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Preoperative *Staphylococcus aureus* surveillance, decolonization, and the implications for SSI prevention and antibiotic prophylaxis

Post-operative surgical site infections (SSIs) secondary to *S. aureus* are a concern and a threat to surgeons in all hospitals and surgical centers. We addressed the issues of surveillance for preoperative nasal colonization with S. aureus in previous DICON Newsletters (November 2006, July 2007, January 2008, May 2008, June 2016). This newsletter focuses on *S. aureus* surveillance and decolonization prior to surgical interventions and is intended as an update to previous newsletters. We also review the issue of perioperative antimicrobial prophylaxis choices based on the presence of risk factors for postoperative SSI due to MRSA.

Active *S. aureus* Surveillance

In our May 2008 newsletter we reviewed the results of two large studies that evaluated the benefits of preoperative surveillance for MRSA colonization. Harbath et al. studied the impact of preoperative nasal swabs to detect MRSA colonization followed by subsequent decolonization with intranasal mupirocin and chlorhexidine gluconate (CHG) body wash in patients who were colonized. No difference in postoperative MRSA infection rates were found in screened and unscreened patients. In contrast, Robiscek et al. used a similar protocol and reported a significant reduction in MRSA SSI infection rates in patients who were colonized with MRSA and then treated.[1,2] Numerous subsequent studies examined the same strategy. Meta-analyses of these studies have inconsistently shown a minor benefit of active *S. aureus* surveillance on postoperative SSI rates.[3]

Based on the preceding data we conclude that a single all-encompassing policy regarding active preoperative *S. aureus* surveillance is not appropriate for the wide variety of hospitals in our network who have different patient populations. We currently *do not* recommend routine preoperative nasal *S. aureus* screening for multiple reasons including the poor sensitivity of screening nasal swab, cost, and logistical limitations of implementation (June 2016). If screening is performed and *S. aureus* is identified, however, we *recommend* decolonization measures with nasal mupirocin with or without CHG bathing. This recommendation is in concordance with evidence cited in the 2017 updated WHO guidelines.[4]

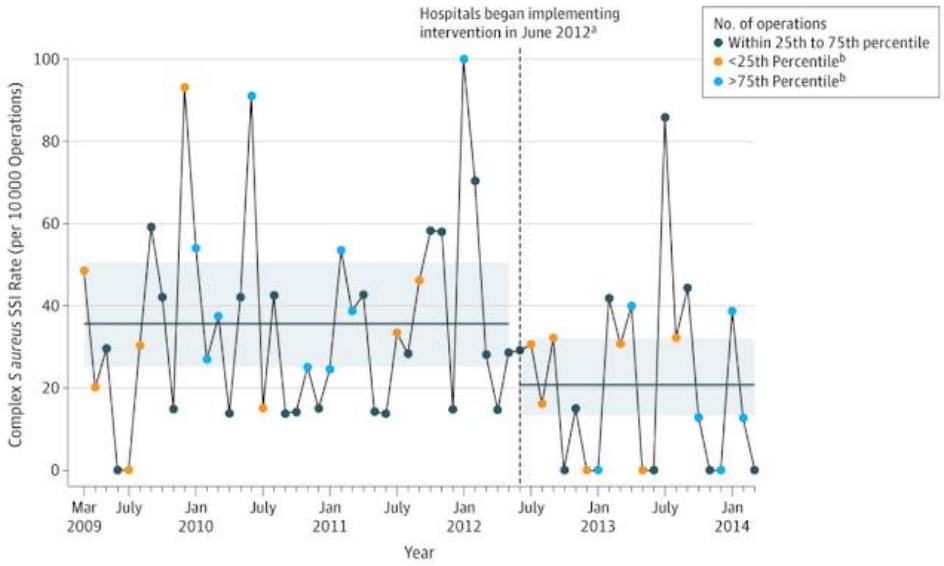
"Treat-all" Decolonization Policies

Universal pre-operative *S. aureus* screening incurs healthcare costs associated with testing, education, and implementation. Costs of the specific logistic plan used to implement a screening and decolonization protocol vary based on the size of each facility but in all cases such costs are substantial. However, post-operative SSIs secondary to *S. aureus* also have a substantial cost. Thus it is useful to discuss whether low-cost pre-operative decolonization measures (without prior screening) make clinical and economic sense.

The authors of several well-designed studies have examined the comparative cost-effectiveness of interventions based on the use of intranasal mupirocin with or without a screening strategy prior to surgical interventions and compared these two approaches to control populations receiving neither intervention.[5,6] Treating all patients with intranasal mupirocin prior to surgery was cost effective compared to no treatment in all of these studies. When rates of *S. aureus* carriage were high, a "treat-all" strategy was more cost-effective than "screen-and-treat" approaches. A "treat-all" strategy also precluded the possibility of clinical

"misses", in which *S. aureus* screening failed to detect a true carrier or in which a patient with a positive pre-operative screen did not receive appropriate decolonization measures. As such, we now *recommend* use of one of the two following strategies: 1) use of preoperative mupirocin decolonization in patients who have clinical criteria that puts them at a higher risk of a postoperative SSI due to MRSA or 2) a "treat-all" approach with intranasal mupirocin.

