CLINICAL STUDIES
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Peer-reviewed published study in American Journal of Infection Control (AJIC) 2017 by Mullen et al. Shows presurgical decolonization with non-antibiotic alcohol-based nasal antiseptic significantly decreased by 81% surgical site infections in spine patients.

Reduction of nasal Staphylococcus aureus carriage in health care professionals by treatment with a nonantibiotic, alcohol-based nasal antiseptic.

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A Novel Protocol for Nasal Decolonization Using Prolonged Application of an Alcohol Based Nasal Antiseptic Reduces Surgical Site Infections.

Poster presented at American Association of Orthopedic Surgeons (AAOS) 2018 by Bostian P et al. Shows nasal decolonization with an alcohol-based sanitizer during the perioperative period was associated with a 78.5% reduction in surgical site infections.

Pre- and Post-operative Participation of Orthopedic Patients and Surgical Staff in a Novel Intervention to Reduce Staphylococcus aureus Infection.

Mullen A, Wieland R, et al. Presented at the 2016 Annual ID Week Conference, New Orleans. The inclusion of alcohol-based nasal antiseptic use by both surgical patients and staff in IC protocols during the peri-operative period resulted in a marked decrease in SSIR.

Impact of Reduced Isolation and Contact Precaution Procedures on Infection Rates and Facility Costs at a Nonprofit Acute Care Hospital.

Presented at American Association for Infection Control APIC 2016 Conference. Elimination of CP in MRSA noninfected patients while maintaining low infection rates and improving staff and patient satisfaction was achieved with IC protocols utilizing nasal (Nozin®) and skin decolonization. A significant reduction in CPrelated PPE costs also resulted.
Perioperative participation of orthopedic patients and surgical staff in a nasal decolonization intervention to reduce Staphylococcus spp surgical site infections.

Brief Report

Perioperative participation of orthopedic patients and surgical staff in a nasal decolonization intervention to reduce Staphylococcus spp surgical site infections

Anildaliz Mullen RN, BSN a,*, Helen J. Wieland RN a, Eric S. Wieser MD, ABOS a, Ernst W. Spannhake PhD b, Rebecca S. Marinos PhD, CNO a

a Baylor Orthopedic and Spine Hospital at Arlington, Arlington, TX
b Johns Hopkins University School of Public Health, Baltimore, MD

Key Words: Spine surgery Perioperative nasal decolonization Alcohol-based nasal antiseptic Anterior nares Staff nasal decolonization

With the goal of reducing rates of surgical site infections in our spine patients, we initiated a trial to investigate the impact of adding perisurgical nasal decolonization involving patients and surgical and nursing staff. We combined immediate presurgical application of a nonantibiotic alcohol-based nasal antiseptic with existing chlorhexidine bath or wipes in a comprehensive pre- and postoperative decolonization protocol. Mean infection rates were significantly decreased by 81% from 1.76 to 0.33 per 100 surgeries during the 15-month trial, when compared with the prior 9-month baseline.

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Transient and sustained carriage of potentially pathogenic bacteria in the nasal vestibule, including both methicillin-susceptible Staphylococcus aureus and methicillin-resistant S aureus and coagulase-negative staphylococci, are recognized to contribute significantly to the risk of postsurgical infections.1,2 The reduction of nasal carriage using 5-day twice-daily topical antibiotic treatment (ie, mupirocin) as part of a protective bundle prior to surgery has been demonstrated in many studies to play a role in reducing surgical site infection (SSI) rates1,3 and has become standard practice in many facilities. However, screen and treat protocols are resource intensive, and universal antibiotic treatment, which has been shown to be more effective than screen and treat,4 is a challenge to antibiotic stewardship. The use of nonantibiotic antiseptic agents, including alcohol-based preparations, to achieve nasal decolonization of S aureus has been discussed recently with the suggestion that they might provide an effective and practical alternative to antibiotic treatment in patients.5

The antiseptic approach was selected by our hospital to address SSI rates that were above those desired, despite a regular regimen of preoperative chlorhexidine gluconate (CHG) bathing and wipes. With the goal of expanding the use of nasal decolonization to address transmission risk that might be posed by nasal carriage in members of our perioperative staff,6 an alcohol-based antiseptic that had been demonstrated to be effective and acceptable for use by nursing and surgical staff was selected.7 This brief report describes the results from a trial carried out in our spine surgical group to determine if implementation of antiseptic nasal decolonization in patients and staff would be associated with a reduction in Staphylococcus spp SSI rates.

METHODS

Our facility is an orthopedic treatment and surgical center with 23 beds, primarily consisting of 1-bed rooms. All patients scheduled for spine surgery were included in the study. Records from 1,073 spine surgical patients undergoing inpatient or outpatient procedures (400 and 673 in the baseline and intervention periods, respectively) were compiled for this report. In the 9-month period prior to the change in our infection control (IC) policies and guidelines, the use of patient-administered nasal mupirocin during the preadmission period was irregularly used; in contrast, during this time, CHG bathing and surgical site decolonization with wipes preoperatively were carried out according to policy, and adherence was recorded.

The modified IC policies and guidelines in place during the trial retained prior CHG procedures. All use of mupirocin in the spine group was uniformly discontinued and replaced by the application of nasal antiseptic to the patient by trained preoperative staff
prior to entering the operating room. Nasal decolonization was recorded in the patient chart. Voluntary self-decolonization by preoperative staff was actively encouraged and systematically recorded during the first 3 months of the trial. Adherence on a daily basis was calculated as the ratio of the number of affirming signatures to the number of scheduled nursing staff. During the surgical timeout between procedures, adherence of the surgical staff to the voluntary decolonization procedure was directly encouraged by the surgeon. After surgery, patients were expected to follow the regular 3 days daily cycle of staff-applied antiseptic application in the postsurgical units until discharge, at which time the patient and family coach were instructed to continue applications for an additional 5-7 days with the remaining antiseptic. The antiseptic used for decolonization was the alcohol-based Nozin Nasal Sanitizer, which was provided at no cost for the first 3 months of the trial by the manufacturer, Global Life Technologies (Chevy Chase, MD). This over-the-counter nasal antiseptic has been used for >10 years and is available to the public. Cultures from all spine surgical patients admitted for SSI, identified in accord with Centers for Disease Control and Prevention’s National Healthcare Safety Network criteria for SSI classifications, were tested for methicillin-susceptible \( S \) aureus and methicillin-resistant \( S \) aureus. Because coagulase-negative staphylococcus is known to be carried in the anterior nares and has been demonstrated to contribute to spine SSS, the few infections in which coagulase-negative staphylococcus was the only isolate were included in the \( S \) aureus infection rate. Rates were calculated on a quarterly basis throughout the baseline and nasal intervention periods. Comparisons between baseline and intervention mean patient data and infection rates were made using a 2-tailed Student t test or, in instances of a failed normality test, the Wilcoxon-Mann-Whitney rank-sum test. A P value ≤0.05 was considered significant.

