

# *Acinetobacter baumannii* Isolated from Clinical Material of Patients from a University Hospital

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**How to cite this paper:** Silva, R.P., de Almeida Matozzo, J.M., Fernandes, R.C., de Melo, F.A., Belato, P.H.S., Filgueiras, V.F. and Loyola, A.B.A.T. (2019) *Acinetobacter baumannii* Isolated from Clinical Material of Patients from a University Hospital. *Open Journal of Medical Microbiology*, 9, 230-237.

<https://doi.org/10.4236/ojmm.2019.94021>

**Received:** October 10, 2019

**Accepted:** December 23, 2019

**Published:** December 26, 2019

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## Abstract

**Model Study:** The genus *Acinetobacter* is composed of opportunistic pathogens that mainly affects immunocompromised and patients during a prolonged hospitalization period. *A. baumannii* can survive in the hospital setting at various locations such as mechanical ventilators, dialysis machines, ventilation systems, water sources, skin and mucous membranes of health professionals and patients, drug preparations and disinfectants among others. Antimicrobials are essential for the treatment of infections, so their use has become common, and often inappropriate and abusive. This pathogen has presented multi-resistance to several classes of antimicrobials and has become a major cause of death in hospitals. **Objective:** To evaluate the occurrence of *Acinetobacter baumannii* in clinical samples from the Laboratory of Clinical Analyzes, HCSL of Pouso Alegre, MG. **Methods:** All the samples referring to the patients of the Samuel Libânio Clinical Hospital including most of the specialties were evaluated. From the positive samples for *Acinetobacter baumannii* the medical records of hospitalized patients were evaluated. From the medical records, data were obtained as gender and age of the patient, place of hospitalization, together with month and year of the laboratory procedure. **Result:** A total of 14,859 samples of diverse materials were evaluated, being 80 (0.5%) samples positive for *Acinetobacter baumannii*. Of these positive samples, the largest occurrences were identified in male patients 59 (73.7%), aged over 60 years 37 (46.3%). The most affected hospital sector was Adult ICU with 44 (55.0%) of the cases. In May 2015, there were 5 (6.3%) cases registered and in May 2016, 16 (20.0%) cases. The clinical material with the highest occurrence of *Acinetobacter baumannii* was Mini Bal 29 (36.3%).

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**Conclusion:** *Acinetobacter baumannii* has been presenting a major increase in clinical samples from the lungs, mainly from male, elderly patients hospitalized in an intensive care unit and with resistance to Polimixin.

## Keywords

*Acinetobacter baumannii*, Resistance, Antimicrobial

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## 1. Introduction

Bacterial resistance emerges as a global public health problem attracting the attention of national and international governmental bodies [1]. Since the introduction of the oldest to the most recent antimicrobial, a selective pressure microorganism has been registering themselves [2].

*Acinetobacter baumannii* is a gram-negative bacterium in the family Moraxellaceae, order Gammaproteo-bacteria. The genus *Acinetobacter spp.* includes 31 different species, and 17 of them are not named, because they are rarely isolated in humans [3].

The intrinsic characteristics, which make the *Acinetobacter baumannii* resistant to antimicrobials, can be grouped into three broad categories: 1) the production of modifier and hydrolyzers enzymes of antimicrobials; 2) changes in permeability of outer membrane and efflux pumps; 3) amendment of the target locations [4].

The *Acinetobacter baumannii* can survive in hospital environment in several locations, in particular, in hospital equipment as on mechanical ventilators, dialysis machines, ventilation systems, water sources, on the skin and mucous membranes of health professionals and patients, drugs preparations and disinfectants, among others [5].

The treatment of infections caused by *Acinetobacter baumannii* is particularly difficult, not only because of the fragility of the host as well as the microorganism's ability to develop resistance and the limited bioavailability of some antimicrobials in places like the lungs and central nervous system [6].

The clinical microbiology laboratory has always had a key role in the control of hospital-acquired infections and this has expanded from the 90s decade with the dissemination of multiresistant microorganisms [7].

The result of the bacteria acquiring resistance is the lack of options to be used as a treatment in the last cases, requiring more and more antimicrobials and the fact that the process of emergence of bacterial resistance is very fast compared to the process of developing new drugs [8].

The rate of imipenem resistance by *Acinetobacter baumannii* has increased from 12.6% to 71.4% in recent years. This high resistance rate reflects directly the impact of mortality that comes to 61.9% [9].

