

Surgical Infection Prevention: A New Methodology in Pre-surgical Nasal Decolonization with a Two-Step, Patient Administered, Nasal Hygiene Technique

John Polley W^{1,2*}, Matthew Smith F^{1,2}, Lilly Newell RN^{1,2}, Tosha Elkins MA^{1,2} and Amy Gray MS^{1,2}

^{*1}Munson Health Cleft and Craniofacial Center, USA

^{*2}Munson Health Great Lakes Plastic Surgery Center, Traverse City, USA.

Received June 29, 2024; Revised July 06, 2024; Accepted July 09, 2024

ABSTRACT

Infection prevention (IP) is an essential component for all surgical procedures. Surgical site infections are a leading cause of hospital acquired infections which severely adversely impact the entire health care system. IP is extensively reviewed in the infection disease literature but current IP concepts also need visibility in our leading surgical journals. Nasal decolonization is an evidence-based IP intervention that has been shown to be highly effective in the reduction of surgical site infections. This study evaluated a surgically based, non-antibiotic, nasal hygiene device and methodology for reducing the presence of nasal vestibular *Staphylococcus aureus* and Methicillin resistant *Staphylococcus aureus* (MRSA) in a consecutive series of patients undergoing elective general soft tissue plastic surgery or reconstructive maxillofacial surgery. Preemptive IP is now an essential component for the care of all surgical patients.

Keywords: Surgical site infections, Nasal hygiene, *Staphylococcus aureus*, Methicillin resistant

INTRODUCTION

Endogenous bacteria are known to be the primary causative agent in postoperative surgical site infections [1]. The nose and nasal vestibules are a rich source of endogenous bacteria and have been linked as a primary source for infectious organisms [2,3]. Nasal decolonization is an evidence-based intervention that has been shown to be effective in the reduction of surgical site infections as well as other healthcare associated infections (HAI's). Surgical nasal decolonization studies have demonstrated a reduction in surgical site infections (SSI'S) in orthopedic and cardiothoracic surgery [4-7]. This study evaluated a commercially available non-antibiotic, alcohol-based nasal hygiene device and methodology for reducing the presence of nasal vestibular *Staphylococcus aureus* and Methicillin resistant *Staphylococcus aureus* (MRSA) in a consecutive series of patients undergoing elective general soft tissue plastic surgery or reconstructive maxillofacial surgery.

METHODOLOGY

All adult patients, ages 18 years and older over a three-month period, from December 1, 2023 through February 29, 2024, scheduled for elective general plastic soft tissue surgery or maxillofacial reconstructive surgery by the lead author (JWP) received a routine anterior nasal vestibular

swab culture (one culture swab obtained from each patient after application in both nasal vestibules) at least two weeks prior to their scheduled surgery date (**Table 1**). All patients in this study were asymptomatic of any ongoing infectious process. All vestibular swabs were analyzed by polymerase chain reaction (PCR) for the identification of *Staphylococcus aureus* and methicillin resistant *Staphylococcus aureus* (MRSA). All patients whose PCR testing was positive for *Staphylococcus aureus* or MRSA were then treated with a seven-day course of a commercially available, over the counter (OTC), two-step alcohol-based nasal hygiene method. Patients were supplied with fourteen nasal hygiene products and instructed to perform the nasal hygiene technique two times per day (BID), once in the morning and once in the evening. At the end of their 7-day nasal hygiene

Corresponding author: John W Polley, Munson Healthcare Great Lakes Plastic Surgery, Traverse City, MI, USA, Tel: 312-519-5923; E-mail: jpolley28@gmail.com

Citation: Polley JW, Smith MF, Newell LRN, Elkins TMA & Gray AMS. (2024) Surgical Infection Prevention: A New Methodology in Pre-surgical Nasal Decolonization with a Two-Step, Patient Administered, Nasal Hygiene Technique. Int J Surg Invasive Procedures, 7(2): 277-279.

Copyright: ©2024 Polley JW, Smith MF, Newell LRN, Elkins TMA & Gray AMS. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

cleansing a repeat anterior nasal vestibular swab was obtained and examined by polymerase chain reaction (PCR) for the identification of *Staphylococcus aureus* and methicillin resistant *Staphylococcus aureus* (MRSA).

