MRSA Infection Control:
Best Practices

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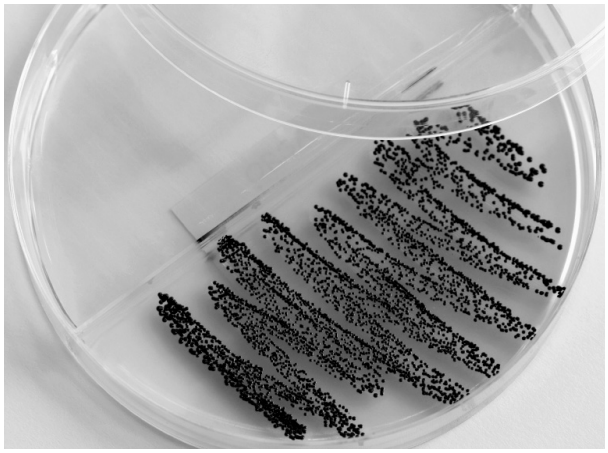
Until recently, most people had never heard of staphylococcus aureus. Now methicillin-resistant staphylococcus aureus (MRSA) seems to be a topic of discussion for most households, workplaces and water coolers. Although there was fear among the general population, healthcare organizations, public health officials and the medical community remained calm. These groups knew about MRSA—it has existed in the healthcare industry for nearly four decades. MRSA was first discovered in the 1960s and it became a focal point in the 1970s with increasing cases in the U.S.

Stories about MRSA have made headlines and news reports worldwide. While this attention raised the alert for infection control practice, it also raised concerns in communities and workplaces. Although MRSA has traditionally been seen as a hospital-associated infection, community-acquired MRSA strains have begun to appear in recent years, notably in the U.S.and Australia. The abbreviations CA-MRSA (community-associated MRSA) and HA-MRSA (hospital-associated MRSA) are now commonly seen in medical literature.

The news coverage of disinfection of schools raised fears as workers who conducted the decontamination used gowns and self-contained breathing apparatus, while students, teachers and others were not provided with PPE. The fear of contracting this so-called "superbug" was so acute that public health officials and healthcare providers received voluminous inquiries. A bank consulted the author to help design an infection control plan for its workplace. Who would have believed that the financial industry would need an infection control plan? But it is a reality and reflects what safety, health, security, environmental professionals and administrators should be thinking about with respect to emergency response planning.

Public officials and the medical community were concerned about media coverage that made it sound as though people would die from MRSA because no antibiotics were available to treat it. Public health officials and the medical community tried to calm fears by stressing the fact that getting an MRSA infection is not a death sentence. While MRSA is strongly resistant to methicillin and to some other modern antibiotics, it can be treated effectively with several other readily available antibiotics.



Public health officials and doctors also stressed that MRSA infections are serious. Good hygiene, particularly regular and thorough handwashing, offers the best protection. A skin infection that resembles a spider bite and gets worse should be seen by a doctor immediately because the infection could be MRSA, which requires prompt treatment with the proper antibiotics. The key to treating any disease and/or illness is early detection, early diagnosis, proper treatment and follow up.

A Teacher's Story

The breaking news stories had many people in a panic. My daughter, a kindergarden teacher, called me to discuss MRSA because parents had asked whether the "superbug" was present in their school. One of her students asked, "Teacher, are we all going to die?"

The MRSA story was emerging at the same time as the southern California wildfires. With these stories circulating throughout the media, the students could not compartmentalize these two issues as separate stories.

She calmed the children by differentiating the two issues. I reviewed the CDC MRSA fact sheet with her. Teachers in the school implemented strict hand washing practices for students. My daughter had the children monitor each other to ensure that they washed their hands after using the restroom and before eating.

How powerful is this lesson? Setting the infection control standard for self-preservation at a young age may sustain this practice throughout their lives. Kudos to my daughter and to her school for implementing an infection control practice.

Although some academic institutions have executed full-blown disinfection of classrooms, cafeterias, gyms and locker rooms, setting infection control practice establishes a continuum of excellent health hygiene practice that is essential in preventing not only MRSA, but other infections such as common colds, flu, foodborne illness and others.