RESULTS

The characteristics of the baseline and intervention patient cohorts (Table 1) were comparable in the average numbers of quarterly surgeries, age, sex, and inpatient days. In the baseline period (October 2014-June 2015), during which only CHG cleansing was standardly used, quarterly \( S \) aureus infection rates were 1.36, 2.38, and 1.55 per 100 surgeries. After the addition of the alcohol-based nasal antiseptic (July 2015-September 2016), quarterly infection rates were 0.83, 0.0, 0.81, 0.0, and 0.0 per 100 surgeries, respectively (Fig 1). This mean change from 1.76 to 0.33 infections per 100 infections in 2 periods represented an 81.3% reduction from baseline, which was statistically significant \((P = 0.036)\). Hospital records indicate that neither of the other 2 orthopedic surgical groups sharing use of these facilities experienced a decline in SSI rates over the 2 periods corresponding to the trial. Adherence rates for the treatment protocols are presented in Table 2. Self-applied and staff-applied CHG rates remained consistent across the baseline and trial periods, with a small (8%) increase in reported CHG wipes. Patient nasal decolonization rates were fairly well maintained, averaging 95% over the 15-month trial period. Systematic records of voluntary use were only kept for preoperative staff during the first 3 months of the trial. These showed a decrease in participation rates after the first month to 74% in the remainder of the quarter.

DISCUSSION

The adoption of protocols for patient and staff decolonization in the spine surgery group at our facility using an alcohol-based nasal antiseptic was associated with a substantial reduction in \( S \) aureus SSIs that was maintained over the subsequent 15-month intervention period. In 3 of the 5 treatment quarters, these SSI rates decreased to zero. In some investigations, separating the relative contributions of patient skin and patient nasal decolonization to infection rate reduction is difficult to assess. In the case of the current study, standardized use of CHG was consistent during the baseline and intervention periods, and the only procedural change was the addition of patient and staff nasal decolonization. Furthermore, the reduction in \( S \) aureus SSIs observed in the spine surgical group during the intervention was not experienced by other groups at the facility during that time, suggesting that a facility-wide improvement in IC was not responsible. We believe that these 2 factors, in combination with the high level of staff adherence to patient decolonization maintained during the intervention period, suggest that the strength of the association between nasal antiseptic use and reduced infection rates is high.

The bundling of patient skin and nasal decolonization is known to be effective and maximizes risk reduction from the 80% of \( S \) aureus infections caused by self-inoculation. To address the contribution to transmission that may be made by staff, voluntary nasal self-decolonization was instituted. Although adherence data for the first 3 months of the trial in preoperative nursing staff suggest the potential for their involvement in strategies to lower human bacterial burden, the data are insufficient to assess their contribution to the present results.
Study limitations

Our spine population was not sufficiently large to establish a concurrent control group, and a before-and-after intervention study design was adopted. Despite efforts to ensure that relevant nonintervention conditions remained as consistent as possible during baseline and trial periods, the inherent characteristics of this design limit the ability to establish the extent of the causal relationship between the treatment and the reduction in SSI rates. Reported compliance data for self-administered applications in both patients and staff are likely to reflect a positive bias. It is recognized that the protocols and results of this present small, single-center intervention may not be generalizable to larger facilities and may be most applicable to acute surgical facilities of similar focus, size, and activity.

CONCLUSIONS

After implementation of an alcohol-based antiseptic nasal decolonization program in patients and members of our hospital spine surgery group, Staphylococcus spp SSIs were significantly reduced from baseline over the subsequent 15-month period.

References


Table 2: Reported adherence to decolonization treatment protocols

<table>
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<tr>
<th>Reporting quarter</th>
<th>Treatment adherence (%)</th>
<th>Preoperative staff</th>
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<tr>
<td></td>
<td>Preadmission CHG bath*</td>
<td>Preoperative CHG wipe†</td>
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<tr>
<td>Baseline</td>
<td></td>
<td>Preoperative nasal decolonization†</td>
</tr>
<tr>
<td>Q4 2014</td>
<td>96</td>
<td>84</td>
</tr>
<tr>
<td>Q1 2015</td>
<td>92</td>
<td>84</td>
</tr>
<tr>
<td>Q2 2015</td>
<td>92</td>
<td>88</td>
</tr>
<tr>
<td>Nasal protocol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q3 2015</td>
<td>96</td>
<td>96</td>
</tr>
<tr>
<td>Q4 2015</td>
<td>89</td>
<td>92</td>
</tr>
<tr>
<td>Q1 2016</td>
<td>100</td>
<td>96</td>
</tr>
<tr>
<td>Q2 2016</td>
<td>100</td>
<td>88</td>
</tr>
<tr>
<td>Q3 2016</td>
<td>88</td>
<td>92</td>
</tr>
</tbody>
</table>

CHG, chlorhexidine gluconate; NR, voluntarily self-administered, not reported; Q, quarter.

*Patient self-administered and reported at admission.
†Preoperative staff-administered in accordance with established infection control policies and guidelines and recorded.
‡Voluntarily self-administered, reported.
Reduction of nasal Staphylococcus aureus carriage in health care professionals by treatment with a nonantibiotic, alcohol-based nasal antiseptic.

Reduction of nasal *Staphylococcus aureus* carriage in health care professionals by treatment with a nonantibiotic, alcohol-based nasal antiseptic

Lisa L. Steed PhD, Justin Costello BA, Shivangi Lohia MD, Taylor Jones BS, Ernst W. Spannhake PhD, Shaun Nguyen MD, MA, CPI*

*Department of Pathology and Laboratory Medicine, Medical University of South Carolina, Charleston, SC*

*Department of Otolaryngology, Head and Neck Surgery, Medical University of South Carolina, Charleston, SC*

*Department of Environmental Health Sciences, Johns Hopkins School of Public Health, Baltimore, MD*

**Key Words:**

Ethanol  
Nasal colonization  
Bacterial burden  
Infection control

**Background:** Antibiotics used to reduce nasal colonization by *Staphylococcus aureus* in patients before admission are inappropriate for carriage reduction on a regular basis within a hospital community. Effective nonantibiotic alternatives for daily use in the nares will allow reduction of this bacterial source to be addressed.

**Methods:** Our study tested the effectiveness of a nonantibiotic, alcohol-based antiseptic in reducing nasal bacterial carriage in health care professionals (HCPs) at an urban hospital center. HCPs testing positive for vestibular *S aureus* colonization were treated 3 times during the day with topical antiseptic or control preparations. Nasal *S aureus* and total bacterial colonization levels were determined before and at the end of a 10-hour workday.

**Results:** Seventy-eight of 387 HCPs screened (20.2%) tested positive for *S aureus* infection. Of 39 subjects who tested positive for *S aureus* infection who completed the study, 20 received antiseptic and 19 received placebo treatment. Antiseptic treatment reduced *S aureus* colony forming units from baseline by 99% (median) and 82% (mean) (*P* < .001). Total bacterial colony forming units were reduced by 91% (median) and 71% (mean) (*P* < .001).

**Conclusions:** Nasal application of a nonantibiotic, alcohol-based antiseptic was effective in reducing *S aureus* and total bacterial carriage, suggesting the usefulness of this approach as a safe, effective, and convenient alternative to antibiotic treatment.

Although estimates vary, studies indicate that between 20% and 40% of healthy individuals within the continental United States exhibit nasal vestibular carriage of *Staphylococcus aureus*. All individuals within health care environments in whom subclinical nasal carriage of *S aureus* and other potentially pathogenic bacteria is present contribute to the burden of infection risk to themselves and others. Nasal colonization is known to be predominantly localized in the anterior, vestibular region of the nasal anatomy.

