

MRSA

RESOURCE LINE

A QUARTERLY SUMMARY OF PEER-REVIEWED PUBLISHED LITERATURE

Higher absolute mortality risk with ICU acquisition of MRSA bacteremia

Thompson et al. Contribution of acquired methicillin-resistant Staphylococcus aureus bacteraemia to overall mortality in a general intensive care unit. J Hosp Infect 2008;70(3):223-7.

Acquisition of MRSA bacteremia in the intensive care unit (ICU) confers an additional absolute mortality risk of over 20%, according to an analysis carried out by UK investigators.

Dr. David S. Thompson, Medway Maritime Hospital, Kent, UK, and colleagues estimated the mortality risk attributable to MRSA bacteremia among admissions to the ICU as well as its contribution to overall hospital mortality. “For each patient with acquired MRSA bacteremia, five controls were selected from those remaining in ICU for five or more days who had no growth of MRSA from any site or growth of any pathogen from blood culture during their stay,” researchers noted. Only patients with an Acute Physiological and Chronic Health Evaluation II (APII) score <10 required controls with a length of stay greater than or equal to the interval between ICU admission and those who tested positive for MRSA.

A total of 1803 admissions remained in the ICU for five or more days, including 175 of 433 patients who were MRSA-positive on admission. Of the remaining 1628 whose admission screens were negative, 267 patients (16.4%) became positive for MRSA while in the ICU. A total of 77 patients out of all MRSA-positive patients developed MRSA bacteremia on or after the fifth day in the ICU. “Mortality among these 77 patients with MRSA bacteremia was 57.1%... compared

with 34.9% predicted from APII score and diagnosis, the mean interval between bacteremia and death [being] 17.8 days,” the authors reported.

In the remaining 1726 patients without MRSA bacteremia, mortality was 31.8%, very similar to that predicted from diagnosis, and APII score at 30.4%. This might suggest that acquisition of MRSA in the ICU not leading to bacteremia might not cause excess mortality, the authors pointed out, but it still carried a 30-fold increased risk of subsequent MRSA bacteremia, underscoring the importance of colonization or infection at other sites as a common precursor to bloodstream invasion. Given that approximately one-fifth of those who acquired MRSA in the ICU progressed to bacteremia, with a 22% additional risk of death, “Prevention of colonization of 25 long-staying patients should prevent five bacteremia [cases] and avoid one,” researchers concluded.

White coats frequently contaminated with *S. aureus*

Treacle et al. Bacterial contamination of health care workers' white coats. Am J Infect Control 2009;37:101-5.

Healthcare workers' white coats are frequently contaminated with *S. aureus* and many of the isolates are methicillin-resistant, according to a Baltimore-based study.

Dr. Amy Treacle, University of Maryland Medical Center, and Baltimore-based colleagues assessed the prevalence of *S. aureus*—including MRSA—as well as vancomycin-resistant enterococci (VRE) on healthcare workers' white coats, along with potential risk factors associated with contamination. The study was carried out at the University of Maryland Medical Center in Baltimore, an inner-city tertiary care hospital with 669 beds. As investigators pointed out, previous studies had shown that the facility has a colonization prevalence of 25% *S. aureus*, 7% MRSA, and 5.2% VRE among recently admitted non-ICU patients.

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Attendees of medical and surgical grand rounds at two separate time points were asked to participate in the study. Participants included 38 students, 64 residents, 12 fellows and 31 grand-round attendees. “A brief, self-administered questionnaire was used to collect demographic data and information on white coat laundering habits of the participants,” investigators noted, “and each participant was asked to culture his or her own white coat after a demonstration of how to do so was given by a member of the research team.”

Of the 149 participants who were wearing their white coats at study entry, 22.8% overall were contaminated with *S. aureus* and 4% were contaminated with MRSA. No coats were contaminated with VRE. The highest prevalence of coat contamination with *S. aureus* was seen in residents at 30%. “For MRSA, the prevalence was greatest in the attendees (13%),” investigators added. Some 94% of participants wearing white coats contaminated with *S. aureus* worked in an inpatient location, while half of participants wearing white coats colonized with MRSA had seen an inpatient earlier that day.

Interestingly, investigators could find no association between the time since the white coats had been laundered and contamination by *S. aureus*. Nevertheless, 17% of all participants had not washed their white coats in over 28 days and 64% had not done so in over a week. Of the 34 participants wearing white coats contaminated with *S. aureus*, 59% indicated they used personal laundry facilities rather than the hospital laundry while 67% of participants wearing white coats contaminated with MRSA used the hospital’s laundry facility.

Given that two-thirds of participants had not washed their coats in more than a week, “efforts could be directed at encouraging workers to launder their coats more frequently.” Moreover, protective gowns should be considered as an alternative to white coats, the authors concluded.

The four cornerstones of infection control in hospitals

Johnston L, Bryce E. *Hospital infection control strategies for vancomycin-resistant Enterococcus, methicillin-resistant Staphylococcus aureus and Clostridium difficile*. CMAJ 2009;180(6):627-31.