Understanding MRSA

MRSA is not a new disease. The treatment for staphylococcus aureus with methicillin was established in the U.K. in 1959. The first case of MRSA was discovered in the U.K. in 1961. In the U.S., the multi-drug-resistant form of staphylococcus aureus was first diagnosed around 1975. Since then, it has become a growing concern for hospitals and other healthcare institutions such as nursing homes and long-term facilities. The germ has caused serious illnesses in healthcare organizations before, but the medical community says cases went unnoticed until this recent wave of fear. This is because all infectious diseases are not reportable to public health organizations. Likewise, MRSA is not a reportable disease to a central depository bank that tracks and trends diseases.

The Institute for Healthcare Improvement (IHI) estimates that nearly 15 million events of medical harm occur annually in the U.S., equaling a rate of 40,000 incidents per day. The healthcare industry is acutely aware of these incidents. Most healthcare professionals and physicians believe these incidents may be preventable. In response to the 1999 "To Err is Human" study, the birth of the "100,000 Lives Saved" campaign resulted

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in healthcare organizations competing with each other to be the best in reducing medical errors. Reducing infection rates by hand washing was adopted as a Joint Commission National Patient Safety Goals (NPSG) Standard. The organizations that partnered with the "100,000 Lives Campaign" monitored its data for patient care, treatment and outcome and their competence to deliver timely and accurate care and to improve outcome. This resulted in a reduction in medical errors, including reduction in healthcare-acquired infections.

IHI has expanded its campaign to include new initiatives. IHI has challenged healthcare institutions to enroll in a "Five Million Lives Saved Campaign." Of the six new targeted interventions in this campaign, reducing hospital-wide MRSA infections fits as a conduit to reduce not only healthcare-acquired infections, but also community-acquired MRSA.

CDC estimates that more than 126,000 hospitalized patients are infected with MRSA annually, leading to approximately 5,000 deaths. Hospitalized MRSA patients have an increased length of stay up to 9.1 days, with roughly $30,000 in additional costs per episode.

According to CDC, 70% of hospital-acquired infections are due to bacteria that are resistant to previously effective antibiotics, with MRSA as one of the fastest-growing and most virulent offenders. About 19% of patients with MRSA colonization at admission and 25% who acquire MRSA colonization during hospitalization actually become infected. Many studies have validated the fact that healthcare workers play a major role in spreading resistant strains from patient to patient via contaminated hands and clothing.

While several U.S. healthcare facilities have significantly reduced rates of MRSA transmission and associated infections through deliberate IHI planning, success in transferring best practices and replicating positive change throughout the continuum of hospital services and beyond has been slow and limited. It has been reported that over two decades, MRSA infections have been significantly reduced or even eradicated in several European healthcare systems. Their success was achieved through aggressive implementation of transmission-based control policies that included prevention, early detection and management via active surveillance cultures to identify colonized patients, with strict isolation precautions for those patients identified as colonized or infected with MRSA.

With such significant results, why cannot the U.S. achieve the same success? Initiatives are planned at the national level, but they are not mandated by any government agencies that will require every healthcare organization to implement mandatory best practice systems. IHI has challenged healthcare organizations to participate in 100,000 Lives and Five Million Lives Saved projects, but they are all volunteer partners.

What Is Five Million Lives?

The side bar below lists IHI's initiative to reduce medical errors (the campaign continues through Dec. 9, 2008). Participating healthcare organizations are required to develop programs to prevent, monitor and reduce incidents related to each initiative. These groups must collect data and submit them to a central depository agency that analyzes and collates the data. Report cards are generated for each participating organization to benchmark best practice guidelines. When reliably implemented, all 12 of these interventions can greatly reduce morbidity and mortality. The campaign also strongly encourages participants to pursue additional interventions to improve care.

Incentive-Based Model for Infection Control

The Center for Medicare Services (CMS) recently published its Condition of Participation standards and Pay for Performance Standards, which will become effective in 2008. The Pay for Performance Standards require that when a patient acquires an infection in a healthcare organization and/or has an adverse outcome because of medical error, the healthcare organization and the healthcare providers will not get reimbursed for treatment, care and services related to these factors.