Figure 1. Post-operative surgical site infections (Schweitzer et al.)



Mupirocin Shortage- Fall 2018.

In October 2018 a nationwide shortage of Mupirocin nasal ointment and cream occurred due to manufacturing problems .[7] This shortage is expected to end in early December of 2018; however, given the recurrent nature of such shortages, it is useful to discuss alternatives to mupirocin for preoperative *S. aureus* decolonization. Alcohol-based nasal disinfectants and povidone-iodine based disinfectants have proven efficacy in reducing *S. aureus* colonization rates in the anterior nares; however there are few data related to clinical outcomes or SSIs in patients receiving these agents preoperatively .[8,9] We reviewed these issues in February 2017 DICON Newsletter. Because of this lack of data on efficacy, we do not recommend nasal decolonization with alcohol-based or povidone-iodine products when mupirocin is not in short supply. However, these topical products are unlikely to cause adverse side effects and both agents are inexpensive. Therefore, we *neither advocate for or against* use of intranasal decolonization as an alternative to mupirocin *in the setting of a shortage in order to maintain an existing decolonization protocol*.

Peri-operative Antimicrobial Prophylaxis

In contrast to nasal decolonization measures, targeted antibiotic prophylaxis at the time of surgery is a more important and well-studied preventive measure for surgical site infections due to *S. aureus*. Routine preoperative use of beta-lactam prophylaxis is the standard protocol in non-allergic patients, however increasing rates of drug-resistant organisms necessitates intermittent review or revision of surgical prophylaxis policies.

Vancomycin should not be used as the sole agent for routine prophylaxis in spinal, joint replacement and cardiac surgery. Although the preoperative administration of vancomycin reduces the incidence of post-operative MRSA SSIs compared to cefazolin, preoperative use of vancomycin alone may increase the likelihood of post-operative methicillin-*sensitive S. aureus* infections and has been associated with an increased risk of postoperative Gram-negative infections.[10]

Vancomycin is best targeted for patients who are high-risk for MRSA infection ***in combination with cefazolin*** (or other appropriate agent in patients with true, clinically significant beta-lactam allergy). Schweizer et al. performed a large, multicenter pragmatic study which evaluated the effect of a targeted "bundle" approach on prevention of post-operative SSIs for all patients that underwent cardiac, hip, or knee surgery.

The "bundle" intervention included pre-operative nasal screens for colonization with S. aureus and subsequent decolonization with nasal mupirocin and CHG body washes in patients with positive cultures. Patients that screened MRSA positive, or who had unknown screening results, also received perioperative vancomycin **in addition** to standard cefazolin or cefuroxime prophylaxis.[11] The results indicated a significant decline in post-operative infections with a rate ratio of 0.58 (CI 0.37 to 0.92, Figure 1) when analyzing combined rates of MSSA and MRSA SSIs.

There are no well-designed, randomized trials that establish which patients should receive vancomycin for perioperative prophylaxis. In concordance with guidelines published by the Society for Healthcare Epidemiology of America,[3] we recommend the addition of vancomycin to beta-lactam prophylaxis based on traditional risk factors for drug-resistant organisms. These risk factors include, but are not limited to, the following:

- Prior colonization with MRSA
- Hospitalization within the past 90 days
- Residence in a long-term care facility in the past year
- Receipt of antibiotics or chemotherapy in the past 30 days
- Ongoing hemodialysis for end stage renal disease
- Inpatient admission for more than 2 days prior to surgery.
- In setting of proven outbreak of SSI due to MRSA

Summary/Key Points:

1. Routine preoperative screening for nasal colonization with MRSA is not recommended
2. If routine *S. aureus* screening is performed, a comprehensive preoperative decolonization approach with nasal mupirocin and CHG bathing should be performed for screen-positive patients.
3. Patients with risk factors for drug-resistant pathogens as delineated above should receive vancomycin in addition to standard beta-lactam surgical prophylaxis.
    a. Vancomycin should also be added If preoperative *S. aureus* screening is performed and indicates the presence of MRSA
4. Data are lacking for the efficacy of povidone-iodine or alcohol based nasal antiseptics as alternative agents to mupirocin. However, these products are inexpensive and have few adverse side effects, and thus they may be used prior to elective surgery as part of a "treat-all" approach or if *S. aureus* colonization is known and mupirocin is not available.

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