Data support the premise that individuals exhibiting subclinical nasal colonization by *S aureus* can be grouped into persistent, intermittent, and noncarrier types. In a study using artificial inoculation, carriage characteristics were similar in intermittent carrier and noncarriers (comprising 76% of the total), but distinct from those of the persistent carrier group. These findings are consistent with the concept that either most individuals are actually intermittent carriers or are noncarriers who exhibit carriage only under environmental pressure (eg, recurring exposure). In either instance, the demonstrated ability of these 2 groups to sustain transient subclinical carriage for 4-14 days on average would put either of them in a position to increase risk for *S aureus* infection in themselves or others with whom they come in contact during that period.

Within the health care community, there are several categories of individuals who maintain a long-term presence within that...
environment who are not screened or treated for S aureus carriage, but who may contribute to its presence. These include longer-term patients as well as health care professionals (HCPs) and support staff who regularly come in contact with patients. In a study of 256 HCPs at a large urban tertiary care teaching hospital, including paramedics, nurses, clerical workers, and physicians, S aureus was isolated from the anterior nares of 43.8% of those screened with 6.6% exhibiting methicillin-resistant S aureus (MRSA) carriage. The authors point to 3 potential consequences of this carriage: self-infection of these workers by their own strains, cross-transmission to patients, and introduction of the pathogen into their communities. Furthermore, a study using whole-genome sequencing to investigate MRSA transmission within a neonatal intensive care unit provided evidence of the complexity of transmission that can occur in both directions involving patients and caregivers.8

Strategies to reduce colonization in patients preadmission have been shown to be very successful. These have primarily focused on regimens that include nasal treatment with the antibiotic mupirocin.13 Recently, a multicenter study suggested the potential utility of universal antibiotic treatment of patients at admission without screening for specific carriage to be an effective approach to reduce intensive care unit MRSA infections.13 Although effective, strategies that incorporate wide use of antibiotics lead to increased opportunities for the development of resistant bacteria. For this reason, nasal antibiotics are typically not used on a regular basis to reduce subclinical colonization in individuals within the health care environment in whom prophylactic treatment might be beneficial. These could include patients with immune deficiency or who are otherwise at higher-risk for infection and longer-term patients, as well as HCPs and other staff who work in the patient environment.

The development of effective and convenient nonantibiotic nasal preparations for daily use could provide appropriate additional methods for infection control, addressing the well-known hand-to-nose-to-hand cycle of inoculation and contamination involving the nasal bacterial repository.14 A nonselective antiseptic agent, such as ethanol, would be expected to reduce colonization by all strains of bacteria, similar to a broad-spectrum antibiotic, but with both gram-positive and gram-negative bacteria being affected and without the risk of resistance being developed. In patients, daily application of such an agent could reduce the risk of self-inoculation and contamination of the hospital room environment. The regular use of a nasal antiseptic by HCPs could reduce their involvement in the process of bacterial transference, as well as contribute to their own preventive and protective hygiene in the work environment.

The goal of our study was to determine the magnitude and breadth of bacterial reduction by a nonantibiotic, alcohol-based nasal antiseptic applied during a typical workday in primary HCPs. Study subjects included nurses and surgical technicians directly participating in patient treatment and care on the day of testing. Data were collected on the treatment effects on both S aureus and total bacterial carriage in the nasal vestibule during a single day of application.

METHODS

Selection and enrollment of study subjects

Volunteers were recruited from the nursing and technical staff working in the main and ambulatory operating rooms and patient care floors of the Medical University of South Carolina Hospital. This randomized double-blind, placebo-controlled study was approved by the Medical University of South Carolina Institutional Review Board (Pro000018198). This study is registered on clinicaltrials.gov (Identifier: NCT01861457).

Eligible to participate were healthy HCPs between ages 18 and 70 years who were able and agreed to refrain from using all nasal spray preparations or washes from the time of their screening through their scheduled study day. Exclusionary criteria included symptoms of upper respiratory disease, including chronic rhinitis/sinusitis, seasonal allergies, upper respiratory infection during the previous 4 weeks; the use of antibiotics in the 2 weeks before or during the study; a known allergy to citrus oil; or being a cigarette smoker. Nonsmokers were defined as those individuals who had abstained from smoking for at least 1 year before the study.

After obtaining informed consent, eligible subjects were screened by nasal swab for vestibular carriage of S aureus as described below. Subjects who screened positive and who accepted enrollment in the study were scheduled for participation within 10 days to minimize loss of carriage status by the study date.

Study protocol

The study period consisted of a single 10-hour workday, during which nasal swab samples from the right and left nasal vestibules of each subject were obtained and pooled (Fig 1). The first combined sample from each subject was collected by the medical study staff at the start of the workday (hour 0), immediately followed by application of the randomly assigned placebo or test preparation with a saturated swab to both nasal vestibules. Application of the placebo preparation was used to control for the potential mechanical effects of the application process, itself. Reapplications of the placebo and treatment preparations were made at hours 4 and 8. At hour 10, the subjects returned to enable collection of the posttreatment nasal sample by the medical study staff.

Preparation and application of the test and control agents

A commercially available, nonprescription product, Nozin Nasal Sanitizer antiseptic (Global Life Technologies Corp, Chevy Chase, Md) was used as the test agent in our study. The safety-tested formulation is composed of 70% ethanol active combined with a mixture of natural oil emollients and the preservative benzalkonium chloride. Sterile phosphate-buffered saline with 0.017% peppermint oil as a masking agent was used as placebo treatment control.

Application of the antiseptic or placebo control preparation was made by saturating a sterile swab with 5 drops (~200 μL) of solution and rotating the swab around the inside of the vestibular surfaces of both nostrils.

Sample collection and analysis

Nasal samples from both screening and study sample collection were obtained using sterile BD ESwab Collection Kits (Becton, Dickinson & Co, Franklin Lakes, NJ). For screening, neat samples were inoculated onto BBL CHROMagar Staph aureus medium (Becton, Dickinson & Co) and incubated at 35°C for 24 hours; mauve colonies were identified as S aureus by Gram’s stain, catalase, and latex agglutination testing. For evaluation of treatment samples, duplicate 75 μL aliquots of neat and 1:10 dilutions of each sample were inoculated onto plates of BBL CHROMagar Staph aureus medium and tryptic soy agar with 5% sheep blood to assess S aureus and total bacterial colony forming units (CFU) counts, respectively. At 24 hours of incubation at 35°C, CHROMagar plates were photographed and mauve colonies were counted and identified as S aureus as described above. At 48 hours of incubation at 35°C, tryptic soy agar plates were photographed for determination of total bacterial CFU. All data from subjects whose baseline inocula
developed fewer than 5 mauve colonies on the CHROMagar plates were excluded from analysis.

Data handling and analysis

*S. aureus* and total bacterial CFU counts for analysis were derived from pairs of plates on which identical 75 μ aliquots of neat or 1:10 dilutions of each nasal sample were cultured. Whenever colony densities allowed, CFU counts from the pair of neat posttreatment plates were used. In the event that neat colony densities were too high to allow accurate counting, the pair of 1:10 dilutions of each nasal sample were cultured. Whenever colony densities were based on subject characteristics and clinical outcomes and their odds ratios were calculated by their position title and worksite location. The presence of 1 or more children between ages 6 months and 11 years and dogs and cats at home were determined as potential contributors to colonization risk. Registered nurses tended to exhibit higher carriage prevalence than staff in other positions. African American women were significantly less likely to be colonized than white women (12.6% vs 23.7%, respectively; odds ratio, 0.466 [95% confidence interval, 0.24-0.91]; P = .03). There were no other factors observed to be associated with the prevalence of *S. aureus* carriage in the screened population.

