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# Novel in vivo mouse model of shoulder implant infection

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## Abstract

**Background:** Animal models are used to guide management of periprosthetic implant infections. No adequate model exists for periprosthetic shoulder infections, and clinicians thus have no preclinical tools to assess potential therapeutics. We hypothesize that it is possible to establish a mouse model of shoulder implant infection (SII) that allows noninvasive, longitudinal tracking of biofilm and host response through in vivo optical imaging. The model may then be employed to validate a targeting probe (1D9-680) with clinical translation potential for diagnosing infection and image-guided débridement.

**Methods:** A surgical implant was press-fit into the proximal humerus of c57BL/6J mice and inoculated with 2 μL of $1 \times 10^3$ (e3), or $1 \times 10^4$ (e4), colony-forming units (CFUs) of bioluminescent Staphylococcus aureus Xen-36. The control group received 2 μL sterile saline. Bacterial activity was monitored in vivo over 42 days, directly (bioluminescence) and indirectly (targeting probe). Weekly radiographs assessed implant loosening. CFU harvests, confocal microscopy, and histology were performed.

**Results:** Both inoculated groups established chronic infections. CFUs on postoperative day (POD) 42 were increased in the infected groups compared with the sterile group ($P < .001$). By POD 14, osteolysis was visualized in both infected groups. The e4 group developed catastrophic bone destruction by POD 42. The e3 group maintained a congruent shoulder joint. Targeting probes helped to visualize low-grade infections via fluorescence.

**Discussion:** Given bone destruction in the e4 group, a longitudinal, noninvasive mouse model of SII and chronic osteolysis was produced using e3 of S aureus Xen-36, mimicking clinical presentations of chronic SII.

**Conclusion:** The development of this model provides a foundation to study new therapeutics, interventions, and host modifications.

**Keywords:** Shoulder; arthroplasty; implant; infection; osteolysis; osteomyelitis.