The Study of Prevalence and Antimicrobial Susceptibility of Tracheal Bacterial Strains Isolated from Pediatric Patients

N. Jonaidi Jafari, R. Ranbar, M.T. Haghi-Ashtiani, M. Abedini and M. Izadi
1Health Research Center,
2Molecular Biology Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran
3Laboratory of Microbiology, Children’s Medical Center, School of Medicine, Medical Sciences/University of Tehran, Tehran, Iran

Abstract: The aim of this study was to investigate the prevalence and antimicrobial susceptibility of bacterial strains isolated from tracheal specimens obtained from pediatric patients admitted to a major children hospital in Tehran, in 2007. Tracheal specimens were cultured on the appropriate bacteriological media. Bacterial isolates were identified by standard biochemical and serological tests. Antimicrobial susceptibility testing was performed according to Clinical and Laboratory Standards Institute (CLSI) guidelines. Pseudomonas spp. was identified as the most prevalent bacterial isolate (32%) followed by Staphylococcus aureus (27%). Thirty strains (16%) were identified as Klebsiella spp., 18 (9.6%) as Enterobacter spp. and the rest belonged to coagulase negative Staphylococci, Streptococcus viridans, Acinetobacter spp., Escherichia coli and Neisseria spp. All Pseudomonas spp. were resistant to ampicillin, kanamycin and cefotaxime. Staphylococcus and Klebsiella spp. showed high degree of resistance to 40% of examined antibiotics.

Key words: Gram negative bacteria, gram positive bacteria, tracheal infections, antimicrobial susceptibility

INTRODUCTION

Respiratory tract infection is one of the most important infectious diseases worldwide. This infection is the leading cause of morbidity and mortality in critically ill patients in developing countries (Navneeth et al., 2002; Pittet, 1994; Kumari et al., 2007). Respiratory infections in particular those occur in upper respiratory tract are seen with great frequency in both children and adults and have remarkable economic impact, related not only to lost output in the workplace but also to the frequent prescription by physicians of antibiotics, even when the causative agents of infection almost certainly are not bacteria (Carroll and Reimer, 1996). On the other side, respiratory tract infections are the most common reason for primary care consultations (Creer et al., 2006).

It is notable that they cause more disease and death than any other infection in the United States and there has been reported little change in mortality caused by respiratory tract infection for more than five decades (Mizgerd, 2008).

Eradication of the causative agents of respiratory tract infections is recognized as a requirement (Dagan et al., 2001), however during the last few years, the increase in the rates of antibiotic resistance amongst the major microbial causes of the respiratory infections in the community has compromised the selection of empirical treatment for some respiratory tract infections (Gonzalo de Liria, 2004). The consequences of increased drug resistance are far-reaching since bacterial infection of the lower respiratory tract is a major cause of death due to infectious disease (Kumari et al., 2007).

To our knowledge, there is limited information on the prevalence of various tracheal bacterial pathogens and their antibiotic resistance patterns in hospitalized pediatrics patients in Iran. Hence, the aim of this study was to determine the prevalence and antimicrobial susceptibility rates of bacterial strains isolated from tracheal specimens obtained from a major pediatric hospital in Tehran, Iran.

MATERIALS AND METHODS

Study design, specimen collection and bacterial identification: The study was conducted from Mar. 2007 to Feb. 2008. The study included all bacterial strains recovered from tracheal specimens obtained from pediatric patients admitted to a major children hospital in Tehran, Iran. The specimens were cultured on to various suitable bacteriological media then were incubated at 37°C for 16-24 h on the basis of each organism. The isolated bacteria then further identified microbiologically according to standard laboratory methods (Pezzlo, 1992; Reisner et al., 1999).

