Methicillin Resistant Staphylococcus Aureus (MRSA): Screening Options

NASS PATIENT SAFETY COMMITTEE
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NASS
NORTH AMERICAN SPINE SOCIETY
I. INTRODUCTION

There are variations in strategies for screening methicillin resistant staphylococcus aureus (MRSA) in pre-operative patients across U.S. health care settings. The non-uniform adoption of MRSA screening protocols reflects an incomplete understanding of MRSA-related surgical site infections (SSI) and the hospital-driven impetus to identify MRSA carriers. The NASS Patient Safety Committee sought to clarify the topic for the NASS membership and spine surgery populations specifically by analyzing the epidemiology of MRSA colonization, MRSA surgical site infections as a specific problem and the background legislation driving hospitals to move to MRSA screening policies. Understanding these points will help surgeons evaluate the MRSA screening policies in their own institutions and recognize the strengths and weakness of these policies. Ideally, thoughtful, proactive physician implementation of screening protocols will allow surgeons to manage pre-operative information in the best possible way to allow safe execution of surgery with a minimized infection risk.

**Public Health Impact of Surgical Site Infections and MRSA as an increasingly frequent SSI pathogen**

The burden of SSIs (all types) on public health is significant with estimates ranging from 300,000 to 1 million cases in the United States annually.\(^1,2\) SSIs are associated with increased healthcare costs, exacting a direct toll of over $3 billion each year.\(^3\) In addition to the economic burden, the consequences of SSI on patients and their quality of life can be devastating by increasing their risk of pain, additional surgery, prolonged antibiotic treatment and increased length of hospital stay. Recent data suggests that SSIs account for 20-22% of hospital acquired infections (HAIs).\(^4\)

SSIs due to MRSA are associated with increased morbidity and mortality rates compared to non-MRSA SSIs. MRSA first emerged as a clinically relevant pathogen in the 1960s. Over the past several decades, MRSA has become a common cause of infection in both the healthcare setting and the community, though there are some clinical differences between hospital/healthcare acquired (H-) versus community acquired (CA-) MRSA. Recent estimates indicate that 49-65% of healthcare associated Staphylococcus aureus infections are caused by methicillin resistant strains. According to the Centers for Disease Control and Prevention (CDC), compared to non-resistant Staphylococcus aureus (S. aureus), the mortality rate from MRSA infection is 2.5 times higher, and close to 19,000 MRSA deaths are reported annually in the United States. Although the treatment options for MRSA SSI are generally limited and less effective when compared to treatment options for methicillin-sensitive S. aureus, increased public health and screening efforts have resulted in a recent decline in overall MRSA infections in healthcare settings.\(^5\)

**Specific Impact on Spinal Surgery**

Although exact rates for SSI after instrumented spinal surgery are unavailable, studies suggest that the estimated average rate is around 2% with a range of 0.2% to 4.7%.\(^6\) The most common organisms causing infection in spinal surgery patients is methicillin-sensitive S. aureus (MSSA); however, the rate of detected MRSA spinal SSI is increasing. In a retrospective observational study, Chen et al found that 2.8% of patients undergoing elective spine surgery were colonized with MRSA. In a retrospective review of 7,529 spine surgery cases conducted by Abdul-Jabbar et al, of the 239 infected patients, 34.3% of the infections were attributed to methicillin-resistant organisms.\(^7\)

Unfortunately, there is no consensus surrounding the most effective MRSA screening, decolonization, and treatment protocol for spinal surgery patients. In a review article, Epstein suggests that preoperative nasal cultures for MRSA and the use of prophylactic mupirocin plus preoperative bathing with chlorhexidine is one adjunct measure that surgeons can utilize to limit the devastating effects of.
MRSA infection. When surveying NASS Patient Safety Committee Members about protocols used at their hospital systems, about half responded that their hospital(s) routinely screen for MRSA during preadmission or admission, although the timing of screening, decolonization, and prophylaxis protocols vary. Some members’ hospitals, per the decision of their Infectious Disease Department, require all surgical patients to receive mupirocin during preoperative preparation and daily during the hospital stay and other hospital systems require that all patients shower with chlorhexidine prior to surgery. Due to high rates of MRSA in the community, one member’s hospital decided to abolish the screening program and implement a comprehensive MRSA prophylaxis protocol for all orthopedic and spine surgery patients that includes preoperative chlorhexidine showers, a three-step preoperative preparation including chlorprep application and the preoperative administration of prophylactic antibiotics, including cefazolin, to all patients or vancomycin to patients undergoing surgery with hardware or implants.

