Efficacy of Commonly Used Irrigation Solutions on Staphylococcal Biofilm Formed on Pedicle Screws and Sublaminar Bands: Preliminary Results

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INTRODUCTION: Antiseptic irrigation solutions are commonly utilized during spine surgery to prevent biofilm formation on spine instrumentation and subsequent deep surgical site infections (dSSIs). dSSIs require revision surgery and prolonged antibiotic regimens, and result in increased morbidity as well as increased cost. While some spine instrumentation is currently available in biocompatible and corrosion-resistant metals, their complex geometry can potentiate biofilm formation as early as two hours post-exposure. This study aimed to investigate the efficacy of commonly utilized antiseptic irrigation solutions against methicillin-sensitive *Staphylococcus Aureus* (MSSA) biofilm established in-vitro on pedicle screws and sublaminar bands (polyester mesh material).

METHODS:

This was an *in-vitro* study of *S. Aureus* immature (24 hours) and mature (72 hours) biofilm established on pedicle screws and sublaminar bands, followed by 3 minute exposure (i.e. wash) to 6 irrigation solutions [(a) 10% povidone-iodine (PI); (b) a 1:1 ratio of 10% PI and 3% hydrogen peroxide (HP); (c) 0.35% diluted PI (dPI); (d) Irrisept; (e) Bactisure; and (f) 1mg/mL of Vancomycin and Saline 0.9%], utilizing phosphate buffered saline (PBS) as a control. Our preliminary analysis included 8 sublaminar bands with immature and mature biofilm formation, subsequently exposed to 10% PI, 10%PI + HP, dPI, and controls. The primary outcome was clinical efficacy of each irrigation solution, defined as a 3-log reduction of bacteria in colony forming units (CFU)/mL compared to PBS controls. Statistical comparisons were performed using the Kruskal Wallis test with significance set to an alpha of 0.05.

RESULTS: Preliminary results showed that on sublaminar bands, 10% PI + 3% HP eradicated all MSSA on 72-hour ($p < 0.001$) and 24-hour ($p < 0.001$) biofilm. 10% PI alone also achieved clinical efficacy on sublaminar bands at 72-hour ($p < 0.001$) and 24-hour ($p < 0.001$) MSSA biofilms. dPI did not achieve clinical efficacy on 72-hour or 24-hour MSSA biofilm.

DISCUSSION AND CONCLUSION: Antiseptic irrigation solutions have varying efficacy against bacterial biofilm grown on sublaminar bands (polyester mesh) utilized in scoliosis surgery. 10% PI ± HP consistently achieved clinical efficacy on sublaminar bands and should be considered for clinical use. Our final analysis will include results on the remaining irrigation solution on immature/mature MSSA biofilm on pedicle screws and sublaminar bands.

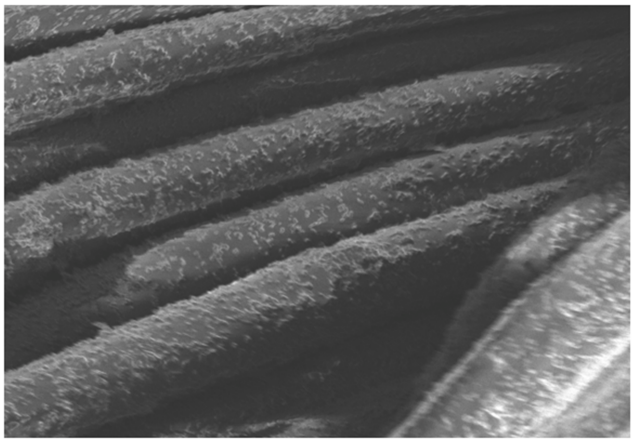

Figure 1. Scanning Electron Microscopy Image of 72 hour biofilm formation on sublaminar bands