**RESULTS**

**Demographic factors in *S. aureus* carriage**

Table 1 summarizes the characteristics of the 387 HCPs who were screened for the presence of nasal *S. aureus* colonization. The population was predominantly female (85%) and composed of 66% white, 27% African American, 4% Asian, and 3% "other" subjects. Of the screened population, 20.2% tested positive for *S. aureus* carriage. Workers were classified by their position title and worksite location. The presence of 1 or more children between ages 6 months and 11 years and dogs and cats at home were determined as potential contributors to colonization risk. Registered nurses tended to exhibit higher carriage prevalence than staff in other positions (26.3%). A peripheral finding was that African American women who were screened were significantly less likely to be colonized than white women (12.6% vs 23.7%, respectively; odds ratio, 0.466 [95% confidence interval, 0.24-0.91]; P = .03). There were no other factors observed to be associated with the prevalence of *S. aureus* carriage in the screened population.

## Table 1

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n (%)</th>
<th>n (%)</th>
<th>OR (95% CI)</th>
<th>P</th>
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<tr>
<td>Mean age, y</td>
<td>40.8</td>
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<td>Total screened</td>
<td>387 (100)</td>
<td>78 (20.2)</td>
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<tr>
<td>Female</td>
<td>329 (85.0)</td>
<td>65 (19.8)</td>
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<tr>
<td>Male</td>
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<td>13 (22.4)</td>
<td>1.17 (0.60-2.3)</td>
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<tr>
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<td>RN</td>
<td>179 (46.3)</td>
<td>47 (26.3)</td>
<td>Ref -</td>
<td>.19</td>
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<td>PCT/ORA</td>
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<td>8 (16.0)</td>
<td>0.54 (0.23-1.22)</td>
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<tr>
<td>MD/PA/NP/CRNA</td>
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<td>7 (20.0)</td>
<td>0.70 (0.29-1.71)</td>
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<td>0.42 (0.23-0.78)</td>
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<tr>
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<td>212 (54.8)</td>
<td>41 (19.3)</td>
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<td>Operating room</td>
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<td>Other</td>
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<td>1.11 (0.55-2.23)</td>
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<td>Children aged 6 mo-11 y</td>
<td>102 (26.4)</td>
<td>20 (19.6)</td>
<td>0.96 (0.54-1.68)</td>
<td>.99</td>
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<tr>
<td>Dog(s)</td>
<td>180 (46.5)</td>
<td>37 (20.6)</td>
<td>1.05 (0.64-1.72)</td>
<td>.96</td>
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<tr>
<td>Cat(s)</td>
<td>67 (17.3)</td>
<td>15 (22.4)</td>
<td>1.18 (0.62-2.23)</td>
<td>.74</td>
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</table>

CI, confidence interval; CRNA, certified registered nurse anesthetist; MD, physician; NP, nurse practitioner; OR, odds ratio; ORA, operating room assistant; PA, physician assistant; PCT, patient care technician; Ref, reference group; RN, registered nurse.  
*Calculated using the indicated reference group and comparing the *S. aureus*-positive population with the *S. aureus*-negative population.

Calculated using the indicated reference group or the corresponding negative characteristic group and comparing the *S. aureus*-positive population to the *S. aureus*-negative population. The *χ²* test was used.

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**Fig 1.** Schematic of the study protocol. Three applications of placebo or antiseptic preparation were made at 4-hour intervals during the workday to both nasal vestibules of subjects randomly assigned to 1 of the 2 treatment groups. Combined nasal swab samples from both vestibules were collected before and after treatment, at 0 hours and 10 hours, to assess changes in nasal vestibular *Staphylococcus aureus* (*S. aureus*) colonization and total bacterial colony forming units (CFU) counts.

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**Table 1**

Characteristics of the screened health care provider study participants

<table>
<thead>
<tr>
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<tr>
<td>Floors</td>
<td>212 (54.8)</td>
<td>41 (19.3)</td>
<td>Ref -</td>
<td>.76</td>
</tr>
<tr>
<td>Operating room</td>
<td>112 (28.9)</td>
<td>24 (21.4)</td>
<td>1.14 (0.65-2.00)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>62 (16.0)</td>
<td>13 (21.0)</td>
<td>1.11 (0.55-2.23)</td>
<td>.92</td>
</tr>
<tr>
<td>Children aged 6 mo-11 y</td>
<td>102 (26.4)</td>
<td>20 (19.6)</td>
<td>0.96 (0.54-1.68)</td>
<td>.99</td>
</tr>
<tr>
<td>Dog(s)</td>
<td>180 (46.5)</td>
<td>37 (20.6)</td>
<td>1.05 (0.64-1.72)</td>
<td>.96</td>
</tr>
<tr>
<td>Cat(s)</td>
<td>67 (17.3)</td>
<td>15 (22.4)</td>
<td>1.18 (0.62-2.23)</td>
<td>.74</td>
</tr>
</tbody>
</table>
Composition of the treatment groups

The characteristics of the 39 subjects who tested positive for *S. aureus* infection who were randomly assigned to the placebo and antiseptic-treatment groups are shown in Table 2. The 2 groups were statistically indistinguishable with regard to participant average ages or their baseline levels of colonization by either *S. aureus* (P = .633) or total bacterial strains (P = .790). Consistent with the characteristics of the total screened pool from which the *S. aureus*-colonized subjects were drawn, the treatment study groups were predominantly women and registered nurses.

Reduction in *S. aureus* and total bacterial carriage

As shown in Figure 2, there was substantial between-subject variation in baseline levels of both *S. aureus*-specific and total bacterial strain colonization. This variation was similar in both control (placebo) and test (antiseptic) groups. Comparison of the baseline level of *S. aureus* to total bacterial carriage in both groups indicates that, on average, *S. aureus* accounted for approximately half of the total vestibular bacterial load in this study population.

Three applications of the antiseptic at 4-hour intervals during the course of the workday significantly reduced the mean ± standard error number of *S. aureus* colonies from 756 ± 338 at baseline to 30 ± 12 at the end of the 10-hour study period (Fig 2). Although 19 of 20 subjects demonstrated a reduction in carriage, 10 subjects showed a 100% decrease with an additional 3 subjects who showed >95% decrease. A similarly pronounced and significantly significant response was seen in total bacterial CFUs, with a reduction of 1,200 ± 379 CFU to 167 ± 70 CFU (Fig 2). The observed reduction in carriage was >90% in 12 subjects, including 4 subjects at 100%.

In marked contrast, the placebo treatment application process resulted in a substantial mean increase in *S. aureus* colony counts from 562 ± 255 CFU to 1,239 ± 838 CFU. This increase was not statistically significant due to the >3-fold increase in variability of the colonization response (increase in standard deviation of the mean from 1,113 to 3,651 CFU) that accompanied the effect. A similar placebo-induced change from baseline in total bacterial CFUs was also not statistically significant. These data are consistent with the notion that the disruption of the relatively stable vestibular colonization caused by the mechanical disturbance of the application process itself may stimulate bacterial growth in the anterior nares in certain individuals if an effective antimicrobial agent is not present to inhibit it.