Due to the variations in protocols, the Patient Safety Committee felt that there was a need to provide resources to the membership on the literature surrounding MRSA screening and decolonization and provide an overview of the current recommendations available in order for spine surgeons to make informed decisions, in consultation with their infection control team, about the most appropriate protocol for their hospital. In any screening program with the objective of eliminating MRSA colonization, the following issues need to be considered: transmission of MRSA within the hospital, and strategies for limiting this; timing of screening patients; and development of further resistance within S. aureus strains as a result of treating screened patients. Spine surgery patients represent a valid subset of the target population for whom MRSA screening should be considered.

II. INITIATIVES AND RESOURCES

Centers for Disease Control and Prevention (CDC)
Reducing the threat of community and hospital acquired MRSA is a top priority for the CDC. The CDC’s prevention efforts have centered around implementing stringent hygiene and contact precautions, recognizing previously colonized patients, rapidly reporting MRSA results and educating healthcare providers and the public on MRSA prevention strategies. Through these preventative measures, the CDC suggests that MRSA infections can be prevented or reduced. Studies evaluating the impact of prevention programs in acute care facilities have documented up to a 70% reduction in the incidence of MRSA after implementation of efforts. When analyzing rates of hospital acquired invasive MRSA infections, a 2010 study released by the CDC suggests that hospital acquired invasive MRSA infections declined 28% from 2005 through 2008. The National Healthcare Safety Network (NHSN) also reported that MRSA bloodstream infections occurring in hospitalized patients fell nearly 50% from 1997 to 2007. See the links below for more information about their prevention campaign and recommendations.

Prevention of MRSA in Health Care Facilities
http://www.cdc.gov/mrsa/healthcare/index.html

Materials for Health Care Professionals
http://www.cdc.gov/mrsa/healthcare/clinicians/materials-hcp/index.html

Prevention Strategies-Interactive Map of State-Based Programs
http://www.cdc.gov/HAI/state-based/index.html

CDC’s Recommendations for Preventing MRSA

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Methicillin Resistant Staphylococcus Aureus (MRSA): Screening Options
NASS Patient Safety Committee

- Comply with CDC hand hygiene recommendations
- Implement Contact Precautions for MRSA colonized and infected patients
- Recognize previously MRSA colonized and infected patients
- Rapidly report MRSA lab results
- Provide MRSA education for healthcare providers

Also consider
- Active surveillance testing – screening of patients to detect colonization even if no evidence of infection

Other strategies
- Decolonization
- Chlorhexidine bathing

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<th>CDC Precautions to Prevent the Spread of MRSA in Healthcare Settings</th>
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**American Academy of Orthopaedic Surgeons (AAOS)**
The American Academy of Orthopedic Surgeons’ (AAOS) “The Current State of Bacterial Screening and Decolonization in Orthopedic Surgery” highlights the impact of SSI, commonly proposed strategies to reduce SSI and issues associated with prevention strategies. The AAOS stresses the importance of optimizing ALL modifiable pre-op risk factors, such as glycemic control, weight, oral health and nutrition. AAOS highlights studies that investigated the benefits of preoperative screening and decolonization efforts in orthopedic surgery patients. Recent studies in the orthopedic literature suggest there was a “74% decrease in orthopaedic SSI with the implementation of a protocol that used screening of nasal carriers with RT-PCR on admission followed by treatment of screen positive patients with a combination of mupirocin nasal ointment and chlorhexidine soap bath treatment for five days.”


**Surgical Care Improvement Program (SCIP)**
SCIP, sponsored by the Centers for Medicare and Medicaid Services (CMS), is a national quality partnership of organizations targeting improvement of surgical care by significantly reducing surgical complications. The reduction of MRSA infections is a top priority of SCIP and is included as target area for the elimination of health care-associated infections. Some accrediting bodies, including The Joint Commission, require implementation of SCIP measures for hospital accreditation purposes. SCIP recommends that antibiotic prophylaxis be given preoperatively and discontinued within 24 hours postoperatively. Per measure specifications, SCIP discourages the routine use of vancomycin in surgical prophylaxis, although it is considered an acceptable agent in hospitals with high rates of MRSA. One of the major concerns with the SCIP measures for MRSA infection prevention is that their recommendations aren’t generalizable to all specialties and SCIP adoption doesn’t always correlate with a decrease in infection rates.

