



Stop SSIs in their tracks

By Maureen Spencer, MEd, RN,
Diane Gulczynski, MS, RN, CNOR

Asymptomatic colonization with methicillin-resistant *Staphylococcus aureus* (MRSA) and methicillin-sensitive *Staphylococcus aureus* (MSSA) is a risk factor for surgical site infections (SSIs). Identifying *S. aureus* colonization during the presurgical screening process is important to help reduce infections. In this article, the authors document the effectiveness of preoperative surveillance and topical decolonization in reducing SSI rates.

MRSA and MSSA are isolates of *S. aureus*. MRSA is classified as either healthcare-acquired (HA-MRSA) or community-acquired (CA-MRSA).

MRSA is characterized by acquired genes with encoded antibiotic resistance to penicillin, including methicillin and other narrow-spectrum beta-lactamase-resistant penicillin antibiotics.¹ MRSA in healthcare settings commonly causes serious and potentially life-threatening infections, such as pneumonia, bloodstream infections, and SSIs. It occurs most frequently in patients undergoing surgical procedures, patients with weakened immune systems, and those undergoing invasive medical procedures. Patients who are carriers of MRSA are at higher risk for infections after surgery than those who don't carry this organism.^{2,3}



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Incidence

Worldwide, an estimated 2 billion people carry some form of *S. aureus*; of these, up to 53 million (approximately 2.7% of carriers) are thought to carry MRSA.⁴ In the United States, 95 million people carry *S. aureus* in their noses; of these, 2.5 million (2.6%) carry MRSA.⁴ Most CA-MRSA isolates are associated with clinically relevant infections, and 23% of patients require hospitalization.⁵

In the United States, increased outbreaks of CA-MRSA colonization and infection via skin contact in locker rooms and gymnasiums, even among healthy populations, have been reported.⁶ A 2007 study found that 4.6% of patients in U.S. healthcare facilities were infected or colonized with MRSA.⁷

S. aureus becomes methicillin resistant by acquiring a *mecA* gene.⁸ Recent outbreaks of CA-MRSA appear to be caused by isolates that also carry genes for Panton-Valentine leukocidin (PVL), a toxin known to cause lysis of white blood cells.⁹ However, the National Institute of Allergy and Infectious Diseases (NIAID) published a report explaining that proteins in drug-resistant strains of *S. aureus* are novel members of the phenol-soluble modulins (PSM) protein family.¹⁰ These strains attract and then destroy protective human white blood cells and essentially eliminate the immune defense

mechanisms against CA-MRSA. The production of the proteins is typically higher in CA-MRSA strains known for severe virulence.¹⁰

Colonization indicates the presence of the organism without symptoms of illness. Colonization can occur in the nares, trachea, skin folds, rectum, or an open wound such as a pressure ulcer. *S. aureus* permanently colonizes the anterior nares of about 20% to 30% of the general population.¹¹

The Society for Healthcare Epidemiology of America (SHEA) recommended routine surveillance cultures at the time of hospital admission for patients at high risk for carrying MRSA. SHEA also noted

that rates of MRSA colonization might be higher among patients who previously spent 15 days in an institutional setting, including long-term or acute care centers.¹²

Program implementation

The New England Baptist Hospital, Boston, Mass., noticed an increase in CA-MRSA and HA-MRSA SSIs in 2005. Twenty-six isolates of both *S. aureus* (16 isolates) and MRSA (10 isolates) were sent to a reference laboratory for pulse field gel electrophoresis (PFGE) to determine if the strains were related. PFGE separates large DNA molecules using multiple electric currents, which allow for genotyping or genetic fingerprinting of pathogenic organisms, such as MRSA. It's commonly considered a gold standard in epidemiologic studies of pathogenic organisms.¹³ Results showed that 23 of the isolates weren't related and were common strains in the community. Only three of the MRSA isolates were closely matched, but weren't related in terms of time of year, type of surgery, surgeon, OR, perioperative staff, and risk factors.

In January 2006, the senior vice president of patient care services developed a white paper for the board of trustees and administration describing the epidemiology of MRSA and recommended measures to control its spread. This included active

surveillance cultures in the preadmission process, more stringent infection precaution techniques, control of certain antibiotics, environmental controls, and a decolonization protocol.

In February 2006, 133 patients had their nares cultured in the OR as part of an anonymous surveillance study. Results showed that 29% were carriers of *S. aureus* and 5% were positive for MRSA. This prompted administration and the Infection Control Committee to recommend an eradication program aimed at eliminating colonization before inpatient surgery.