The effects of placebo and antiseptic treatments on bacterial nasal carriage expressed as percent change from baseline are shown in Figure 3. Antiseptic treatment produced a uniform reduction in CFUs at a level of 82% (mean) and 99% (median) for *S. aureus* and 71% (mean) and 91% (median) for total bacteria. These reductions were significantly different from corresponding placebo-related effects, despite the wide variance displayed in the latter data. In contrast, the near 100% mean increase observed in *S. aureus* colonization in the placebo-treated group was not statistically significant from baseline due to that variance.

### Table 2
Comparison of characteristics of treatment groups in healthcare provided testing positive for *Staphylococcus aureus* infection

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Placebo</th>
<th>Antiseptic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total subjects</td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td>Mean age</td>
<td>35.4 (26-67)</td>
<td>34.5 (26-64)</td>
</tr>
<tr>
<td>Baseline colonization</td>
<td>562 ± 1,113</td>
<td>756 ± 1,512</td>
</tr>
<tr>
<td><em>S. aureus</em> All strains</td>
<td>1,289 ± 1,718</td>
<td>1,200 ± 1,694</td>
</tr>
<tr>
<td>Female</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>Male</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RN</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>PCT/ORA</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>MD/PA/NP/CRNA</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Location</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floors</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Operating room</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

NOTE. Values are presented as n, y (range), or colony forming units ± standard deviation.

CRNA, certified registered nurse anesthetist; MD, physician; NP, nurse practitioner; ORA, operating room assistant; PA, physician assistant; PCT, patient care technician; RN, registered nurse.

*As determined by growth on tryptic soy agar plates (5% sheep blood).

Figure 2. Nasal vestibular bacterial colonization in baseline (PRE) and posttreatment (POST) samples. Numbers of colony forming units in identical samples plated onto CHROMagar SA (Becton, Dickenson & Co, Franklin Lakes, NJ) and tryptic soy agar blood agar plates for assessment of *Staphylococcus aureus* and total bacterial colonization before and after treatment, as described in detail in the Methods section. *No significant difference from the baseline value in the corresponding placebo-treated group. Significantly different (P < .001) from the PRE value.
Nonselectivity of antiseptic action in the nasal vestibule

The broad-spectrum, nonselective characteristics of the ethanol-based antiseptic preparation were assessed by evaluating the correlation between its antibacterial effectiveness in reducing *S. aureus* colonization and total bacterial colonization in individual subjects. Comparison of individual values for the pair was based on CFU counts made on the same sample. The mean and median percent reductions in colonization of the 2 bacterial target groups fell within 11% and 8% of each other, respectively, and the statistically significant Pearson correlation coefficient value for these data from all antiseptic-treated subjects was 0.827 (*P* < .001). These data are consistent with a comparable effectiveness of the antiseptic preparation in reducing nasal carriage of these 2 bacterial target groups.

DISCUSSION

The need for a screening process to identify subjects who were *S. aureus*-colonized enabled the characterization of the population of 387 HCPs from which the antiseptic treatment study participants were drawn. The 20.2% prevalence of *S. aureus* carriage in our study population fell at the lower end of the wide spectrum reported for HCPs, which may range from 20%–40% or higher depending on the facility and nature of the workforce. Some data suggest that carriage in female HCPs can be lower than that in male HCPs and that may have been a contributing factor to low carriage in our predominantly female screening population. The small proportion of men in our screened population (58 men, 15% of those screened) likely provided insufficient power to identify a significant effect of sex on carriage prevalence.

One potential concern for the use of alcohol- or other antiseptic agent-based preparations in the nasal vestibule is dryness, irritation, or other discomfort associated with its repeated use. A formulation designed to address this concern by incorporating moisturizing constituents, such as the natural oil mix of the test preparation used in our study, is essential. There were no reports of these or other adverse consequences made during the exit interview by the participants in the multitreatment protocol. Although the preparation used in our study has been available as an over-the-counter product for the past 6 years, the short-term nature of our study does not address the question of potential adverse effects over time, nor does it provide insight into the potential positive cumulative effectiveness of the preparation in reducing carriage when used in a multiday regimen.

Three applications of the alcohol-based antiseptic preparation during the course of a single workday resulted in a pronounced reduction in nasal vestibular carriage of both *S. aureus* and other cultivable bacteria. In general, reductions were very consistent across subjects, with a median decrease in the antiseptic-treated group of 98.8% at the end of the 10-hour workday. The design of our study did not allow assessment of the rate of bacterial killing during the study period. However, a surgical scrub study showed that the bactericidal activity of 70% ethanol in the presence of emollients, as was the case in the test preparation, resulted in near-maximum activity within minutes of application. If applicable to our study, nasal decolonization may also have been demonstrable in the study subjects at times before collection of the end-of-day sample.

There is no obvious explanation for the 1 of 20 subjects in the treatment group who did not demonstrate decolonization. Because that response was unique to that subject and was seen in both *S. aureus* and total bacterial CFU counts, it might be that the outcome resulted from a procedural error in application or sampling or that there was an unreported modification to the nasal environment by the subject during the study day.

Application of the phosphate-buffered saline placebo unexpectedly led to dramatic shifts in colonization. Because the application process was identical in control and antiseptic-treated subjects, it is reasonable to assume that the same effect was produced in both treatment groups. An interesting possibility is that the mechanical process of swabbing can lead to disruption of a stable bacterial environment in some individuals leading to stimulated growth in the absence of a deterring antibacterial agent. Whatever its cause, this effect was completely eliminated in the antiseptic-treated subjects, further supporting the effectiveness of the alcohol-based preparation in achieving carriage reduction.

The observation of highly correlated and statistically significant reductions in *S. aureus* and total bacterial CFU counts is consistent with the notion that the antiseptic exhibited broad efficacy against the range of bacteria colonizing the nasal vestibule. Further studies following a similar design and using 16S ribosomal RNA analysis to determine effects on the range of bacterial taxa within a given individual will be needed to verify the consistency of antibacterial reduction across the constituent bacterial flora.

CONCLUSIONS

The results of our unique study demonstrate the effectiveness of single-day, alcohol-based nasal antiseptic treatment in reducing vestibular colonization by *S. aureus* and other potentially pathogenic bacteria in HCPs. The HCPs selected for our study represent 1 of several populations within the health care environment, along with chronic-care patients and support staff, whose long-term presence contributes to the bacterial burden and associated risk of hospital-acquired infection in themselves and others. It is likely that a large, multicenter study will be necessary to establish the evidential basis for the effect of nasal antiseptic use in contributing to reduction of infection outcomes in health care settings. Given the multifaceted nature of the sources likely contributing to the overall bacterial burden and residual infection rates within most health care environments, such multicenter studies could be designed to address carriage by patients, HCPs, or both in combination. Data preliminary to larger-scale studies might be provided by investigations focused on currently nondecolonized patients and HCPs at facilities, perhaps long-term, where prevalence of staph infections are especially high. It may also be possible that data in support of the effectiveness of nonantibiotic nasal antiseptic use will result as a consequence of its adoption by proactive health care facilities, as was the case with the initial adoption of alcohol-based hand sanitizer use by HCPs. Within the patient population, incorporating the use of this antiseptic approach, in conjunction with the use of hand sanitizers and body wipes, may provide an important adjunct or alternative to preventive antibiotic therapy surrounding surgical and medical procedures. Further, because it will not contribute to bacterial resistance, the ethanol-based antiseptic provides a unique opportunity for regular daily use over prolonged periods by patients and staff in long-term care environments.

