Methicillin-resistant *Staphylococcus aureus* in First Nations communities in Canada

Canadian Paediatric Society

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First reported in Canada in 1981 by Low et al (1), methicillin-resistant *Staphylococcus aureus* (MRSA) has emerged as an important hospital-based bacterial pathogen in Canada (2,3). Hospital surveillance data from nine Canadian provinces have been collected since 1995 (4). Reported from 1995 to 1999, this surveillance documents a steady increase in the incidence of infections caused by MRSA and MRSA colonization. Regional variations in MRSA prevalence are observed. By 1999, just over 5% of *S aureus* strains isolated from hospitalized patients in Canada were methicillin-resistant (4). The corresponding rate for isolates from American hospitals was 35% (5,6). Prevention of transmission of MRSA in hospitals has focused on infection-control practices and surveillance (6-8).

In 1999, the Canadian Paediatric Society published the statement "Control of methicillin-resistant *Staphylococcus aureus* in Canadian paediatric institutions is still a worthwhile goal" (8) (Table 1). The present statement describes the development of community-acquired MRSA infections in First Nations communities in Canada.

TABLE 1
Summary of the 1999 Canadian Paediatric Society statement on methicillin-resistant *Staphylococcus aureus* (MRSA) in paediatric institutions

- Gives standards for MRSA laboratory testing.
- Identifies methods of MRSA transmission in hospitals.
- Reports a medium duration of carriage of 40 months.
- Reports that the virulence of MRSA, as evidenced by morbidity and mortality, appears equal to methicillin-sensitive strains.
- States that MRSA carriage eradication with multiple agents is 80% to 100% successful in the short term.
- Suggests that treatment of carriage be limited to health care workers epidemiologically linked to hospital outbreaks, patients in long-term care facilities where infection control measures such as isolation were not feasible, and outbreak control in some circumstances.
- Gives hospital infection-control measures aimed at preventing spread within paediatric health care facilities, including surveillance, isolation, barrier precautions, handwashing and staff education.

Data from reference 8

COMMUNITY-ACQUIRED MRSA

MRSA emerged as a community-acquired pathogen in children in the 1990s. Paediatric hospital series from Chicago, Illinois (9), and Corpus Christi, Texas (10), identified an increasing incidence of community-acquired MRSA. Four fatal paediatric cases attributed to community-acquired MRSA were reported in Minnesota and North Dakota between 1997 and 1999 (11). Community-acquired MRSA was defined as a culture-positive specimen collected in a community setting or collected within 48 h to 72 h of hospital admission (12).

There have been several reports (13-16) of asymptomatic paediatric MRSA carriage, with published rates in urban Canadian and American communities of 0.2% to 2.2%. Carriage rates for *S aureus*, sensitivity not specified, have been identified as 30% to 50% for intermittent carriage and 10% to 20% for persistent carriage (7,8). Nares, perineum and skin are principal sites of paediatric colonization (8). A meta-analysis (17) of 10 community surveys of MRSA carriage pooled over 8000 patients on three continents and found an MRSA prevalence of 1.3%. Risk factors for MRSA carriage included hospitalization or recent outpatient attendance, antibiotic use, chronic illness, intravenous drug abuse and close contact with an individual with any of these risk factors.

MRSA IN FIRST NATIONS COMMUNITIES IN CANADA

One of the earliest reports of community carriage of MRSA was in a First Nations community in Alberta (18). Twenty-one of 422 (4.9%) consecutive patients admitted to hospital from that community between 1987 and 1989 were identified as carrying MRSA. Prior hospital care was the only identifying risk factor. A retrospective survey of five teaching hospitals in the Canadian Prairies between 1990 and 1992 identified First Nations patients as accounting for 62% of those who were MRSA-positive on hospital admission (19).

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In 1999, a resident in a long-term care facility in northeastern Saskatchewan who had been recently hospitalized was found to have MRSA. By 2002, 180 cases and carriers were reported in the region, with 76% of these community-acquired infections occurring in three First Nations and Métis communities. Children younger than 10 years of age accounted for 39% of the cases and carriers (20). In six First Nations and Métis communities in northern Saskatchewan, community-acquired MRSA was endemic between 2000 and 2002. Approximately 50% of the cases were among children 14 years of age or younger. Most cases had skin infections (J Irvine, personal communication).

Community-acquired MRSA has also been identified as the cause of infection in American Indian communities. Forty-six of 62 (74%) MRSA infections were classified as community-acquired at an Indian Health Service outpatient clinic in a rural midwestern community (21). Community-acquired MRSA has been identified among Australian Aboriginals from remote communities in the Northern Territory (22). In their paper, Maguire et al (22) called for a community-based control program to improve housing and hygiene, control skin sepsis and make appropriate use of antibiotics.

Crowding, lack of quality running water and heavy antibiotic use may be additional reasons for the MRSA observed in First Nations communities in Canada.

ANTIBIOTIC SENSITIVITY

The majority of strains of *S aureus* produce beta-lactamase, capable of inactivating beta-lactam antibiotics including penicillin and ampicillin. MRSA has further adapted the mechanism for cell wall assembly, with modified receptors for binding penicillin. Bacteria with these modified receptors are resistant to all penicillins and cephalosporins (7). Current Canadian hospital data (23) on the reported resistance and sensitivity pattern of MRSA to antibiotics are as follows:

- 93% resistant to erythromycin and clindamycin;
- 87% resistant to ciprofloxacin;
- 46% resistant to trimethoprim/sulfamethoxazole;
- 3% resistant to fusidic acid; and
- 2% resistant to mupirocin.

No Canadian isolates of MRSA have been identified as having reduced sensitivity to vancomycin (23,24). Strains of MRSA with reduced sensitivity to vancomycin have been identified in Japan, the United States and Europe (24,25).

Community-acquired strains of MRSA are less likely than hospital-acquired MRSA strains to be resistant to nonbeta-lactam antibiotics (9,10,12,15,26,27). Clindamycin and trimethoprim/sulfamethoxazole sensitivity has been retained for over 90% of community-acquired MRSA isolates from patients in American centres (28,29). Some Canadian clones of MRSA are reported to have developed mupirocin resistance (30).

RECOMMENDATIONS

Awareness

- Practitioners must be aware of the emergence of community-acquired MRSA as a cause of infection in Canada, particularly in First Nations communities.

Prevention

- Use antibiotics appropriately to reduce or minimize antibiotic resistance (31).
- Optimize the water supply in First Nations communities.
- Provide instruction, beginning in early childhood, regarding the method and value of frequent handwashing.

Infection control

- Emphasize the importance of hand hygiene before and after each completed patient contact by all staff.
- Maintain available 'waterless' handwashing supplies in locations where sinks and running water are not readily available.

Treatment

- Incision and drainage, with collection of specimens for antimicrobial culture (when possible) before treating potential *S aureus* infection.
- Antibiotic selection for potential *S aureus* infection (28,29,32):
  - mild, localized cutaneous infections: washing with antibacterial soap and water.
  - superficial, localized infections: consider topical treatment with fusidic acid in addition to washing with soap and water.
  - mild to moderate, more generalized infections – one of the following:
    - standard therapy: start with cloxacillin, first-generation cephalosporin or amoxicillin/clavulanic acid
    - in MRSA community: trimethoprim/sulfamethoxazole or clindamycin (note that trimethoprim/sulfamethoxazole does not provide coverage for Group A beta-hemolytic streptococcus)
  - severe or life-threatening staphylococcal infection: initial coverage should include vancomycin pending culture and sensitivity.
- In communities in which MRSA is known to occur, general efforts to determine carriage rates among asymptomatic household contacts are not recommended (33).

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