

An Outbreak of Community Associated Methicillin Resistant *Staphylococcus aureus* Subtype USA300 at an International School in Singapore

Dixon Grant, ¹MD, Tse Hsien Koh, ²MBChB, DTM&H, FRCPath, Yen Ee Tan, ²MBBS, Li Yang Hsu, ^{3,4}MRCP, DTM&H, MPH, Asok Kurup, ⁵MRCP, Shelly K Donahue, ⁶RN, BSN, Janelle Mann, ⁶MPH, NP, BN, Dale Fisher, ^{3,4}MBBS, FRACP, DTM&H

Abstract

Community associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA) subtype USA300 remains relatively well confined within North American shores. Between August and November 2010, a large international school in Singapore recorded 27 skin and soft tissue infections, 8 of which were confirmed USA 300. This study reports the outbreak investigation and the interventions instituted.

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Introduction

Methicillin resistant *Staphylococcus aureus* (MRSA) can be classified epidemiologically (hospital or community associated), genotypically and phenotypically. Over the last decade, pulse field gel electrophoresis (PFGE) type USA300 has become the dominant strain isolated from skin and soft tissue infections (SSTIs) arising in the community in the US.¹ The incidence of SSTIs in the United States (US) over the last decade has increased 2- to 3-fold, largely due to the emergence of this highly pathogenic strain. There were an estimated 1.3 million cases of MRSA SSTIs in the US during 2005; double the number of SSTIs during 1997. USA300 has been involved in outbreaks among sports teams, prison inmates, military personnel and day care centres.^{1,2} In the last decade, USA300 has spread abroad with documented SSTIs in Colombia, Europe, Iraq, Australia and Japan.¹⁻⁵

The predominant CA-MRSA type in Singapore is MLST

ST30 and SCCmec IV.⁶ Here we report MRSA USA300 in Singapore and the outbreak it caused at an international school with a student body of 3800, most of whom hold US passports and had travelled to the US during summer months. The school has extensive indoor and outdoor facilities used for physical education, intramural sports, and community athletics.⁷

Materials and Methods

Proven cases were defined as those with a clinical infection, a positive MRSA culture, and the consistent antimicrobial susceptibility profile. Possible cases were clinical SSTIs between September and November with no alternative culture. For proven cases, culture and antibiotic sensitivity reports were obtained, and a survey detailing the infection, risk factors, and preventive measures used was

¹Singhealth, Singapore

²Pathology Department, Singapore General Hospital, Singapore

³Department of Medicine, Yong Loo Lin School of Medicine, National University of Singapore, Singapore

⁴Division of Infectious Disease, Department of Medicine, National University Health System, Singapore

⁵Mount Elizabeth Medical Centre, Mount Elizabeth Hospital, Singapore

⁶Singapore American School, Singapore

Address for Correspondence: A/Prof Dale Fisher, Infectious Disease Division, Department of Medicine, National University Health System, NUHS Tower Block, 1E Kent Ridge Road, Level 10, Singapore 119228.

Email: mdcfda@nus.edu.sg

distributed. In possible cases, further data was not sought.

Live cultures were obtained for 2 cases, SAS-1/10 and 2/10. A known USA300 strain (251/05), courtesy of K. Singh at Rush University Medical Center, Chicago, IL was used as a control. The isolates were tested using previously published methods for the presence of Pantone-Valentine leukocidin (PVL),⁸ arginine catabolic mobile element (ACME)⁹ and SCCmec type.¹⁰ Molecular epidemiological profiling was performed via PFGE,¹¹ spa-typing¹² and MLST.¹³

Results

Our investigation revealed 27 students with proven or possible MRSA SSTIs from September to November 2010. The first case was identified shortly after the summer holiday. Of the 27 cases, 8 were microbiologically proven. Students of this school typically experience 3 to 4 SSTIs per month and not of the severity seen during this outbreak.