Acknowledgments

The authors thank the Medical University Hospital HCPs who agreed to participate in the study and the nursing supervisors and the hospital administrators who enabled their participation.
References


A Novel Protocol for Nasal Decolonization Using Prolonged Application of an Alcohol Based Nasal Antiseptic Reduces Surgical Site Infections.

A Novel Protocol for Nasal Decolonization Using Prolonged Application of an Alcohol Based Nasal Antiseptic Reduces Surgical Site Infections

Phillip A. Bostian, T. Ryan Murphy, Adam E. Klein, Benjamin M. Frye, Matthew J. Dietz, Brock A. Lindsey
Department of Orthopaedics, WVU School of Medicine, Morgantown, WV

Disclosures: Nozin® Nasal Sanitizer® was provided free of charge from the manufacturer for the duration of the study. An unrestricted research grant in support of this project was provided by Global Life Technologies.

Colonization of the nares is a modifiable risk factor for surgical site infection (SSI) following total joint arthroplasty

Decolonization of the nares has led to decreased rates of surgical site infections

Published decolonization protocols utilize antibiotics in the preoperative setting only and do not prevent recolonization or de novo colonization in the postoperative setting

Widespread application of topical antibiotic preparations (mupirocin) has been associated with the emergence of bacterial resistance

Introduction

Purpose

To evaluate the clinical utility of a non-antibiotic, alcohol based nasal decolonization agent administered preoperatively and postoperatively in decreasing rates of surgical site infections following total joint arthroplasty

Methods

IRB approved prospective study

Elective arthroplasty patients underwent nasal sanitization using an alcohol based agent.

Patients undergoing non-elective procedures, or those presenting through the emergency department were excluded from analysis

Nozin® Nasal Sanitizer® was applied using a cotton tipped applicator to the nares once in the preoperative setting and three times daily for two weeks after surgery.

Primary outcome measure was surgical site infection as defined by NHSN (National Healthcare Safety Network) reporting criteria in the first 90 days

Results were compared to historical controls prior to decolonization protocols at our institution

Compliance was tracked using a patient tracking card

Statistical analysis was performed using z-test analysis to determine differences in infection reduction rates. Significance was set at p < 0.05.

A-priori power analysis determined that 259 patients were needed to achieve 80% power with an effect size of an 80% reduction in infection

Nasal decolonization with an alcohol based nasal antiseptic was associated with a 78.5% reduction in surgical site infections (1/293 vs 7/527, p = 0.045, odds ratio = 4.5)

Patients took a mean of 32.4 doses of the prescribed 42

Compliance was greater than 75% throughout the course of prolonged treatment

Utilization of an alcohol based product for nasal decolonization results in reduction of bacterial carriage without fear of emerging antibiotic resistance

Reduction of SSI observed in this study is comparable to or greater than those reported with the use of preoperative povidone-iodine or mupirocin

SSI reduction observed in this study is similar to that reported by Mullen et al. in the spine literature

DEMOGRAPHIC DATA

Demographic data of the historical control group and the alcohol nasal sanitization. No significant differences are noted.

SURGICAL SITE INFECTION RATE

Nasal decolonization with an alcohol based nasal antiseptic was associated with a 78.5% reduction in surgical site infections.

REPORTED COMPLIANCE

Adherence to the prescribed protocol diminished with time. Patients took a mean of 32.4 doses of the required 42.

This low cost intervention with high compliance rate significantly reduced our infection rate when first introduced to our hospital system. Future studies examining changes in resistance patterns and cost benefits should continue to be explored.

Conclusion
Results

- 293 patients met inclusion criteria for the experimental arm, and 527 were included in the historical control arm.
- No significant differences in demographics were identified.
- Decolonization with the alcohol-based antiseptic was associated with a 78.5% reduction in surgical site infection (1/293 vs 7/527, \( p = 0.045 \), odds ratio = 4.5).
- Patients took a mean of 32.4 doses of the prescribed 42.

**Demographic Data**

<table>
<thead>
<tr>
<th>Age</th>
<th>Historical Control</th>
<th>Alcohol Nasal Sanitation</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years (range)</td>
<td>62.1 (range 19-93)</td>
<td>61.4 (range 25-90)</td>
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<table>
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<th>Alcohol Nasal Sanitation</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>47.3% (249/527)</td>
<td>48.1% (141/293)</td>
<td>0.94</td>
</tr>
<tr>
<td>Female</td>
<td>52.7% (278/527)</td>
<td>51.9% (152/293)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of Procedure</th>
<th>Historical Control</th>
<th>Alcohol Nasal Sanitation</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>79.1% (417/527)</td>
<td>85.0% (249/293)</td>
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<tr>
<td>Revision</td>
<td>20.9% (110/527)</td>
<td>15.0% (44/293)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Location of Procedure</th>
<th>Historical Control</th>
<th>Alcohol Nasal Sanitation</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip</td>
<td>50.9% (278/527)</td>
<td>48.8% (143/293)</td>
<td>0.66</td>
</tr>
<tr>
<td>Knee</td>
<td>49.1% (259/527)</td>
<td>51.2% (143/293)</td>
<td></td>
</tr>
</tbody>
</table>

Demographic data of the historical control group and the alcohol nasal sanitization. No significant differences are noted.

**Surgical Site Infection Rate**

Nasal decolonization with an alcohol-based nasal antiseptic was associated with a **78.5% reduction** in surgical site infections.
A Novel Protocol for Nasal Decolonization Using Prolonged Application of an Alcohol Based Nasal Antiseptic Reduces Surgical Site Infections

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Introduction

To evaluate the clinical utility of a non-antibiotic, alcohol based nasal decolonization agent administered preoperatively and postoperatively in decreasing rates of surgical site infections following total joint arthroplasty

Purpose

IRB approved retrospective study
Elective arthroplasty patients underwent nasal sanitization using an alcohol based agent.
Patients undergoing non-elective procedures, or those presenting through the emergency department were excluded from analysis
Nozin® Nasal Sanitizer® was applied using a cotton tipped applicator to the nares once in the preoperative setting and three times daily for two weeks after surgery.

Primary outcome measure was surgical site infection as defined by NHSN (National Healthcare Safety Network) reporting criteria in the first 90 days
Results were compared to historical controls prior to decolonization protocols at our institution
Compliance was tracked using a patient tracking card
Statistical analysis was performed using z-test analysis to determine differences in infection reduction rates. Significance was set at p < 0.05.

