

## RATIONALE

The effects of the use of vancomycin powder in foot and ankle surgery are ill-defined. Wukich et al. evaluated the use of vancomycin powder exclusively in foot and ankle procedures, though this was performed in a population composed solely of patients with diabetes mellitus [1]. The authors concluded that odds of surgical site infections (SSIs) (73% decrease) and deep infections (80% decrease) were significantly reduced in diabetic patients who underwent reconstructive surgery of a foot and/or ankle deformity or trauma and received topically-applied vancomycin when compared with a group of patients who did not receive topically-applied vancomycin. The rate of superficial infections did not differ significantly between the two groups. Based on this retrospective controlled study, the authors concluded that foot and ankle surgeons may consider topically applying 500 to 1,000 mg of vancomycin powder prior to skin closure in patients who are not allergic to vancomycin. To our knowledge, no others studies have evaluated the use of vancomycin powder exclusively in foot and ankle surgery.

The effectiveness of vancomycin powder has been documented more extensively in other orthopaedic subspecialties than foot and ankle [2–6]. A systematic literature review by Kanj et al. showed local vancomycin-impregnated cement and powder to be associated with lower infection rates while also being safe and effective in clean orthopaedic surgery [2]. The authors especially recommended utilizing local vancomycin in spine surgery, in which patients without local antibiotic prophylaxis were more than four times more likely to experience a deep postoperative wound infection. Evaniew et al. concluded through their meta-analysis that there is a lack of high-quality evidence to inform the use of intrawound vancomycin in spine surgery [3]. Xie et al. found from their meta-analysis on intrawound vancomycin in spinal surgery that the odds of developing postsurgical wound infection without prophylactic local vancomycin use were 2.83-fold higher than the odds of experiencing wound infection with the use of intrawound vancomycin [4]. Furthermore, a retrospective review performed by Singh et al. that assessed the efficacy of intraoperative vancomycin powder administration on preventing deep SSI in high-energy lower extremity trauma (including tibial plateau fractures and pilon fractures) found that the rate of deep SSI between the groups was not statistically significantly different [7].

Concerns have been raised about the potential risks of the local use of vancomycin, including selection for gram-negative and multi-drug-resistant bacteria, increased local tissue irritation, hypersensitivity or anaphylaxis, impaired renal function, and increased seroma

formation [8]. However, these adverse effects are mostly hypothetical and have not been reported in the literature, though a case of circulatory collapse due to topical vancomycin application during spine surgery was identified [9].

Although vancomycin powder appears to be effective at decreasing postoperative infections in spine surgery according to some studies, a large void remains in the evidence for other orthopaedic subspecialties, especially foot and ankle. Randomized controlled trials, particularly within the fields of arthroplasty and trauma, are needed to determine the efficacy of local vancomycin powder for infection reduction. In this scenario, a phase III prospective randomized clinical trial is being conducted among high-risk tibial fracture patients to assess the efficacy of locally administered vancomycin powder in the prevention of SSI after fracture surgery [10], which may bring increased clarity to this matter.

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**Authors:** Kristin Englund, Nima Heidari

**QUESTION 2:** Is there a role for the use of dilute povidone-iodine (betadine) irrigation or other antiseptic irrigation solutions during total ankle arthroplasty (TAA) or other foot and ankle procedures?

**RECOMMENDATION:** With regards to TAA, there is a lack of evidence to recommend for or against the use of betadine solution.

**LEVEL OF EVIDENCE:** Consensus

**DELEGATE VOTE:** Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)

## RATIONALE

In 2016, the World Health Organization (WHO) published guidelines for the prevention of surgical site infections (SSIs) [1]. Based upon a review of 17 randomized controlled trials, there is moderate quality evidence that alcohol-based antiseptic solutions for preparation of the surgical site decrease the risk of SSIs in comparison to aqueous solutions. A low quality of evidence showed decreased SSI risk with alcohol-based chlorhexidine gluconate compared to alcohol-based betadine. While alcohol may be concerning for persons from certain religions, the WHO guideline highlights the statement issued in 2002 by the Muslim Scholars Board of the Muslim World League. According to the Board, medicines containing alcohol may be used as an external cleaner. With the use of alcohol-based agents, care must be taken to allow them to dry completely, as operating rooms fires have been reported. According to the Centers for Disease Control and Prevention (CDC), skin preparation with an alcohol-based antiseptic solution should be completed prior to surgery, to reduce the risk of SSI [2].

A systematic review and meta-analysis of combination chlorhexidine gluconate (CHG) and betadine implicated the utility of these agents, despite the low quality of the evidence. A major limitation of many of these studies, however, was the use of bacterial colonization as an endpoint rather than the development of a true SSI [3].

Privitera et al. recently provided a meta-analysis updating and clarifying issues from prior meta-analyses which had not clearly distinguished among studies using alcohol and aqueous-based products. In the updated meta-analysis, there was subgroup analysis showing decreased colonization rates with chlorhexidine, but there was not a statistically significant difference in SSI due to the low numbers of SSI [4].

Although the use of antiseptic agents for skin preparation is necessary for bioburden reduction and prevention of infection, there is minimal data available regarding the role of antiseptic irrigation solutions during TAA. The use of antiseptic agents for irrigation is often performed in the setting of periprosthetic joint infections (PJI) of the hip and the knee, although the utility in total ankle replacements is unknown.

Randomized controlled studies have evaluated the use of various irrigates in open fracture wounds, noting that normal saline was more efficacious and as effective at decreasing infection

in comparison to castile soap and bacitracin solution, respectively [5,6]. Chlorhexidine solutions have been evaluated in an in vitro model as being beneficial to decreasing the biofilm load, particularly at concentrations above 2%. However, of importance is that concentrations as low as 0.02% CHG have shown to lead to fibroblast toxicity [7,8]. Dilute betadine may be advantageous in this regard, as it has minimal cellular toxicity at low concentrations and excellent efficacy for prevention of infection [9].

Based on the available data, the CDC has recommended that strong consideration should be given to the use of dilute betadine during all surgical procedures. Although no data in TAA exists, extrapolating the recommendations of the CDC to TAA appears to be reasonable as dilute betadine is inexpensive, efficacious and carries little-to-no cell toxicity.

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**Authors:** Nima Heidari, Alexander Charalambous, Iris Kwok, Alexandros Vris, Yueyang Li

## QUESTION 3: Does revascularization prior to foot and ankle surgery reduce the incidence of surgical site infection (SSI)?

**RECOMMENDATION:** Several studies support the effect of peripheral vascular disease (PVD) on wound healing and SSI. Despite this, there have been no specific studies proving the beneficial effect of revascularization on SSI prior to surgical intervention in the setting of traumatic or elective foot and ankle surgery. The majority of studies on revascularization are in the setting of diabetic foot infection or established ischemia.

We recommend that in the presence of an inadequate vascularization in the foot and ankle, vascular optimization should be undertaken prior to elective surgery.

**LEVEL OF EVIDENCE:** Limited

**DELEGATE VOTE:** Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)

## RATIONALE

Oxygenation of soft tissues is a critical component of wound healing, with wound tissue oxygen tension having a direct correlation with the risk of postoperative wound infection [1].

Diabetes mellitus (DM) and its complications, such as PVD, have proven to be risk factors for increased infection and complication rates after surgery for ankle fractures [2-4]. A large cohort study of