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Multimodal imaging guides surgical management in a preclinical spinal implant infection model

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Abstract

Spine implant infections portend disastrous outcomes, as diagnosis is challenging and surgical eradication is at odds with mechanical spinal stability. Current imaging modalities can detect anatomical alterations and anomalies but cannot differentiate between infection and aseptic loosening, diagnose specific pathogens, or delineate the extent of an infection. Herein, a fully human monoclonal antibody 1D9, recognizing the immunodominant staphylococcal antigen A on the surface of Staphylococcus aureus, was assessed as a nuclear and fluorescent imaging probe in a preclinical model of S. aureus spinal implant infection, utilizing bioluminescently labeled bacteria to confirm the specificity and sensitivity of this targeting. Postoperative mice were administered 1D9 probe dual labeled with 89-zirconium (89Zr) and a bars represent SEM dye (NIR680) (89Zr-NIR680-1D9), and PET-CT and in vivo fluorescence and bioluminescence imaging were performed. The 89Zr-NIR680-1D9 probe accurately diagnosed both acute and subacute implant infection and permitted fluorescent image-guided surgery for selective debridement of infected tissue. Therefore, a single probe could noninvasively diagnose an infection and facilitate image-guided surgery to improve the clinical management of implant infections.

Keywords: Bacterial infections; Bone Biology; Diagnostic imaging; Infectious disease; Surgery.