The *Acinetobacter baumannii* has shown high rates of resistance to anti-

crobiales. Treatment with antimicrobials as potent as the carbapenems became essential. However, by the prescription of these antibiotics; it has been observed growing indexes of resistant strains to these drugs. Therefore, the use of the lipopolypeptides (polymyxin B and polymyxin E), considered as a “last resource”, has been increasingly necessary [10].

The carbapenem resistance has limited the treatment to the use of polymyxins as the main therapeutic option. Some studies show that despite the resistance to polymyxins be very rare in isolates of *Acinetobacter baumannii*, the clinical efficacy in the treatment of infections is not always satisfactory, even when the minimum inhibitory concentration (MIC) is on the range of susceptibility [3].

A growing number of studies have been published indicating that the tigecycline may be a good therapeutic option for *Acinetobacter baumannii* MR; however, there is still controversy about its indication: the tigecycline has no cutoff point established by CLSI [11].

In Brazil, data on infection by *A. baumannii* are scarce and few comprehensive. Furthermore, these data are not consolidated by most hospitals, hindering even more the recognition of the extent of the problem in the country.

Samuel Libânio clinics hospital (HCSL), located in Pouso Alegre, in the South of Minas Gerais State, considered Pole Municipality Macroregional South, is inserted in the network of urgency and emergency response. Nowadays, it answers to 16 micro-regions of Minas Gerais State, corresponding to 191 cities with an estimated population of 3.5 million inhabitants.

The objective of this work was to evaluate the occurrence of *Acinetobacter baumannii* in clinical samples of Clinical Analysis Laboratory, Department of Microbiology, HCSL of Pouso Alegre, MG. In addition, to assess susceptibility of *Acinetobacter baumannii* strains against the antimicrobials tested and evaluate the hospitalized patients' medical records to obtain data regarding gender and age, and what are the isolated clinical materials with more frequency.

## 2. Methodology

An observational, longitudinal, analytical, retrospective and prospective study was performed between May 2015 to May 2016.

The study was approved by the Research Ethics Committee of UNIVÁS (approval no.1.417.438) and performed in accordance with the Resolution 466/2012 of the Brazilian National Health Council (CNS) on research involving human beings.

Inclusion criteria were all samples concerning patients of HCSL were evaluated, including most specialties of the medical and surgical clinic, Intensive Care Unit (ICU), Adult (clinical and surgical), neonatal ICU, pediatric ICU, adult and pediatric urgency and emergency service. The medical records of the patients hospitalized that presented as positive samples for *Acinetobacter baumannii* were evaluated.

Exclusion criteria were all samples concerning patients of HCSL before May

2015 and after May 2016.

From the records data as gender and age of the patient, place of hospitalization, together with month and year of the laboratory procedure and the sensitivity containing the susceptibility profile was obtained.

**Insulation:** samples were sown in the means of culture agar chocolate or blood Teague and incubated at 35° for 24 to 48 hours. In the case of growth, microscopically (by gram coloring) are examined for presumptive diagnosis. For samples that obtained growth, it was performed the evidence identification for species or gender of an isolated microorganism. For cultures, The Hemocult® system was used, PROBAC composed of a laminocultive with two faces attached to the top of a plastic container containing a broth supplemented with yeast extract and polydill-sulfonate sodium (SPS) and increased of organic and inorganic substances for the neutralization of antimicrobials, incubated at 35°C for a period of no more than 5 days.

**Identification:** the methodology for identifying strains of *Acinetobacter baumannii* is based on the miniaturization of sensitivity tests with previously dehydrated dilution broth already incorporated in the panel Negative Combo Type 66 (SIEMENS) in MicroScan® autoSCAN®-4 (BECKMAN COULTER).

**Susceptibility:** The methodology for Susceptibility profile was based on the miniaturization of sensitivity tests with previously dehydrated broth dilution already incorporated in the Negative Combo Type 66 (SIEMENS) panel.

Antimicrobials tested against *Acinetobacter baumannii* were Amikacin, Ampicillin/Sulbactam, Cefepime, Ceftazidime, Ciprofloxacin, Gentamicin, Imipenem, Levofloxacin, Meropenem, Polymyxin, Tigecycline, Tobramycin, Sulfamethoxazole/Trimethoprim.

