Epidemiology of CA-MRSA and the HKSAR’s Public Health Response

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Surveillance Mechanism and Data Source

Community-associated methicillin resistant Staphylococcus aureus (CA-MRSA) was first reported in Hong Kong in 2004. Since 2004, a monitoring group was formed, under the coordination of the Department of Health’s Centre for Health Protection (CHP) and the Centre of Infection of the University of Hong Kong, to conduct laboratory-based surveillance for CA-MRSA. The participating microbiology network comprised 17 sites, including five public hospital laboratories, six private hospital laboratories, and six private community laboratories. This network was estimated to cover half of the Hong Kong population. The laboratories screened clinical information in laboratory request forms and identified MRSA isolates with a non-multiresistant antibiogram. Suspected CA-MRSA isolates were referred to the Centre of Infection for further molecular characterisation.

Since January 2005, all hospital microbiologists in Hong Kong were encouraged to report CA-MRSA cases to this monitoring system. The CHP also received voluntary reports of CA-MRSA infection from public hospitals and general practitioners. In late 2006, five Accidents and Emergency Departments (AED) in public hospitals began a programme that routinely collected wound swabs from patients with purulent skin and soft tissue infection for culture of MRSA. Since January 2007, CA-MRSA infection was listed as a notifiable infectious disease in order to strengthen surveillance and implement public health measures more effectively.

The surveillance case definition of CA-MRSA is shown in Box 1. CA-MRSA infection is diagnosed by laboratory via demonstrating presence of Panton-Valentine leucocidin (PVL) gene and positive Staphylococcal cassette chromosome mec (SCCmec) type IV or V, usually in patients without significant exposure to health care facilities within the past one year.

Local Epidemiology

Figure 1 shows the monthly reported cases of CA-MRSA during the period January 1, 2005 - June 30, 2007. The average monthly incidence was higher after than before January 2007, when statutory notification came into effect (11.7 vs. 1.6 cases, p<0.01). Due to limited data, no conclusion on seasonal pattern can be drawn. During January 1 - June 30, 2007, the CHP recorded 70 cases of CA-MRSA infection. This corresponds to an annualised population incidence rate of 2.0 per 100,000 per year (2.6, 2.1, and 0.9 per 100,000 among age groups <18 years, 18-64 years, and >65 years respectively). Approximately 30% of notifications came from the private sector. Cases were more or less evenly distributed geographically (Hong Kong Island 26%, Kowloon 30%, New Territories East 19%, New Territories West 26%).

No statistically significant sex predilection was observed among the 70 case-patients (38 males and 32 females). The majority (54/70, or 77%) were adults aged 18-64 years, while 12 (17%) were children under 18. The median age was 34.5 years. The youngest patient was a 3-month-old girl, while the eldest case was 102 years old. In terms of ethnicity, Chinese accounted for 61% (43/70), Filipinos 23% (16/70), and other ethnic groups 16% (11/70). No occupation pattern was seen among ethnic Chinese cases. 37% (10/27) of non-Chinese cases were domestic helpers.

Of the 70 cases, 66 were sporadic, the remaining four came from two family clusters each involving two family members. The majority of cases were healthy; only four patients had underlying medical conditions (e.g., diabetes mellitus, chronic eczema on long term steroid, obstructive sleep apnoea, chronic hepatitis B infection). During one year before illness onset, 16% (11/70) of cases reported antibiotic usage, and 14% (10/70) had engaged in contact sports. Two (3%) had history of contact with known CA-MRSA patients. There was one (1.4%) intravenous drug user.

Almost all (68/70, or 97%) CA-MRSA case-patients presented with skin and soft tissue infections such as skin abscesses, boils, carbuncles, or furuncles, of which 50% (35/70) were found in the buttock, perineum, or lower limbs. Four (6%) had skin and soft tissue infections at multiple sites. Systemic symptoms such as fever, chills and rigor were present in 33% of the cases. Two (3%) patients suffered more serious non-cutaneous complications. A 9-year-old boy had pneumonia caused by CA-MRSA, and a 52-year-old female developed septicaemia following cellulitis of left ankle. None of the 70 CA-MRSA cases was fatal.