In July 2006, the hospital instituted an active surveillance and topical decolonization program. The program was implemented in the preadmission screening process and included early identification of carriers using rapid polymerase chain reaction (PCR) technology that provided results in 2 hours for MRSA. All inpatient surgeries were screened and those with positive results for MRSA and *S. aureus* were treated. (See *NEBH Staph aureus and MRSA eradication program*). A decolonization protocol was administered to colonized patients, and surgical prophylaxis was adjusted to vancomycin for MRSA colonized patients.¹⁴ SSIs due to MRSA and *S. aureus* were monitored and reported to the Infection Control Committee and administration on a monthly basis.

Eradicating MRSA and *S. aureus*

The Infection Control Committee formed a Task Force to develop a protocol to eradicate MRSA and *S. aureus* during preadmission screening. The Task Force met in March 2006 and discussed necessary action plans.

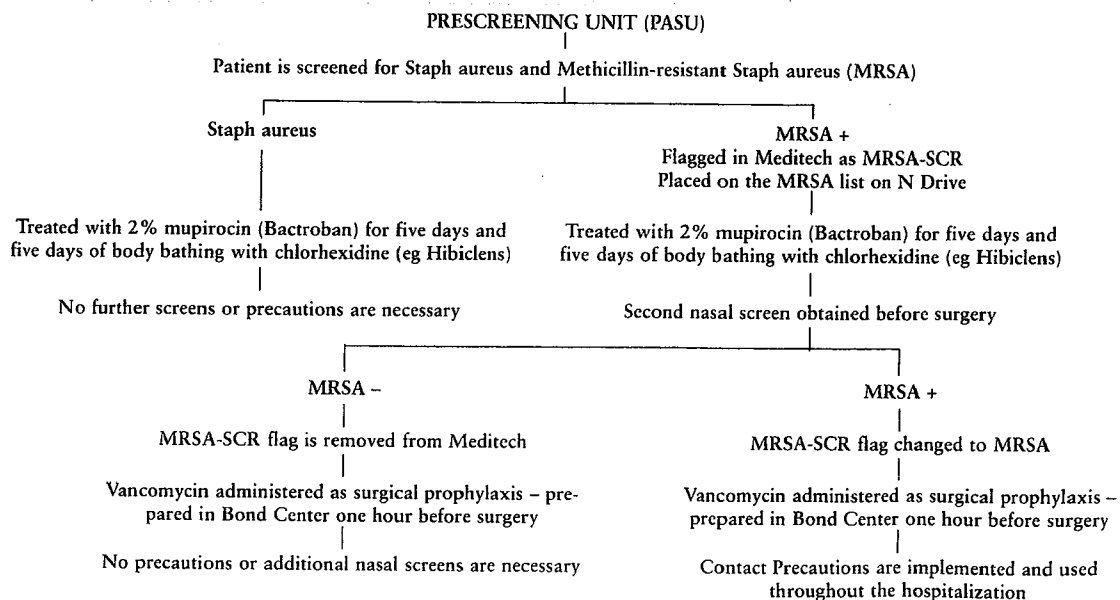
Additional subgroups were also formed. The Microbiology Laboratory Subgroup met in March 2006 to discuss the implications and needs of the microbiology lab to perform molecular diagnostic testing and cross-train all microbiologists.

The Prescreening Unit (PASU) formed a subgroup to discuss their needs for obtaining the nasal screens and providing patient education and compliance follow-up phone calls.

A hospital-wide subgroup met in April 2006 to discuss the implications and needs for patient access, continuing care, patient education, pharmacy, OR, postanesthesia care unit (PACU) and nursing. An Information Systems subgroup met to discuss the need for broadcasting positive results, a flagging system for positive screens, and other necessary reports.

The expanded Task Force also met in April 2006 and recommended instituting a pilot study on the spine service starting in July 2006 to work out the procedural steps to the program before

NEBH Staph aureus and MRSA eradication program



Source: New England Baptist Hospital.

undertaking the complete active surveillance and treatment plan.

New positions were filled to launch the pilot study. The microbiology lab created and filled a position to handle the new PCR equipment. Another position was created for PASU—a MRSA Coordinating Technician (MCT) who would obtain nares screens, educate patients, and facilitate communication of positive results.

In September 2006, the program was successfully implemented for all inpatient surgeries and the Task Force continued to meet weekly to evaluate the program.

Program overview

The MRSA and *S. aureus* screening and eradication program was implemented on July 17, 2006. The program included

- collection of a nares screen
- identification and notification of positives
- treatment of MRSA and *S. aureus* colonized patients with 2% mupirocin ointment to each nostril twice a day and daily bathing with 2% chlorhexidine antiseptic scrub
- education on MRSA, *S. aureus*, hand hygiene, and prevention and control measures in the home and hospital
- reculture of MRSA-positive patients before surgery
- use of contact precautions in the presurgical unit, OR, PACU, and nursing units
- use of vancomycin as surgical prophylaxis for MRSA-positive patients.