Key hospital interventions—hand hygiene, environmental cleaning, barrier precautions and screening—are the four cornerstones of infection control for the prevention of resistant organisms, methicillin-resistant *Staphylococcus aureus* (MRSA) among them.

Dr. Lynn Johnston, Capital District Health Authority, Halifax, Nova Scotia, and Dr. Elizabeth Bryce, Vancouver

General Hospital, British Columbia, reviewed current knowledge and best practices in these four areas as applied to the Canadian hospital setting. In the last 10 years, studies have shown that rates of MRSA and vancomycin-resistant enterococci (VRE) have fallen in hospitals that have introduced alcohol-based, waterless hand antiseptics. Although compliance with hand hygiene did improve with these measures, physicians appeared to be the least compliant with hand-hygiene opportunities, the authors noted.

Factors that may reduce adherence to good hand hygiene include poor accessibility to sinks, towels or hand rubs. Physician attitude can also undermine good hand hygiene, they added. Awareness of being observed, believing they are a role model for other colleagues and a positive attitude toward hand hygiene predict physicians’ adherence to this preventive measure, the authors indicated.

The need to maintain a clean and orderly healthcare environment is almost as important as hand hygiene for optimal infection control, the authors continued. Here, common sense dictates regular and thorough cleaning, “particularly for shared equipment such as commodes, toilets and lifting equipment or high-touch surfaces such as keyboards,” they added.

Whether different disinfectants clean more effectively than others continues to be debated. What is not debatable is avoiding cross-contamination of the environment via contaminated mop heads, cleaning solutions or cloths and keeping clutter to a minimum. Everyone should understand that there is a need to clean from the top down and use fresh solutions in the correct concentration for adequate amounts of time.

Gloves, gowns, masks and eye protection are all part of routine practice for infection prevention and control and their use is mandatory in given situations. Gowns, masks and eye protection should be used to protect personnel from splashes, sprays of blood, body fluids, secretions and excretions, as mentioned by the authors. Gloves should also be worn when entering a patient’s room and a gown should be worn for direct contact with a patient and, potentially, his or her contaminated environment. Masks in turn are required to protect mucous membranes from contamination.

It is also “imperative” that patients for whom precautions are necessary be identified in a timely manner. This may be done by screening patients believed to be at risk for colonization with MRSA and VRE and samples should be taken for specified sites.

“Experience and evidence have taught us that the core components of infection prevention and control are consistent application of proper hand-hygiene measures, maintenance of a clean environment, use of barriers where appropriate, and prompt identification of patients at high risk of colonization with transmissible organisms,” the authors concluded, “whether or not the pathogen is known.”

Colonization pressure for predetermining nosocomial transmission of MRSA

Williams et al. The role of colonization pressure in nosocomial transmission of methicillin-resistant Staphylococcus aureus. Am J Infect Control 2009;37:106-10.

Colonization pressure (CP) is an important independent predictor of MRSA transmission in a general medicine unit, according to Canadian investigators. An increase in CP above the median is a signal that routine infection practice and control strategies for MRSA management may be insufficient to stop nosocomial transmission.

Dr. Victoria Williams, Sunnybrook Health Sciences Centre, Toronto, Ontario, and colleagues determined the contribution that CP makes to the nosocomial transmission of MRSA in a general medicine unit. They also set out to establish a threshold CP above which additional infection prevention and control practice need to be implemented to prevent MRSA transmission and avoid an outbreak. “The study was conducted on a 36-bed general medicine unit located within a 1200-bed, tertiary care, university-affiliated teaching hospital,” investigators stated.

Standard infection practice and control precautions were taken for all patients, they added, including isolation of MRSA-colonized or infected patients in single rooms or cohorted with other cases if necessary. Contact precautions with gowns, gloves, and masks were used by staff providing care to all patients and worn upon entry to the room. Additionally, all patients admitted directly from a healthcare facility outside of Canada were cared for using contact precautions until screening results were available.

Based on risk criteria, MRSA screening was performed on admission to the unit between January 2005 and May 2005. “Patients were screened for MRSA within 48 hours of admission to the unit,” investigators noted, “and MRSA was determined to be nosocomially acquired on the medical unit if it was detected in a patient who had been on the unit for at least 48 hours or who had a previous admission to the unit in the past year without intervening contact with another healthcare facility.”

Between January 2005 and November 2006, patients with MRSA accounted for 12.7% of 918 admissions to the unit. The monthly CP percentage over the screening interval ranged from a low of 1.5% to a high of 20.6%, for a median value of 6.7%. “And in seven of the eight months in which nosocomial transmission of MRSA was observed, the preceding month’s CP was greater than the median of 6.7%,” researchers stated. Indeed, the relative risk of MRSA acquisition was 7.6% greater in the subsequent month when the preceding month’s CP was greater than 6.7%, they added.

“This study has demonstrated that when the CP rises above the median, reliance on routine infection practices

and control strategies for management of MRSA such as active surveillance cultures, hand hygiene, and use of barrier precautions for care of infected or colonized patients may not be sufficient,” they concluded. The solution, they proposed, is to implement enhanced practices normally associated with outbreak management when the number of patients with MRSA on the unit rises above the accepted level. These practices include the use of nursing cohorts to minimize staff movement between infected or colonized patients and those without MRSA; placement of all MRSA-infected patients in a designated section of the unit; dedicated equipment for the MRSA cohort; and enhanced cleaning measures.