Corresponding Author: R. Ranbar, Molecular Biology Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran
Antimicrobial susceptibility testing: Antimicrobial susceptibility testing was performed according to the standard CLSI guideline (Clinical and Laboratory Standard Institute, 2005) using following antibiotic disks (Pafdan Teb): amikacin (AN, 30 μg), ampicillin (AM, 10 μg), cefazolin (CZ, 30 μg), cephalaxin (CFX, 30 μg), cefotaxime (CTX, 30 μg), ceftriaxone (CRO, 5 μg), cefalotin (CF, 30 μg), ciprofloxacin (CP, 5 μg), chloramphenicol (C, 30 μg), clindamycin (CD, 2 μg), cloxacillin (CX, 5 μg), erythromycin (E, 15 μg), gentamicin (GM, 10 μg), kanamycin (K, 30 μg), penicillin (P, 10 μg), piperacillin-tazobactam (PTZ, 85 μg), tobramycin (TOB, 10 μg), trimethoprim-sulfamethoxazole (SXT, 30 μg) and vancomycin (V, 30 μg).

RESULTS AND DISCUSSION

A total of 188 tracheal specimens had positive results for bacterial cultures. Sixty isolates (32%) were identified as Pseudomonas spp., 52 (27.6%) as S. aureus, 30 (16%) as Klebsiella spp., 18 (9.6%) as Enterobacter spp., 10 (5.3%) as coagulase negative Staphylococci, 6 (3.2%) as Acinetobacter spp., 5 (2.6%) as S. viridans, 5 (2.6%) as E. coli and 2 (1.1%) as Neisseria spp. All Pseudomonas spp. strains were resistant to ampicillin, kanamycin and ceftazime. More than 60% of S. aureus, coagulase negative Staphylococci and Enterococcus spp. strains were resistant to the most commonly used antibiotics. Table 1 and 2 show the frequency of antibiotic susceptibility among gram negative and positive bacterial strains respectively.

Infectious diseases are an important cause of mortality and morbidity in children. The Children Medial Center is a major hospital for pediatric treatment in Tehran. Ranjbar et al. (2007a, b, 2008a, b) have recently investigated the prevalence of some pediatric infections such as shigellosis in this hospital. The aim of current study was to investigate the prevalence and antimicrobial susceptibility of bacterial strains isolated from tracheal specimens obtained from pediatric patients admitted to this hospital in 2007. Respiratory tract infection is considered as one of the most important infectious diseases in developing countries. There are a few reports on the prevalence of tracheal bacterial pathogens and their antibiotic resistance patterns in hospitalized pediatric patients in Iran.

It is notable that around one third of all respiratory tract infections are lower respiratory tract infections with incidence rate of 44-50 per 1000 (Macfarlane et al., 1993; Creer et al., 2006). The main causal agents have been reported as S. aureus and resistant gram-negative bacteria which constitute a major problem in intensive respiratory care units (Kamat et al., 1989; Kumari et al., 2007).

In a study on the epidemiology of respiratory tract bacterial pathogens carried out by Varotto et al. (2001) P. aeruginosa has been reported as the most prevalent organism (24%) followed by S. pyogenes (18%), S. aureus (17%) and K. pneumoniae (8%) (Varotto et al., 2001). In an Indian study carried out by Kumari et al. (2007) on bacterial isolates from respiratory tract of ICU patients, the percentage isolation rate for P. aeruginosa, Klebsiella spp., Enterobacter spp. have been reported 21.5, 19, 8 and 6.2%, respectively.

As shown in Table 1 and 2 the gram-negative bacterial isolates in order of the frequency in our study were Pseudomonas spp. (32%), Klebsiella spp. (16%) and Enterobacter spp. (9.6%) which is comparable, however the isolation rate of S. aureus in our study was higher than reported by two above mentioned studies. The highly resistant gram-negative bacilli continue to

Table 1: Prevalence and antimicrobial susceptibility (%) of gram negative bacterial strains recovered from tracheal samples

