

Prevalence and characteristics of methicillin-resistant *Staphylococcus aureus* colonization among healthcare professionals in a university hospital in Japan

Fumi Yamasaki Pham¹ | Seisho Takeuchi MD^{1,2} | Yoshio Uehara PhD^{1,2} |
Masahide Matsushita MD³ | Kazumi Arise BSN² | Norihito Morimoto MT^{2,4} |
Hiromi Seo MD¹

¹Department of General Medicine, Kochi Medical School Hospital, Nankoku, Japan

²Department of Infection Control and Prevention, Kochi Medical School Hospital, Nankoku, Japan

³Department of Family Medicine, Kochi Medical School, Nankoku, Japan

⁴Department of Clinical Laboratory, Kochi Medical School Hospital, Nankoku, Japan

Correspondence

Seisho Takeuchi, MD, Department of General Medicine, Kochi Medical School Hospital, Nankoku 783-8505, Japan.
Email: takeuti@kochi-u.ac.jp

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Abstract

Background: Asymptomatic carriers of methicillin-resistant *Staphylococcus aureus* (MRSA) are important sources of nosocomial transmission. MRSA may be transmitted from hospitalized patients to healthcare professionals and vice versa.

Methods: The prevalence of MRSA colonization among forty-five healthcare professionals in a Japanese hospital was determined by performing surveillance cultures to identify unrecognized carriers of MRSA. All MRSA isolates were evaluated using multilocus sequence typing (MLST) to identify the transmission routes.

Results: The proportion of MRSA colonization was significantly higher in healthcare professionals (11.1%) than in community residents (0.72%; $P < 0.0001$) or admission case (2.5%; $P = 0.018$). MLST analysis revealed that both the ST8 and ST764 strains were identified in residents, patients, and healthcare professionals. MRSA colonization was more frequently observed among physicians (4/13; 31%) than nurses (1/32; 3%) ($P = 0.020$).

Conclusion: Multilocus sequence typing results suggest that ST8 and ST764 are involved in the occurrence of nosocomial MRSA infections. These findings emphasize the necessity for the effective education of physicians to prevent MRSA transmissions.

KEYWORDS

infection control, MRSA, multilocus sequence typing, surveillance

1 | INTRODUCTION

Control of nosocomial infections remains a major clinical concern. Since its discovery in 1961, methicillin-resistant *Staphylococcus aureus* (MRSA) is a major nosocomial pathogen. MRSA bacteremia, skin and soft tissue infections, and surgical site infection are

associated with prolonged hospitalization, increased mortality rates, and greater healthcare costs.¹ Numerous hospital-based strategies have been proposed by infection control personnel and hospital administrators to mitigate the spread and impact of MRSA. However, the incidence of MRSA infection remains consistent.

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TABLE 1 Frequency of methicillin-resistant *Staphylococcus aureus* colonization in various settings

	Residents (positive/analyzed)	Admission cases (positive/analyzed)	Hospitalized patients (positive/analyzed)	Healthcare professionals (positive/analyzed)
Rate of MRSA colonization	0.72% (8/1111)	2.5% (4/163)	3.8% (6/157)	11.1% (5/45)
P-value ^a	<0.0001	0.018	0.08	

^aChi-squared test.

Clarifying the mode of MRSA transmission is important for the effective avoidance of nosocomial MRSA infections. Prior hospital admission is a known risk factor for MRSA infection.^{2,3} Therefore, MRSA may be transmitted from hospitalized patients to healthcare professionals and vice versa. Several studies have shown that MRSA is colonized in healthcare professionals.⁴⁻⁶

The objective of the present study was to determine the prevalence of MRSA colonization among healthcare professionals in a Japanese hospital by performing surveillance cultures to identify unrecognized carriers of MRSA.

2 | MATERIALS AND METHODS

This study was conducted at the Kochi Medical School Hospital, Nankoku, Japan, a 605-bed tertiary-care general hospital with 13 wards. Forty-five healthcare professionals serving at a surgical ward including 50 beds were analyzed in June 2008. The participants consisted of 13 doctors and 32 nurses.

Culture of bilateral anterior naris samples obtained from all participants was performed. Isolation and identification of MRSA, and multilocus sequence typing (MLST) analysis were performed as described previously.⁷

The protocol of this study was approved by the ethics committee of the Kochi Medical School (approved number: 374-20-7), and written informed consent was provided by all participants. Frequencies and proportions of MRSA colonization were analyzed using the chi-squared test. Fisher's exact test was used in the analysis among physicians and nurses.

