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Concise Communication

Effectiveness and acceptability of intranasal povidone-iodine decolonization among fracture fixation surgery patients to reduce *Staphylococcus aureus* nasal colonization

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Abstract

We evaluated povidone-iodine (PVI) decolonization among 51 fracture-fixation surgery patients. PVI was applied twice on the day of surgery. Patients were tested for *S. aureus* nasal colonization and surveyed. Mean *S. aureus* concentrations decreased from 3.13 to 1.15 CFU/mL ($P = .03$). Also, 86% of patients stated that they felt neutral or positive about their PVI experience.

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Surgical site infections (SSIs) after fracture fixation surgery are associated with increased patient morbidity and costs.[1] *Staphylococcus aureus* is the leading cause of SSI, accounting for 38% of orthopedic SSIs.[2] Approximately 30% of people are nasally colonized with *S. aureus*, which is a risk factor for SSI.[3]

Prior studies found that nasal decolonization significantly decreases the incidence of *S. aureus* SSIs.[4,5] However, patient adherence with self-administration of a decolonization ointment (ie, mupirocin) is low, especially among patients having urgent surgery.[4]

Preoperative decolonization with mupirocin is impractical for fracture-fixation surgery given the urgent nature of trauma care.[4] Intranasal povidone-iodine (PVI) is a pragmatic option for nasal decolonization before fracture fixation because it can be used on the day of surgery and still achieve *S. aureus* decolonization.[5] In this pilot study, we assessed the effectiveness and acceptability of PVI decolonization among patients treated with operative fracture fixation.

Methods

Participants included individuals aged ≥18 years who underwent operative lower extremity fracture-fixation surgery at the University of Iowa Hospitals and Clinics between February 2020 and June 2021. We excluded patients with dementia, delirium, traumatic brain injuries or other cognitive defects, iodine allergy, head or neck trauma, non-English speakers, and patients who underwent surgery in the late afternoon or evening.

Patients who provided informed consent received intranasal PVI regardless of *S. aureus* colonization. Intranasal PVI (10% w/w Profend, PDI Healthcare, Woodcliff Lake, NJ) was administered to the patient's nares ~1 hour before surgical incision in the preoperative unit for outpatients and in either the preoperative unit or the wards for inpatients. PVI was reapplied the evening after surgery.[6]

Patients received a 15-second application of a swab presaturated with PVI to the circumference of each naris and 6 revolutions inside each anterior naris according to the manufacturer's instructions. This process was performed twice to each naris (4 swabs per application). PVI was administered by the patient's nurse or self-applied by the patient with supervision. If the nurse was not familiar with PVI, on-site training was done. On rare occasions, a researcher administered the PVI.

The primary outcome was reduction in *S. aureus* nasal colonization after surgery. Patients were tested for *S. aureus* nasal colonization before surgery, the evening after surgery, and the day after surgery. Samples were obtained before the application of PVI. At each time point, a rayon swab was used to sample the anterior apex of both nostrils. The swabs performed the evening and day after surgery were inoculated into 1 mL Dey-Engley neutralizer and spun in a vortexer for 15 seconds. For all swabs, a series of dilutions were performed and plated on mannitol salt agar (MSA) plates. The cultures were quantitatively assessed to determine the reduction in *S. aureus* after use of PVI. Statistical analysis was done using ANOVA and the Skillings-Mack test, which is a nonparametric test for repeated measures data.

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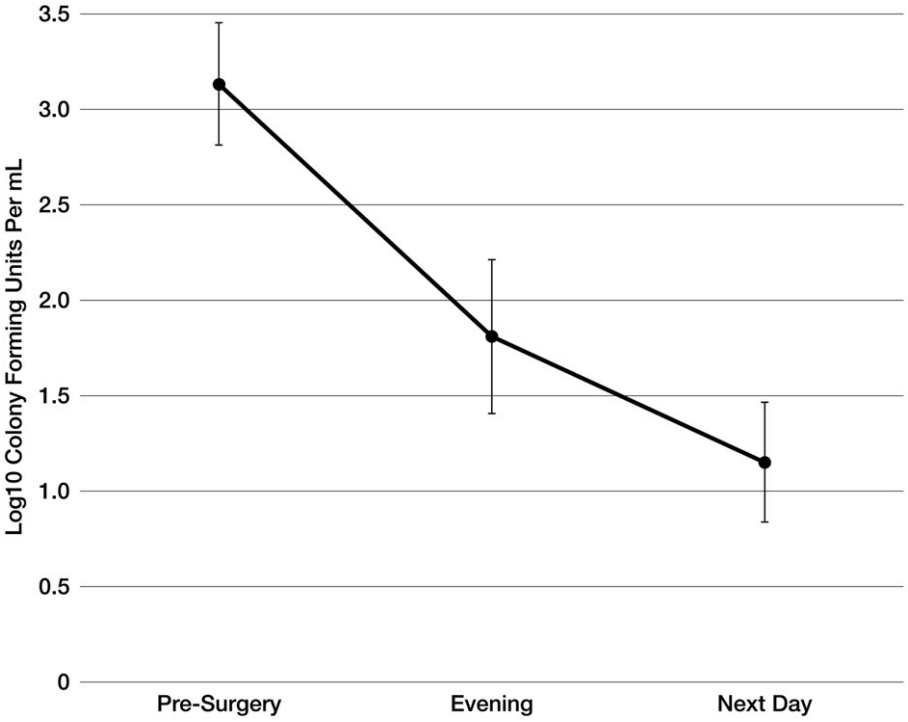

