Isolation of *Acinetobacter* species and their antimicrobial resistance pattern in an Intensive care unit (ICU) of a tertiary care hospital in Dhaka, Bangladesh

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Abstract
Critically ill patients acquire an infection during their stay in an intensive care unit (ICU) and the frequency of these infections varies considerably in different populations and clinical settings. The purpose of this study was to know the antimicrobial sensitivity pattern of *Acinetobacter* isolates from tracheal aspirate, blood from central venous catheter, peripheral blood, urine and endotracheal tube of patients admitted in ICU at BSMMU(Bangabandhu Sheikh Mujib Medical University) hospital, Dhaka, Bangladesh over a one year period from January 2010 to December 2010. A total 95 ICU samples were studied of which 32(33.7%) were *Acinetobacter* species. *Acinetobacter* species isolated from endotracheal tube (100%), tracheal aspirate (54.3%), blood from central venous catheter (36.4%), peripheral blood (13.6%), and urine (12.5%). *Acinetobacter* isolates were 100% resistant to amoxicillin, ceftriaxone cefuroxime and gentamicin. Higher level of resistance was recorded for amikacin (68.4%) and imipenem (66.7%). Lower resistance only showed in colistin (10.5%). The findings of this study will help our clinician to apply antibiotics for treatment of the patients admitted in ICU. Producing a local antibiogram database will improve the knowledge of antimicrobial resistance patterns in Bangladesh and will also help to improve treatment strategies.

Key words: *Acinetobacter*, intensive care unit, antimicrobial sensitivity pattern.

Introduction
Critically ill patients acquire an infection during their stay in an intensive care unit (ICU) and the frequency of these infections varies considerably in different populations and clinical settings¹⁻³. Patients in the ICU have encountered an increasing emergence and spread of antibiotic-resistant pathogens. Rates of nosocomial infections range from 5% to 30% among ICU patients. Although ICUs generally comprise <5% of all hospital beds, they account for 20% to 25% of all nosocomial infections. The increased risk of infection is associated with the severity of patient’s illness, length of exposure to invasive devices and procedures, increased patient contact with healthcare personnel and length of stay in the ICU ⁴.

During the last two decades clinicians in various countries have witnessed a growing number of critically ill patients who suffer from infections due to microorganisms that belong to the *Acinetobacter* genus, mainly strains of the species *Acinetobacter baumannii*. *Acinetobacter* are a group of non-fermentative Gram-negative bacteria that have minimal nutritional requirements and can survive on a variety of surfaces and aqueous environments⁵⁻⁶. Apart from ICU patients it has been shown to be a cause of nosocomial pneumonia, meningitis, endocarditis, skin and soft tissue infections, urinary tract infections, conjunctivitis, burn wound infections and bacteremia⁶. Outbreaks of *Acinetobacter* infections are linked to contaminated respiratory equipment, intravascular access devices, bedding materials and transmission via hands of hospital personnel⁷. An ICU study from BIRDEM(Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorder) hospital, Dhaka showed that major isolated organisms were *Pseudomonas sp*, *Acinetobacter sp*, *Candida sp*, *Escherichia coli*, *Klebsiella sp*. An Indian ICU study showed that, most common organisms were *Acinetobacter*, *Escherichia coli*, *Klebsiella*, *Pseudomonas*, *Staphylococcus*, *Streptococcus*. Multidrug resistance of
Acinetobacter isolates is a growing problem and has been widely reported\(^{10}\). Resistance in Acinetobacter to majority of commercially available antimicrobials (aminoglycosides, cephalosporins, quinolones and imipenem) raises an important therapeutic problem\(^{11,12}\).

In ICU, monitoring of bacterial etiologies and infection patterns prevent development of drug resistance. Knowledge of sensitivity pattern of the organism isolated in the ICU is helpful in selecting empirical therapy. There are few data about Acinetobacter isolation and their antibiotic susceptibility pattern from ICU samples of our country. Therefore, the purpose of this study was to examine the antimicrobial sensitivity pattern of Acinetobacter isolates from tracheal aspirate, blood from central venous catheter, peripheral blood, urine and endotracheal tube of patients admitted in ICU at BSMMU (Bangabandhu Sheikh Mujib Medical University) hospital, Dhaka, Bangladesh over a one year period from January 2010 to December 2010.

**Material and methods**

Clinical samples were collected from patients admitted in Intensive Care Unit (ICU) of Bangabandhu Sheikh Mujib Medical University (BSMMU). Samples were tracheal aspirates, blood from central venous catheter, peripheral blood, endotracheal tubes and urine collected from patients having catheter. Laboratory works were performed in the department of Microbiology & Immunology, Bangabandhu Sheikh Mujib Medical University (BSMMU) Dhaka between a period of January 2010 to December 2010.

**Isolation and identification of Acinetobacter**

Typical colonies were enumerated, selected and examined further. Acinetobacter was identified by Gram staining, motility, oxidase, catalase, citrate utilization, indole and urease tests, glucose oxidation in Kriger Iron Agar (KIA) media and biochemical tests in oxidation and fermentation media (OF media). These identification scheme were done as per standard technique\(^{13,14}\).

**Antimicrobial susceptibility tests**

All the Acinetobacter isolates were tested for antimicrobial susceptibility testing by disc diffusion method using the Kirby-Bauer technique\(^{15}\) and as per recommendations of the National Committee for Clinical laboratory Standards (NCCLS)\(^{16}\). Antimicrobial disks used for sensitivity tests were amoxicillin (10 mg), gentamicin (10 mg), ceftriaxone (30 mg), cefuroxime (30 mg), amikacin (30 mg), imipenem (10 mg) and colistin (10 mg).

