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An Outbreak of Enteritis Induced by Methicillin-Resistant
Staphylococcus aureus Producing Enterotoxin Types A and C,
Toxic Shock Syndrome Toxin-1 and Coagulase Type II

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Methicillin-resistant Staphylococcus aureus (MRSA) is one

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of the most common pathogens causing hospital infections
(1). Enteritis caused by MRSA is a serious problem, especially
for postoperative patients (2).

In a hospital with 420 beds, 4 patients successively contracted
serious acute enteritis and 2 patients contracted mild enteritis. MRSA was isolated from the stools of the patients. The isolates from patients with MRSA infection or from its carriers in the same hospital just before the outbreak were tested for chromosomal DNA typing by using pulsed-field gel electrophoresis (PFGE) (CHEF Mapper™: Bio-Rad Laboratories, Hercules, Calif., USA), plasmid DNA typing on agarose gel electrophoresis, antibiotic resistance pattern (WalkAway™, Dade Behring, Deerfield, Ill., USA), enterotoxin serotyping (SET-RPLA: Denka Seiken Co., Tokyo), toxic shock syndrome toxin-1 (TSST-1) production (TST-RPLA: Denka Seiken), and coagulase serotyping (Denka Seiken).

Six different PFGE patterns of Smal DNA digests (Fig. 1) were detected. A band-based cluster analysis of these patterns (Molecular Analyst™: Bio-Rad) revealed that patterns B to G shared more than an 89% similarity, while sharing a relatively lower similarity with pattern A (Fig. 2). There were three different kinds of plasmid with sizes of >10 kb, 5 kb, and 2 kb (Fig. 3). Twelve isolates had one, two, or three of them (from the carriage pattern of the plasmids, the isolates were classified into four groups), while six had none. Sensitivity to antibiotics is shown in Table 1; there were four different patterns. All isolates produced enterotoxin types C, TSST-1, and type II coagulase (Table 2). Numbers 407 and 414 produced enterotoxin type B, and Nos. 412, 416, 520, 521, 522, and 524 produced enterotoxin type C in addition.

As summarized in Table 2, four isolates (Nos. 520-522 and 524) from serious enteritis patients in either ward 5E or the ICU shared the same character with the one (No. 412) obtained before the outbreak. They all produced enterotoxin types A and C, TSST-1, and coagulate type II and had the same PFGE pattern of Smal DNA digests, BglI digests and BstXI digests (Fig. 4), the same spectrum of antibiotic susceptibility and the same plasmid pattern (no plasmid). The}

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**Table 1. Antibiotic pattern classified by antibiotic pattern of 18 antibiotics against MRSA**

<table>
<thead>
<tr>
<th>Antibiotics pattern</th>
<th>Antibiotics listed in footnote*</th>
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<tbody>
<tr>
<td>CLDM</td>
<td>GM</td>
</tr>
<tr>
<td>a</td>
<td>R</td>
</tr>
<tr>
<td>a'</td>
<td>R</td>
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<tr>
<td>b</td>
<td>R</td>
</tr>
<tr>
<td>c</td>
<td>R</td>
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<tr>
<td>d</td>
<td>R</td>
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*Listed antibiotics are ampicillin, benzyl-penicillin, cefmetazole, cefotiam, erythromycin, cefazolin, fosfomycin, floroxef, imipenem/cilastatin, levofloxacin, oxacillin, and piperacillin.

results indicated that an enterotoxins A and C- and TSST-1- producing MRSA strain caused enteritis in the outbreak. Toxin production is a useful marker in predicting MRSA enteritis outbreak.

REFERENCES
