Acinetobacter species-associated infections and their antibiotic susceptibility profiles in Malaysia.

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Abstract

Forty clinical isolates of Acinetobacter species were collected from Selayang hospital, Selangor, Malaysia. Thirty-nine percent of the isolates were identified from respiratory tract followed by urine (19%) and pus (18%). All the isolates were re-identified and confirmed as Acinetobacter species in our laboratory. The antibiotic susceptibility profiles of all the isolates were determined using Kirby-Bauer disk diffusion method as recommended by CLSI. Aminoglycosides (gentamicin) was found to be the most active antimicrobial agent with 47.5% susceptibility followed by amikacin (45%) and 30% to the beta-lactams (imipenem, cef-tazidime). Meropenem showed the maximum resistance (92.5%) followed by piperacillin (77.5%) and ampicillin (75%). It was also found that 5% of the Acinetobacter strains were resistant to one antibiotic, 10% strains were resistant to two antibiotics and 85% strains were multidrug resistant. Acinetobacter spp isolated from respiratory tract, urine and pus showed the highest rate of multidrug resistance.

Keywords: Antibiotic susceptibility, Multi-drug resistance, Acinetobacter species.

Introduction

The genus Acinetobacter has a long and convoluted taxonomic history. In 1911 Beijerinck, a Dutch microbiologist working in Delft, isolated and described the organism which is now recognised as Acinetobacter [1]. In the nature Acinetobacter spp are widely distributed. Species of the genus Acinetobacter is ubiquitous, free-living and fairly stable in the environment. They are strictly aerobic nonfermentative and Gram-negative bacilli that emerge as significant nosocomial pathogens in the hospital setting and are responsible for intermittent outbreaks. The outbreak of Acinetobacter is much more in the regions where temperature is hot and humid. Pneumonia, septicemia, wound sepsis, urinary tract infection, endocarditis and meningitis are the common infections caused by Acinetobacter spp and is a known nosocomial pathogen causing a wide range of clinical diseases including blood stream infections (BSI).

Acinetobacter species cause infections that are difficult to control due to multi-drug resistance. Acinetobacter species are noted for their intrinsic resistance to antibiotics and for their ability to acquire genes encoding resistance determinants. Foremost among the mechanisms of resistance in this pathogens are the production of beta-lactamases and aminoglycoside-modifying enzymes [2]. Nevertheless, little knowledge has been gained on tracing the development of antibiotic resistance in Acinetobacter species. However, there are few recent surveillance studies reporting in Malaysia showed multiple-drug resistance of Acinetobacter species and the development of antibiotic resistance in Acinetobacter species [3].

The aim of this study was to assess the current levels of antimicrobial susceptibility and to evaluate the resistance and their biological response towards different antibiotics among the clinical isolates of Acinetobacter species isolated from patients admitted to Selayang Hospital, Malaysia.

Materials and Methods

Forty clinical isolates of Acinetobacter species were collected from different patients who were admitted to Selayang Hospital, Selangor, Malaysia between January 2010 and June 2010. The Acinetobacter isolates were obtained from different clinical specimens including pus, respiratory fluids, blood, tracheal asp, abdominal fluid, sputum and urine. All the clinically isolated samples were identified as Acinetobacter species by the hospital per-
sonnel. We have reidentified all the isolates as *Acinetobacter* species at our laboratory by the conventional biochemical tests [4] i.e., gram staining, catalase test, oxidase test, motility test, Triple Sugar Iron Assay, citrate test, urease test and indole test etc.

**Antibiotic susceptibility testing:** The Kirby-Bauer disk diffusion method [5] was performed to determine the antibiotic susceptibility. The antibiotics tested were Gentamicin (10 µg), Imipenem (10 µg), Amikacin (30 µg), Piperacillin (100 µg), Ciprofloxacin (5 µg), Ceftazidime (30 µg), Cefoperazone (75 µg), Piperacillin/ Tazobactam (110 µg), Meropenem (10 µg), and Ampicillin (10 µg), respectively. Results of disk diffusion method were interpreted in accordance to the Clinical and Laboratory Standards Institute (CLSI, 2009).

**Results**

The sources of clinical specimens from patients of Selangor Hospital are shown in **Figure 1**.

![Figure 1](image1.png)

**Figure 1.** Percentage of *Acinetobacter* species isolated from various clinical specimens.

The antimicrobial susceptibility testing revealed that *Acinetobacter* species strains were resistant to most of the antibiotics tested which are shown in **Figure 2**.

![Figure 2](image2.png)

**Figure 2.** Number of bacterial strains based on antibiotic susceptibility.
Antibiotic susceptibility profiles of Acinetobacter species …

The percentage of sensitivity was: ciprofloxacin (37.5%), imipenem (30%), amikacin (45%), gentamicin (47.5%), ampicillin (12.5%), ceftazidime (30%), meropenem (7.5%), piperacillin (16%), cefoperazone (17.5%), tazobactam 10/Piperacillin 75 (22.5%) and the percentage of resistance was: ciprofloxacin (55%), imipenem (67.5%), amikacin (50%), gentamicin (52.5%), ampicillin (75%), ceftazidime (60%), meropenem (92.5%), piperacillin (77.5%), cefoperazone (60%), and tazobactam/piperacillin (67.5%) (analyzed from Figure 2), respectively.

