Infectious Diseases

Methicillin-resistant *Staphylococcus aureus* and Vancomycin-resistant Enterococci Among Older Adults

Focus on Long-term Care Facilities

Shelly A. McNeil, MD, FRCPC, Division of Infectious Diseases, Queen Elizabeth II Health Sciences Centre and Dalhousie University, Halifax, NS.

Lona Mody, MD, Divisions of Geriatric Medicine, Veterans Affairs Medical Center and The University of Michigan Medical School, Ann Arbor, MI, USA.

Suzanne Bradley, MD, Divisions of Geriatric Medicine and Infectious Diseases, Veterans Affairs Medical Center and The University of Michigan Medical School, Ann Arbor, MI, USA.

Methicillin-resistant Staphylococcus aureus (MRSA) and vancomycin-resistant enterococci (VRE) are important causes of morbidity and mortality in hospitals, and rates of MRSA and VRE in long-term care facilities (LTCF) have increased. However, the majority of residents in LTCF are asymptomatically colonized and the risk of infection with MRSA or VRE in this setting is low. Extension of stringent infection control practices required to control the spread of MRSA and VRE in acute care hospitals is not warranted in the LTCF setting. Patients known to be colonized with MRSA or VRE should not be refused admission to a LTCF, and, in the absence of symptomatic infection, measures beyond routine standard precautions are not necessary.

**Key words:** methicillin-resistant Staphylococcus aureus, vancomycin-resistant enterococci, long-term care, antimicrobial resistance, infection control.

Introduction

Interest in the epidemiology of infection and colonization with antimicrobial-resistant organisms (AROs), and the means of controlling these organisms in long-term care facilities (LTCFs), has grown in the last decade as the care of older adults increasingly moves out of acute care hospitals into LTCFs and the community. In Canada, as the baby-boomer generation ages there will be a corresponding increase in the LTCF population. Given the frequency of transfer of people between acute care hospitals and LTCFs, it is imperative that efforts to control the spread of AROs involve enhanced communication, education and vigilance in both settings. However, extending infection control practices necessary to control the spread of AROs in acute care hospitals to the LTCF setting is generally not feasible and poses undue hardship on both the staff and residents of a LTCF. In principle, the intensity of infection control practices must be determined based upon:

- the baseline prevalence of an organism in a facility;
- the likelihood of transmission of the organism in that setting;
- the clinical implications of transmission in the patient or resident population at risk, and;
- the resources available for infection control.

In this article, we endeavor to compare the epidemiology of methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant enterococci (VRE) in the acute care hospital with that in the long-term care setting in order to illuminate the reasons for their respective differences in infection control recommendations.

**MRSA and VRE in Acute Care Hospitals: Setting the Scene**

Since it was first described in Canada in 1981, MRSA has emerged as an important cause of morbidity and mortality in Canadian hospitals. Surveillance conducted by the Canadian Nosocomial Infection Surveillance Program (CNISP) has demonstrated an alarming increase in the number of patients colonized or infected with MRSA. Between 1995 and 1999, the proportion of clinical *S. aureus* isolates comprised by MRSA increased from 0.95/100 isolates to 5.97/100 isolates. Overall, *S. aureus* is the fourth most common cause of nosocomial bacteremia, pneumonia and soft tissue infections among hospitalized older adults. In the acute care setting, 30–60% of colonized patients will develop a nosocomial MRSA infection. Since older patients with *S. aureus* infection are more than twice as likely to die as younger patients with similar infections, MRSA has significant implications for hospitalized older adults.

Like MRSA, VRE have emerged as important nosocomial pathogens. In 1995, only two Canadian hospitals in two provinces had seen VRE in a patient, whereas today VRE infection or colonization has been documented in more than 110 hospitals in 11 provinces and territories. In 1999, CNISP data demonstrated that 0.9% of all Canadian enterococcal isolates were VRE. The majority of VRE cases are among seriously ill hospitalized patients, primarily in intensive care units.
following prolonged hospital stays, exposure to broad-spectrum antimicrobials and frequent use of invasive devices. Although mortality from VRE infection is high, infection with VRE does not appear to be an independent risk factor for mortality in hospitalized patients. It is postulated that increased mortality from VRE is due to lack of effective antimicrobial therapy and to the severity of underlying illness in populations at risk, rather than from increased virulence of VRE.