Proven cases are presented in Fig. 1. There was 1 volleyball player, 1 fencer, 5 football players, and only 1 student who did not participate in sports. However this student had a lip abscess which was preceded by wiping his cracked lip with a towel during physical education. Of the 19 possible cases of MRSA skin infections, 2 had a notable clinical course. A 16-year-old female student had a neck abscess rupture on 30 September 2010. She received 3 different antibiotic courses, however, laboratory data were unavailable. A 17-year-old male football player with a pustular skin infection over the right forearm for almost 2 months reported 2 failed courses

of antibiotics yet success with linezolid. Cultures were negative. The remaining 17 students between the ages of 8 and 17 had minor skin infections with negative cultures and only one required systemic antibiotics.

The 8 confirmed cases had antimicrobial susceptibility testing results (Fig. 2). Seven of 8 cases had identical antimicrobial susceptibility profiles. Case 8 was resistant to gentamicin. All were resistant to ciprofloxacin which is common for USA300 but not the locally predominant CA-MRSA strain, ST30 SCCmec IV.⁶

Unfortunately, only cases 2 and 7 had accessible cultures. These had identical PFGE patterns (Fig. 3). Additionally, case 7 isolate was PVL positive, ACME positive, SCCmec type IV, Spa type T008 and MLST ST8: identical to the known typing profile of USA 300.^{1,2}

All 8 proven cases received at least 1 week of antibiotics including linezolid (5), trimethoprim and sulfamethoxazole (2), and doxycycline (2). Inappropriate antibiotics were used initially in at least 2 cases. Six cases required incision and drainage. Three cases recrudesced in the subsequent month: 2 required surgery and 1 only antibiotics. All infected students had contact with the athletic facilities and 3 had an obvious skin break. Students with infections were not sharing personal items. Two of the 7 cases had family screening done and 4 took precautionary measures at home such as washing their laundry, bed linen and dishes separately, disinfecting door knobs and washing with chlorhexidine. No family transmission was documented. Four of the 8 cases had travelled to the US during the preceding summer,

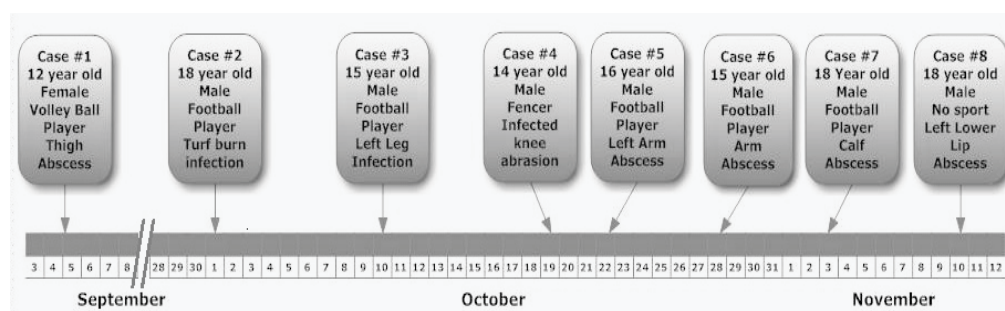


Fig. 1. A timeline for the eight confirmed cases of CA-MRSA USA300 at a Singapore International School.

Case	Culture	Gent	Cip	Bac	Vanc	Clin	Ery	FA	Tet	Lin	Ami	Clox	Teic
1	MRSA	S	R	S	S	S	R	S	S	S	S	R	S
2	MRSA	S	R	S	S	S	R	S	S	S	S	R	S
3	MRSA	S	R	S	S	S	R	S	S	S	S	R	S
4	MRSA	S	R	S	S	S	R	S	S	S	S	R	S
5	MRSA	S	R	S	S	S	R	S	S	S	S	R	S
6	MRSA	S	R	S	S	S	R	S	S	S	S	R	S
7	MRSA	S	R	S	S	S	R	S	S	S	S	R	S
8	MRSA	R	R	S	S	S	R	S	S	S	S	R	S

Fig. 2. Culture and antibiotic sensitivity results from the 8 proven cases of CA-MRSA USA300 skin and soft tissue infections at a Singapore International School.