![Percentage of Resistant Bacteria](image)

**Figure 3.** Percentage of Acinetobacter species isolates sensitive to different antibiotics.

![Percentage of Sensitve Bacteria](image)

**Figure 4.** Percentage of Acinetobacter species resistant to different antibiotics.

![Antibiotic Resistance](image)

**Figure 5.** Percentage of Acinetobacter species resistant to various numbers of antibiotics

Distribution of the Acinetobacter species isolates according to the specimen type and its correlation to Multi-drug Resistance (MDR) which are shown in Table 1.

**Table 1.** Presence of multidrug-resistant isolates (MDR) based on specimen type.

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Number of specimens</th>
<th>No. MDR isolates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Pus</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Respiratory fluids</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>Urine</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Tracheal aspirations</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Abdominal fluid</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sputum</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Discussion

*Acinetobacter* species are important nosocomial pathogens, with a rising prevalence of hospital-acquired infection [6]. It was reported that the overall incidence of *Acinetobacter* species isolation from all infective samples was 9.5% (510 of 5391), indicating its importance as a nosocomial pathogen, since in most cases the patients were symptomatic for sepsis [7]. *Acinetobacter* spp infections are usually involved with organ systems that have a high fluid content (e.g., respiratory tract, CSF, peritoneal fluid, urinary tract), manifesting as nosocomial pneumonia, infections associated with continuous ambulatory peritoneal dialysis (CAPD), or cather-associated bacteiriaria.

In this present study, it was found that out of 40 clinical *Acinetobacter* species isolates, 16 strains (40%) were identified from respiratory fluids followed by urine, 8 (20%) cases. Gentamicin was found to be the most effective agents (47.5% sensitivity) followed by amikacin and ciprofloxacin (45% and 37.5%, respectively). Study in India also showed *Acinetobacter* species were sensitive to amikacin (44.66%), gatifloxacin and imipenem (33.33%), meropenem and cefaperazone (25%) [8]. Antibiotic susceptibility profiles of *Acinetobacter* species used at the Universiti Malaya Medical Center (UMMC), Kuala Lumpur, Malaysia were obtained. In descending order of effectiveness, imipenem, amikacin and ciprofloxacin were found to be the most effective against the *Acinetobacter* species strains [9]. In our studies, the percentages of antimicrobial resistance of the isolates were 92.5% to meropenem, 77.5% to piperacillin, 75% to ampicillin and 50% to amikacin, respectively. From National surveillance on antibiotic resistance of Malaysia, resistance to meropenem increased from 47.7% in 2007 to 54.3% in 2008 and resistance to imipenem was increased from 46.7% in 2007 to 52.9% in 2008. However, this study showed the resistance was 67.5% to imipenem. In this current study, antibiotic resistance to ceftazidime was shown to be 60% but in 2008, resistance to ceftazidime was 49.8%.

It was, however 48.3% in 2007. Resistant to ciprofloxacin was 48.9% of 9101 isolates in 2008 compared to 43.6% of 7479 isolates in 2007. Our study, however, showed 55% to ciprofloxacin and 52.5% to gentamicin where 43.6% of 9265 isolates in 2008 compared to 37.9% of 7886 isolates in 2007. Our study showed 67.5% resistance to piperacillin/tazobactam and imipenem where in 2008 resistant to piperacillin/tazobactam were 55.4% of 6993 isolates compared to 50.9% of 5713 isolates in 2007. In 2008 resistant to ampicillin/subbactam was found to be 43.2% of 8716 isolates compared to 38% of 7952 isolates in 2007, but current studies showed 75% resistance to ampicillin. Among the 40 clinical isolates of *Acinetobacter* species tested in our study, many strains were found to be multidrug-resistant (MDR). In this study it was found that, 5% of the *Acinetobacter* species strains were resistant to one antibiotic, 10% strains were resistant to two antibiotics and 85% were multidrug- resistant (MDR). The resistance to antibiotics of the investigated problematic strains of *Acinetobacter* species was higher than the mean *Acinetobacter* species resistance found in Malaysia [7]. In this study, *Acinetobacter* species isolated from respiratory fluids, pus, blood and urine samples showed the highest rate of multi-drug resistance. Gradually *Acinetobacter* species is emerging as multidrug-resistant nosocomial pathogen, increasingly involved in hospital-acquired infections but the correlation between the multi-drug resistance and the site of infection is not yet known. Risk factor analyses will be useful for further hospital epidemiology studies of *Acinetobacter* species.

In summary, gentamicin was found to be the most active antimicrobial agent with 47.5% susceptibility followed by amikacin (45%). Meropenem showed the maximum resistance (92.5%) followed by piperacillin (77.5%) and ampicillin (75%). Eighty-five percent of the *Acinetobacter* species isolates were multidrug-resistant. *Acinetobacter* species isolated from respiratory tract, urine and pus showed the highest rate of multi-drug resistance (MDR).

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Reference

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