This new requirement has raised awareness at the healthcare leadership level to develop systems to manage adverse outcomes and to control infection. Initiatives implemented include screening high-risk patients for MRSA on admission. High-risk patients may be patients transferred from nursing homes or long-term care environments, the homeless, patients with compromised immune systems, cancer patients, dialysis patients and others with chronic illnesses. Before admitting these patients, precautionary isolation placement has been used in certain cases.

IHI Initiative to Reduce Medical Errors

IHI Initiative for Five Million Lives

•**Prevent pressure ulcers** by reliably using science-based guidelines for prevention of this serious and common complication.

•**Reduce MRSA infection** through basic changes in infection control processes throughout the hospital.

•**Prevent harm from high-alert medications.** Focus on anticoagulants, sedatives, narcotics and insulin.

•**Reduce surgical complications** by reliably implementing changes in care recommended by the Surgical Care Improvement Project.

•**Deliver reliable, evidence-based care for congestive heart failure** to reduce readmission.

•**Get boards on board** by defining and spreading new and leveraged processes for hospital boards of directors so that they can become more effective in accelerating the improvement of care.

100,000 Lives Campaign

•**Deploy rapid-response teams** at the first sign of patient decline.

•**Deliver reliable, evidence-based care for acute myocardial infarction** to prevent deaths from heart attack.

•**Prevent adverse drug events** by implementing medication reconciliation.

•**Prevent central line infections** by implementing a series of interdependent, scientifically grounded steps called the central line bundle.

•**Prevent surgical site infections** by reliably delivering the correct perioperative antibiotics at the proper time.

•**Prevent ventilator-associated pneumonia** by implementing a series of interdependent, scientifically grounded steps, including the ventilator bundle.

IHI offers a variety of campaign and informational products about these initiatives. Learn more at www.ihi.org.

What Is MRSA?

Staphylococcus aureus is the most common cause of staph infections. Staphylococcus aureus lives on human skin and/or in the nose and can cause a range of illnesses from minor skin infections, such as pimples, impetigo, boils, cellulitis and abscesses to life-threatening diseases [e.g., pneumonia, meningitis, endocarditis, toxic shock syndrome (TSS) and septicemia].

In 1880, Sir Alexander Ogston, a surgeon in Aberdeen, Scotland, discovered S. aureus in pus from surgical abscesses. Each year, some 500,000 patients in U.S. hospitals contract a staphylococcal infection. S. aureus may occur as a commensal on human skin, particularly the scalp, armpits, penis and vagina; in about 25% of the population, it occurs in the nose and throat. Infrequently, it may be found in the colon and in urine.

The finding of S. aureus under these circumstances does not always indicate infection and, therefore, does not always require treatment. It can survive on domesticated animals such as dogs, cats and horses and can cause bacterial inflammatory infection and bumblefoot in chickens. It can survive for up to 6 hours on dry environmental surfaces. The efficacy of environment in the spread of S. aureus is currently being researched and debated.

S. aureus infections can be spread through contact with pus from an infected wound, skin-to-skin contact with an infected person and contact with objects such as towels, sheets, clothing or athletic equipment used by an infected person. If S. aureus is harbored in deep tissues and organs, infections can be severe. Prosthetic joints put a person at particular risk for septic arthritis, staphylococcal endocarditis (infection of the heart valves) and fulminant pneumonia.

Categories of Staphylococcus aureus

Depending on the strain, S. aureus is capable of secreting several toxins that are categorized into three groups. Many of these toxins are associated with specific diseases.

1) Pyrogenic toxin superantigens (PTSAgs) have superantigen activities that induce TSS. This group includes the toxin TSST-1, which causes TSS associated with tampon use. The staphylococcal enterotoxins, which cause a form of food poisoning, are included in this group.

2) Exfoliative toxins are implicated in staphylococcal scalded-skin syndrome, which occurs most commonly in infants and in young children. The protease activity of the exfoliative toxins causes peeling of the skin observed with staphylococcal scalded-skin syndrome.