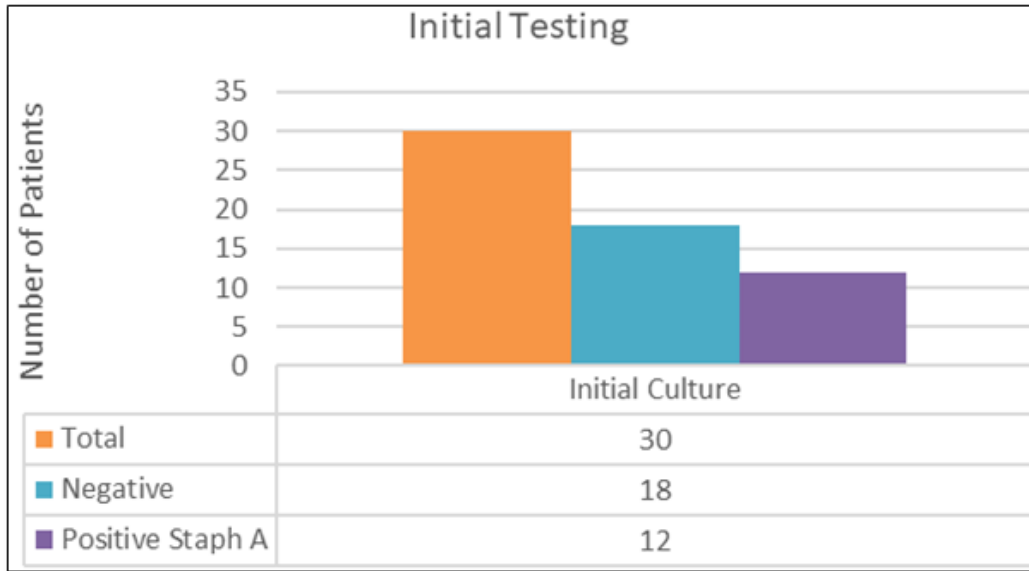


Table 1. Initial Nasal Swab Test Results.

RESULTS

Clinical Microbiology Study Results

Thirty consecutive preoperative adult patients undergoing general plastic surgery (soft tissue only, n = 18) or maxillofacial reconstructive surgery (soft and skeletal tissue, n=12) had an anterior nasal vestibular PCR culture. In twelve of the thirty patients (40%) the PCR culture was positive for *Staphylococcus aureus*. Four of the patients positive for *Staphylococcus aureus* were also positive for MRSA. After seven consecutive days of the twice per day nasal hygiene cleaning method, eleven patients who were

initially positive for *Staphylococcus aureus* tested negative for *Staphylococcus aureus* with their repeat anterior nasal vestibular swab (Table 2). The four patients who were positive for both *Staphylococcus aureus* and MRSA were all negative for both organisms in the repeat anterior nasal vestibular culture after the nasal hygiene method. Therefore 11 of 12 consecutive patients converted from positive to negative for *Staphylococcus aureus* and MRSA following the seven-day, twice per day (BID) nasal hygiene treatment. All 11 patients also successfully underwent their surgical procedures without developing a post-operative surgical site infection.

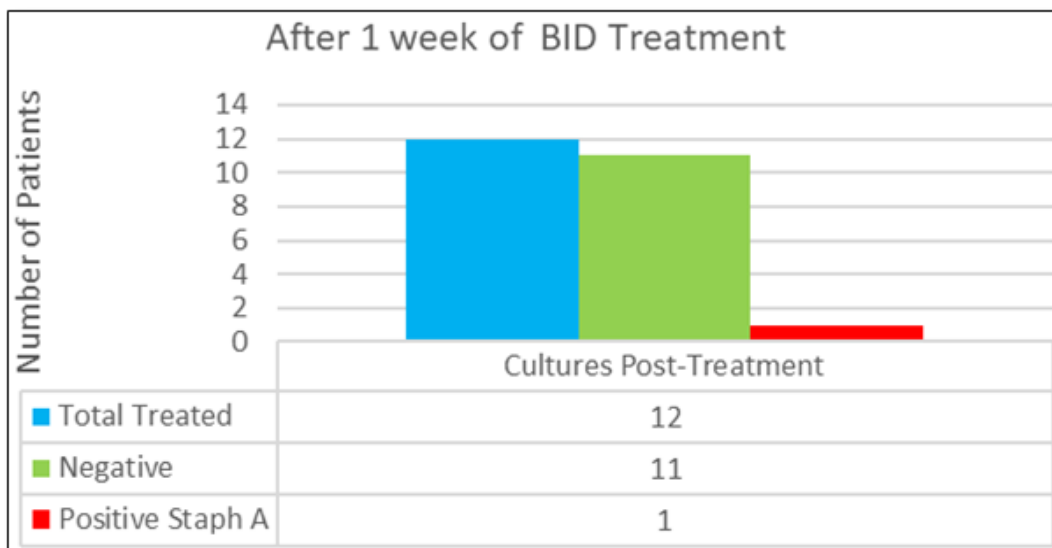


Table 2. Test Results After Decolonization Prescribed Use.