MRSA and VRE spread readily in acute care facilities where widespread antimicrobial use and concentrations of high-risk patients confer a survival benefit. Outbreaks of colonization and infection in this setting are common and molecular studies have shown that spread is predominantly due to clonal dissemination rather than development of resistance among susceptible strains. This suggests that the major means of transmission of these organisms is from patient-to-patient, and transfer of organisms on the unclean hands of health care workers has been shown to be the major means of transmission. This conclusion is supported by the fact that strict infection control policies, including targeted surveillance cultures, the use of stringent barrier precautions, and isolation or cohorting of colonized patients, have been shown to dramatically reduce the spread of MRSA and VRE in acute care hospitals.

**MRSA and VRE in Long-term Care Facilities**

**Prevalence of Colonization**

In order to understand the epidemiology of AROs in LTCFs, it is important to understand the distinction between colonization and infection. While residents with infection will have signs and symptoms of disease associated with a positive culture, residents who are colonized will harbour an ARO but will be asymptomatic. The majority of residents in LTCFs with MRSA or VRE are asymptptomatically colonized; the ratio of MRSA-colonized to MRSA-infected residents in an LTCF typically exceeds 20:1, and is probably even higher for VRE.

The extent and significance of MRSA and VRE in LTCFs in most areas of Canada is poorly defined. Given the increased prevalence of these organisms in acute care facilities and the frequency of exchange of patients between acute and LTCFs, it can be expected that the number of LTCFs caring for residents with asymptomatic colonization with MRSA or VRE will continue to increase. However, rates of colonization of residents with asymptomatic colonization with MRSA or VRE in referring acute care facilities, severity of illness in the patient population and institutional infection control practices, will continue to increase. However, rates of colonization will vary widely by geographic location, facility size, prevalence of MRSA and VRE in referring acute care facilities, severity of illness in the patient population and institutional infection control practices.

**Risk Factors for Colonization**

Not all residents of LTCFs are at equal risk for acquiring colonization with AROs. Several factors have been shown to increase a resident’s risk of acquiring MRSA (Table 1). These include several resident factors, such as impaired functional status, presence of invasive devices and areas of skin breakdown such as wounds or decubitus ulcers. As expected, residents who have had exposure to an acute care hospital or to broad-spectrum antibiotics also are at increased risk. Although risk factors for acquisition of VRE infection or colonization in the LTCF population are less well defined, they appear to include those identified for MRSA. Additionally, residents who acquire VRE are typically sicker with greater numbers of comorbidities, and have frequently had recent exposure to vancomycin or a third-generation cephalosporin.

Similar to acute care hospitals, the primary mode of transmission of AROs between residents in LTCFs is person-to-person on the unclean hands of health care workers. Therefore, institutional characteristics that influence the likelihood of health care worker compliance with recommended infection control practices also have been shown to influence a resident’s risk of colonization with AROs (Table 1). Increased levels of nursing staff, use of antimicrobial soap and increased access to handwashing sinks all protect residents of LTCFs from acquiring AROs.

**Transmission in Long-term Care Facilities**

Although it is clear that both MRSA and VRE spread rapidly in acute care hospitals without adherence to strict infection control policies, this does not appear to be the case in LTCFs. This may be due to the fact that the number of people with

---

**Table 1**

<table>
<thead>
<tr>
<th>Resident Characteristics</th>
<th>Institutional Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impaired functional status</td>
<td>Availability of handwashing sinks</td>
</tr>
<tr>
<td>Recent exposure to broad-spectrum antimicrobials</td>
<td>Staffing levels</td>
</tr>
<tr>
<td>Presence of invasive devices (e.g., urinary catheters, nasogastric feeding tubes, intravenous lines)</td>
<td>Use of antibacterial soap</td>
</tr>
<tr>
<td>Decubitus ulcers/wounds</td>
<td></td>
</tr>
<tr>
<td>Prior hospitalization</td>
<td></td>
</tr>
</tbody>
</table>
risk factors, particularly exposure to broad-spectrum antibiotics and presence of wounds or invasive devices, is substantially less in the LTCF setting. In a study examining the natural history of MRSA in a LTCF, although MRSA was endemic, 65% of residents never acquired MRSA during an average length of stay of three months, despite the use of only routine standard precautions for all residents.\(^4\) In fact, only 10% of colonized residents acquired MRSA in the LTCF (25% of residents already carried MRSA on admission from an acute care hospital). Furthermore, only 3% of the at-risk roommates of residents known to be MRSA-colonized acquired MRSA over the one-year study period.\(^4\) Residents who acquired MRSA from their roommates all had significant functional impairment and required at least moderate assistance with activities of daily living. Once colonized, 80% of LTCF residents carry the same strain of MRSA for three months to three years, contributing to the high prevalence of MRSA in some LTCFs.\(^4\)