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Methicillin Resistant Staphylococcus Aureus (MRSA): Screening Options
NASS Patient Safety Committee

To subscribe to the SCIP listserv and receive program updates, go to:
https://www.qualitynet.org/dcs/ContentServer?cid=1137346750659&pagename=Medqic/Content/ParentShellTemplate&parentName=TopicCat&c=MQParents.

Association for Professionals in Infection Control and Epidemiology (APIC)
In their guideline, Guide to the Elimination of Methicillin-Resistant Staphylococcus aureus (MRSA) Transmission in Hospital Settings, 2nd Edition,10 APIC provides guidance on the prevention and control of MRSA by providing recommendations in the following areas: MRSA risk assessment, MRSA surveillance programs and compliance with basic infection prevention and control strategies (ie, hand hygiene, contact precautions, prevention of device-related hospital associated infections, thorough environmental and equipment cleaning and decontamination). In addition, APIC offers enhanced infection prevention and control strategies (e.g., active surveillance testing, etc.) in situations where there are issues controlling MRSA transmission rates; education of healthcare workers, patients, families and the public; cultural transformation and change management; antimicrobial stewardship; and MRSA decolonization strategies.


Society for Healthcare Epidemiology of America (SHEA)
SHEA’s guideline, Strategies to Prevent Transmission of Methicillin-Resistant Staphylococcus aureus in Acute Care Hospitals,11 highlights practical recommendations to assist acute care facilities in their efforts to prevent transmission of MRSA. Due to contradictory research reporting the efficacy of universal screening programs, SHEA does not make a recommendation regarding universal screening; however, SHEA recommends that active surveillance testing may be useful in facilities that have implemented and optimized adherence to basic MRSA transmission prevention practices, but continue to experience high MRSA rates. In implementing an active surveillance system, SHEA recommends selecting and identifying the patient populations to be screened and recommends that MRSA surveillance be performed during admission to the hospital or specific unit. When determining the anatomic sites to include in the screening program, SHEA recommends that the anterior nares be tested as they appear to be the most frequently positive site with sensitivity ranging from 73% to 93%. SHEA suggests that the optimal decolonization therapy has not yet been determined; however, most experience has been with the use of 2% mupirocin administered intranasally with or without chlorhexidine bathing.

To download the guide, go to: https://www.premierinc.com/safety/topics/HAI/downloads/HAI-Compendium-HAI-mrsa.pdf.

British Hospital Infection Society
In their Guidelines for Control and Prevention of Methicillin-Resistant Staphylococcus aureus (MRSA) in Healthcare Facilities,12 the British Hospital Infection Society suggests that certain high risk patients should be screened for MRSA routinely and certain high risk units should be screened at least intermittently in all hospitals. However, due to lack of evidence of clinical and cost-effectiveness of universal screening, they recommend that the decision regarding whether or not to perform admission screening should be made explicitly by the infection control team in consultation with the clinical staff of each unit. When screening, the following sites should be sampled: anterior nares, skins lesions and wounds and sites of catheters, catheter urine, groin/perineum, tracheostomy and other skin breaks in patients. The sampling of the throat is also recommended.

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III. KEY FINDINGS FROM SELECTED SCIENTIFIC LITERATURE

The summaries below provide an overview of studies evaluating the outcomes and cost effectiveness of implementing a MRSA screening and decolonization program. While the long-term efficacy of these programs has yet to be proven, most of the researchers agree that there is a health and cost benefit to implementing a MRSA prevention protocol. Due to the paucity of evidence examining the clinical and cost-effectiveness of MRSA screening and decolonization in spine surgery patients, the examples below include a mix of general surgery, neurosurgery and orthopedic surgery patients.