3) Staphylococccal toxins that act on cell membranes include alpha-toxin, beta-toxin, delta-toxin and several bicomponent toxins. The bicomponent toxin Panton-Valentine leukocidin (PVL) is associated with severe necrotizing pneumonia in children. The genes encoding the components of PVL are encoded on a bacteriophage found in CA-MRSA strains.

Diagnosis

The key to treating a disease and/or illness is early detection, early diagnosis, proper treatment and follow-up with a doctor. It is essential to obtain a full history and to perform a physical, including checking skin for any infection. Depending on the type of infection present, an appropriate blood specimen is obtained accordingly and sent to the laboratory for definitive identification.

Prevelance, Morbidity & Moratlity

According to the Department of Health and Human Services (DHHS) and CDC, it has been difficult to quantify the degree of morbidity and mortality attributable to MRSA. A 2004 study showed that patients in the U.S. with S. aureus infection, on average, had three times the length of hospital stay (14.3 vs. 4.5 days); incurred three times the total cost ($48,824 vs $14,141); and experienced five times the risk of in-hospital death (11.2% vs 2.3%) than inpatients without this infection.

A CDC study published in the Oct. 17, 2007, issue of the *Journal of the American Medical Association* estimates that MRSA would have been responsible for 94,360 serious infections and associated with 18,650 hospital-stay-related deaths in the U.S. in 2005. These figures would make MRSA infection responsible for more deaths in the U.S. each year than AIDS.

The U.K. Office for National Statistics reported 1,629 MRSA-related deaths in England and Wales for the same year, indicating a MRSA-related mortality rate half of that in the U.S. for 2005, even though figures from the British source were high because of "improved levels of reporting, possibly brought about by the continued high public profile of the disease" during the 2005 U.K. general election.

Clinical Epidemiology

S. aureus most commonly colonizes the anterior nares (the nostrils), although the respiratory tract, opened wounds, intravenous catheters and the urinary tract are also potential infection sites. Healthy individuals may carry MRSA asymptomatically for periods ranging from a few weeks to many years. Patients with compromised immune systems are at a significantly greater risk of symptomatic secondary infection.

According to infection control experts, MRSA can be detected by swabbing the nostrils of patients and isolating the bacteria found inside. Combined with extra sanitary measures for those in contact with infected patients, screening patients admitted to hospitals has been found to be effective in minimizing the spread of MRSA at the Veterans Affairs Hospital in Pittsburgh, PA, and in hospitals in Denmark, Finland and the Netherlands.

Many people who are symptomatic have pus-filled boils and occasionally rashes. In the U.S., CDC issued guidelines on Oct. 19, 2006, citing the need for additional research but declined to recommend such screening.

It is estimated that 2 billion people carry some form of S. aureus worldwide. Of these, up to 53 million (2.7% of carriers) are thought to carry MRSA. In the U.S., 95 million carry S. aureus in their noses. Of these, 2.5 million (2.6% of carriers) carry MRSA.

In the U.S., outbreaks of MRSA colonization and infection through skin contact in locker rooms and gymnasiums, even among healthy populations, have been reported. MRSA has also been found in public school systems throughout the country. MRSA is also becoming a problem in pediatric settings, including hospital nurseries. A 2007 study found that 4.6% of patients in U.S. healthcare facilities were infected or colonized with MRSA.

MRSA causes as many as 20% of S. aureus infections in populations that use intravenous drugs.

Author's Story

When I entered nursing school in Rugby, U.K., and prior to the placement

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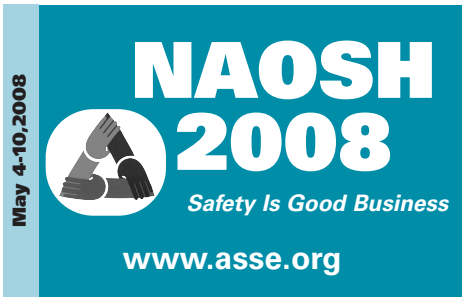
of student nurses as interns in patient care wards, we were all screened for S. aureus via nasal swabs. We needed to wait until the laboratory results were sent to the nursing school before we could work in patient care areas. One of the student nurses could not participate in the internship until she was examined by a physician. I do not know what her treatment was, but her internship was delayed until the next rotation. This is an example for prevention, and as I reflect on my experience as a nurse in various states in the U.S., why do we not implement screening of healthcare workers and patients to prevent the spread of S. aureus and MRSA?