The risk of spread of VRE in a LTCF also appears to be lower than in the acute care setting. In a LTCF in Michigan, U.S., where rates of rectal colonization in residents ranged from 9–19%, transmission of VRE between residents was not observed despite the fact that 33–47% of residents’ rooms were contaminated with VRE and up to 41% of health care workers had VRE isolated from their hands.\(^19\) Following introduction of VRE into a small LTCF in Pittsburgh, PA, prospective surveillance revealed transmission to only three residents over a six-month period.\(^20\) Residents who acquired VRE had significant comorbidity and most had wounds or devices and had received antimicrobials in the two weeks preceding their first positive VRE culture. Following transfer of VRE-colonized residents from an acute care hospital, prospective surveillance revealed no transmission of VRE in three LTCFs in Quebec over 234 days of observation.\(^16\)

**Implications of Transmission**

The clinical implications of transmission of AROs in the LTCF setting also differ significantly from the experience in acute care settings. Although up to 60% of hospitalized patients with MRSA colonization will develop a nosocomial infection, only 5–15% of colonized residents in a LTCF will develop infection, and the mortality from MRSA in the LTCF setting is very low.\(^4\) In fact, in six studies characterizing MRSA in LTCFs encompassing over 10 years and more than 20,000 LTCF admissions, only 104 infections and five infection-related deaths were reported.\(^21\) Almost 50% of the reported infections were skin and soft tissue infection, and few of these patients required transfer to a hospital for intravenous antibiotics.\(^21\) Approximately 20% of MRSA infections were urinary tract infections and these were seen primarily in residents with urinary catheters and, thus, may be preventable. Similarly, 20% of reported MRSA infections were pneumonias, most of which were complications of influenza in residents without vaccination.\(^21\) Comorbidity and overall severity of ill-

---

### Table 2

**Routine Measures for the Control of MRSA and VRE in Long-term Care Facilities**

<table>
<thead>
<tr>
<th>Recommended</th>
<th>Not Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Room Placement</strong></td>
<td>Refusal of admission of colonized residents</td>
</tr>
<tr>
<td>– single room not required(^\dagger)</td>
<td></td>
</tr>
<tr>
<td>– do not place colonized residents in room with residents at high risk (wounds, invasive devices, etc.)</td>
<td></td>
</tr>
<tr>
<td><strong>Routine Practices</strong> (standard precautions)</td>
<td>Requirement of screening or decolonization prior to admission</td>
</tr>
<tr>
<td>– handwashing before and after all contact with residents or their environment</td>
<td></td>
</tr>
<tr>
<td>– gloves if contact with body fluids</td>
<td></td>
</tr>
<tr>
<td>– gowns if soiling of clothing likely</td>
<td></td>
</tr>
<tr>
<td><strong>Housekeeping</strong></td>
<td>Attempt decolonization of colonized residents or staff in absence of outbreak of infection</td>
</tr>
<tr>
<td>– routine housekeeping practices sufficient for MRSA</td>
<td></td>
</tr>
<tr>
<td>– daily cleaning of all contact surfaces recommended for VRE</td>
<td></td>
</tr>
<tr>
<td><strong>Patient Care Equipment</strong></td>
<td>Routine surveillance swabs for identification of asymptomatic colonization</td>
</tr>
<tr>
<td>– use dedicated equipment for colonized residents</td>
<td></td>
</tr>
<tr>
<td>– careful disinfection of shared equipment between residents</td>
<td></td>
</tr>
<tr>
<td><strong>Surveillance</strong></td>
<td>Restriction of activities of colonized residents</td>
</tr>
<tr>
<td>– regular review of clinical microbiology data for MRSA or VRE</td>
<td></td>
</tr>
<tr>
<td>– maintain line-listing of known colonized residents</td>
<td></td>
</tr>
<tr>
<td>– establish baseline infection rates and infection thresholds which would prompt more aggressive infection control measures</td>
<td></td>
</tr>
</tbody>
</table>

\(^\dagger\) When possible, placement in a single room is preferred for residents colonized with VRE; cohorting or placement with a low-risk roommate is acceptable if no private room is available.

