INTRODUCTION

- Chronic wounds requiring hospitalization often harbor a high bacterial burden that negatively impacts tissue healing.
- Knowledge of a wound’s bioburden is currently obtained via culture analysis of wound swabs. This knowledge greatly impacts clinician treatment decisions. However, 24-48 hours can pass before results are available and false negative rates are high.
- Real-time, point-of-care detection of critical levels of bioburden relies primarily on visual inspection of wounds and clinical signs and symptoms, which are subjective and suboptimal.
- To address this problem, fluorescence imaging has been used to visualize red-fluorescing, pathogenic bacteria in real-time at the bedside using a non-contact handheld device 1-4.
- This 7-week pilot study aimed to assess the effects of bacterial fluorescence images on clinician decisions and patient care.

METHODS

Bacterial Fluorescence Imaging (MolecuLight i:X)
- When excited by 405 nm violet light, tissues fluoresce green while bacteria fluoresce red (porphyrin-producing, e.g. Staphylococcus aureus) or cyan (cytochrome-producing Pseudomonas aeruginosa).
- This enables real-time, point-of-care detection and localization of bioburden within and around wounds 1-4.
- This study used a handheld fluorescence imaging device which was selected to allow the study team to perform wound imaging on-site as needed.

RESULTS

Bacterial Fluorescence Guides Debridement, Sampling, and Treatment Selection
- 83-year-old male with septic sacral ulcer, diminishing mobility, and minimal at-home care. Fluorescence images taken post debridement revealed extensive remaining bioburden. Images immediately guided swabbing location and maintenance on IV antibiotics. Images also guided additional, targeted debridement (paring non-contaminated regions) on day 5. Images acquired at each subsequent dressing change tracked significant decreases in bioburden and wound size (see week 1 images). Swabs confirmed heavy growth of Morganella morganii, E. coli, and Enterococcus faecalis.

Bacterial Fluorescence Prevents Discharge of Patients Requiring Systemic Antibiotics
- During this 7-week trial, images with extensive bacterial fluorescence prevented imminent discharge of 3 patients requiring systemic antibiotics.

Bacterial Fluorescence Targets Swabbing to Region of Bioburden, Identifies Asymptomatic Pseudomonas
- 74-year-old female with VLU was referred to wound specialist for staged healing. Patient had previously received multiple courses of systemic antibiotics, without effect. Wound had no clinical signs and symptoms of Pseudomonas aeruginosa. However, fluorescence images revealed its signature cyan fluorescence (arrows). A Pseudomonas-targeted dressing was therefore selected which was effective; no further systemic antibiotics were required. Swabs of cyan region confirmed moderate growth of Pseudomonas aeruginosa.

Images Negative for Bacterial Fluorescence Allow for Confidence when Skin Grafting
- 36-year-old man with numerous orthopedic trauma injuries developed a wound along ulnar aspect of proximal forearm. Clinicians determined that a skin graft was required, which is contingent when a wound is contaminated. Real-time fluorescence images were negative for bacterial fluorescence. Skin graft was therefore applied with confidence within 36 hours. Swabs confirmed no growth of bacteria.

Imaging Negative for Bacterial Fluorescence Guide Antimicrobial Stewardship
- 57-year-old male with gastric cancer, prescribed systemic antibiotic after partial gastrectomy. Present with midline dehiscence, antibiotics maintained. Returned when antibiotics were to conclude that midline was opening. Fluorescence images showed no evidence of contamination. These images prevented prescription of further antibiotics.

CONCLUSIONS

Positive effects of bacterial fluorescence imaging on patient care and wound management were noted in six areas:
1. Guided the extent and location of wound debridement, sparing non-contaminated tissue.
2. Led clinicians to swab wounds which had otherwise been considered to have clinically significant bacterial loads. This real-time information guided immediate treatment decisions.
3. Prevented imminent discharge of three patients requiring systemic antibiotics.
4. Guided selection of antimicrobials and directly influenced antimicrobial stewardship practices.
5. Facilitated patient education on bacterial presence and helped prevent discharge of patients requiring antibiotics.
6. Images negative for bacterial fluorescence allowed for confidence when skin grafting.

• These results highlight the ability of bacterial fluorescence imaging to provide invaluable, real-time information on a wound’s bioburden, contributing to clinician treatment decisions in cases where bacterial contamination could impede wound healing and in cases where bacterial fluorescence was not present.

REFERENCES


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