Efficacy of Prophylactic Citrate-Based Aseptic Lavage in Preventing Surgical Site Infections in Extremity Fracture Surgery: A Single-Surgeon Experience

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INTRODUCTION: Surgical site infections (SSI) following open treatment of extremity fractures are linked to significant mortality and costs (Badia et al., 2017; Edwards et al., 2008). Prophylactic routine saline irrigation, along with consideration of local antibiotic powder and/or solutions, are strategies to prevent SSI, though they carry risks such as cytotoxicity and potential antimicrobial resistance (Groenen et al., 2024; O'Toole et al., 2017; O'Toole et al., 2021). Local aseptic lavage of surgical wounds offers an alternative way to reduce SSI risk. In vitro, citrate-based aseptic lavage has demonstrated significant reductions in colony-forming units for Staphylococcus aureus planktonic bacteria and biofilm formation (Hamad et al., 2025). However, the clinical efficacy of FDA-approved citrate-based aseptic lavage in reducing SSI risk has not been evaluated in fracture care, where current guidelines typically recommend saline (without additives) for managing surgical wounds in major extremity trauma (Goldman et al., 2023). This pilot study aimed to evaluate the protocolized integration of routine prophylactic citrate-based aseptic lavage after open treatment of extremity fractures.

METHODS: Institutional review board approval was obtained for this study. From January 2021 to August 2025, we reviewed 1986 cases of extremity fractures performed by a single fellowship-trained orthopedic trauma surgeon. Until September 2022, only normal saline was used for routine prophylactic lavage as part of this surgeon's practice. In September 2022, routine use of prophylactic citrate-based aseptic lavage was adopted as part of a single practice change. The cases were retrospectively reviewed as part of a hospital-wide quality surveillance using official SSI criteria set by the National Healthcare Safety Network, including presentation within 30 days of the index surgery. Inclusion criteria included purulent drainage, culture-positive specimens, surgical irrigation, and debridement, or clinical diagnosis of SSI following surgical treatment. Percutaneous cases and previously infected cases were excluded. A one-way Fisher's exact test assessed the significance of the difference in SSI rates before and after implementing aseptic lavage, based on the hypothesis that citrate-based irritants would reduce SSI rates. Statistical significance was defined as $P < 0.05$.

RESULTS: A total of 1986 cases were analyzed in this particular database. Before September 2022, 685 cases had an SSI incidence of 1.17% (8 cases). After September 2022, 1301 cases were reviewed, with an SSI incidence of 0.38% (5 cases). The relative risk reduction with routine prophylactic lavage was 0.33 (95% CI, 0.11-1.00). The absolute risk reduction was 0.78, with a number needed to treat of 128 (Fisher's exact, one-sided, $P = 0.042$).

DISCUSSION: Routine use of citrate-based aseptic lavage in treating extra-articular extremity fractures was linked to a significant reduction in SSI rates within this quality dataset. Further research into aseptic lavage for extremity trauma management remains important, with future studies focusing on healing rates and more detailed outcomes.

SIGNIFICANCE/CLINICAL RELEVANCE: Routine prophylactic wound irrigation with citrate-based lavage in open treatment of extraarticular fractures may lower SSI incidence in extremity fracture cases.

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