

# Expert Consensus on Intraoperative Wound Irrigation in Orthopedic Surgery: A Delphi Study to Optimize Antiseptic Use and Combat Biofilm and Antimicrobial Resistance

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**Introduction:** Intraoperative wound irrigation (IOWI) has been demonstrated to help reduce the risk of periprosthetic joint infection (PJI) following total joint arthroplasty (TJA) by minimizing wound microbial contamination. However, specific guidance regarding implementation and ideal characteristics of antiseptic irrigation solutions is lacking. Once established, surgical site infection (SSI) involves formation of persistent biofilm within the surgical wound, requiring morbid revision surgery that leads to significant impaired quality of life and an increasing burden on healthcare systems. Intraoperative wound irrigation (IOWI) is a commonly employed surgical intervention to clear biofilm, but inconsistent results and substantial variability in how IOWI is used has limited its clinical standardization to date. To quantify surgeons' perceptions on the pathogenesis of PJI, indications for IOWI and proper use of IOWI, an expert-driven, evidence-based consensus process was implemented.

**Methods:** Seventy statements concerning PJI and IOWI were developed, based on results from a literature review and nationwide survey of high-volume orthopaedic surgeons. A mapping process was conducted to identify nine panelists, who were selected on the basis of peer-reviewed publications, scholarly activity, infectious disease research, and expertise in the field of orthopedic surgery. A modified Delphi consensus method was used to gain agreement or modification of statements. The response rate was required to be  $\geq 70\%$  and scoring used a Likert scale from 1-5 (1 strongly disagree to 5 strongly agree). Consensus agreement for statements was defined as mean score  $\geq 4$  and standard deviation  $\leq 1$ . Development and reporting of these guidelines followed the Appraisal of Guideline Research and Evaluation (AGREE) criteria.

**Results:** Seventy consensus statements were established across grouped topic areas pertaining to IOWI clinical evidence, ideal characteristics of an irrigation solution, impacts of SSI, challenges of biofilms, combating antimicrobial resistance (AMR), IOWI clinical evidence, and future research. Consensus reached agreement in the 3-stage Delphi process. Key consensus statements include: (1) Antiseptic irrigation solutions that provide sustained antimicrobial activity following irrigation provide continued kill and thus additional support towards Surgical Site Infection prevention (mean 4.56, SD 0.73); (2) Intra-operative wound irrigation solutions should be effective against a broad range of microorganisms commonly implicated in Surgical Site Infection (mean 4.89, SD 0.33); (3) Antiseptic irrigation solutions requiring a rinse step following application have diminished antimicrobial activity against subsequent contamination events (mean 4.89, SD 0.33); (4) Contamination of the wound can occur during the closure portion of the surgical procedure (mean score 4.78 with SD 0.44); (5) Biofilms are the main cause of delayed onset infection and recurrent infection post-surgery (mean score 4.22 with SD 0.97); (6) Infections caused by antibiotic resistant bacteria pose an increasing challenge in post-surgical complications (mean score 4.78 with SD 0.67); and (7) Antiseptic irrigation solutions may lower the incidence of SSI compared to saline (mean score 4.67 with SD 0.50).

**Discussion:** These consensus recommendations explore the challenges of SSI and PJI. Delphi consensus was achieved amongst the expert surgeon panel identifying ideal attributes of IOWI solutions and practical guidelines for the implementation of these tools. There was alignment to attributes for ideal irrigation solutions providing consistent guidance for optimal IOWI. The findings highlight key clinical priorities of IOWI, importance in preventing biofilm, and supporting antimicrobial stewardship by guiding more targeted clinical studies and ultimately providing improved patient outcomes.

**Significance/Clinical Relevance:** In the field of orthopedic hip and knee arthroplasty, there is widespread use of intraoperative wound irrigation solutions. There is documented variability among surgeons on the selection, usage, ideal attributes, desired properties, and tolerable cytotoxicity of the various IOWI solutions. This Delphi consensus establishes practical guidelines for selection and optimal usage of IOWI. There is a need for more focused clinical studies to develop societal based clinical practice guidelines.