The MCT collected specimens, educated patients and family members, and notified patients, surgeons, OR staff, and infection control of positive screens. The NPs called in a prescription for 2% mupirocin, and patients were instructed to purchase a large bottle of 2% chlorhexidine and initiate the decolonization protocol.

The MRSA-positive patients were required to return for a second screen or to have one done by their primary care provider and fax results to the PASU. The MCT placed follow-up phone calls to all MRSA and *S. aureus*-positive patients to assure compliance with the decolonization protocol.

Patient education included the following:

- A hand hygiene brochure describing the importance of personal hygiene and encouraging patients to ask healthcare workers if they've washed their hands.

- A MRSA and *S. aureus* eradication brochure.
- Instructions for what to do in case of a positive result. (See *Preadmission screening unit patient information MRSA/S.aureus*).

Lab flagging system

If a patient was MRSA positive, a unique screen-labeled MRSA-SCR was entered into the medical record system to flag the patient for contact precautions and the need for vancomycin at the time of surgery. A color-coded label affixed to the medical record in PASU was also used as a back-up system for patient identification. A confidential secured list of positive MRSA patients was posted to the hospital intranet system for authorized users. This list was maintained and updated by the infection control unit.

Results

From July 17, 2006 to September 30, 2007, 7,019 patients were screened, representing 100% of eligible patients. During the time period there were 13 SSIs among the 7,019 screened patients (0.18%).

There were 1,897 positive patients for MRSA and *S. aureus* and 5,122 negative screens. Of the positive patients, 1,588 (23%) were *S. aureus* positive and 309 (4%) were MRSA positive. Repeat nasal screens were obtained from MRSA patients before surgery and revealed 78% eradication.

Seven SSIs occurred out of the 5,122 negative screens (0.14%) and included one MRSA and six *S. aureus*.

Out of the 1,588 *S. aureus* positive screens, there were three SSIs (0.19%). Out of the 309 MRSA positive screens there were three SSIs (0.97%). This was a significant difference between the two groups of colonized patients ($P = 0.05$).

As a comparison, a group of historical controls of inpatient surgeries from October 1, 2005 to July 16, 2006 was analyzed for the number of SSIs caused by *S. aureus* and MRSA. There were 24 *S. aureus* and MRSA SSIs out of 5,293 (0.45%). The eradication program resulted in a 60% reduction in MRSA and *S. aureus* SSIs when compared with the screened and treated group in 2007. The SSI reduction rate associated with MRSA and *S. aureus* screening was significant ($P = 0.009$).

Conclusions

SSIs following orthopedic surgery have been shown to result in an excess length of stay, increased cost,

and longer hospitalization.¹⁵ These are challenging adverse outcomes for the patient, surgeon, perioperative staff, and hospital administration.

We have successfully implemented an MRSA and *S. aureus* eradication program for all inpatient surgeries during the prescreening process. This program has led to early identification of patients with *S. aureus* and MRSA, allows us to administer a

decolonization protocol before surgery, and allows surgeons to adjust the surgical prophylaxis for MRSA.

Since implementation, we've documented a reduction in infections due to *S. aureus* and MRSA. A multidisciplinary approach with strong administrative support and consistent communication was vital to the implementation of the program. **OR**

Preadmission screening unit patient information (MRSA/*S. aureus*)

One important part of your preoperative evaluation is the identification of possible sources of infection. It's important to diagnose and treat any infections prior to surgery to reduce the risk of infection after surgery. This process involves some specific testing in preadmission screening.

- During your preadmission visit, a nasal culture will be obtained to check for staphylococcal bacteria. Staphylococcal bacteria can be present on the skin and in the nose of healthy individuals without symptoms (known as colonization).
- If your culture shows the presence of *Staphylococcus aureus* or MRSA, you will receive a phone call and be given a prescription for a nasal ointment mupirocin 2% (brand name is Bactroban nasal). Please follow the application instructions in the package insert and use the ointment for 5 days.
- In addition, we recommend you purchase, at a local pharmacy, a bottle of 4% chlorhexidine gluconate antimicrobial scrub (brand name is Hibiclens) and shower each day with it. Pay careful attention to wash under your arms and in the groin/buttock area since MRSA grows in moist areas.
- Mupirocin treatment must be completed at least 2 days before your surgery. A second culture prior to, or on the day of, surgery will be necessary if your culture was positive for MRSA.
- To prevent the spread of any infection, careful hand hygiene is encouraged with the use of soap and water or alcohol-based hand rubs. Notify your primary care provider's office if you are MRSA positive so they may institute appropriate infection prevention measures.

Source: New England Baptist Hospital.

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At New England Baptist Hospital, Boston, Mass., Maureen Spencer is the infection control manager and Diane Gulczynski is the senior vice president for Clinical Operations and the CNO.

