Prevalence and Resistance Profile of Acinetobacter baumannii Clinical Isolates from a Private Hospital in Khartoum, Sudan

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Abstract: Acinetobacter baumannii is an important cause of nosocomial infections worldwide. It is difficult to control, and the infections caused by it are difficult to treat, because it is multidrug resistant. Objectives: This retrospective study was conducted to determine the prevalence and antibiotic resistance pattern of A. baumannii at Royal Care International Hospital, Khartoum, Sudan over a 37 month period. Methodology: Antimicrobial susceptibility testing of the isolates was performed by the disk diffusion method as recommended by Clinical Laboratory and Standards Institute CLSI [1]. Result: Non duplicate 275 A. baumannii were isolated out of a total 2899 pathogenic Gram negative isolates (9.5% prevalence). The most frequently isolated A. baumannii was from ICU patients (72%) followed by inpatients (24%) and outpatients (4%). The greatest number of isolates were recovered from sputum (61%) followed by wound (19%). The Resistance rates were higher than most of the internationally reported levels. Cephalosporins, aminoglycoside, aztreonam, fluoroquinolones and carbapenems are becoming practically ineffective, where the colistin elicited the highest susceptibility levels. Conclusion: This report shows for the first time (to our knowledge) the prevalence and resistance profile of A. baumannii in Sudan. The prevalence will help to conduct better infection control policy, and an update the local antibiogram will improve the knowledge of antimicrobial resistance patterns in our region.

Keywords: Acinetobacter baumannii, antibiogram, RCIH


1. Introduction

The genus Acinetobacter is a member of the family Moraxellaceae in the order Pseudomonadales. More than 25 species within the genus Acinetobacter have been described [2]. The most important species of this genus is Acinetobacter baumannii which causes 2-10% of all Gram-negative infections in the Unites State and Europe [3]. It possesses little risk to healthy individuals, but generally causes infections in those with weakened immune systems specifically, the intensive care unit (ICU). The latter equipped with ventilators and invasive tools such as catheters that are factors that predispose to A. baumannii infections such as Ventilator Associated Pneumonia (VAP), meningitis, wound infection, septicemia, and urinary tract infections [3]. The clinical impact of Acinetobacter infection in terms of morbidity and mortality has been discussed widely in which the mortality rates range from 19% to 54% [4].

The infections caused by A. baumannii are often treated with cephalosporins including ceftazidime and ceftriaxone, aminoglycosides such as tobramycin and amikacin, carbapenems, and tetracycline. However, to date, most strains of A. baumannii have become increasingly resistant to all these currently available antibacterial agents [5]. The clinical significance of A. baumannii has grown significantly over the last few decades mainly due to the fact that this species possesses a variety of antibiotic resistance genes on plasmids, transposons and integrons and innate antimicrobial resistance mechanisms such as cell surface structures that prevent the influx of antibiotics which lead to failure of treatment [6].

Due to growing the numbers of A. baumannii infections and lack of new forms of antibiotics to treat the infections, some studies are focused to assess the in vitro combination activity of different types of currently used antibiotics against carbapenem-resistant A. baumannii such ascarbapenem/ sulbactam combination and colistin/ rifampicin combination. Some reports showed that the in vitro combinations of antibiotics such as imipenem/
A. baumannii has already been compared to methicillin-resistant Staphylococcus aureus (MRSA), and has even been termed the ‘Gram-negative MRSA’ [8]. Also it has been identified as an ESKAPE pathogen (Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa, and Enterobacter species); a group of pathogens with a high rate of antibiotic resistance that are responsible for the majority of nosocomial infections [9]. Colloquially, A. baumannii is referred to as 'Iraqibacter' due to its seemingly sudden emergence in military treatment facilities during the Iraq War [10].

In the literature, various terms have been used to describe the resistance rate of A. baumannii to antibiotics like Multidrug Resistant A. baumannii (MDR-AB) is used to describe the isolates which are resistant to at least three classes of antibiotics including Penicillins, cephalosporins, fluoroquinolones and aminoglycosides. While the term Extreme Drug Resistant (XDR) is used when the isolates are resistant to the three above mentioned families plus carbapenems, Finally the Pandrug-Resistant (PDR) which is used to describe the A. baumannii which are (XDR) with resistance to polymyxins [11].

Susceptibility of A. baumannii to antimicrobials is considerably different among countries, among centers and even among the wards of a given hospital. These differences may reflect different patterns of antimicrobial usage and different epidemiological situations, including antimicrobial control measures and policies [12].

Regarding Sudan, there are no published records about the prevalence of A. baumannii in hospitals. However, some reports are available from other countries. In the Islamic Republic of Iran, for example, a prevalence of 15% was reported [13], in India it was 9.5% [14], and in Kuwait it was 22.1% [15]. In one study carried out in Saudi Arabia, A. baumannii was the most common isolated organism among Gram-negative bacteria, with a prevalence of 31.7% [16]. The variations in the prevalence and resistance patterns among isolates stress the importance of local surveillance to determine the best antimicrobial therapy for A. baumannii infections.