Concerning clinical management, 45 (64%) cases were hospitalised for CA-MRSA infection, 21 (30%) were managed as outpatients, and the remaining four (6%) were admitted for other reasons. Sixty-two (88%)....
patients received antibiotics as empirical treatment, and 52 (74%) required surgical management (e.g., aspiration of abscess, incision and drainage, surgical debridement, masurpialisation, flap surgery).

Molecular analysis of the CA-MRSA isolates showed that 71% (50/70) were of SCCmec type IV and the remaining 29% (20/70) were type V. SCCmec type IV was predominant among non-Chinese cases (26/27, or 96%), while SCCmec type V was more commonly found among Chinese cases (19/43, or 44%) compared with non-Chinese cases (1/27, or 4%).

Contact tracing in connection to the 70 CA-MRSA case-patients identified about 320 household and other close contacts. Some 400 nasal, skin and wound swabs were taken from them and cultured for CA-MRSA. Fourteen (5%) asymptomatic close contacts tested positive for the organism.

Public Health Measures

For every notified case of CA-MRSA, the CHP conducts a series of public health measures to investigate and contain the spread of the infection. The index patient is interviewed for detailed clinical and exposure history, with particular reference to possible risk behaviours and factors. Wound swabs are taken from the patient for bacteriological investigations. Household and close contacts (i.e., defined as having frequent body contact with case-patients) are identified for each case-patient. Close contacts are screened for MRSA colonisation status.

Empirical decolonisation therapy is given to both cases and close contacts. Decolonisation regimen consists of application of 2% mupirocin ointment (Bactroban) twice daily to both nostrils, and a daily wash or bath using 4% chlorhexidine gluconate (Hibiscrub) for five consecutive days. No systemic antimicrobial therapy is given. Furthermore, education on personal and home hygiene measures is also delivered by public health nurses.

At the community level, public education campaigns are conducted focusing on personal hygiene and proper use of antibiotics. Posters and pamphlets on CA-MRSA have been designed to create community awareness and put across more detailed knowledge. For health care professionals and infection control practitioners working in both the public and private sector, the CHP promulgates clinical guidelines for the management of CA-MRSA and organises seminars and forums to foster knowledge of this infection. Antibiotic prescription guideline is also provided to doctors to promote proper prescription practices.

Most of the above information is accessible at the CHP’s website (www.chp.gov.hk).

Discussion

There appears to be an increasing reported incidence of CA-MRSA over the past two years in Hong Kong. The extent to which this trend has resulted from changes in surveillance practice during this period is uncertain. The proportion of clinically more serious CA-MRSA cases (e.g., pneumonia, septicemia, meningitis, fatal) has fallen after January 2007 compared with before (2.9% vs. 6.3%). Nonetheless, a longer period of observation is required to conclude that statutory notification has increased the sensitivity of surveillance in detecting milder cases, especially when the possible influence of seasonal factors is not to be discounted.

The transmission dynamics of CA-MRSA infection in Hong Kong are not well understood, and there are apparent differences among local cases compared with Western countries. The majority of local CA-MRSA cases occur among healthy adults. Filipinos seem to be over-represented as an ethnic group, but there is no documented transmission arising from Filipino domestic helper. No occupational group is found to be at special risk. Risk factors for transmission from overseas studies (e.g., MSM, intravenous drug use) contact sports, correctional facilities are either absent or present in only a small proportion of cases in Hong Kong. Further studies are needed to elucidate local risk factors for infection.

Intra-familial transmission CA-MRSA is well documented. In the present series, the probability of intra-familial transmission resulting in clinical cases is around 3% (2 families out of 68). Family clusters tend to be small - two cases in each of the two family clusters in 2007. The first local family cluster of CA-MRSA was detected in 2005, involving two adolescent siblings of a Nepalese family. Their other three siblings all had history of skin abscesses in the past one year, without laboratory confirmation of CA-MRSA infection. Two family clusters occurred in 2006, involving a brother-sister pair and mother-son pair, all with skin and soft tissue abscesses. Onset dates within the family clusters were separated by five to twelve weeks.

