The investigation of in vitro activity of ceftaroline, vancomycin and teicoplanin for methicillin-resistant Staphylococcus aureus isolates

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Objectives
Methicillin-resistant Staphylococcus aureus (MRSA) strains have previously been considered as resistant to all beta-lactam agents, however the introduction of cephalosporins with anti-MRSA activity, i.e. ceftaroline and ceftobiprole, necessitated an update in this consideration. Until recently, vancomycin has been used as the first choice treatment option for serious infections due to MRSA, however the demonstration of treatment failure and increased mortality in infections due to MRSA strains with vancomycin minimal inhibitory concentration (MIC) of ≥1 mg/L resulted in search for alternative agents. Ceftaroline fosamil is indicated for the treatment of community acquired bacterial pneumonia and acute bacterial skin and skin structure infections. In our study we aimed to determine the MIC values for vancomycin (VA), teicoplanin (TEC) and ceftaroline fosamil (CFT) in a collection of clinical MRSA isolates.

Methods
MRSA strains (n = 105) isolated from clinical specimens between 2012 and 2015 were included in the study. The isolates were identified with MALDI-TOF MS instrument (Bruker Daltonics, Germany). Initial antimicrobial susceptibility testing was performed using VITEK 2 instrument (bioMérieux, France).

Results
MIC0 and MIC90 values of the strains were determined as 0.5 mg/L and 1 mg/L for VA, 0.5 mg/L and 2 mg/L for TEC and CFT, respectively. When evaluated with the current EUCAST clinical breakpoints, 1.5% (n = 2) and 23.8% (n = 25) of the study isolates for VA, TEC and CFT, respectively. The MRSA isolate with VA MIC of 4 mg/L in BMD method also demonstrated an MIC of 4 mg/L with VA gradient strip test, and with VA/TEC gradient strip the values 4/16 mg/L were obtained (Figure 1).

Table 1. The in vitro activity of vancomycin, teicoplanin and ceftaroline for clinical MRSA isolates (n = 105)

<table>
<thead>
<tr>
<th>MIC (mg/L)</th>
<th>Susceptibility (%)</th>
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<tbody>
<tr>
<td>MICc0</td>
<td>MICc90</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>0.125 – 4</td>
</tr>
<tr>
<td>Teicoplanin</td>
<td>0.125 – 4</td>
</tr>
<tr>
<td>Ceftaroline</td>
<td>0.125 – 2</td>
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Conclusion
- Even though ceftaroline fosamil has not entered into clinical practice in our country yet, ceftaroline susceptibility among clinical MRSA isolates was determined as 76.2%.
- Among the study MRSA isolates we detected an isolate with VA MIC of 4 mg/L which is nonsusceptible to vancomycin according to EUCAST breakpoints and confirmed as glycopeptide intermediate S. aureus by using GRD MIC test strip.
- We observed two teicoplanin resistant isolates with TEC MIC of 4 mg/L.

Figure 1. Phenotypic test results of the MRSA strain with VA MIC of 4 mg/L.
A) VA MIC test strip: VA MIC = 4 mg/L
B) GRD MIC test strip: VA MIC = 4 mg/L, TEC MIC = 16 mg/L