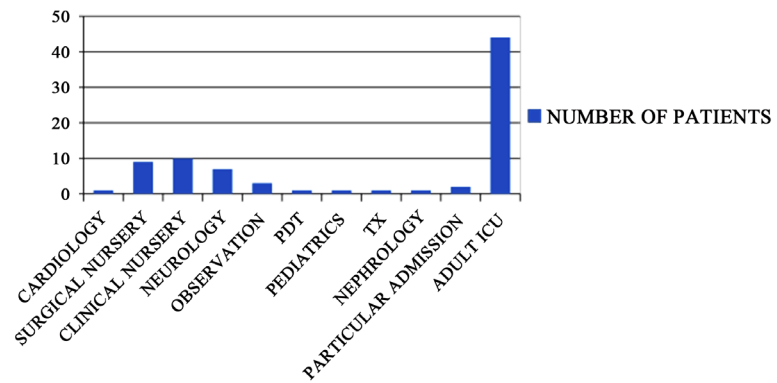
### 3. Results

Materials from different sectors of the HCSL were sent to the microbiology sector of the laboratory of clinical analysis. Between May 2015 to May 2016 14,859 samples of several materials were received in the laboratory, being 80 (0.5%) positive samples for *Acinetobacter baumannii*.

Of the 80 samples that obtained growth, 21 (26.3%) samples were isolated from female patients and 59 (73.7%) samples of the male gender. As for the age of the patients, 3 (3.7%) were between 0 to 20 years, 19 (23.8%) aged between 41 to 60 years, 21 (26.3%) aged between 21 to 40 years, and 37 (46.3%) aged over 60 years.

Regarding the number of patients infected by *Acinetobacter baumannii* in different areas of hospitalization, they were: Cardiology 1 (1.3%), PDT 1 (1.3%), Pediatrics 1 (1.3%), Tx1 (1.3%), Nephrology 1 (1.3%), Private Hospitalization 2 (2.5%), Observation 3 (3.7%), Neurology 7 (8.7%), Surgical Ward 9 (11.3%), Clinical Ward 10 (12.5%), Adult ICU 44 (55.0%) (**Figure 1**).

Of all the isolated strains in the 12-month period between May 2015 to May 2016. The month with the highest occurrence of *Acinetobacter baumannii* was



**Figure 1.** *Acinetobacter baumannii* isolated from clinical material of patients regarding the hospitalization sector during the period between May 2015 to May 2016.

May 2016, with 16 (20.0%), followed by the month of November 2015 which presented 13 (16.3%), December 2015 13 (16.3%), October 2015 11 (13.7%), August 2015 6 (7.5%), May 2015 5 (6.3%), February 2016 5 (6.3%), March 2016 5 (6.3%), June 2015 3 (3.7%), July 2015 1 (1.3%), September 2015 1 (1.3%), January 2016 1 (1.3%), respectively (**Figure 2**).

Regarding the materials contaminated by *Acinetobacter baumannii* received by the laboratory of clinical analysis of the HCSL, a larger occurrence was in Mini Bal 29 (36.3%). Followed by the Urine materials 17 (21.3%), Blood 7 (8.7%), Catheter Tip 8 (10%), Unspecified Secretion 5 (6.3%), Tracheal Secretion 3(3.7%), Surgical Wound Secretion 3 (3.7), Pleural Fluid 1 (1.3%), Central Venous Access Secretion 1 (1.3%), Drain Secretion 1 (1.3%), Secretion of Escher 1 (1.3%), Wound Secretion 1 (1.3%), Secretion of Oropharynx 1 (1.3%), Ear Secretion 1 (1.3%), Nasal Swab 1 (1.3%) (**Figure 3**).

Of the 13 antimicrobials tested, five (Cefepime, Ceftazidime, Ciprofloxacin, Imipenem and Meropenem) showed resistance in all samples of *Acinetobacter baumannii*, representing a total of 38.46%.

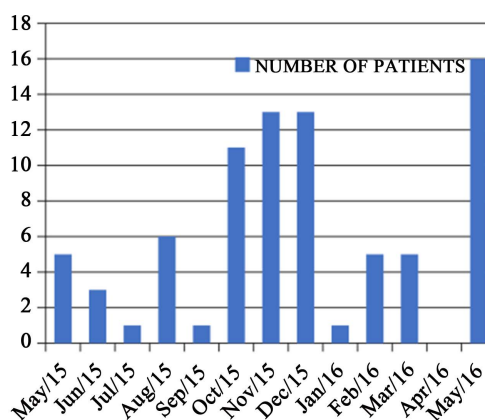
Only Tigecycline presented 100% of sensitivity facing all *Acinetobacter baumannii* samples in this study, representing 7.69% of the tested drugs.