Atkins et al\textsuperscript{13} investigated the impact of MRSA colonization and subsequent infection in patients undergoing inpatient neurosurgery at Kaiser Permanente. Patients underwent a variety of neurosurgical procedures including burr holes, cranioplasty, lumbar laminectomy, and shunt placement. Per hospital protocol, patients admitted to the intensive care unit underwent MRSA screening via nasal swab cultures. These patients were designated as either MRSA positive or negative and compared to a group of patients who were not screened. Patients with positive MRSA cultures were treated prophylactically with an antibiotic chosen by their surgeon. The rate of postoperative wound infection in patients who received MRSA-specific prophylactic antibiotics, mainly vancomycin, was 7.4% compared to the infection rate of 32.1% in patients who received standard prophylaxis treatment, mainly cefazolin (p=0.04). The authors suggest that neurosurgical centers with significant rates of postoperative infections caused by MRSA should consider preoperative screening of MRSA and administration of MRSA active prophylactic antibiotics to colonized patients.

In a prospective study, Gilpin et al\textsuperscript{14} evaluated the long-term efficacy of a standardized MRSA decolonization regimen in acute and community-based hospitals. Patients were screened on admission for MRSA carriage if they met any of the following 1) have a history of MRSA colonization; 2) admitted from nursing or residential homes or another hospital; 3) admitted to the intensive care, neonatal or renal units; 4) where requested by their clinician or the infection control department and 5) during outbreaks. The anterior nares, axillae and groin, and throat were initially swabbed, and if MRSA was cultured, a full site-specific screen was performed. MRSA positive patients underwent decolonization for seven days with the following protocol: 1) application of mupirocin ointment to the nose three times daily; 2) daily full-body washing with 4% chlorhexidine gluconate solution; 3) daily application of 1% chlorhexidine powder to axillae and groins; 4) twice weekly hair washing with 4% chlorhexidine gluconate solution; 5) application of 0.2% chlorhexidine throat spray if throat swab was positive; and 6) use of clean towels and daily change and laundering of bed linens and clothes. Results indicated that of the 137 patients enrolled, only 58% were successfully decolonized. Of the patients who were successfully decolonized, only about half remain decolonized at one year. The authors suggest that this protocol did not result in the long-term clearance of MRSA carriage in most patients studied.

Harpeth et al\textsuperscript{15} evaluated the efficacy of mupirocin in eradicating MRSA carriage at multiple body sites in a randomized, double-blind, placebo-controlled trial at a 1,500 bed acute care facility. Groups were either treated with mupirocin or placebo that was applied to the anterior nares for five days. Both groups also used chlorhexidine soap for body washing. Results suggest that MRSA eradication had a 25% success rate in the mupirocin group compared to 18% in the placebo group. In addition, the authors observed an association between low-level mupirocin resistance at study entry and subsequent treatment failure (p=0.003). Resistance to chlorhexidine was not observed. The authors suggest that...
nasal mupirocin is only marginally effective in the eradication of multisite MRSA carriage in a setting where MRSA is endemic.

In another study by Harbath et al\textsuperscript{16}, the effect of implementing an early MRSA detection strategy on nosocomial MRSA infection rates in patients undergoing surgery at the University of Geneva Hospitals was evaluated. Twelve wards in eight different specialties were enrolled in the study, including abdominal surgery, orthopedics, urology, neurosurgery, cardiovascular surgery, thoracic surgery, plastic surgery and solid organ transplantation. Each ward was assigned to either the control or intervention group for a nine month period and then switched over to the other group for the next nine months. The intervention protocol included a rapid screening intervention whereby patients admitted to the ward for more than 24 hours were screened before or on admission by rapid, multiplex polymerase chain reaction. For both groups, standard infection control measures were used for patients with MRSA including contact isolation, wearing appropriate shielding materials including gowns, gloves and masks, adjustment of perioperative antibiotic prophylaxis, use of computerized MRSA alert system and topic decolonization for five days. Results indicated that the rate of MRSA SSI and nosocomial MRSA acquisition did not change significantly. The authors suggest that the universal, rapid MRSA admission screening strategy did not significantly reduce nosocomial MRSA infection in surgical departments with endemic MRSA prevalence, but relatively low MRSA infection rates. The authors suggest that “surgical services and infection control teams should carefully assess their local MRSA epidemiology and patient profiles before introducing a universal screening policy.”

In patients undergoing surgery at Duke University Medical Center, Engemann et al\textsuperscript{17} documented a significantly higher risk of adverse outcomes and increased expense in managing patients with SSI due to MRSA when compared with patients infected with antibiotic-susceptible strains. The difference in median hospital charges among the groups studied were highly significant (p<0.001); $29,455 for patients without infection, $52,791 for patients with methicillin-susceptible S. aureus infection and $92,363 for patients with MRSA. Patients with MRSA were also found to have higher 90-day mortality rates than patients infected with methicillin-susceptible S. aureus.

