Original Article

Antimicrobial Susceptibility of *Stenotrophomonas maltophilia* Clinical Isolates from Blood Samples in Iran

Amir Hesam Nemati¹, Hamid Solgi¹, Farzam Vaziri², *Fereshteh Shahcheraghi*¹

¹Department of Bacteriology, Pasteur Institute of Iran, Tehran, Iran; ²Department of Tuberculosis and Pulmonary Research, Pasteur Institute of Iran, Tehran, Iran.

Received Sep 05, 2016; accepted Oct 04, 2016

**INTRODUCTION**

*Stenotrophomonas maltophilia* is a gram negative rod shaped bacteria which causes serious nosocomial infections in immuno-deficient populations such as HIV infected ones, patients with cancer, neutropenia and specially cystic fibrosis and stem cell transplantation recipients. This microorganism has a high mortality rate and is one of the most important agents of blood and respiratory tract infections in patients with cancer and venous catheter [1-4]. This bacterium has been recovered from soil, plants, animals, water resources and various wet surfaces in hospitals [5]. *S. maltophilia* infections can occur in children and adults and community-acquired infections include bacteremia, wound/soft tissue infections and urinary tract infections has been reported [6]. Some inherited molecular mechanisms such as outer membrane decreased permeability, efflux pumps, β-lactamases, integrons and biofilm formation have made this bacterium resistant to a large number of antimicrobials such as β-lactams, quinolones, co-trimoxazole, carbapenems, tetracyclines, chloramphenicol, and disinfectants [1, 5, 7, 8]. Antibiotics that commonly are used for *S. maltophilia* infections include co-trimoxazole, levofloxacin, ticarcillin/clavulanic acid and minocycline. Co-trimoxazole is the first choice treatment but increasing resistance to that has been reported [9, 10]. Ticarcillin/clavulanic acid has been suggested as an alternative for co-trimoxazole resistant isolates while emerging resistance to this agent also has been reported [10]. Combination of antibiotics is a new strategy and synergistic effect for *S. maltophilia* infections between co-trimoxazole and ticarcillin/clavulanic acid or ceftazidim was observed [11]. Increasing rate of immunocompromised patients, prolonged consumption of antibiotics in hospitalized patients and some genetic disorders like cystic fibrosis make it essential to monitor *S. maltophilia* drug resistance status. In this study, our objective was determining the antimicrobial susceptibility of *S. maltophilia* clinical isolates to different antibiotics.

**MATERIAL AND METHODS**

**Isolation and identification.** Isolates were collected from blood samples of hospitalized patients that have symptoms including fever, nausea, general body ache and tachycardia in Imam Khomeini hospital laboratory. They were identified by conventional biochemical tests such as cytochrome oxidase activity, motility, TSI medium growth pattern, lysis decarboxylase activity and extracellular DNase production (Difco, Detroit, MI, USA) [12].

**Antimicrobial susceptibility test.** Susceptibility to co-trimoxazole, levofloxacin, minocycline, ticarcillin/clavulanic acid, chloramphenicol and ceftazidime were determined by disk diffusion (Mast Ltd, UK) and Minimum Inhibitory Concentration (MIC) of ticarcillin/clavulanic acid tested by E-test (Lioflichem, Teramo, Italy) according to Clinical and Laboratory Standards Institute (CLSI). All antibiotic disks and strips have been quality controlled by *Escherichia coli* ATCC 25922 [13].

*Correspondence:* Fereshteh Shahcheraghi
Department of Bacteriology, Pasteur Institute of Iran, No. 69, Pasteur Ave, Tehran, Iran, 1316943551.

Email: shahcheraghi@ereshteh@yahoo.com

Tel/Fax: +98 (21) 66405535

http://jommid.pasteur.ac.ir
Nemati et al.

Pure stored isolates were subcultured for recovery then microbial suspensions with turbidity equivalent to 0.5 McFarland were cultured on Mueller Hinton agar plates (Difco, Detroit, MI, USA); disks and strips were put on plates and results were checked after 18 to 24 h incubation at 37°C.

RESULTS

Totally 45 clinical isolates collected from blood samples of hospitalized patients during 2013 to 2014. The identity of the isolates was confirmed as S. maltophilia by various biochemical tests. Then they were stored at -80°C in nutrient broth (Difco, Detroit, MI, USA) containing 15% glycerol. Detailed data is shown in table 1.

Antimicrobial susceptibility testing. All isolates (100%) were resistant to ceftazidime and were susceptible to co-trimoxazole, levofloxacin and minocycline. 11.1% of isolates were resistant to ticarcillin/clavulanic acid by disk diffusion and MIC of ticarcillin/clavulanic acid for these isolates were ranged from 128 to 256 µg/ml and all of them were resistant (Table 2).