This study aimed to determine the prevalence and antibiotic resistance pattern of A. baumannii isolated from various clinical specimens at Royal Care International Hospital (RCIH) Khartoum, Sudan.

2. Materials and Methods

This retrospective study was carried out over a period of 37 month from July 2011 to August 2014 in the department of microbiology, (RCIH) located in Khartoum, Sudan. Consecutive, non-duplicate (275) isolates of A. baumannii were recovered from various clinical specimens, namely; Sputum, wound swabs, urine, blood, soft tissue, Central Venous Catheter Tip (CVC) and other body fluids (CSF, synovial and ascitic fluid).

The samples were collected and processed during the course of routine diagnostic work up from patients in the ICU, wards and outpatient departments of the hospital. The specimens received in the laboratory were inoculated on 5% Blood Agar and MacConkey Agar and incubated overnight aerobically at 37°C. Blood specimens were inoculated on tryptone soya broth (Hi-Media, Mumbai) and then sub cultured on chocolate agar and MacConkey agar. A. baumannii isolates were initially identified by colonial morphology, Gram staining, growth at 37°C, a negative oxidase test, and oxidation of glucose. API E20 (BioMérieux, marcy l’Etoile, France) were used to confirm the identification of the isolates [17].

Antimicrobial susceptibility was done by disc diffusion method as per the (CLSI) guidelines [1], using Muller-Hinton agar (Hi-Media, Mumbai) and antimicrobial discs (bioanalyse, Turkey and Hi-Media, Mumbai). The following antimicrobial agents (μg) were used: Cefazidim (30), cefepime (30), cefuroxime (30), gentamicin (10), amikacin (30), ciprofloxacin (5), amoxiclav (30), meropenem (10), cephalexin (30), ceftriaxone (30) aztreonam (30) and colistin (10). The diameter of inhibition zones was measured and data were reported as susceptible and resistant. Quality control of the disks was checked by using reference strains.

3. Results

During the study period the total number of pathogenic Gram negative isolates, was 2899, of which 275 isolates were A. baumannii (9.5%). The majority of A. baumannii was isolated from sputum 61% followed by wound 19%, blood 9%, urine 3%, and others including: pus, CSF, synovial fluid, bone, soft tissue, CVC tip, ascitic fluid was 8% (Table 1).

Of the 275 A. baumannii isolates, 198 were isolated from ICU patients (72%), while 65 (24%) were from inpatients and 12 (4%) from outpatients department (Figure 1).

In this study most of A. baumannii isolates were highly resistant to the tested antibiotics, 92% were resistant to ceftazidime, 96% to cefepime, 99% to ceftriaxone, 100% to cefuroxime, 100% cephalaxin, 92% gentamicin, 81% amikacin, 91% ciprofloxacin, 98% amoxiclav, 89% meropenem, 95% aztreonam, 37% colistin (Figure 2).

<table>
<thead>
<tr>
<th>Sample</th>
<th>Number</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sputum</td>
<td>123</td>
<td>61</td>
</tr>
<tr>
<td>Wound</td>
<td>47</td>
<td>19</td>
</tr>
<tr>
<td>Blood</td>
<td>18</td>
<td>9</td>
</tr>
<tr>
<td>Urine</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Pus</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>CSF</td>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td>Synovial fluid</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Ascitic fluid</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Bone</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Soft tissue</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CVC Tip</td>
<td>3</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Figure 1. prevalence of the A. baumannii among ICU, In patient (IN) and out patients (OUT) at RCIH
workers responsible for patient care. Frequent contamination of the hands of health care having multiple wounds and indwelling devices and immunocompromised patients who are colonized, patients opportunities for cross transmission, rate when compared to two other studies in one of which were Extreme XDR. This is considered high resistance aminoglycosides, fluoroquinolones and cephalosporins. 89% resistant to three groups of antibiotics include \( \text{RCIH} \) hospital showed that 97% were MDR which most of \( A. \) \text{baumannii} was isolated from sputum specimen (61%). Other studies similar to this, were carried out by Jaggi et al., [19] where the maximum isolates were obtained from sputum 54.6% and Villerset al., [21] reported a predominance of \( A. \) \text{baumannii} in tracheo-bronchial secretions 48.8%. All these findings may support the presence of \( A. \) \text{baumannii} as a common colonizer in the respiratory tract, Its isolation from sputum without clinical signs and symptoms and may not necessary mean that they are causing infection.

In conclusion, we report for the first time in Sudan the prevalence and resistance rate of \( A. \) \text{baumannii}. This study is limited because it does not sharply identify patients with true infections versus those who are colonized but the present report is alarming because the emergence and increase in the rate of PDR \( A. \) \text{baumannii} which can be due to excessive antibiotic misuse in our region.

**References**


**Figure 2.** Resistance pattern of \( A. \) \text{baumannii} isolates against different antibacterial agent


