Comparison of chelating agent, soap, and antibiotic irrigation in removing adherent bacteria from orthopaedic implants

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Introduction: Adherent bacteria on orthopaedic implants are difficult to eradicate despite irrigation and treatment with IV antibiotics. This has led to the use of other irrigation solutions including surfactants (castile soap), antiseptics (povidine, chlorhexidine, hydrogen peroxide) and antibiotics (bacitracin, neomycin, and polymyxin).

The mechanism of bacteria adhesion offers another yet unexplored strategy for irrigation. Bacterial adhesion ligands require calcium. Calcium removal has been shown to interfere with adherence to surfaces(1). Thus an agent that can bind calcium ions may disrupt bacterial adhesion. Such agents include chelators, organic compounds that bind to and inactivate metal ions. Ethylenediaminetetraacetic acid (EDTA) is a chelator that binds calcium and iron ions. EDTA has multiple uses for bacterial adhesion ligands. EDTA can inhibit normal bacterial adherence, leading to easier removal by soap and apparent lack of efficacy of antibiotic irrigation is consistent with results of these studies. Povidine, chlorhexidine, hydrogen peroxide, and alcohol have been shown to be cytotoxic and were not included for comparison in this study (5).

Many factors could account for the lack of efficacy of EDTA in this study. Review of positive studies on EDTA have all had EDTA added in culture medium at onset of incubation of bacteria and/or had EDTA present for >=24hrs. In this study, after 18 h of incubation, bacterial exposure to EDTA was <5 min during the 1 L irrigation. EDTA mechanism of action may be such that it has to be present at onset to prevent bacterial adherence or that its rate of action is slower and requires longer exposure. Another factor may be the less than physiologic concentration of calcium ions in the TSB culture medium. Calcium ion deficiency may require longer exposure. Another factor may be the less than physiologic concentration of calcium ions in the TSB culture medium. Calcium ion deficiency may inhibit normal bacterial adherence, leading to easier removal by soap and apparent lack of effect of EDTA. TSB was used as culture medium to maintain consistency between this study and those done by others in the past. The incubation time of 18 hours, also chosen to maintain consistency with other studies, may be insufficient for a mature biofilm to form. In clinical practice, acute post-operative infections involving implants would usually occur and be treated after at least 4-7 days post-operatively, not 18 hours. Future studies would address these issues.


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