A-priori power analysis determined that 259 patients were needed to achieve 80% power with an effect size of an 80% reduction in infection

Methods

293 patients met inclusion criteria for the experimental arm, and 527 were included in the historical control arm
No significant differences in demographics were identified
Decolonization with the alcohol based antiseptic was associated with a 78.5% reduction in surgical site infection (1/293 vs 7/527, p = 0.045, odds ratio = 4.5)
Patients took a mean of 32.4 doses of the prescribed 42

Results

Nasal decolonization with an alcohol based sanitizer during the perioperative period was associated with a 78.5% reduction in surgical site infections (p = 0.045)
Compliance was greater than 75% throughout the course of prolonged treatment
Utilization of an alcohol based product for nasal decolonization results in reduction of bacterial carriage without fear of emerging antibiotic resistance
Reduction of SSI observed in this study is comparable to or greater than those reported with the use of preoperative povidone-iodine or mupirocin
SSI reduction observed in this study is similar to that reported by Mullen et al. in the spine literature

Discussion

- Nasal decolonization with an alcohol based sanitizer during the perioperative period was associated with a **78.5% reduction in surgical site infections** (p = 0.045)
- **Compliance was greater than 75%** throughout the course of prolonged treatment
- Utilization of an alcohol based product for nasal decolonization results in reduction of bacterial carriage without fear of emerging antibiotic resistance
- Reduction of SSI observed in this study is comparable to or greater than those reported with the use of preoperative povidone-iodine or mupirocin
- SSI reduction observed in this study is similar to that reported by Mullen et al. in the spine literature

Conclusion

This low cost intervention with high compliance rate significantly reduced our infection rate when first introduced to our hospital system. Future studies examining changes in resistance patterns and cost benefits should continue to be explored.
ABSTRACT

Nasal Decolonization with Alcohol Based Sanitizer is Effective at Preventing Surgical Site Infection Following Total Joint Arthroplasty

Phillip A. Bostian MD¹, Matthew J. Dietz MD¹, Benjamin Frye MD¹, T. Adam E. Klein MD¹, Ryan Murphy MD¹, Brock A. Lindsey MD¹
¹West Virginia University School of Medicine, Department of Orthopaedics, Center for Joint Replacement, Morgantown, WV

Introduction

Bacterial colonization of the nares is considered a modifiable risk factor for surgical site infection (SSI) following total joint arthroplasty. Use of antibiotic based decolonization agents has led to concern for increasing incidence of resistant *Staphylococcus aureus* strains and decreased rates of successful nasal clearance. The purpose of this study was to evaluate the clinical utility of an alcohol based nasal decolonization agent (Nozin, Global Life Technologies Corp) in decreasing SSI following total joint arthroplasty.

Methods

A prospective clinical trial was performed in total joint arthroplasty patients treated perioperatively with an alcohol-based sanitizer and compared to a one-year cohort of historical controls. The alcohol-based sanitizing agent was administered preoperatively on the day of surgery to patients and every 8 hours for two weeks following surgery. The patient’s primary caregiver also underwent nasal decolonization. Patients were followed for 90 days and assessed for signs or symptoms of SSI. Patients were included in the study if scheduled for elective surgery and attended a preoperative education class. Statistical analysis was performed using descriptive statistics and the single sided Z-test.

Results

Three-hundred and thirteen patients were included in the experimental arm and 527 patients were included in the historical control arm. Patients receiving alcohol based nasal decolonization had a significantly lower rate of SSI when compared to historical controls not receiving nasal decolonization (0.33% (1/313) vs 1.5% 7/527), p=0.045, odds ratio 4.5). No significant differences in type of surgery (knee vs hip) or demographics were identified.

Conclusion

Utilization of an alcohol based nasal sanitizer decreased infection risk by 78% in our elective total joint arthroplasty setting and should be considered for patients undergoing these procedures.
Pre- and Post-operative Participation of Orthopedic Patients and Surgical Staff in a Novel Intervention to Reduce Staphylococcus aureus Infection.

Pre- and Post-operative Participation of Orthopedic Patients and Surgical Staff in a Novel Intervention to Reduce *Staphylococcus aureus* Infection

Anidailiz Muller, RN, BSN, Helen J. Wieland, RN, Ernst W. Spannhake, Ph.D., Rebecca S. Marinatos, Ph.D., CNO

**Background**

Overall reduction of potentially infectious bacteria in the immediate patient environment is critical to effective infection control (IC) during both pre- and post-surgical periods. This study was designed to determine if *Staphylococcus aureus* surgical site infection rates (SSI) could be reduced by the inclusion of patients and their most proximal healthcare personnel in nasal carriage reduction using an alcohol-based nasal antiseptic along with pre-existing IC protocols.

**Methods**

During the three prior quarters that served as the study baseline, surgical IC protocols included pre-operative chlorhexidine gluconate bathing that was sometimes combined with patient-applied nasal mupirocin ointment prior to admission. During the three consecutive quarters of the study period in our spine surgery group, the IC protocol was amended to include nasal patient decolonization using an alcohol-based antiseptic by nursing staff during pre-operative preparation, while in the post-anesthesia care unit (PACU) and on a daily basis until discharge. To foster carriage reduction post-discharge, patients were instructed to continue applications for 5-7 days using the same antiseptic. In addition, surgeons and surgical staff agreed to self-decolonization prior to each surgery, as did the circulating PACU staff. Nasal antiseptic use by floor nursing personnel was strongly encouraged and facilitated.

**Results**

In the 3 quarters that served as the baseline for the change in IC protocol, SSI were 3.36, 3.38, and 3.81/100 surgeries, respectively. During the immediately subsequent three quarters that extended through March, 2016 in which nasal antiseptic use was implemented, SSI were 0.03, 0.00, and 0.81/100 surgeries, respectively. This constituted a 99% decrease in average SSI during the 9-month study period compared to the 9-month baseline.

**Conclusions**

The inclusion of alcohol-based nasal antiseptic use by both surgical patients and staff in IC protocols during the peri-operative period resulted in a marked decrease in SSI. The capability to selectively incorporate non-antibiotic nasal decolonization into this type of comprehensive approach to reducing infections in high-risk environments may warrant further consideration.

**Background**

*Staphylococcus aureus* (*S. aureus*), of both antibiotic-sensitive and resistant strains, is a major cause of surgical site infections. Potential sources of *S. aureus* in the patient environment includes nasal carriage and contaminated skin of the patients themselves, as well as the hands and anterior nares of surgical and nursing staff with whom the patient will interact. The presence of these sources within the environment, along with surfaces and other fomites, increase the environmental bacterial burden and the risks for both *S. aureus* transmission and infection in surgical settings. Growing concerns for the contributions of universal decolonization to bacterial resistance and the unacceptability of regular antibiotic use to reduce non-patient sources of risk greatly limit the usefulness of mupirocin in increasing the effectiveness of infection prevention decolonization strategies.

With the goal of reducing *S. aureus* SSI infection rates in our orthopedic surgical facility, a trial was conducted in our spine surgery patients to see if nasal decolonization using a non-antibiotic, alcohol-based nasal antiseptic would be effective when added to the existing practice of pre-operative skin decolonization using chlorhexidine gluconate bathing and body wipes. In addition to patient nasal decolonization carried out by the staff during the pre-operative preparation, pre-op nurses, the surgical staff, including nurses, technicians and the surgeon, and the post-anesthesia care unit nurses agreed to participate through self-application of the nasal antiseptic.

The Baylor Orthopedic and Spine Hospital at Arlington (BOSHSA) is an orthopedic treatment and surgical center with 23 beds in one- or two-bed rooms. Surgical and treatment specialty areas include spine and joint.
METHODS

Adoption Process: A series of meetings was held during which the rationale for the change in existing infection Prevention and Control protocols was vetted and the proposed integration of an alcohol-based nasal antiseptic into existing infection control protocols was proposed and approved. These meetings involved members of the hospital administration and representatives of all staff stakeholders, including the Chief Nursing Officer, Operating Room Supervisor, Infection Control Specialist and surgeons. In addition to use in patients, agreement was reached regarding voluntary self-application of nursing and surgical staff in members of the spine group to which the required antiseptic nasal decolonization protocol would be applied. The finalized plan with regard to patient decolonization was implemented through a change in BOSHA Infection Control Policies and Guidelines.