**Results**

A total 95 ICU samples were studied which included tracheal aspirates (35), blood from central venous catheter (11), peripheral blood (22), urine (24), endotracheal tube (3). Out of 95 samples, 32 (33.7%) Acinetobacter species were isolated. Acinetobacter species isolated from endotracheal tube 3 (100%), tracheal aspirate 19 (54.3%), blood from central venous catheter 4 (36.4%), peripheral blood 3 (13.6%), and urine 3 (12.5%) (Table I).

**Table I: Acinetobacter species isolated from different samples**

<table>
<thead>
<tr>
<th>Samples</th>
<th>Number</th>
<th>Acinetobacter species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracheal aspirate</td>
<td>35</td>
<td>19 (54.3%)</td>
</tr>
<tr>
<td>Blood from central venous catheter</td>
<td>11</td>
<td>4 (36.4%)</td>
</tr>
<tr>
<td>Peripheral blood</td>
<td>22</td>
<td>3 (13.6%)</td>
</tr>
<tr>
<td>Urine</td>
<td>24</td>
<td>3 (12.5%)</td>
</tr>
<tr>
<td>Endotracheal tube</td>
<td>3</td>
<td>3 (100%)</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>32 (33.7%)</td>
</tr>
</tbody>
</table>

Acinetobacter isolates were 100% resistant to amoxicillin, ceftriaxone, cefuroxime and gentamicin. Higher level of resistance was recorded for amikacin (68.4%) and imipenem (66.7%). Colistin showed lower resistance (10.5%) in Acinetobacter isolates (Table II).

**Table II: Antibiotic resistance pattern of Acinetobacter species isolated from different site of infection**

<table>
<thead>
<tr>
<th>Name of drugs</th>
<th>Tracheal aspirates</th>
<th>Blood from central venous catheter</th>
<th>Peripheral blood</th>
<th>Urine</th>
<th>Endotracheal tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Cefuroxime</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>95.0%</td>
<td></td>
<td>100%</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>Amikacin</td>
<td>68.4%</td>
<td></td>
<td></td>
<td>33.3%</td>
<td>66.7%</td>
</tr>
<tr>
<td>Imipenem</td>
<td>63.1%</td>
<td>50%</td>
<td></td>
<td>33.3%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Colistin</td>
<td>10.5%</td>
<td>0.0%</td>
<td></td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

**Discussion**

The severity and extent of disease caused by multidrug-resistant pathogens varies by the populations affected and by the institutions in which they are found, but the prevention and control of multidrug resistant organisms should be a national priority\(^{17}\). Critically ill patients in intensive care unit are at a higher risk of nosocomial infection due to multiple...
causes including disruption of barriers to infection by endotracheal intubation and tracheostomy, urinary bladder catheterization and central venous catheterization. This study included antibiotic susceptibility pattern of Acinetobacter species isolated from different samples from ICU patients but the source of infection and underlying disease condition of the patients were not included.

In this study, 33.7% Acinetobacter species were isolated from different ICU samples. In BIRDEM hospital, 27.5% Acinetobacter species were isolated from ICU samples. In India, Acinetobacter is reported for about 13.2% of nosocomial infections in ICU patients. High isolation rates of Acinetobacter species of about 100% from endotracheal tube, followed by 54.3% from tracheal isolates, 36.4% from central venous catheter blood, 13.6% from peripheral blood and 12.5% from urine. Acinetobacter is commonly isolated from skin and throat of healthy people. The respiratory tract is an important site of colonization and is the most frequent site of infection. Acinetobacter colonization has been reported from the nares, nasopharynx, and tracheostomy sites. Rates of colonization increase during ICU stays. In BIRDEM hospital, Acinetobacter species were isolated from blood (18.4%), urine (4.7%) and respiratory secretions (40.9%). In India, a study reported that, the high isolation rate of Acinetobacter species of about 24% were from tracheal aspirates, 12% from endotracheal tube, and 6% from blood.

This study showed, Acinetobacter species were 100% resistant to amoxicillin, cefuroxime, ceftriaxone and gentamicin. High level of resistance was recorded for amikacin (68.4%), imipenem (66.7%) and maximum activity with an overall low resistance showed in colistin (10.5%). BIRDEM hospital showed that, Acinetobacter species were 100% resistant to piperacillin, higher resistance was seen for ceftriaxone (98.2%), gentamicin (93.2%), aztreonam (91.6%), amikacin (81.4%) and imipenem (72.4%). Susceptibilities of Acinetobacter against various antimicrobials are considerably different among countries, centers and even among different wards of the same hospital, therefore, such type of local surveillance studies are important in deciding the most adequate therapy for Acinetobacter infections.

In conclusion, Acinetobacter is now a day a common threat in hospital acquired infection especially in critically ill patients admitted to intensive care unit. Acinetobacter species were found to be resistant to most commonly used antibiotics. Only lower resistance was seen in colistin. However colistin resistant Acinetobacter species are emerging slowly. It is a great challenge for the physician to treat multidrug resistant Acinetobacter species. So, nationwide antibiotic policy and guidelines is necessary due to increase resistance patterns. Producing a local antibiogram database will improve the knowledge of antimicrobial resistance patterns in Bangladesh and will also help to improve treatment strategies.

References:


