

# Comparison of Viable and Cadaveric Human Bone Model Environments for Evaluating Wound Irrigation Solutions

Authors: Shea Silhan Maxey, Robert Coggins, Rebekah J. Park, Hugh Jones, Alisina Shahi

UT Health Houston McGovern Medical School CORIT Lab

Email: [shea.s.maxey@uth.tmc.edu](mailto:shea.s.maxey@uth.tmc.edu)

DISCLOSURES: Shea S. Maxey (N), Hugh Jones (N), Robert Coggins (N), Rebekah J. Park (N), Alisina Shahi (N)

## BACKGROUND:

Intraoperative wound irrigation is a commonly used in orthopaedic surgery to reduce postoperative infections. The efficacy of irrigation solutions may vary depending on the biological environment. Factors such as tissue viability, lipid content, and protein interactions may alter antimicrobial properties. This study sought to investigate how these factors impact the efficacy of these solutions by comparing ex vivo viable human bone with washed sterile cadaveric bone cores. The hypothesis of this study was that the ex vivo biochemical environment influences the antiseptic performance of these solutions.

## METHODS

Viable femoral heads were obtained from primary total hip arthroplasty procedures, and cadaveric femoral heads were harvested as controls. From each, trabecular bone cores (15 × 10 mm; 9 male, 8 female donors) were prepared. Cadaveric cores underwent washing and sterilization with ethanol, sterile water, and microwave irradiation. Both viable and cadaveric cores were incubated in Dulbecco's Modified Eagle Medium (DMEM) supplemented with 10% fetal bovine serum (FBS). A total of 32 viable and 32 cadaveric bone cores were inoculated with *Staphylococcus aureus* and incubated for 6 hours at 37 °C. Cores were then exposed for 10 minutes to one of four irrigation solutions: polyhexamethylene biguanide (PHMB), hypochlorous acid (HOCl), dilute povidone-iodine (PVI), or phosphate-buffered saline (PBS, control). Following treatment, surviving bacterial recovery was performed by sonication and vortexing in neutralizing broth for plate counting.

## RESULTS

Differences in bacterial survival were observed between infected viable and cadaveric bone cores following treatment with the irrigation solutions (Figure 1). Viable cores had a reduction of 1.5 log compared to a 3.4 log reduction for the cadaveric cores (p= 0.03) when washed with the dilute iodine solution. Cadaveric specimens exposed to hypochlorous acid after inoculation also trended a greater log reduction (1.7 log) than the viable bone cores (1.04 log), however, the difference was not significant (p= 0.24). The PHMB containing solution tended to reduce the bacterial population greater in the viable group (3.2 log) compared to the cadaveric group (2.03 log) (p= 0.06).

## DISCUSSION

These results demonstrate the ex vivo biochemical environment significantly influences the bactericidal efficacy for some irrigation solutions. Iodine and HOCl were less effective in viable bone compared to cadaveric bone, while PHMB showed a trend toward improved efficacy in viable tissue. Differences are likely due to lipids, proteins, and enzymes binding in viable tissue, which has been reported to affect antiseptic availability.

## SIGNIFICANCE/CLINICAL RELEVANCE

This study highlights the importance of using biochemically relevant models for preclinical evaluation of irrigation solutions. Results suggest that conventional in vitro models may overestimate antiseptic efficacy, potentially misrepresenting their clinical utility. By demonstrating how the biochemical environment alters irrigation performance, these findings underscore the need for physiologically accurate testing to guide the selection of irrigation fluids and optimize infection prevention in orthopaedic surgery.

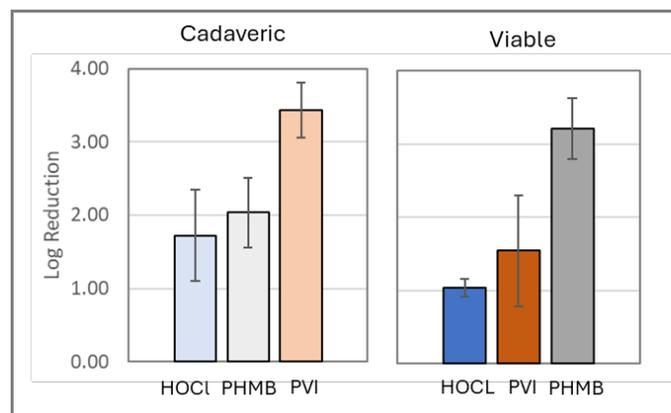


Figure 1