Slover et al\textsuperscript{18} conducted a Markov decision analysis to assess the cost effectiveness of implementing a preoperative S. aureus screening and decolonization program prior to hip (THA) and knee (TKA) arthroplasties and spine fusions at New York University Hospital. All patients in the institution’s preadmission test program undergoing THA, TKA or spinal fusion participated in the screening program. All patients were given a prescription for mupirocin treatment and received a nasal culture preoperatively. Compliant patients with positive MRSA cultures received antibiotic prophylaxis with vancomycin and patients with positive MSSA cultures received traditional perioperative cephalosporin. In addition, non-compliant patients received mupirocin treatment in addition to the perioperative antibiotic prophylaxis. The authors conducted a two-way sensitivity analysis to calculate the needed reduction in SSIs to make the program a cost savings. They suggest that if the cost of treating an infected THA or TKA is equal to the cost of the primary arthroplasty, then the screening program needs a 35% reduction in the revision rate to be considered a cost saver. For spine fusions, the reduction in the revision rate to make the program a cost savings is only 10%.

Chen et al\textsuperscript{19} conducted a systematic review of 19 studies investigating the clinical success of an S. aureus screening and decolonization program in preventing SSI in patients undergoing various orthopedic surgeries, including hip and knee arthropasty, orthopedic trauma, total joint replacement and spinal surgery. The authors also evaluated 10 studies analyzing the cost-effectiveness of these screening and decolonization efforts. According to the analysis, the majority of studies detected S. aureus colonization
Methicillin Resistant Staphylococcus Aureus (MRSA): Screening Options
NASS Patient Safety Committee

using cultures, most SSI were defined by CDC criteria and the most commonly used decolonization protocol was 2% intranasal mupirocin and chlorhexidine gluconate for 3 to 5 days. Results from the systematic review suggest that all 19 studies showed a reduction in SSI, including rates of MRSA, when a S. aureus screening and decolonization protocol was used. It is important to note that not all reductions in SSI were statistically significant. The reductions ranged from 13% to 200%. When reviewing the cost effectiveness of implementing the S. aureus screening and decolonization protocol, all of the economic models showed that implementing the protocols was the economically preferred strategy.

In a prospective cohort study with a two-year follow-up, Rao et al. evaluated the impact of preoperative screening and selective decolonization efforts on the rate of SSI in patients undergoing elective total joint arthroplasty (TJA). Per the study protocol, patients were either enrolled in the control group or received the preoperative intervention, which consisted of screening for S. aureus nasal carriage two to four weeks before surgery. Specimens were cultured on MRSA and MSSA plates. Approximately one week prior to surgery, patients with nasal cultures positive for S. aureus were instructed to apply mupirocin nasal ointment twice daily to both nares and to bathe with chlorhexidine daily for five days before the surgery. Additionally, all patients received perioperative cefazolin. Patients with a history of MRSA and those found to be MRSA carriers through screening received perioperative vancomycin. The overall SSI rate decreased from 2.7% in the control group to 1.2% in the intervention group (p=0.009). The authors suggest that preoperative screening and selective decolonization was associated with fewer infections after elective TJA, and the lower infection rate during the intervention period reduced the projected amount of lost revenue by $283,500 per year.

In an economic analysis study, Lee et al. utilized a stochastic decision-analytic computer simulation model to evaluate the cost effectiveness of routine preoperative MRSA screening and decolonization programs in orthopedic surgery patients. The authors conducted a literature search to determine the various clinical outcomes of MRSA colonization in orthopedic surgery patients. Each clinical outcome was associated with a quality adjusted life year (QALY) unit. Statistical simulations were developed for various clinical outcomes. Each simulation consisted of 1,000 hypothetical patients, with varying characteristics, who were in the preoperative stage. Each hypothetical patient was placed in the model 1,000 times for various clinical scenarios, resulting in a total of 1 million potential outcomes for each simulation. The incremental cost-effectiveness ratio (ICER) was determined using $50,000 per QALY as a cut-off point for cost-effectiveness. Two separate statistical analyses were conducted, including the third-party payer perspective and the hospital perspective. Results from the third-party payer analysis indicated that routine preoperative MRSA screening was either strongly cost-effective or economically dominant for a wide variety of surveillance and decolonization protocols. When using anterior nares swabs, the model suggested that MRSA testing was economically dominant when decolonization was at least 50% successful and when the prevalence of MRSA colonization was at least 2.5%. Even when the prevalence was below 2.5%, routine MRSA screening protocols were found cost-effective in the model. Anterior nares swabs were priced at $100 per sample. Using the hospital perspective model, MRSA surveillance was found to be economically dominant in every scenario when the MRSA prevalence was at least 1% and decolonization success was at least 25% at costs of up to $200. The authors suggest that preoperative screening and decolonization of orthopedic surgery patients is not only a health benefit, but also cost effective for both third-party payers and hospitals.

