Research Article

Prevalence and Antibiotic Susceptibility Pattern of *Pseudomonas aeruginosa* Isolated from Hospital Environment in South Libya

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Abstract: *Pseudomonas aeruginosa* has been emerged as a significant pathogen and is the most common dreadful gram-negative bacilli found in various health care-associated infections all over the world due to its virulence, well-known ability to resist killing by various antibiotics and disinfectants. The aim of this study was isolation and identification of *Pseudomonas aeruginosa* in the hospital environment and determining the antibiotic susceptibility of the isolates to four antibiotics (Ciprofloxacin, Amikacin, Imipenem, and Piperacillin). A total of 200 sterile cotton swab samples were collected from hospital environment including ground, walls, beds, bed sheets, blankets, doors, doors handle, nurse tables, trays, chairs, electronic equipment’s, medicine cabinet, windows and (operation theater) (Sabha medical center and Brack general hospital were enrolled in this cross-sectional study). Bacterial isolates were identified by standard microbiological procedures. Antibiotic susceptibility testing was carried out by disc diffusion method. Results revealed that out of the 200 collected samples, 12 *Pseudomonas* spp. (6%) were isolated. Other different bacterial species isolated were 148 (74%) and 40 samples (20%) were negative for growth. Most isolates were obtained from sinks 6 (50%) and then ground 2 (16.7%), Air conditions 2 (16.7%), walls 1 (8.3%), Chairs 1 (8.3%). we found that all *Pseudomonas* spp. isolates were sensitive to Ciprofloxacin, Amikacin, Piperacillin, and Imipenem.

Keywords: *Pseudomonas aeruginosa*, hospital contamination, antibiotic susceptibility pattern.

1. Introduction

Nosocomial infection or hospital-acquired infections (HAIs) are one of the most important problems in the worldwide. These infections are more dangerous than other infections because they are caused by bacteria have a high resistance to antibiotics. These infections are an important cause of increased morbidity, mortality and healthcare costs worldwide (Uma Maheswaran et al., 2007). According to a study cited by the WHO (World Health Organization), over 1.4 million people worldwide suffer from HAI at any given time (WHO, 2002). The risk of nosocomial infection depends on a number of factors. These include the ability of pathogens to remain viable on a surface, the rate at which contaminated surfaces are touched by patients and healthcare workers, the context in which the patient is exposed, and the levels of contamination that result in transmission to patients (Boyce, 2007). For many healthcare-associated pathogens, the degree of hospital surface contamination is closely correlated with the risk of transmission (Nseir et al., 2011).

*Pseudomonas* spp. are commonly found in nature (soils, water, plants, and animals) and water treatment systems, thus demonstrating their adaptation to environments with low nutrient concentration, and over a large temperature range, between 4 and 42°C (Penna et al., 2002). Pseudomonads are diverse group of established and emerging pathogen and are major agents of nosocomial and community-acquired infections, widely distributed in the hospital environment where they are particularly difficult to eradicate (Ravichandra et al., 2012). Most members of the genus (especially *Pseudomonas aeruginosa*) are
opportunistic pathogens often associated with infections of the urinary tract, respiratory system, soft tissue, bone and joint, gastrointestinal infections, dermatitis, bacteremia, and a variety of systemic infections, particularly in patients with severe burns, cancer and AIDS (Pirnay et al., 2005).

Antibiotic-resistant bacteria are implicated in an increasing amount of hospitalized patient infections worldwide. Among patients diagnosed with an infection, antibiotic resistance is associated with an increased length of hospital stay, health care costs, and patient morbidity, and mortality (Boyce and Pittet, 2002). Pseudomonas aeruginosa is one of the most important microorganisms which causes problems clinically as a result of its high resistance to antimicrobial agents. The widespread occurrence of antibiotic-resistant strains of Pseudomonas aeruginosa in hospitals is a matter of growing concern. Unfortunately, there are no specific measures to prevent nosocomial pseudomonal infections (Lutfu et al., 2005). The overall prevalence of antibiotic-resistant P. aeruginosa is increasing, with up to 10% of global isolates found to be multi-drug resistance. It is recognized as the second leading cause of gram-negative nosocomial infection and a major treatment challenge for Pseudomonas aeruginosa (Nasreen et al., 2015). Infections in hospitals are dynamic: patients, staff, and visitors can import any kind of infection into hospital, and they can also acquire infections within hospital and carry infectious agents to other hospitals or into the community. The term ‘nosocomial infection’ is usually restricted to the infections that patients acquire in hospital, but has importance in occupational medicine as well. The development of infections follows certain well-defined rules, the understanding of which is important for prevention. Microbiological diagnosis is essential to understand the importance of the diagnosis of infections (Zsolt Filetoth, 2003). Rapid and accurate detection of Pseudomonas aeruginosa is necessary to implement adequate infection control measures to prevent nosocomial spread. The aim of this study was isolation and identification of Pseudomonas aeruginosa and evaluation of the bacterial contamination rate of items in the hospital setting that are in frequent contact with patients and/or physicians and determining the antibiotic susceptibility of the isolates to four antibiotics (Ciprofloxacin, Amikacin, Imipenem, and Piperacillin).