Education and Training: Programs were scheduled to enable education regarding the actions and use of the alcohol-based antiseptic and hands-on application training in all involved members of the BOSHA staff. These were carried out by the manufacturer’s representatives in the weeks prior to initiating the IC policy change.

Policy: The approved policy stated that, upon arrival on the day of surgery, each patient will follow a protocol of alcohol-based nasal antiseptic administration by trained pre-op staff prior to entering the OR. Following surgery, the patient will fall into the regular daily cycle of nasal antiseptic application in the Post-Anesthesia Care Unit (PACU) and/or Post-Surgical Unit (PSU). Application by staff will continue in the Post-Surgical Unit (PSU) up to the time of discharge and instructions will be given to the patient/family with encouragement to continue applications at home for an additional 5-7 days.

Procedure: Applications of the nasal antiseptic were made to the patients using a cotton swab and a multi-dose dispensing dropper bottle at three times (~30 sec each) during the period between intake and transport to the OR.

- The patient’s assigned and labeled bottle traveled with the chart to the Post-Surgical Unit.
- After leaving the OR, additional applications were made at 3:00 pm and/or 9:00 pm on the day of surgery, depending upon the time of arrival in the PACU.
- On each subsequent day in the hospital, the nasal antiseptic was applied to the patient by trained Post-Surgical Unit staff at 9:00 am, 3:00 pm and 9:00 pm.
- Record of all applications were kept on a form in the patient’s chart
- At discharge, patient/family home care instructions included an information brochure and encouragement to use the bottle and swab to continue applications for 5-7 days.

Nasal Decolonization Compliance: The individual chart record of applications to the patients by staff were used to monitor compliance with the protocol. Staff compliance with the self-application guidelines were estimated from self-recorded daily tally sheets in the pre- and post-op units. An additional effort to foster compliance by the OR staff was lead by the surgeon during the inter-case “time-outs” by querying new members of the team and encouraging self-application.

Determination of Infection Rates: On a monthly basis, SSIs in patients whose surgeries fell within the previous 30-day period and were a part of the nasal antiseptic decolonization protocol were identified and those culturing S. aureus were tallied. Quarterly infection rates were calculated as the number of relevant infections per 100 surgeries for the period.
RESULTS

Data were collected from a total of 803 spine surgery patients, 399 during the 9-month baseline period and 403 during the 9-months of nasal antiseptic use. Table 1 describes the general characteristics of the two cohorts, which were very similar in age, sex and length of stay post surgery for those who remained for at least one night. The average numbers of patients in each reporting quarter were identical in the two groups.

Figure 1 shows the *S. aureus* infection rates for the three quarters of the baseline and nasal treatment periods. The mean rate during the reference period was 1.75 infections per 100 surgeries. This rate was reduced to 0.55 during the subsequent 9-month period of nasal antiseptic use in our protocol. This 69% decrease in *Staph* infections in our spine group was statistically significant (P = 0.04).

The success of this on-going effort has led to an expansion of its adoption by other surgical groups within BOSHSA. Critical to its success has been the leadership and motivation provided by key members of the nursing and surgical teams and the enthusiasm of the participating staff.

SUMMARY

1. An infection control protocol was initiated that involved both patient and key surgical and nursing staff participation in nasal decolonization with an alcohol-based antiseptic.
2. The addition of nasal antiseptic to our standard procedures for reducing skin carriage resulted in a marked and significant decrease in *S. aureus* SSI.

CONCLUSIONS

We have found the alcohol-based nasal decolonizing antiseptic to be a highly effective and acceptable method for use in both patients and medical staff to reduce infection rates in our orthopedic surgical facility.

Poster presented at the 2017 Annual IDWeek meeting
October 27, New Orleans, LA.
Impact of Reduced Isolation and Contact Precaution Procedures on Infection Rates and Facility Costs at a Nonprofit Acute Care Hospital.

Impact of Reduced Isolation and Contact Precaution Procedures on Infection Rates and Facility Costs at a Non-profit Acute Care Hospital

Background
Contact precautions (CP) and isolation are commonly used to reduce transmission and infection risk due to methicillin-resistant Staphylococcus aureus (MRSA). Despite potential negative impacts on the quality of nursing care, patient satisfaction, and CP-associated costs, lack of clarity regarding CP use in non-infected carriers and the absence of conservative alternatives continue to drive its practice.

Methods
In October 2014, a facility-wide change in CP protocols and infection control (IC) procedures was initiated at our 113-bed acute care hospital. Previously, isolation and full CP were applied to all patients with active MRSA infections or positive nasal screen or carriage history. With the change, isolation with CP was limited to MRSA-infected patients. For all MRSA patients (history, colonized or active), an IC protocol was initiated that included daily applications of an alcohol-based nasal antiseptic to the anterior nares by swab. Additionally, we did daily bathing of all Intensive Care Unit patients with chlorhexidine gluconate cloths to reduce nasal and skin colonization. During the 1-year trial period, best practices to improve IC compliance and promote integration of nasal antiseptic use into existing staff procedures were developed. MRSA Hospital-Acquired (HAI) infections were tallied quarterly and compared to those of the previous 3 years. In addition, CP personal protective equipment (PPE) costs were evaluated.

Results
Our relatively low MRSA HAI rates/1000 patient days were maintained during the trial despite the change in CP Procedures. Averaged quarterly rates for 2012-2014 were 0.152, 0.122, and 0.126, respectively. The averaged rate in 2015 was 0.124. CP-related PPE costs in 2015 were reduced by $64,350 compared to 2014.

Conclusions
Elimination of CP in MRSA non-infected patients while maintaining low infection rates and improving staff and patient satisfaction was achieved with IC protocols utilizing nasal and skin decolonization. A significant reduction in CP-related PPE costs also resulted.

Keywords: contact precautions, isolation, nasal antiseptic, cost, colonization, infection rates, chlorhexidine gluconate
Impact of Reduced Isolation and Contact Precaution Procedures on Infection Rates and Facility Costs at a Non-Profit Acute Care Hospital

Nina Deatherage, BSN, RN, PHN, CIC
Infection Prevention & Control Lead, Marshall Medical Center

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**METHODS:** In October 2014, a facility-wide change in CP protocols and infection control (IC) procedures was initiated at our 113-bed acute care hospital. Previously, isolation and full CP were applied to all patients with active MRSA infections or positive nasal screen or carriage history. With the change, isolation with CP was limited to MRSA-infected patients. For all MRSA patients (history, colonized or active), an IC protocol was initiated that included daily applications of an alcohol-based nasal antiseptic to the anterior nares by swab. Additionally, we did daily bathing of all Intensive Care Unit patients with chlorhexidine gluconate cloths to reduce nasal and skin colonization. During the 1-year trial period, best practices to improve IC compliance and promote integration of nasal antiseptic use into existing staff procedures were developed. MRSA Hospital-Acquired (HAI) infections were tallied quarterly and compared to those of the previous 3 years. In addition, CP personal protective equipment (PPE) costs were evaluated.

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**CONCLUSIONS:** Elimination of CP in MRSA non-infected patients while maintaining low infection rates and improving staff and patient satisfaction was achieved with IC protocols utilizing nasal and skin decolonization. A significant reduction in CP-related PPE costs also resulted.