IV. HOSPITAL MOTIVATION: BACKGROUND

Hospitals are responding to financial pressures that stem from past legislative ruling. Hospital-Acquired Conditions (HAC), or conditions deemed by CMS as reasonably preventable, have been targeted as an

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Methicillin Resistant Staphylococcus Aureus (MRSA): Screening Options
NASS Patient Safety Committee

area of pay for performance. Section 5001(c) of Deficit Reduction Act of 2005 required the Secretary of HHS to identify conditions that are: (a) high cost or high volume or both, (b) result in the assignment of a case to a DRG that has a higher payment when present as a secondary diagnosis, and (c) could reasonably have been prevented through the application of evidence based guidelines. On July 31, 2008, in the Inpatient Prospective Payment System (IPPS) Fiscal Year (FY) 2009 Final Rule, CMS included 10 categories of conditions that were selected for the HAC payment provision.

The 10 categories of HACs include:

1. Foreign Object Retained After Surgery
2. Air Embolism, Blood Incompatibility
3. Stage III and IV Pressure Ulcers
4. Falls and Trauma (includes Fractures, Dislocations, Intracranial Injuries, Crushing Injuries, Burn, Other Injuries)
5. Manifestations of Poor Glycemic Control (including Diabetic Ketoacidosis, Nonketotic Hyperosmolar Coma, Hypoglycemic Coma, Secondary Diabetes with Ketoacidosis, Secondary Diabetes with Hyperosmolarity)
6. Catheter-Associated Urinary Tract Infection (UTI)
7. Vascular Catheter-Associated Infection
8. Mediastinitis Following Coronary Artery Bypass Graft (CABG)
9. Surgical Site Infection Following Bariatric Surgery for Obesity (including Laparoscopic Gastric Bypass, Gaeroenterostomy, Laparoscopic Gastric Restrictive Surgery)
10. Surgical Site Infection Following Certain Orthopedic Procedures (Spine, Neck, Shoulder, Elbow)

To encourage hospitals to avoid hospital-acquired conditions, as of October 1, 2008, Medicare no longer pays hospitals for their higher costs of care that result when a patient is harmed by one of the listed conditions if it was hospital-acquired. Medicare prohibits the hospital from billing the beneficiary for the difference between the lower and higher payment rates. Medicare, however, will pay for physician and other covered items or services that are needed to treat the hospital-acquired condition, including the costs of post-acute care that would not have been needed for the patient’s initial medical problem, but are needed because of the hospital-acquired condition. Although the science to support specific MRSA prevention strategies is unavailable, this implementation of these payment adjustments may be a significant motivation factor in a hospital’s establishment of a MRSA screening program. 22

V. DISCUSSION

When determining the most appropriate action steps for MRSA screening, decolonization, and prophylaxis regiments, it should be considered whether MRSA status at the nares reflects colonization at the rest of body, including the surgical site. The presumption should be yes for a MRSA screening and decolonization program for spinal surgery pre-operative patients; screening positive patients should be treated with mupirocin (bactroban) at the nares (5 days, bid topical application) as well as chlorhexidine wash/wipes to the surgical site. Mupirocin treatment at the nares alone is inadequate to address the colonization at the surgical site that is presumed to be present in a screening positive patient. The combination treatment will be the most effective way to decolonize patients who are positive at screening.