---

\(^4\) In absence of an outbreak of infection.
ness are important predictors of MRSA infection among those who are colonized. Residents with diabetes mellitus or peripheral vascular disease, or those requiring invasive procedures such as hemodialysis or surgery, are most likely to go on to develop infection.

Rates of infection with VRE, even in areas of prevalent colonization, are very low. In fact, no infections due to VRE are seen in most studies examining the epidemiology of VRE in LTCFs. When infections do occur, urinary tract infections predominate and mortality is exceedingly low. Although VRE may be isolated from wounds, particularly from decubitus ulcers, their role in infection in this setting is unclear.

Infection Control in Long-term Care Facilities: What Is Reasonable?

Recognizing the differences between acute and LTCFs in patient population, goals of care, risk of transmission, implications of transmission and resources available, The Society for Healthcare Epidemiology of America and the Association for Practitioners in Infection Control and Epidemiology (APIC) have published recommendations for the control of MRSA and VRE in the long-term care setting (Table 2). These guidelines are in agreement on several important recommendations. Most importantly, residents known to be colonized with MRSA or VRE can be safely cared for in the long-term care setting and should not be denied admission. Decolonization therapy should not be required prior to admission to a LTCF. Residents colonized with MRSA or VRE should be permitted to participate normally in group activities and their movement within the LTCF should not be restricted, unless they are likely to be shedding organisms excessively (e.g., colonized wounds that cannot be contained by dressings, tracheostomy with inability to contain secretions, incontinent residents with urinary or fecal colonization).

Routine practices (or standard precautions) (Table 2) should be used in the care of all LTCF residents; no additional measures are required for colonized residents in the absence of symptomatic infection. Furthermore, routine surveillance culturing to detect colonization is not warranted in the LTCF. Routine surveillance for MRSA and VRE should be performed in the LTCF through regular review of all microbiological data obtained in association with patient care; a list-keeping of all known colonized residents should be maintained and a threshold infection rate which would prompt additional inter-vention should be established. There must be open communication between acute and long-term care facilities when patients are being transferred to allow appropriate control measures to be implemented.

It is important to note that in the event of an outbreak of infection with MRSA or VRE, additional infection control measures, including strict isolation of colonized or infected residents and decolonization of residents or staff, may be necessary. Identification of infections above baseline rates warrants prompt consultation with public health authorities.

The Take-home Message

Although rates of colonization with MRSA and VRE are increasing and can be expected to increase as these organisms become more prevalent in acute care hospitals, LTCFs differ from acute care facilities in several important ways. In the acute care setting, rapid spread and frequent infections mandate the use of aggressive infection control measures, including surveillance cultures, strict isolation or cohorting of colonized or infected patients and the use of stringent contact precautions. However, implementing similar strategies in LTCFs would have significant impact on the quality of life of residents, impair the rehabilitation process and consume considerable limited resources. Moreover, benefit in LTCFs from the implementation of strategies shown to be effective in controlling these organisms in acute care facilities is not supported by available epidemiological data. Patients colonized with MRSA or VRE can be safely cared for in LTCFs with careful adherence to routine practices (or standard precautions), and should not be denied admission to a LTCF.

References


It’s time to listen.

Attend the 2003 Heart & Stroke Clinical Update.
Hear about leading-edge findings and recommendations on important topics such as Diabetes, Encouraging Behaviour Change in Patients, Congestive Heart Failure and Cerebrovascular Disease.
And take this knowledge back to your practice.

To register online or for more information, visit our Web site at: www.heartandstroke.ca/conference

Or call:
In Toronto: 416-650-7835
Toll-free: 1-877-3UPDATE (987-3283)

Metro Toronto Convention Centre
December 11, 12 and 13, 2003

www.geriatricsandaging.ca