Reducing surgical site infections through *Staphylococcus aureus* carrier detection and decolonization: does it work?

Surgical site infections (SSI) are the most common healthcare associated infection and result in increased morbidity, mortality, prolonged hospital stays, and increased healthcare costs. *Staphylococcus aureus* (SA) is the most common cause of SSIs in the United States and is responsible for approximately 30% of culture positive surgical site infections. Colonization with SA is a known risk for subsequent SA infection. Therefore, many trials have investigated whether active surveillance for SA carriage and targeted decolonization reduces SSI risk. These studies have shown mixed effect of SA screening on SSI reduction. This newsletter reviews the methods of preoperative SA screening and decolonization, summarizes the evidence for and against SA screening, and provides rationale behind the DICON recommendation against pre-operative screening for SA and targeted decolonization.

**Method of SA screening:**

SA screening requires providers to swab the anterior nares of the patient for culture or polymerase chain reaction (PCR) to detect SA. In general, culture methods to detect SA are less expensive, but have longer turnaround time (24-48 hours). On the other hand, PCR is more expensive, but provides results in a few hours. Unfortunately, SA nares screening lacks sensitivity, identifying only 68%-70% of carriers [1].

**SA Decolonization:**

The typical regimen for SA decolonization includes a combination of intranasal mupirocin and chlorhexidine bathing. However, there is no standardized protocol. Many studies use 2% mupirocin intranasally twice daily for 5 days and 2% chlorhexidine gluconate wash daily for 5 days. Extensive mupirocin use can lead to increasing mupirocin resistance. For example, a single center British study demonstrated a sequential and significant increase in mupirocin resistant SA in surgical patients who received mupirocin decolonization from 1990-1993 (2.8% in 1990 to 65% in 1993) [2].

**Evidence for SA screening and decolonization:**

Bode et al conducted a multicenter randomized controlled trial evaluating the effect of SA screening and decolonization on hospital acquired SA infection (HAI-SA) rates.[3] The authors screened 6771 patients admitted to all surgical and internal medicine services for SA using PCR. The authors identified 1251 SA carriers and randomized 917/1251 SA carriers to either 5 days of mupirocin and chlorhexidine washes or placebo treatment. Bode et al identified 49 HAI-SA, 17 in the mupirocin-chlorhexidine group and 33 in
the placebo group (RR 0.45, 95% CI (0.25-0.75)). Therefore, the authors concluded that mupirocin-chlorhexidine prevented HAI-SA in hospitalized patients.

Schweizer et al performed a quasi-experimental study evaluating SA screening and decolonization as part of a bundle to prevent SSI in cardiac and orthopedic surgery patients [4]. The bundle consisted of screening all patients for SA, and then using 5 days of mupirocin and 5 days of chlorhexidine bathing for decolonization for SA carriers. Carriers of methicillin-resistant SA (MRSA) received vancomycin in addition to a cephalosporin for perioperative antimicrobial prophylaxis. All patients were instructed to bathe with CHG the night before and morning of surgery, regardless of SA screening results. The authors evaluated SSI rates in 28,218 pre-bundle operations and 14,316 post-bundle operations. Schweizer et al found a statistically significant decrease in monthly SSI rates after bundle implementation (RR 0.58, 95% CI (0.37-0.92)). Adherence to the bundle was low (39% full adherence), and this significantly limits interpretation and generalizability of the results.

Evidence against SA screening and decolonization:

Harbarth et al performed a large prospective crossover study to evaluate the effect of MRSA screening and decolonization of surgical inpatients on HAI-SA rates (specifically, SSI and bloodstream infection) [5]. The authors enrolled 21,754 surgical patients requiring admission and overnight stay and screened 10,193 of these patients for MRSA. MRSA screening identified 515 patients who then underwent decolonization with 5 days of intranasal mupirocin and chlorhexidine bathing. HAI-SA occurred in 93 patients during the intervention period and 76 patients during the control period (incidence rate ratio 1.2, 95% CI 0.9-1.7). Hence, the authors of this very well done study concluded that MRSA screening and decolonization made no difference in HAI-SA rates.

A Cochrane review of 9 randomized controlled trials evaluating the effect of nasal mupirocin use on surgical site infection rates concluded that mupirocin use had no effect on rate of SSI (RR 0.63, 95% CI 0.38-1.04), and patients who received mupirocin had a higher rate of non-SA infections compared to controls (RR 1.38, 95% CI 1.12-1.72) [6].

DICON position and rationale:

Overall, DICON does not promote the use of SA screening and decolonization as a tool to reduce surgical site infections because of the pitfalls of screening and targeted decolonization summarized below.

1. **The sensitivity is poor.** SA nares screening lacks sensitivity, identifying only 68%-70% of SA carriers. While anterior nares are a frequent site of colonization, many individuals are colonized at other sites including axillae and inguinal areas and would be missed by nares swabbing.
2. **The cost is high.** PCR methods are expensive and require batching (i.e.—multiple patient samples go through the machine at once); therefore, molecular methods may not be logistically possible for all locations.
3. **The pathogen is common.** Patients may become colonized between the time of testing and the time of operation
4. **The logistics are difficult.** Effective SA screening requires significant infrastructure to ensure screening results are returned in a timely fashion.

Alternate approach to active surveillance
1. **Universal CHG bathing.** There are no randomized controlled trials that evaluate if CHG bathing reduces SSI rate. However, multiple small, non-randomized studies show an overall trend toward SSI reduction with the use of universal CHG bathing.[7-10] Moreover, CHG bathing is well tolerated and safe.

2. **Risk assessment to determine need for pre-operative vancomycin.** Established risk factors for MRSA colonization include:
   - Hospitalization in the past 90 days
   - Residence in a long term care facility (LTCF) in the past year
   - Receipt of antibiotics or chemotherapy in the past 30 days
   - Currently requiring hemodialysis for end stage renal disease
   - Inpatient admission for more than 2 days prior to surgery

   It is reasonable to use vancomycin peri-operatively in patients that meet one or more of the above risk factors who are undergoing high-risk procedures (i.e., typically clean procedures involving implants or prosthetic material) including joint replacement, spinal fusion, vascular graft, and cardiac procedures.

**DICON recommendations:**

1. CHG bathing should be included as part of pre-operative care for patients undergoing high-risk procedures.
2. We do not recommend active SA surveillance for the reasons outlined above. However, if this approach is chosen, we recommend that it be performed as part of a comprehensive bundled intervention including screening for SA, decolonization, and targeted antimicrobial prophylaxis for patients undergoing high-risk clean procedures.
3. We recommend creating local protocols to define patients at high-risk for MRSA colonization and procedure categories that would benefit from perioperative prophylaxis targeting MRSA.

**References**