2. Materials and Methods

2.1. Sample Collection
A total of 200 sterile cotton swab samples were collected from hospital environment including ground, walls, beds, bed sheets, blankets, doors, doors handle, nurse tables, trays, chairs, electronic equipment’s, medicine cabinet, windows (Sabha medical center and Brack general hospital were enrolled in this cross-sectional study).

2.2. Isolation and identification of Pseudomonas spp.
After collection, all samples were transferred to the laboratory, cultured on Nutrient broth then subcultured on Blood Agar (B.A.) and MacConkey Agar (McA) plates and incubated at 37°C for 18-24 hrs. Pseudomonas spp. identification was performed by Gram stain, oxidase, and catalase test, sugar fermentation in Triple Sugar Iron Agar (TSI) and Oxidation-Fermentation (OF) tubes and all Pseudomonas collected were tested by conventional biochemical tests using API 20 NE (bioMérieux, France).

2.3. Antibiotic susceptibility testing of isolated bacteria
All Pseudomonas spp. isolates were tested for sensitivity against four commonly used antibiotics (Ciprofloxacin, Amikacin, Imipenem, and Piperacillin) by using disc diffusion method according to CLSI.

3. Results

Out of the 200 collected samples, 12 Pseudomonas spp. were isolated (6%), 7 from Brack hospital and 5 from the Sabha medical center. Other different bacterial species isolated were 148 (74%) (Tables 1 & 2).

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudomonas</td>
<td>12</td>
<td>6%</td>
</tr>
<tr>
<td>Other species</td>
<td>148</td>
<td>74%</td>
</tr>
<tr>
<td>-Ve Growth</td>
<td>40</td>
<td>20%</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 2. Frequency of occurrence of Pseudomonas spp. isolates in different surfaces.

<table>
<thead>
<tr>
<th>Surface</th>
<th>No. of Pseudomonas isolates</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sinks</td>
<td>6</td>
<td>50%</td>
</tr>
<tr>
<td>Grounds</td>
<td>2</td>
<td>16.7%</td>
</tr>
<tr>
<td>Walls</td>
<td>1</td>
<td>8.3%</td>
</tr>
<tr>
<td>Air conditions</td>
<td>2</td>
<td>16.7%</td>
</tr>
<tr>
<td>Chairs</td>
<td>1</td>
<td>8.3%</td>
</tr>
<tr>
<td>total</td>
<td>12</td>
<td>100%</td>
</tr>
</tbody>
</table>

Results of antibiotic sensitivity testing revealed that all Pseudomonas spp. isolates were sensitive to Ciprofloxacin, Amikacin, Piperacillin, and Imipenem.

4. Discussion

Numerous studies have shown that hospital surfaces and frequently used medical equipment become contaminated by a variety of pathogenic and nonpathogenic organisms (Hayden et al., 2006; Carling et al., 2008). The common nosocomial pathogens may well survive or persist on surfaces for months and can thereby be a continuous source of transmission if no
regular prevention surface disinfection is performed (Kramer et al., 2006).

In this study, out of the 200 collected samples, 12 Pseudomonas spp. were isolated (6%). Other different bacterial species isolated were 148 (74%) and 40 samples were negative for growth (20%). Most isolates were obtained from sinks 6 (50%) and then ground 2 (16.7%). Air conditions 2 (16.7%), walls 1 (8.3%), Chairs 1 (8.3%). P. aeruginosa often has been isolated from sinks and other moist sites in hospitals. The possible transmission of P. aeruginosa from sinks to patients has been reported. Recent reports showed extensive bacteriological screening of the inanimate hospital environment has identified Pseudomonas spp. in the majority of moist sites of hospital. The important and environmental sources of Pseudomonas spp. are humid places. The role of contamination of the environment with Pseudomonas in hospital has been the subject of several studies (Panagea et al., 2005; Pal et al., 2010). P. aeruginosa has been emerged as a significant pathogen and is the most common dreadful gram-negative bacilli found in various health care-associated infections all over the world due to its virulence, well-known ability to resist killing by various antibiotics and disinfectants (Sentharamai et al., 2014).

Recent studies have focused on the decreased susceptibility of P. aeruginosa to currently used antipseudomonal agents, including β-lactams, aminoglycosides, and fluoroquinolones. The carbapenems, imipenem, and meropenem are usually active against multidrug-resistant (MDR) isolates of P. aeruginosa; however, resistance to these compounds has also become a growing therapeutic problem (Andrade et al., 2003).

In our study, we found that all Pseudomonas spp. isolates were sensitive to Ciprofloxacin, Amikacin, Piperacillin, and Imipenem. Masood and Zahra (2014) in their study reported low levels of resistance to the same antibiotics (23%) to Imipenem, (16%) to Amikacin, (5%) to Ciprofloxacin, (28%) to Piperacillin (Masood and Zahra, 2014).

Acknowledgments

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References