Table 1. Data of patients and their related collected isolates

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Patients (%)</th>
<th>Ward</th>
<th>Number of Samples (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>25 (55.6%)</td>
<td>Emergency 1</td>
<td>19 (42.2%)</td>
</tr>
<tr>
<td>Male</td>
<td>20 (44.4%)</td>
<td>Emergency 2</td>
<td>11 (24.4%)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td>Heart surgery</td>
<td>1 (2.2%)</td>
</tr>
<tr>
<td>≤1</td>
<td>3 (6.6%)</td>
<td>Infectious diseases</td>
<td>5 (11.1%)</td>
</tr>
<tr>
<td>≥20-40</td>
<td>9 (20%)</td>
<td>Neurology</td>
<td>1 (2.2%)</td>
</tr>
<tr>
<td>&gt;40-60</td>
<td>22 (48.8%)</td>
<td>General</td>
<td>3 (6.6%)</td>
</tr>
<tr>
<td>&gt;60</td>
<td>11 (24.4%)</td>
<td>NICU</td>
<td>3 (6.6%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nephrology</td>
<td>2 (4.4%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>45</td>
</tr>
</tbody>
</table>

Table 2. Antimicrobial susceptibility test

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Sensitive (%)</th>
<th>Disk diffusion</th>
<th>Resistant (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-trimoxazole</td>
<td>45 (100%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Levofloxacin</td>
<td>45 (100%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Minocycline</td>
<td>45 (100%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Ticarcillin/clavulanic acid</td>
<td>40 (88.8%)</td>
<td>5 (11.1%)</td>
<td></td>
</tr>
<tr>
<td>Chloramphenicol</td>
<td>38 (84.4%)</td>
<td>7 (15.5%)</td>
<td></td>
</tr>
<tr>
<td>Ceftazidime</td>
<td>0 (0.0%)</td>
<td>45 (100%)</td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION

Choosing the appropriate antibiotic for S. maltophilia infections treatment is difficult due to lack of adequate and precise information about its susceptibility to antimicrobial agents. In this study we determined S. maltophilia antimicrobial susceptibility to recommend efficient antibiotics. The highest resistance rate was detected against ceftazidime (100%), chloramphenicol (15.5%) and ticarcillin/clavulanic acid (11.1%). The ceftazidime resistance was higher than those of two other studies in Imam Khomeini hospital in Iran [14, 15]. Most of isolates were collected from Emergency 1 and 2 in Imam Khomeini hospital and all of them were recovered from blood samples, which is in agreement with another study (41.5%, emergency 1 and 23.6%, emergency 2) [14]. It is the first report on resistance of S. maltophilia isolates to ticarcillin/clavulanic acid in Iran. Another study reported more ticarcillin/clavulanic acid resistance rate (59.3%) compared to 11.1% in our study and the least effective antibiotic was ceftazidime which is in concordant with our results [16]. Co-trimoxazole, quinolones like levofloxacin and ticarcillin/clavulanic acid are the most effective antibiotics which are used for S. maltophilia infections worldwide [2, 10]. Different reports in resistance rates may be originated from geographic conditions and less studies on S. maltophilia drug resistance in Iran. S. maltophilia is an emerging microorganism and its antimicrobial resistance in Iran is not as high as other countries but there is a few studies about its drug resistance in Iran. Reports in South Korea, Japan and Germany mentioned different resistance rate to ticarcillin/clavulanic acid (59.3%, South Korea) [16], co-trimoxazole (17.7%, Japan) [17], levofloxacin (28.8%, Germany) and ceftazidime (54.4%, Germany) [18]. We tested MIC only for ticarcillin/clavulanic acid because it was the only choice antibiotic that some isolates were resistant by disk diffusion method. E-test results for ticarcillin/clavulanic acid confirmed disk diffusion results. Regarding the prevalence of S. maltophilia associated infections in hospitalized patients, and its increasing antibiotic resistance, correct investigation of resistance profile can help us to adopt appropriate prevention and control measures for associated infections and to avoid increase in drug resistance. We recommend that antibiotic resistance associated genes to be investigated for better and comprehensive report of S. maltophilia antimicrobial resistance status.
ACKNOWLEDGEMENT

We acknowledge the financial support and funding for this study which was granted by Pasteur institute of Iran for MSc thesis. We thanks Ms. Fahimeh shooraj for her technical help, Dr. Alireza abdollahi and Mrs. Saeideh mahfoozi for collaboration in isolates collection from microbiology laboratory of Imam Khomeini hospital. This study was a part of medical microbiology MSc thesis.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest associated with this manuscript.

REFERENCES