Fig. 1. Quantitative assessment of intranasal *S. aureus* colony forming units (CFU) before surgery, the evening after surgery and the day after surgery among patients included in the povidone-iodine intervention. Note: The concentration of intranasal *S. aureus* decreased from a mean of 3.13 (SE, 0.32) $\log_{10}$ CFU/mL from the presurgery swab to 1.81 (SE, 0.41) $\log_{10}$ CFU/mL from the evening swab to 1.15 (SE, 0.32) $\log_{10}$ CFU/mL from the next-day swab. Points represent geometric means at each time point. Error bars are standard error of the mean.

The morning after surgery, a patient survey was administered to determine the acceptability of intranasal PVI. SSI within 30 and 90 days of surgery was assessed by medical record review using definitions of the Centers for Disease Control and Prevention's National Healthcare Safety Network.[7] The University of Iowa Institutional Review Board approved this project (clinicaltrials.gov identifier NCT04146116).

Results

Of 65 patients who gave informed consent for the study, 13 were excluded for surgery cancellation or same day discharge from the hospital. In addition, 1 patient dropped out of the study. Overall, 51 patients received 2 doses of PVI and were tested for *S. aureus* colonization.

Nasal samples from 12 participants (23.5%) grew *S. aureus*. Of these, samples from 9 participants were cultured quantitatively. Samples from the other 3 participants had such small quantities of *S. aureus* that they were only detected via overnight growth. Among the 9 samples that were cultured quantitatively, there was a statistically significant reduction in the concentration of *S. aureus* across the 3 time points ($P = .032$) (Fig. 1).

No patients experienced an SSI within 30 days of surgery. One patient (2%) experienced an SSI within 90 days of surgery. This patient was not a *S. aureus* nasal carrier, and cultures from the infected site were negative; thus, the organism causing this patient's infection was unclear.

In total, 51 patients were surveyed on the day after surgery. Among them, 16 (31%) reported at least 1 side effect while using PVI. Reported side effects included dripping (14%), itching (12%), dryness (8%), stinging (8%), staining (6%), unpleasant taste (6%), runny nose (4%), burning (2%), sneezing (2%), sore throat (2%), tickling (2%), and cough (2%). No serious adverse events were reported. Moreover, 16% of participants found the PVI annoying to use due to its feeling, color, or side effects. However, 42 surveyed participants (88%) agreed that the benefit of preventing SSI outweighed any discomfort.

Patients rated their experience with PVI. Most patients (45%) stated that PVI felt pleasant. One (2%) patient found it very unpleasant, 6 patients (12%) found it to be unpleasant, 9 patients (18%) rated their PVI experience as neutral, and 12 (23%) found the PVI to be very pleasant.

Discussion

We found that nasal PVI before surgery and the evening after surgery was acceptable and effective at reducing *S. aureus* colonization. Most patients rated nasal PVI as neutral, pleasant, or very pleasant and felt that the benefit outweighed the discomfort. Among patients with *S. aureus* colonization, nasal PVI significantly decreased the quantity of *S. aureus* in the patients' noses.

The magnitude of decolonization in our study was similar to that reported by Ghaddara et al,[6] who assessed a single dose of nasal PVI among hospitalized patients and found a significantly decreased concentrations of *S. aureus* for 6 hours. Our survey results are also comparable with those by Maslow et al,[8] in which patients undergoing elective orthopedic surgery received 1 application of nasal PVI. Most participants in both studies stated that using PVI was a neutral or pleasant experience.[8]

A prior quasi-experimental study found that 1 application of preoperative nasal PVI among patients having orthopedic trauma surgery was associated with a significant decrease in SSI.[5] A single-center randomized controlled trial found no difference in SSI rates when comparing a single preoperative application of nasal PVI with a 5 day application of nasal mupirocin among patients undergoing arthroplasty or spine fusion surgery.[9] Decolonization with nasal PVI has many practical benefits compared with nasal mupirocin. PVI can be given on the day of surgery rather than for 5 days before the surgery. A quality improvement study in which all surgical patients received preoperative nasal PVI found that the

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application was easy, straightforward, and did not interfere with nursing duties.[10]

Our study had several limitations. The sample size was small and we lacked a control group, which limits conclusions about the effectiveness of intranasal PVI for preventing SSI. Although we found that intranasal PVI significantly reduced concentrations of nasal *S. aureus* colonization, the amount of *S. aureus* suppression necessary to decrease the risk of SSI is unknown. Larger clinical trials should evaluate whether this 2-application regimen of PVI significantly decreases rates of SSI among patients treated with fracture fixation.

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Conflicts of interest. Dr Schweizer is a paid speaker for 3M. No other authors have a conflict of interest.

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