Antibiograms for MRSA Isolates from a Regional Hospital in El Oro Province, Ecuador

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Background

Methicillin-resistant Staphylococcus aureus (MRSA) is an antibiotic-resistant strain of the bacterium Staphylococcus aureus. Infection by S. aureus causes soft tissue and skin infections, which are normally treated with antibiotics[1]. However, antibiotics are ineffective when the infection is caused by a resistant strain. MRSA poses serious health threats on the global scale due to its increased difficulty to treat, accounting for a significant portion of hospital-acquired infections and resulting in thousands of deaths annually[2].

Transmission of S. aureus/MRSA can occur through physical contact of colonized hospital personnel with patients. Risk factors associated with acquisition of S. aureus/MRSA are prolonged hospitalization, dialysis treatments, or heavy antibiotic treatment[3].

Little published data exists on the prevalence of MRSA in Ecuador, resulting in a poorly understood health impact for the country. The results indicate that MRSA is a potentially serious health threat in this hospital that warrants further investigation.

Materials and Methods

Sample Collection: Nasal swabs were collected using StarSwab™ Platinum Series swabs (Starplex Scientific, Inc.) from patients and staff age 12 or older in Machala Hospital, a regional public hospital in El Oro Province, Ecuador.

Manitol Salt Agar (MBA) & Oxacillin (OX): Samples were inoculated onto MBA and incubated at 37 degrees Celsius for 24 hours to select for halotolerant specimens, and identify potential S. aureus isolates based on colony morphology and manitol fermentation. Additionally, samples were inoculated onto MBA containing 4 µg/mL oxacillin and incubated under the same conditions to indentify any methicillin-resistant isolates.

Polymerase Chain Reaction Analysis: Polymerase chain reaction (PCR) using three increasingly selective primers was performed on suspected Staphylococcus isolates (passed Gram stain, catalase, and latex agglutination tests). Samples were run on agarose gels and compared with a positive S. aureus control, a positive MRSA control, and a PCR negative control in order to accurately identify each isolate as S. aureus, MRSA.

Minimum Inhibitory Concentration Analysis: Minimum inhibitory concentration (MIC) was determined for eight different antibiotics on each MRSA isolate previously identified by PCR analysis. Samples were inoculated onto micro titer plates (Figure 1) set up according to the serial dilution schematic outlined in table 1. Inoculated plates were incubated at 37 degrees for 24 hours before growth was observed.

Results

Table 1: Schematic representation of a micro titer plate set up for minimum inhibitory concentration analysis for the eight antibiotics listed.

<table>
<thead>
<tr>
<th>Antibiotic Initial Concentration</th>
<th>Serial Dilution Concentration (µg/mL)</th>
<th>Growth Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloramphenicol (Chl)</td>
<td>156 µg/mL 10 mg/mL 5 mg/mL 2.5 mg/mL 1 mg/mL 0.5 mg/mL</td>
<td>No Growth No Growth No Growth No Growth No Growth</td>
</tr>
<tr>
<td>Gentamicin (Gen)</td>
<td>20 mg/mL 10 mg/mL 5 mg/mL 2.5 mg/mL 1 mg/mL</td>
<td>No Growth No Growth No Growth No Growth</td>
</tr>
<tr>
<td>Trimethoprim-Sulfamethoxazole (TMP-SMZ)</td>
<td>780 µg/mL 313 µg/mL 156 µg/mL 78 µg/mL 39 µg/mL</td>
<td>No Growth No Growth No Growth No Growth</td>
</tr>
<tr>
<td>Ampicillin (Amp)</td>
<td>10 mg/mL 5 mg/mL 2.5 mg/mL 1.25 mg/mL 0.625 mg/mL</td>
<td>No Growth No Growth No Growth No Growth</td>
</tr>
<tr>
<td>Amikacin (Amk)</td>
<td>100 mg/mL 50 mg/mL 25 mg/mL 12.5 mg/mL 6.25 mg/mL</td>
<td>No Growth No Growth No Growth No Growth</td>
</tr>
<tr>
<td>Ceftazidime (Crz)</td>
<td>100 mg/mL 50 mg/mL 25 mg/mL 12.5 mg/mL 6.25 mg/mL</td>
<td>No Growth No Growth No Growth No Growth</td>
</tr>
<tr>
<td>Erythromycin (Ery)</td>
<td>20 µg/mL 10 µg/mL 5 mg/mL 2.5 mg/mL 1.25 mg/mL</td>
<td>No Growth No Growth No Growth No Growth</td>
</tr>
<tr>
<td>Vancomycin (Van)</td>
<td>100 mg/mL 50 mg/mL 25 mg/mL 12.5 mg/mL 6.25 mg/mL</td>
<td>No Growth No Growth No Growth No Growth</td>
</tr>
</tbody>
</table>

Table 2: Resistance profiles for all MRSA isolates, and the minimum inhibitory concentrations for the eight antibiotics studied in the event of resistance. Resistance MICs are bolded (4).

Graph 1: Relative difference in resistance for all antibiotics studied. Percentages displayed reflect the total number of isolates with resistance for each of the eight antibiotics tested.

Discussion

It is no surprise that all of the MRSA isolates tested in this study, every one was found to be resistant to oxacillin (based on nationally established standards [4]). In addition to Oxacillin resistance, 29 of the 31 total samples were also found to be resistant to Ampicillin.

Another observation from the MIC data in Table 2 is that every single MRSA isolate is resistant to multiple antibiotics. On average, each isolate is resistant to 3 of the 8 different antibiotics tested. Several isolates were resistant to 5 of the 8 antibiotics tested. This information is extremely valuable for hospital personnel, as MRSA infections become increasingly difficult to treat when they are resistant to multiple antibiotics.

References


Acknowledgments

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