healed and no more red bacterial fluorescence was observed by fluorescence imaging.

1 Week

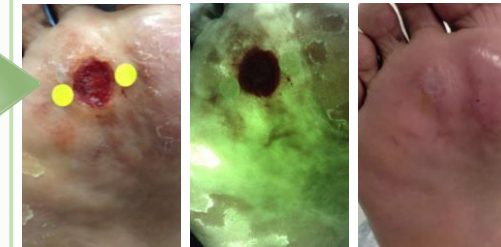
## Discussion

Detection of CIBL through fluorescence imaging provides an accurate assessment of a wound's bioburden. Frequent and thorough treatments to reduce bacterial loads are needed to prevent/disrupt biofilm formation and improve healing rates. Fluorescence imaging enabled the classification of bacterial involvement in an incremental fashion in order to objectively develop a systematic and stepwise progression of the mechanical methods of bacterial removal.

## Abdo Classification Table

| Stage | Description of imaging findings   | Recommended point-of-care interventions  |
|-------|---|--|
| 0     | No evidence of CIBL on imaging or from standard clinical assessment   | <ul style="list-style-type: none"> <li>Standard of care</li> <li>Basic wound hygiene</li> <li>Consider timing (Initial visit or failed SoC?)</li> <li>May be ready for advanced products (e.g., CTPs)</li> </ul>   |
| I     | CIBL present but can be <i>entirely eliminated through hygiene or selective debridement.</i>  | <ul style="list-style-type: none"> <li>Basic hygiene, added scrub or selective debridement</li> <li>Standard dressings</li> <li>May be ready for advanced products (e.g., CTPs)</li> <li>Plan to re-image at next visit</li> <li>Educate patient on at home hygiene</li> </ul>   |
| II    | CIBL present and persists in <b>wound bed only</b> after hygiene or selective debridement   | <ul style="list-style-type: none"> <li>Add a stronger antiseptic</li> <li>Use of a topical antimicrobial</li> <li>Consider local infection; take a tissue sample</li> <li>Plan to re-image at next visit</li> <li>Educate patient on at home hygiene</li> </ul>  |
| III   | CIBL present and persists in <b>periwound</b> after hygiene or selective debridement  | <ul style="list-style-type: none"> <li>Add stronger antiseptic</li> <li>Consider local infection; take a tissue sample.</li> <li>Use a topical antimicrobial</li> <li>If persistent, consider oral antibiotics in addition to local treatments (e.g., debridement, topical antimicrobials) to address infection</li> <li>Follow up within 1 week and plan to re-image.</li> <li>Educate patient on at home hygiene.</li> </ul> |
| IV    | CIBL persists in wound bed and/or periwound <b>after aggressive surgical or hydro-surgical debridement</b>  | <ul style="list-style-type: none"> <li>Add stronger antiseptic</li> <li>Consider local infection; take a tissue sample.</li> <li>Prescribe a topical antimicrobial option</li> <li>Consider oral or systemic antibiotics after receiving microbiology results.</li> <li>Follow up within 1 week and plan to re-image</li> </ul>  |
| V     | CIBL on images <b>spreading outside periwound:</b><br>a) If in asymmetric pattern, potentially cellulitis <sup>5</sup> .<br>b) If uniform pattern, consider local or spreading infection. | <ul style="list-style-type: none"> <li>Take a tissue sample.</li> <li>Consider aggressive systemic (IV) antibiotics together with local treatments to address infection</li> <li>Consider consultation to infectious disease and/or additional imaging diagnostics (e.g. thermal, MRI).</li> <li>Increase visit frequency; re-image at next visit.</li> </ul>  |

## Case Study: Stage 0



Initial Visit

4 Weeks

A 58 year old male presented with a neuropathic ulcer on the right plantar sole. No clinical signs of infection were present.

The wound was 1.4cm<sup>2</sup> with 0.2cm depth. Fluorescence imaging (MolecuLight) was absent of fluorescence signals indicating CIBL. Basic wound hygiene, debridement and off-loading performed.

Wound had healed after 4 weeks of treatment.

## Case Study: Stage I



Gauze with cyan fluorescence

A 65 year old African American male presented a diabetic foot ulcer to the left midfoot. The patient had a long history of diabetes and displayed peripheral neuropathy. The wound had no signs or symptoms of infection (redness, swelling, malodor) though there was a recent evidence of wound breakdown.

The wound was 2.8cm<sup>2</sup> with 0.4cm depth. Fluorescence imaging (MolecuLight) revealed cyan fluorescence, indicating the presence of *Pseudomonas aeruginosa*.

An antimicrobial cleanser (Biakos) was selected and fluorescence imaging was used to assess the effectiveness in real-time. Aggressive cleansing was effective at removing the cyan fluorescence. Cyan fluorescence was seen being actively removed to the gauze.

## Case Study: Stage IV



Initial Visit

1 Month

A 66 year old Caucasian female presented with a neuropathic ulceration of the right great toe. Evidence of increased redness, warmth and swelling with foul drainage and odor.

The wound was 15cm<sup>2</sup> with 0.2cm depth with a hyperkeratotic rim with undermining. Fluorescence imaging (MolecuLight) demonstrated high levels of red fluorescence indicating CIBL extending to the right of the ulceration and was **not** irradiated by debridement alone.

Antimicrobial gel (Revyve) and an oral antibiotic were prescribed. A biopsy was taken; results showed presence of *Corynebacterium*, *Streptococcus* and *Enterobacter*.

After 1 month of treatment, wound has decreased to 0.56cm<sup>2</sup>; no red fluorescence present. Wound went on to heal within the month.

\*MolecuLight, Inc. Toronto, ON Canada

1. Armstrong et al IWJ 2023, 2. Jacob et al IWJ 2023, 3. Le et al Adv Wound Care 2021, 4. Rennie et al Diagnostics 2019 5. Andersen et al IWJ 2021