However, caveats include failure to achieve total/permanent MRSA eradication, and emergence of resistant strains. Resistance to mupirocin has been described, 15 but not to chlorhexidine. As described previously by Giplin et al, 14 MRSA recurrence in successfully decolonized patients is common, suggesting that decolonization is not a permanent switch in status. To that end, given the potential ease of MRSA
transmission in the healthcare inpatient setting, it is worth considering why, for several reasons, successfully decolonized pre-operative patients do not get rescreened upon discharge from the acute care facility. Screening and decolonizing healthcare providers and other workers might reduce the overall rate at which screened, decolonized patients revert back to MRSA colonization leaving the hospital. MRSA colonization in the early post-operative phase might increase the chance of MRSA SSI. Screening patients on discharge is not currently routinely done.

VI. GUIDANCE

The lack of consensus on this topic even within the field of spine surgery is reflected by the mixed responses received when polling Patient Safety Committee Members, as discussed earlier in this guide. As guidance, the Patient Safety Committee has provided below an example of a preoperative MRSA screening protocol. **Spine providers should consult with their infection team before implementing a MRSA screening protocol for patients.**

**FOR ELECTIVE-SURGERY PATIENTS**

Screen patient 10 to 14 days prior to surgery, typically when generating other preoperative labs.

- **If negative:** consider a chlorhexidine wipe/wash protocol for all these patients (at least 3 days of wipe/wash to surgical site) and then cefazolin as the pre-operative antibiotic

- **If positive:** treat with bactroban to nares and chlorhexidine wash/wipes to the surgical site for 5 days and consider rescreening pre-operatively
  - Rescreen with negative result available prior to operation: consider prophylactic administration of cephalexin and final chlorhexidine wipe immediately pre-operatively
  - Rescreen with positive result available prior to operation: Retreat with bactroban and consult with Infection Control Department
  - If not rescreening prior to operation or after treatment or if rescreening results are only available after operation, consider treating with vancomycin.

- At the surgeon’s discretion, vancomycin may be considered in patients with a history of MRSA infection.

**FOR NON-ELECTIVE/URGENT OR EMERGENT SURGERY PATIENTS**

If data cannot be generated pre-operatively, consider patient factors such as co-morbidities, frequency of healthcare contact and hospital admissions, duration of surgery, use of instrumentation and tissue trauma to guide pre-operative antibiotic prophylaxis choice. The use of pre-operative chlorhexidine wipes may be considered, even on the day of surgery and/or the night before.

The NASS Evidence-Based Guideline on *Antibiotic Prophylaxis in Spine Surgery* can serve as a guide when deciding on the most appropriate antibiotic prophylaxis regimen for your patient and can be found on the NASS website at: [https://www.spine.org/Documents/ResearchClinicalCare/Guidelines/AntibioticProphylaxis.pdf](https://www.spine.org/Documents/ResearchClinicalCare/Guidelines/AntibioticProphylaxis.pdf).
VII. SUMMARY

In conclusion, the Patient Safety Committee recognizes that pre-operative MRSA screening and treatment may likely only result in the short term eradication of MRSA, but this may be sufficient enough to prevent early SSI. There may be various reasons why hospitals implement a pre-admission MRSA protocol, including providing proof that it wasn’t acquired during inpatient stay (i.e., disprove that the infection was acquired through the facility). This example raises more concerns than it solves because the process in which this screening protocol was implemented does not lead to coordinated screening and management of MRSA colonized patients. In order to facilitate more coordinated care at your health care center, spine care providers should discuss how current screening programs are meeting objectives. If the screening programs are not meeting objectives, constructively discuss with leadership ways to improve screening efforts to decrease preventable infections.

The information provided in this guide is provided as a resource only and has been developed to assist surgeons in the treatment of MRSA carriers in time to minimize the risk of early SSI. Consider working with your institution to raise the question of in-patient screening as well as the optimal timing of pre-operative screening. If HA-MRSA is a different entity, ideally it should be screened for by the time of discharge. Providers should be aware of muporicin-resistant MRSA strains, and if patients repeatedly test MRSA positive, providers should consult with their infection colleagues on the appropriate decolonization measures prior to surgery.

In closing, the following unresolved questions should also be considered when developing and implementing a MRSA control plan for your patients:

- Should you treat/decolonize MSSA positive patients?
- Does nasal status reflect the surgical site status?
- Do these screening programs and treatments actually inadvertently promote even more antibiotic resistance?
- What is the role of re-screening patients on the day of surgery?
- What is the role of re-screening the patient prior to hospital discharge?
Methicillin Resistant Staphylococcus Aureus (MRSA): Screening Options
NASS Patient Safety Committee

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