3 | RESULTS

Methicillin-resistant *Staphylococcus aureus* colonization was investigated in 45 healthcare professionals. The results were compared

with previous MRSA surveillance data and are summarized in Table 1.^{7,8} The proportion of MRSA colonization was significantly higher among healthcare professionals (11.1%) than community residents (0.72%; $P < 0.0001$) or admission case (2.5%; $P = 0.018$). Community residents were composed of 317 residents from a rural community in Kochi Prefecture and 794 supermarket employees in Osaka Prefecture. Admission cases were composed of 163 patients admitted at Kochi Medical School Hospital. Samples of the admission cases were collected at the time of admission. Although the rate of MRSA colonization was higher in healthcare professionals than hospitalized patients, the difference was not statistically significant (3.8%; $P = 0.08$). Samples of hospitalized patients were collected on the day of discharge.

Multilocus sequence typing analysis revealed that five isolates from healthcare professionals consisted of two ST8 and three ST764 isolates. These results were combined with previous MRSA surveillance data and are summarized in Table 2.^{7,8} Both ST8 and ST764 strains were isolated from residents, admission cases, hospitalized patients, and healthcare professionals. The ST5 strain was identified in admission cases and hospitalized patients. In contrast, the ST509, ST688, and ST608 strains were identified only in residents.

The rate of MRSA colonization was also compared according to the type of occupation. MRSA colonization was more frequently observed among physicians (4/13; 31%) than nurses (1/32; 3%), and the difference was statistically significant ($P = 0.020$).

4 | DISCUSSION

In this study, the rate of MRSA colonization among healthcare professionals was 11.1%. This rate is higher than that reported in previous studies showing a prevalence of 2%-7%.⁴⁻⁶ The proportion of MRSA colonization was significantly higher in healthcare professionals than community residents, suggesting that labor in a hospital

TABLE 2 Distribution of methicillin-resistant *Staphylococcus aureus*

	Residents	Admission cases	Hospitalized patients	Healthcare professionals
ST5	0	2	4	0
ST8	1	1	1	2
ST764	3	1	1	3
ST509	2	0	0	0
ST688	1	0	0	0
ST608	1	0	0	0
Total	8	4	6	5

setting is a risk factor for MRSA colonization. Collectively, healthcare professionals may facilitate the spreading of MRSA infection in hospitals.

The results of the MLST analysis suggest that the ST5 strain was circulating among patients, whereas the ST509, ST688, and ST608 strains were limited to the community. In contrast, the ST8 and ST764 strains were identified in residents, patients, and healthcare professionals. These findings suggest that ST8 and ST764 found among healthcare professionals are involved in the occurrence of nosocomial MRSA infections. ST5 is the most prevalent clone in Japan. Both ST5 and ST764 strains are closely related and are classified as clonal type CC5, while ST8 is classified as clonal type CC8. ST 764, ST509, ST688, and ST608 were not the endemic strains in the hospitalized patients in Japan. ST5, ST22, ST36, ST45, ST239, and ST247 are classified as healthcare-acquired MRSA, and ST1, ST8, ST30, ST59, ST80, ST89, and ST91 are recognized as community-acquired MRSA.

We identified several limitations in the present study. First, this study was conducted in 2008. In Japan, the prevalence of MRSA is recently decreasing, especially hospital-acquired MRSA, but community-acquired MRSA is increasing. Therefore, it is not clear whether the present proportion of MRSA in healthcare professionals is still higher than in community residents. This point should be clarified in the future study. Second, the discriminatory power of MLST may not be sufficient to determine the diversity of MRSA. Inclusion of PCR-based open reading frame typing would increase the relevance of the data. Finally, this study was conducted in a surgical ward in a single medical school hospital. Therefore, it might be difficult to generalize the status of MRSA colonization in healthcare professionals in Japan.

Based on our experience and that of others, the higher rate of MRSA colonization observed among physicians may be attributed to poor hand hygiene practice.⁹ MRSA is known to be transmitted through the gowns and gloves of healthcare professionals.¹⁰ These findings emphasize the necessity for the effective education of physicians to prevent nosocomial MRSA infections.

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CONFLICT OF INTEREST

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

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