<table>
<thead>
<tr>
<th>Bacterial strains</th>
<th>N (%)</th>
<th>CP</th>
<th>CRO</th>
<th>TBO</th>
<th>CZ</th>
<th>CAZ</th>
<th>CPM</th>
<th>CT</th>
<th>AN</th>
<th>GM</th>
<th>PT</th>
<th>AM</th>
<th>SXT</th>
<th>CF</th>
<th>K</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudomonas spp.</td>
<td>60(32.0)</td>
<td>83.3</td>
<td>5.0</td>
<td>56.6</td>
<td>20.0</td>
<td>1.6</td>
<td>0</td>
<td>41.6</td>
<td>36.6</td>
<td>51.6</td>
<td>0.0</td>
<td>8.4</td>
<td>1.6</td>
<td>0</td>
<td>8.3</td>
<td></td>
</tr>
<tr>
<td>Klebsiella spp.</td>
<td>30(16.0)</td>
<td>70.0</td>
<td>3.3</td>
<td>20.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
<td>3.3</td>
<td>6.6</td>
<td>40.0</td>
<td>3.3</td>
<td>43.3</td>
<td>0.0</td>
<td>0</td>
<td>46.6</td>
<td></td>
</tr>
<tr>
<td>Enterobacter spp.</td>
<td>18(9.6)</td>
<td>93.4</td>
<td>2.2</td>
<td>56.7</td>
<td>16.6</td>
<td>11.0</td>
<td>0</td>
<td>22.0</td>
<td>56.7</td>
<td>83.2</td>
<td>5.5</td>
<td>66.0</td>
<td>5.5</td>
<td>0</td>
<td>72.2</td>
<td></td>
</tr>
<tr>
<td>E. coli</td>
<td>5(2.6)</td>
<td>20.0</td>
<td>20.0</td>
<td>20.0</td>
<td>20.0</td>
<td>20.0</td>
<td>20</td>
<td>40.0</td>
<td>60.0</td>
<td>60.0</td>
<td>20.0</td>
<td>20.0</td>
<td>20.0</td>
<td>40</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Acinetobacter spp.</td>
<td>6(3.2)</td>
<td>33.3</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
<td>99.0</td>
<td></td>
</tr>
</tbody>
</table>


Table 2: Prevalence and antimicrobial susceptibility (%) of gram positive bacterial isolates recovered from tracheal samples

| Bacterial strains | N (%) | P | CP | CRO | V | CZ | CN | CD | E | AN | GM | CX | AM | SXT | CF | C |
|-------------------|-------|---|----|-----|---|----|----|----|---|----|----|----|----|-----|----|---|---|
| S. aureus         | 52(27.6) | 0 | 40 | 27 | 98 | 33 | 38.4 | 46 | 22 | 31 | 0 | 2.8 | 29 | 33 | 98 |
| Coagulase negative Staphylococci | 10(5.3) | 70 | 40 | 30 | 70 | 50 | 40.0 | 20 | 20 | 50 | 0 | 0.0 | 30 | 60 | 50 |
| Streptococcus (viridans group) | 5(2.6)   | 20 | 40 | 40 | 60 | 20 | 20.0 | 40 | 40 | 20 | 0 | 0 | 40.0 | 20 | 40 | 80 |

disseminate in hospitals causing therapy problems in many parts of the world, particularly in developing countries (Kumari et al., 2007). The increasing frequency of antibiotic resistance has been reported first in infections at sites where penetration of the antimicrobial agent is restricted and the level of therapeutic concentrations is consequently more difficult to be achieved. It could also hinder the eradication of infections in respiratory tract infections treated using standard antibiotic therapy regimens (Dagan et al., 2001). Accurate information on local epidemiology and antimicrobial resistance patterns of pathogens among the children is essential to select a clinically effective antibiotic therapy for the infections (Bassetti et al., 2000).

We observed a high level of resistance to the most antibiotics tested particularly among Pseudomonas, Klebsiella and E. coli isolates which is consistent with the results obtained from other countries (Kumari et al., 2007). In an Indian study on antibiotic resistance pattern of gram-negative bacterial isolates of lower respiratory tract secretions, the highest and lowest mean resistance among predominant gram negative bacteria in tracheal aspirate has been noted to ampicillin (96.68%) and amikacin (28%), respectively (Navaneeth et al., 2002). Compared to previous report from Iran, an increased rate of antibiotic resistance was observed in Acinetobacter spp. (Ranjbar et al., 2007b) and P. aeruginosa against some tested antibiotics (Shirazi et al., 2005, 2007).

We concluded the most the isolates had a high level of resistance to examined antibiotics. There are many possible reasons for this alarming phenomenon, including inappropriate and incorrect administration of antimicrobial agents in empiric therapies and lack of appropriate infection control strategies. This problem indicates importance of performing antibiotic susceptibility testing before empirical therapy.

REFERENCES


