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Community-associated methicillin-resistant *Staphylococcus aureus* skin and soft tissue infections in Hong Kong

Key Message

Community-associated methicillin-resistant *Staphylococcus aureus* is an emerging cause of skin and soft tissue infections in Hong Kong, especially among certain ethnic minorities.

Introduction

Community-associated methicillin-resistant *Staphylococcus aureus* (MRSA) has the ability to cause serious and even fatal infections (necrotising pneumonia, meningitis, pyomyositis, and severe sepsis) in healthy individuals, in addition to the more common skin and soft tissue infections (SSTIs). With few exceptions, community-associated MRSA strains possess the Panton-Valentine leukocidin (PVL) genes and one of the novel *Staphylococcus* cassette chromosome mec (SCCmec) elements (types IV and V). These isolates have been described worldwide, including outbreaks involving 'closed populations', for example, among contact sports athletes, jail inmates, military recruits, and some indigenous communities.[1] In 11 major United States cities, community-associated MRSA strains related to the USA300 clone have emerged as the most common cause of SSTI among patients presenting to emergency departments. Moreover, such infections may be more likely to spread to household members and recur than methicillin-sensitive *S aureus* (MSSA) infections.

Community-associated MRSA strains are also emerging in Asia, but their prevalence in SSTIs remains undefined. In Hong Kong, such infections may be disproportionately common among individuals from foreign families.[2,3] Pulsed-field gel electrophoresis (PFGE) and multilocus sequencing typing showed that most isolates were attributed to the ST30-HKU100 and ST59-HKU200 clones.

Aims and objectives

To determine the burden of PVL-positive community-associated MRSA among patients presenting to the emergency department with purulent SSTI and assess potential associated risk factors.

Methods

An enhanced surveillance for community-acquired MRSA was conducted over a 4-month period from November 2006 to February 2007. It involved the emergency departments in six regional hospitals estimated to provide service to half of the 6.6-million inhabitants in Hong Kong. Wound swabs were obtained for culture from all patients who present with purulent SSTIs of less than 7 days duration.

All MRSA and a subset of MSSA were further characterised at the laboratory in the Centre of Infection, University of Hong Kong. The SCCmec types and presence of PVL genes were determined as described.[2,3] A standardised questionnaire was used to collect patient information on demographics, history, and underlying medical conditions. Community-associated MRSA infection was defined by outpatient presentation and the absence of health care exposures (including hospitalisation, surgery, or dialysis within the past 12 months), any indwelling catheter or percutaneous device (eg urinary catheter) at the time of presentation, and residence in a nursing home.

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Table. Epidemiologic and microbiologic characteristics of 13 Panton-Valentine leukocidin (PVL) positive community-associated methicillin-resistant *Staphylococcus aureus* infections

Strain	Patient sex/ age (years)	Ethnicity	*Staphylococcus* cassette chromosome mec	*agr*	Resistance pattern*	spa type	Pulsed-field gel electrophoresis†
AE-052	M/43	Chinese	IV	3	None	t019	HKU100
AE-090	M/41	Chinese	IV	3	None	t019	HKU100
AE-255	F/8	Chinese	IV	-	None	t019	HKU100
AE-069	F/42	Filipino	IV	3	None	t019	HKU100
AE-086	F/32	Filipino	IV	3	None	t019	HKU100
AE-088	F/34	Filipino	IV	3	None	t019	HKU100
AE-156	M/27	Filipino	IV	3	None	t019	HKU100
AE-124	M/24	Chinese	IV	4	E, CC	t437	HKU200
AE-136	M/18	Chinese	IV	4	Te	t437	HKU200
AE-260	M/50	Chinese	V	4	Te	t437	HKU200
AE-281	M/25	Chinese	V	4	E, CC, Ch, Te	t437	HKU200
AE-297	M/48	Chinese	V	4	E, CC	t437	HKU200
AE-298	F/28	Sri Lankan	IV	1	None	t008	HKU400‡

* E denotes erythromycin, CC clindamycin, Te fusidic acid, gentamicin, rifampin, and tetracycline, and Ch Chloramphenicol
† Pulsed-field gel electrophoresis and spa type identical to the singleton isolate (strain 7295) in our study[3]
‡ Polymerase chain reaction negative on repeat testing

Results

A total of 298 patients aged 2 to 97 (median, 41) years with purulent SSTIs were recruited. About 66% of patients were males, and 3% were children aged 12 years or less. About 92% of the patients were Chinese. The other ethnic groups were Filipino (n=10), Pakistani (n=5), Indian (n=3), Nepalese (n=3), Caucasian (n=1), Sri Lankan (n=1), and mixed (n=1).

