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Novel in vivo mouse model of implant related spine infection.

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Novel in vivo mouse model of implant related spine infection

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Abstract

Post-operative spine infections are a challenge, as hardware must often be retained to prevent destabilization of the spine, and bacteria form biofilm on implants, rendering them inaccessible to antibiotic therapy, and immune cells. A model of posterior-approach spinal surgery was created in which a stainless steel k-wire was transfixated into the L4 spinous process of 12-week-old C57BL/six mice. Mice were then randomized to receive either one of three concentrations (1×10^2 , 1×10^3 , and 1×10^4 colony forming units (CFU)) of a bioluminescent strain of *Staphylococcus aureus* or normal saline at surgery. The mice were then longitudinally imaged for bacterial bioluminescence to quantify infection. The 1×10^2 CFU group had a decrease in signal down to control levels by POD 25, while the 1×10^3 and 1×10^4 CFU groups maintained a 10-fold higher signal through POD 35. Bacteria were then harvested from the pin and surrounding tissue for confirmatory CFU counts. All mice in the 1×10^4 CFU group experienced wound breakdown, while no mice in the other groups had this complication. Once an optimal bacterial concentration was determined, mice expressing enhanced green fluorescent protein in their myeloid cells (Lys-EGFP) were utilized to contemporaneously quantify bacterial burden, and immune response. Neutrophil fluorescence peaked for both groups on POD 3, and then declined. The infected group continued to have a response above the control group through POD 35. This study, establishes a noninvasive in vivo mouse model of spine implant infection that can quantify bacterial burden and host inflammation longitudinally in real time without requiring animal sacrifice. © 2016 Orthopaedic Research Society. Published by Wiley Periodicals, Inc. J Orthop Res 35:193-199, 2017.

Keywords: *Staphylococcus*; bioluminescence; implant infection; spine.

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Figures

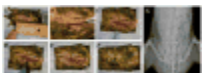


Figure 1

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Mouse surgical procedures. (A) A...

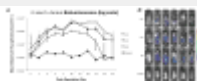


Figure 2

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Measurement of bacterial burden using...

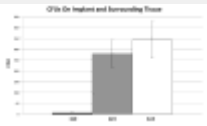


Figure 3

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Confirmation of bacterial burden using...

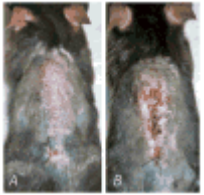


Figure 4

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Images of the dorsal skin...



Figure 5

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In vivo bioluminescence and EGFP-neutrophil...