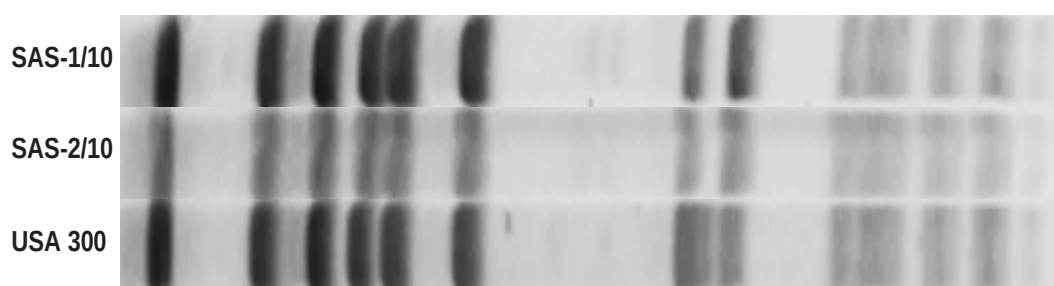


Fig. 3. Pulse field gel electrophoresis (PFGE) of Case 7 isolate (SAS-1/10), Case 2 isolate (SAS-2/10), and USA300 control (251/05, Rush University Medical Centre, Chicago, IL).

including case 1.

To prevent further spread of MRSA, students were asked to cover all wounds or to stay away from school. Four students were kept from school for quarantine and 3 were withheld from participation in sports. In October, after the first case of MRSA in a football player was confirmed, the school escalated cleaning in athletic facilities by using disinfectant products containing sodium dichloroisocyanurate. With more cases by November, a letter was sent alerting faculty and students about MRSA, focusing on prevention, including proper hygiene. Surveillance and reporting was systematised with physical education and sport coaches requiring all student to report any skin infections. If any new skin infection was noted, students were required to visit the school nurse. Policies further standardised cleaning particularly of sports equipment and uniforms. Chlorhexidine hand rub dispensers were placed in gymnasiums and locker rooms.

A specific task force headed by the superintendent and involving infectious disease physicians, a microbiologist, school nurses, principals (from all levels), and athletic directors was formed on 23 November 2010. Specific recommendations from the task force were: to audit the implementation of recent policies, expand the availability of chlorhexidine hand disinfectant, and withhold students with infected wounds from swimming. There were no known cases of CA-MRSA at the school in the 6 months following the interventions. There have been no reported cases of USA300 in Singapore outside of this international school cluster.

Conclusion

This outbreak of 27 SSTIs over 3 months, including 8 confirmed cases of CA-MRSA USA300, represents the first published outbreak in a school outside of the United States and the first documented cases of USA300 in Singapore. CA-MRSA USA300 may have been imported from the USA by one or more students after colonisation during their summer break.

CA-MRSA USA300 is known to cause outbreaks of SSTIs among sports teams, primarily football teams.¹⁴

Interestingly, the cases in this outbreak did not always have direct personal contact suggesting that the spread of MRSA in this outbreak happened predominantly through fomites such as artificial turf and athletic equipment. The importance of disinfecting athletic facilities and limiting spread was recognised early by the school and the outbreak was controlled.

Ideally, we would have been able to obtain live cultures for all 8 proven cases and confirm them with PFGE rather than relying only on antimicrobial susceptibility pattern for 6 of the 8 cases. It also would have been useful to do a more thorough investigation of possible cases. This was deemed to be over intrusive to students as their cultures were negative, infections were minor, and the outbreak had largely resolved.

This investigation documents the spread of CA-MRSA USA300 to Singapore and demonstrates that international schools may represent a high-risk population for the import and foreign spread of CA-MRSA USA300. It also shows how a rapid response abated the outbreak.

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