*Staphylococcus aureu*s was isolated from 126 (42%) patients, including MSSA from 105 of them, MRSA from 19, and borderline oxacillin-resistant *S aureus* from two. Moreover, MRSA was isolated from 5% (13/241) of abscesses, 13% (5/40) of infected wounds, and 17% (1/6) of purulent discharges associated with cellulitis.

The PVL gene was detected in 13 of the 19 MRSA isolates, including 12 isolates from abscesses and one from cellulitis. Among the six patients with PVL-negative MRSA, four had recognised risk factors for health care–associated infection, including a history of hospitalisation in three, indwelling medical devices in two, and one each for nursing home residence and intravenous drug abuse. None were health care workers. All patients with PVL-positive MRSA represented community-associated infection. In univariate analysis, Filipino ethnicity was significantly more likely than Chinese to be infected by PVL-positive community-associated MRSA (odds ratio, 14.8; 95% confidence interval, 3.3-70.0; P<0.001). All other clinical and epidemiologic features were not predictive of PVL-positive community-associated MRSA. In addition, an analysis was conducted for the patient subset consisting of healthy young adults aged between 18 and 49 years who were Chinese or Filipinos and who met the criteria for community-associated infection. This subset comprised 83 Chinese and 9 Filipinos. The result confirmed Filipino ethnicity as a significantly risk factor (odds ratio, 10.3; 95% confidence interval, 2.2-48.6; P=0.003).

Epidemiologic and microbiologic features for the 13 PVL-positive community-associated MRSA are summarised in the Table. Four patients (AE-69, AE-86, AE-88, and AE-298) were foreign domestic workers, and in two, the symptoms occurred within a short period of their arrival for employment (3 weeks for AE-86 and 3 months for AE-69). The other patients had diverse occupations. The PFGE types for the 13 PVL-positive isolates were characteristic of community-associated MRSA (seven were HKU100, five were HKU200, and one was HKU400). All PVL-posit–associated MRSA had SCCmec type IV or V. Conversely, PVL-negative isolates had PFGE patterns and spa types (t1081 or t037), which were typical of health care–associated MRSA in Hong Kong. Their SCCmec types were III, IV, or V.

Discussion

Community-associated MRSA is rapidly emerging in Hong Kong. Among patients with purulent SSTIs, 10% (13/125) of all *S aureus* isolates and 5% (12/241) of cutaneous abscess were attributed to PVL-positive community-associated MRSA. The figures represent a remarkable increase since the first detection of PVL-positive community-associated MRSA isolates in Hong Kong 3 years ago.

Four (31%) of the 13 PVL-positive MRSA isolates were recovered from Filipinos. This ethnic group only comprises 2% of the Hong Kong population. Filipino ethnicity was identified as a risk factor for PVL-positive MRSA infection. Because most Filipinos are domestic workers in Hong Kong, the observed association could possibly reflect poverty and inadequate access to medical services. Both PFGE and spa type confirms that the MRSA isolates among the Filipino patients were clonally related. Because the cases had no apparent epidemiologic linkage, the reason for the clonal spread is unclear. As some of these cases were

work migrants, country-to-country transmission involving MRSA carriage is a possibility.

For the treatment of purulent SSTIs, the importance of incision and drainage has been clearly established. On the contrary, the impact of an initial active antimicrobial therapy on clinical outcomes was mixed. Although earlier studies found clinical resolution for most community-associated MRSA SSTIs after drainage, regardless of whether the patient received an appropriate antimicrobial agent, one recent report clearly demonstrates a small but significant number of treatment failures after certain active antimicrobial therapies.[4]

Conclusions

Community-associated MRSA is an increasingly important public health issue in Hong Kong. Accordingly, its notification has been made mandatory since January 2007. Active contact tracing and MRSA decolonisation with daily nasal mupirocin and chlorhexidine detergent for showers for 5 days are offered to all carriers. Future studies should address the effectiveness of this approach, and home sanitation and hand hygiene as control measures. The over-representation of Filipinos among PVL-positive community-associated MRSA infections deserves further investigation with a larger sample.

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