MRSA control measures in neonatal ICU

Lepelletier et al. Eradication of methicillin-resistant Staphylococcus aureus in a neonatal intensive care unit: which measures for which success? Am J Infect Control 2009;37(3)195-200.

Widespread use of mupirocin by staff and patients did not control an outbreak of MRSA in a neonatal intensive care unit (ICU) in France and it is therefore not recommended as a strategy for MRSA control.

Dr. Didier Lepelletier, Nantes University Hospital, France, and multicentre colleagues described various measures initiated in an attempt to control a MRSA outbreak in their neonatal ICU occurring between April 2004 and August 2007. Infection control strategies initially implemented included barrier precautions for five neonates with MRSA at the time, and having infection control nurses directly observe healthcare workers’ hygiene practices and educate them about proper contact isolation techniques and the importance of hand hygiene. “Signs informing staff and patients’ families about the need for contact isolation and hand hygiene were placed in readily visible locations as well,” the authors added.

Despite these measures, there was ongoing transmission of MRSA in the unit and additional measures were implemented. These included an order for surveillance cultures to be done on all neonates on admission, and then once a week; decolonization with mupirocin in all neonates with known MRSA colonization; and cohorting of the neonates only.

Unfortunately, these additional measures again proved insufficient, at which point all hospitalized neonates and a large number of healthcare workers were given mupirocin ointment administered to the anterior nares twice daily for five days. Although this strategy was temporarily effective, a cluster of new cases emerged later in 2005, at which point nurses were separated into those who cared for neonates known to be colonized with MRSA; another for exposed neonates; and the

third for new admissions. Additional alcohol-based products were also made available near the neonatal ICU entrance area and in each of the neonates' rooms. Routine surveillance by nasal swab was stopped at the end of 2005, when the CP had decreased to zero.

"The adoption of this aggressive approach is not recommended in similar situations, but here it was implemented to achieve earlier control of the spread of MRSA in the neonatal ICU," the authors noted. They added that despite the outbreak, no deaths occurred among neonates with MRSA infection and no subsequent infections developed in neonates who were colonized with MRSA.

S. aureus MRSA, the cause of significant community-acquired pneumonia during the flu season

Kallen et al. Staphylococcus aureus community-acquired pneumonia during the 2006 to 2007 influenza seasons. Ann Emerg Med 2009;53:358-65.

During the influenza season, *S. aureus* causes significant amounts of community-acquired pneumonia (CAP), with most reported cases caused by MRSA, according to the largest *S. aureus* case series reported to date.

Dr. Alexander Kallen, National Center for Preparedness, Detection and Control of Infectious Diseases, Atlanta, Georgia, and multicentre colleagues solicited additional case reports over and above those reported to public health authorities in early 2007 so as to better define rates of *S. aureus* CAP during the 2006-2007 influenza season. "Cases were defined as primary CAP caused by *S. aureus* occurring between November 1, 2006, and April 30, 2007," researchers indicated. Case findings were conducted through an Emerging Infections Network survey and through contacts with state and local health departments.

As the authors noted, 51 cases of *S. aureus* CAP were reported during the study interval from a total of 19 states. "Forty-four patients had positive culture results for *S. aureus*, four patients had a positive *S. aureus* immunohistochemistry result at autopsy and pathology consistent

with necrotizing pneumonia, and three patients had both," researchers noted. Thirty-seven patients or 73% of the case series were infected with MRSA, they added, while only 20% were infected with methicillin-susceptible *S. aureus*. Susceptibility results were not available for the remaining 8%.

As the authors pointed out, patients in the case series were often otherwise healthy, young individuals; still, morbidity and mortality rates were high. Some 84% of all case patients required hospital admission (median length of stay, 9.5 days) while 79% of all hospitalized patients required admission to the intensive care unit (ICU) for part of their hospital stay. Information on outcomes was available for 47 patients; of these, 24 patients or over half died from their illness, at a median time to death of four days from symptom onset.

"This series reinforces that *S. aureus* CAP occurs in young, otherwise healthy people even during milder influenza seasons," the authors concluded, "[and that] MRSA accounts for the majority of reported cases in this series, raising concern that this organism might be playing a greater role in CAP than previously reported."

The authors added that only about half of patients with MRSA CAP were treated with either linezolid or vancomycin empirically—"suggesting that MRSA was not initially suspected... and that it should remain in the differential diagnosis of severe CAP occurring during the influenza season."

The CDC investigators have confirmed the substantial mortality risk that hospital-acquired MRSA infection carries. All potential sources of MRSA infection and *S. aureus* infection contribute to CAP often with or after pneumonia. Infection control measures have been well documented, leaving only to implement them more fully to contain the spread of MRSA. Equally important, vigilance must be directed towards the detection and treatment of CA-MRSA as community-acquired infection represents a serious source of contamination once patients require hospital admission for infections such as CAP. □

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