

UCLA

UCLA Previously Published Works

Title

Preclinical Evaluation of Photoacoustic Imaging as a Novel Noninvasive Approach to Detect an Orthopaedic Implant Infection.

Permalink

<https://escholarship.org/uc/item/0jj157gs>

Journal

The Journal of the American Academy of Orthopaedic Surgeons, 25 Suppl 1(Suppl 1)

ISSN

1067-151X

Authors

Wang, Yu
Thompson, John M
Ashbaugh, Alyssa G
[et al.](#)

Publication Date

2017-02-01

DOI

10.5435/jaaos-d-16-00630

Peer reviewed

Preclinical Evaluation of Photoacoustic Imaging as a Novel Noninvasive Approach to Detect an Orthopaedic Implant Infection

[Yu Wang](#)¹, [John M Thompson](#), [Alyssa G Ashbaugh](#), [Pavlo Khodakivskyi](#), [Ghyslain Budin](#), [Riccardo Sinisi](#), [Andrew Heinmiller](#), [Marleen van Oosten](#), [Jan Maarten van Dijk](#), [Gooitzen M van Dam](#), [Kevin P Francis](#), [Nicholas M Bernthal](#), [Elena A Dubikovskaya](#), [Lloyd S Miller](#)

Affiliations expand

- PMID: 27941556
- PMCID: [PMC6056014](#)
- DOI: [10.5435/JAAOS-D-16-00630](#)

Abstract

Introduction: Diagnosing prosthetic joint infection (PJI) poses significant challenges, and current modalities are fraught with low sensitivity and/or potential morbidity. Photoacoustic imaging (PAI) is a novel ultrasound-based modality with potential for diagnosing PJI safely and noninvasively.

Materials: In an established preclinical mouse model of bioluminescent *Staphylococcus aureus* PJI, fluorescent indocyanine green (ICG) was conjugated to β -cyclodextrin (CDX-ICG) or teicoplanin (Teic-ICG) and injected intravenously for 1 week postoperatively. Daily fluorescent imaging and PAI were used to localize and quantify tracer signals. Results were analyzed using 2-way analysis of variance.

Results: Fluorescence clearly localized to the site of infection and was significantly higher with Teic-ICG compared with CDX-ICG ($P = 0.046$) and ICG alone ($P = 0.0087$). With PAI, the photoacoustic signal per volumetric analysis was substantially higher and better visualized with Teic-ICG compared with CDX-ICG and ICG alone, and colocalized well with bioluminescence and fluorescence imaging.

Conclusion: Photoacoustic imaging successfully localized PJI in this proof-of-concept study and demonstrates potential for clinical translation in orthopaedics.

Figures

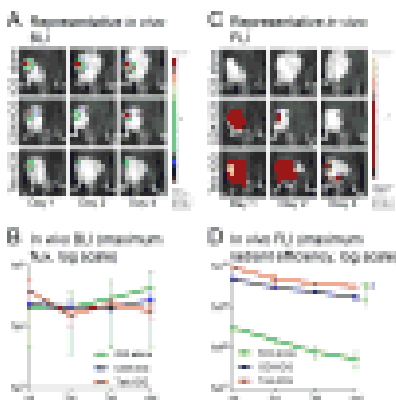


Figure 1. In vivo bioluminescence (BLI) and...

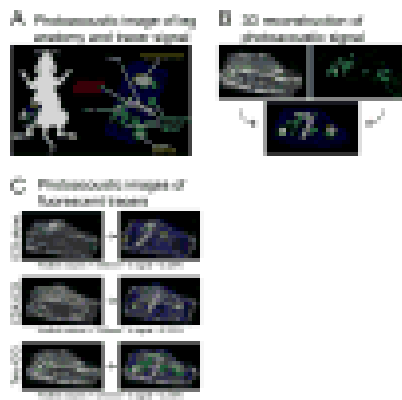


Figure 2. Photoacoustic imaging (PAI) workflow and...