DISCUSSION

The principal organism involved in most postoperative surgical site infections, regardless of the specific procedure, is *Staphylococcus aureus* [8,9]. Preoperative nasal decolonization has been shown to be effective in the reduction of nasal vestibular endogenous *Staphylococcus aureus*, and in a corresponding reduction in the incidence of postoperative surgical site infections (SSIs) [4-8]. Current agents available for nasal decolonization were considered including mupirocin and povidone-iodine (PI). Mupirocin, a topical antibiotic, has been proven effective for topical *Staphylococcus aureus* nasal decolonization, however, its widespread use has led to mupirocin resistant strains of *Staphylococcus aureus* [6]. Povidone-iodine is bactericidal and viricidal, but professional supervision is required for use, it is not available over the counter (OTC) and can cause nasal irritation. Potential povidone-iodine allergy is also a concern. This study evaluated a new nasal decolonization methodology based on surgical prep principles which incorporates the importance of mechanical cleaning as well as the application of a disinfecting agent.

The two-step, alcohol-based method and device was selected for use in this nasal decolonization study. The antiseptic method has bactericidal activity against most gram-positive and gram-negative bacteria and is also viricidal. The application method is easy to use, and follows the strict surgical principle of a two-step, dual prep technique. Particularly helpful is that it is self-administered by the patient and does not require professional supervision for use. It is a non-antibiotic method, so bacterial resistance is not an issue.

The method used for evaluating the anterior nasal swabs was PCR or polymerase chain reaction identification. This technique evaluates a vortexed buffer solution that has been soaked in a nasal swab from the nasal culture. Through vortexing and heat, *Staphylococcus aureus* and MRSA colonies are fragmented, and their nucleic acid identified independently. Machine sensitivity and specificity both are rated by Cepheid at 95%. The use of PCR is considered the gold standard for detection of MRSA [10].

CONCLUSION

Nasal decolonization is an evidence-based intervention that has been shown to be effective in the reduction of surgical and other healthcare associated infections. In this study a two-step, alcohol-based nasal decolonization method was administered for all patients who tested positive preoperatively for nasal vestibular *Staphylococcus aureus* and MRSA. Nasal decolonization twice per day for seven days pre-operatively demonstrated a 92% reduction in patients with nasal *Staphylococcus aureus* colonization. Eleven of twelve surgical patients were successfully decolonized using this method and underwent reconstructive surgery without development of a post-operative infection.

This suggests this two-step, alcohol-based, method of decolonization should be considered as an integral part of a patient's preoperative infection prevention protocol.

REFERENCES

- Owens CD, Stoessel K (2008) Surgical site infections: Epidemiology, microbiology and prevention. *J Hosp Infect* 70 Suppl 2: 3-10.
- Köck R, Werner P, Friedrich AW, Fegeler C, Becker K (2016) Persistence of nasal colonization with human pathogenic bacteria and associated antimicrobial resistance in the German general population. *New Microbes New Infect* 9: 24-34.
- Wertheim HFL, Melles DC, Vos MC, van Leeuwen W, van Belkum A, et al. (2005) The role of nasal carriage in *Staphylococcus aureus* infections. *Lancet Infect Dis* 5(12): 751-762.
- Ong C, Lucet JC, Bourigault C, Birgand G, Aho S, et al. (2020) *Staphylococcus aureus* nasal decolonization before cardiac and orthopedic surgeries: First descriptive survey in France. *J Hosp Infect* 106(2): 332-334.
- Septimus E, Schweizer M (2016) Decolonization in prevention of Health Care-Associated Infections. *Clin Microbiol Rev* 29(2): 201-222.
- Mullen A, Wieland HJ, Wieser ES, Spannhake EW, Marinos RS (2017) Perioperative participation of orthopedic patients and surgical staff in a nasal decolonization intervention to reduce *Staphylococcus spp* surgical site infections. *Am J Infect Control* 45(5): 554-556.
- Hetem DJ, Bonten MJ (2013) Clinical relevance of mupirocin resistance in *Staphylococcus aureus*. *J Hosp Infect* 85(4): 249-256.
- Saadatian-Elahi M, Teyssou R, Vanhems P (2008) *Staphylococcus aureus*, the major pathogen in orthopedic and cardiac surgical site infections: A literature review. *Int J Surg* 6(3): 238-245.
- Ontario Health (Quality) (2022) Pre-surgical Nasal Decolonization of *Staphylococcus aureus*: A Health Technology Assessment. *Ont Health Technol Assess Ser* 22(4): 1-165.
- Weiser MC, Moucha Calin S (2015) The Current State of Screening and Decolonization for the Prevention of *Staphylococcus aureus* Surgical Site Infection After Total Hip and Knee Arthroplasty. *J Bone Joint Surg Am* 97(17): 1449-1458.