The clinical presentations of CA-MRSA infection in Hong Kong generally resemble those described in the literature. Skin and soft tissue infections are the most frequent clinical manifestations. Less commonly, necrotising pneumonia, empyema, sepsis syndrome, pyomyositis, osteomyelitis, necrotising fasciitis, and disseminated infections with septic emboli may occur. Two fatal cases were recorded in Hong Kong during 2005-06. The first was a 37-year-old Chinese lady who developed meningitis. Her cerebrospinal fluid and blood culture yielded CA-MRSA and she died despite antibiotics treatment 12 days after symptom onset. The second fatal case was a 30-year-old Chinese lady with a right facial swelling that progressed to septicemia within two days. Blood culture and wound swab yielded CA-MRSA. She succumbed five days after symptoms onset.

Public health measures to control CA-MRSA have yielded mixed results in different countries. The Netherlands, which has one of the lowest prevalence of MRSA in the world, has attributed its success to a national “search and destroy” policy, in combination with restrictive antibiotic use. There is no unifying practice of using decolonisation regimens for CA-MRSA cases and patients. Experts in the United States consider the use of decolonisation regimens...
for patients with recurrent MRSA infection, or to abort outbreak in places where ongoing MRSA transmission has occurred\textsuperscript{24,27}. Various decolonisation strategies have been used but experts have differing opinions on their effectiveness\textsuperscript{28,29}. These include various combinations of systemic antimicrobials, mupirocin nasal ointment, and chlorhexidine body washes. Mupirocin has excellent anti-staphylococcal activity and has proved effective in eradicating of MRSA carriage from patients\textsuperscript{10}. However, mupirocin resistance appears to be increasing worldwide\textsuperscript{30}, and mupirocin resistant CA-MRSA cases are reported overseas recently\textsuperscript{31}.

The current public health measures in Hong Kong to control CA-MRSA (i.e., statutory notification, intensive laboratory surveillance, decolonisation therapy to case-patients and contacts, guidance to health care professionals, community education) are on the more stringent side of the international scale. Nonetheless, it remains to be seen how far this ‘search-and-destroy’ strategy would work. The crude prevalence of CA-MRSA carriage among close contacts of CA-MRSA cases is around 5\% in the present series. This percentage is likely several times higher than the local general population. A local study found carriage rate of MRSA (not CA-MRSA) among first year university students and their family members to be 1.7\% and 0.9\% respectively\textsuperscript{32}. Another local study (2006) found no CA-MRSA carriage among elderly people living in residential care homes for the elderly\textsuperscript{33}. In comparison, major CA-MRSA outbreaks have been reported in the US and Canada\textsuperscript{34,35}. Some US cities such as Atlanta, Baltimore, and Chicago have reported CA-MRSA incidence rates of 18 - 164 per 100,000\textsuperscript{15,37}. At this point, it appears that population carriage rate of CA-MRSA in Hong Kong is still at a level amenable to case-based interventions, and that enhanced home hygiene and eradication of CA-MRSA carriage in contacts of case-patients is epidemiologically meaningful. On the other hand, the increasing case-notification rate for CA-MRSA is a cause for concern. Other warning signs to look out for include a rising proportion of CÀ-MRSA among MRSA isolates, as well as transmission in institutional settings. In conclusion, CA-MRSA remains a challenging infection and we are now at a critical stage in its evolution and control in Hong Kong.

**Figure 1: Number of CA-MRSA notifications received by the Centre for Health Protection (January 1, 2005 - June 30, 2007)**

**Box 1: Surveillance Case Definition of CA-MRSA**

i. Clinical criteria:
   - Skin / soft tissue infections (e.g. infected eczema / boil / abscess); OR
   - More serious infections (e.g. blood stream infections or pneumonia)

ii. Epidemiological criteria:
   - No permanent indwelling catheters or medical devices that pass through the skin into the body AND no medical history in the past year of:
     - Hospitalisation
     - Admission to nursing home, skilled nursing facility, or hospice
     - Dialysis
     - Surgery

iii. Laboratory criteria:
   - Isolation of MRSA strain from any clinical specimen with the following characteristics:
     - Staphylococcal cassette chromosome mec (SCCmec) type IV or V; AND
     - Positive for Panton-Valentine leucocidin (PVL) gene

Conformed case is a clinically compatible case that is laboratory confirmed.

**References**