Treatment

CA-MRSA often results in abscess formation that requires incision and drainage. Before the spread of MRSA into the community, abscesses were not considered contagious because it was assumed that infection required violation of skin integrity and the introduction of staphylococci from normal skin colonization. However, newly emerging CA-MRSA is transmissible (similar but with very important differences) from hospital-acquired MRSA. CA-MRSA is less likely than other forms of MRSA to cause cellulitis.

Both CA-MRSA and HA-MRSA are resistant to traditional anti-staphylococcal beta-lactam antibiotics, such as cephalexin. CA-MRSA has a greater spectrum of antimicrobial susceptibility, including to sulfa drugs, tetracyclines and clindamycin. HA-MRSA is resistant to these antibiotics and is often susceptible only to vancomycin. Newer drugs, such as linezolid, may be effective against both CA-MRSA and HA-MRSA.

It has also been reported that early infections—characterized by a boil that resembles a spider bite—may be arrested with an ichthammol salve, which drains the abcess. Care must be taken to keep the infected area clean with 70% alcohol swabs.



Prevention & Infection-Control Strategies

Seventy-percent alcohol has proven to be an effective topical sanitizer against MRSA. Quaternary ammonium can be used in conjunction with alcohol to increase the duration of the sanitizing action. The prevention of healthcare-acquired infections involves routine and terminal cleaning. Non-flammable Alcohol Vapor in Carbon Dioxide systems (NAV-CO2 systems) are effective, as they do not demage metals or plastics used in medical environments and do not contribute to antibacterial resistance.

In healthcare environments, MRSA can survive on surfaces and fabrics, including privacy curtains or garments worn by care providers. Complete surface sanitation is necessary to eliminate MRSA in areas where patients are recovering from invasive procedures. Testing patients for MRSA upon admission, isolating MRSA-positive patients, decolonization of MRSA-positive patients and terminal cleaning of patients' rooms and all other clinical areas they occupy is the current best practice protocol for nosocomial MRSA.

MRSA in the Workplace

At present, no guidelines exist for managing workers with MRSA infections even for healthcare organizations or for general workplaces. Unless directed by a healthcare provider, exclusion from work should be reserved for those with wound drainage that cannot be covered and contained with a clean, dry bandage and for those who cannot maintain good hygiene practices. Workers with active infections should be excluded from activities where skin-to-skin contact is likely until their infections are healed. Healthcare workers should follow CDC's guidelines for infection control among healthcare workers.

To prevent the spread of staph or MRSA in the workplace, employers should ensure the availability of adequate facilities and supplies that encourage workers to practice good hygiene, that routine housekeeping in the workplace is followed and that contaminated equipment and surfaces are cleaned with detergent-based cleaners or EPA-registered disinfectants. Seventy-percent alcohol is effective in decontaminating and disinfection for MRSA.

Definition

Terminal Cleaning: When patients are hospitalized and identified as having MRSA or infections that can be spread to other patients, best practices isolate these patients in rooms which are subjected to terminal cleaning when the patient is discharged. Methods vary but usually include the removal of all detachable objects in the room, cleaning of lighting and air duct surfaces in the ceiling and everything down to the floor. Items removed from the room are disinfected or sanitized before being returned to the room.

Conclusion

Over the past 5 years, infection control issues have emerged as a challenge for workplaces outside the healthcare industry. In 2004, we were faced with SARS. Then came the anthrax scares, avian flu and the potential for a flu pandemic. Such developments should cause us to question whether our employers have a plan in place to handle infectious diseases. Infection control is a coalesce issue. We must develop workplace infection control policies and provide tools to control infections in each workplace. We cannot wait to act until there is a news story about an emerging disease. ■

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