Paper #13

In-Vitro Analysis of Anti-Biofilm Effect of Intraoperative Irrigation Solutions

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Introduction: A diverse array of antibacterial solutions are utilized by orthopaedic surgeons in an attempt to disperse bacterial biofilm. These solutions vary significantly in their cost and toxicity profile. To date, there are very few studies that compare these agents against biofilm grown on clinically relevant orthopaedic surfaces. This study examined in-vitro effect of commercially available intraoperative antibacterial solutions against biofilm-based Methicllin-sensitive Staphylococcus aureus (MSSA) growing on plastic, cement and porous titanium.

Methods: MSSA derived from a clinical isolate (Xen36, Perkin Elmer) was utilized. Three clinically relevant materials were chosen to establish biofilm: plastic Falcon® 48-well plates, PMMA cement beads (SimplexTM P; Stryker) and grit blasted Ti-6Al-4V acetabular screw caps (G7®; Zimmer-Biomet). Antibacterial solutions included: isotonic saline, vancomycin (1mg/mL), diluted polymyxin-bacitracin (500,000 U/L - 50,000 U/L, respectively), povidone-iodine 0.3%, povidone-iodine 10%, a 1:1 combination of povidone iodine 10% and 4% hydrogen peroxide, Irrisept® (Irrimax), Prontosan® (B.Braun), and Bactisure® (Zimmer Biomet). Antibacterial solutions were tested according to manufacturer specifications/guidance. 24-hour and 72-hour Xen36 biofilms were exposed to antibacterial solutions for 3 minutes to reproduce intraoperative conditions. Solution efficacy was measured through sonication of treated surfaces followed by counting colony forming units (CFUs). Experiments were performed in triplicate and repeated at least once. A three-fold log reduction in CFU counts vs. controls was considered as a measure of solution efficacy.

Results: Povidone-iodine 10% and a 1:1 combination of povidone iodine 10% and 4% hydrogen peroxide were the only effective solutions across all three surfaces. Bactisure® was effective against 24-hour biofilm grown on cement and titanium, and only titanium at 72 hours. Irrisept® was effective against biofilm grown on titanium for 24 hours.

Conclusions: Commercial antibacterial solutions vary significantly in their efficacy against MSSA biofilm. Efficacy globally decreased as biofilm maturity increased. Increased solution cost did not confer increased efficacy.

Notes