#### 4. Discussion

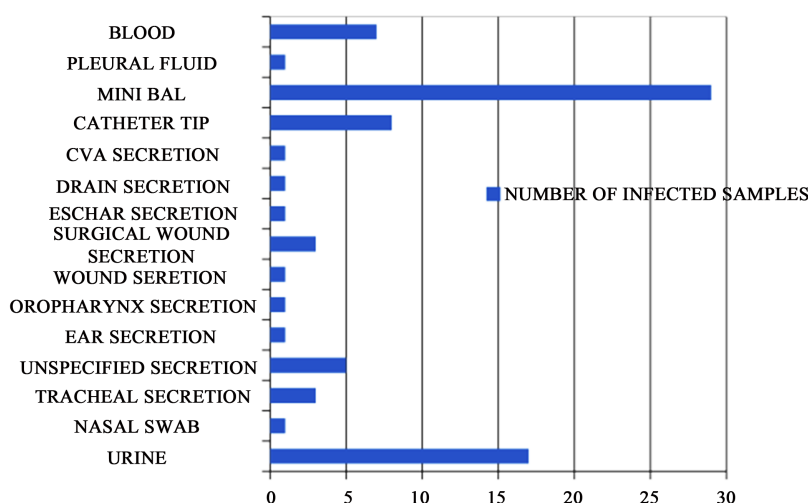
In a study conducted in Rio de Janeiro during an outbreak of *Acinetobacter baumannii* that took place in 2011, 27 samples of patients and the environment were obtained, with samples that presented high levels of resistance. The highest percentage of resistance found was to Ciprofloxacin (96%, n = 26) [10].

In our study it was detected that 80 (100%) of the samples collected presented resistance to the Ciprofloxacin, as well as the Cefepime, Ceftazidime, Imipenem and Meropenem.

Colistin is currently administered as the last therapeutic drug against infection by isolates from *A. baumannii*. However, despite the fact that Colistin has an in vitro activity against most of the strains of *Acinetobacter baumannii*, clinical isolates resistant to Polymyxins have already been reported [12].



**Figure 2.** *Acinetobacter baumannii* isolated from clinical material of patients as to the date of collection during the period between May 2015 to May 2016.



**Figure 3.** *Acinetobacter baumannii* for patient-isolated clinical material during the period from May 2015 to March 2016.

In the antibiograms collected between May 2015 and May 2016 in the HCSSL, 8.75% of the isolated microorganisms presented resistance to Polymyxins.

There are a good number of reports of outbreaks in ICUs caused by *Acinetobacter baumannii* that have been published in several countries in the last decade, mainly in Europe, North America and Latin America [13].

In the study conducted at the university hospital, in Pouso Alegre, Minas Gerais, it was possible to observe a high index of patients' contamination by *Acinetobacter baumannii* in the ICU (intensive therapy unit) with 44 (55%) of cases, which presented susceptibility to a small number of antimicrobials.

According to the study conducted by Gaynes and Edwards in the United States, it was reported that 5% to 10% of cases of pneumonia associated with ventilation mechanisms in UTIs were caused by *Acinetobacter baumannii* [14]. In Latin America, according to data of antimicrobial surveillance SENTRY, the most common infection sites of this bacterium are the lower respiratory tract (17.7%) [13].

A report by the National Nosocomial Infection Surveillance System (NNIS) in the U.S. has studied infections caused by gram-negative bacilli acquired at the hospital in the intensive care units. In 2003, *Acinetobacter baumannii* was responsible for 6.9% of pneumonias and 1.6% of urinary tract infections [5].

The biggest occurrences of *Acinetobacter baumannii* in our study were in Mini Bal 29 (36.3%) and Urine 17 (21.3%) materials. According to national and international studies conducted and comparing results obtained, there is a similarity between the occurrences of *Acinetobacter baumannii* as to the places of hospitalization and clinical materials.

The genus *Acinetobacter* is composed of opportunistic pathogens that mainly affects immunocompromised patients and patients with extended period of hospitalization [15].

Indiscriminate use of antimicrobials for this and other pathogens is responsible for generating an intrinsic resistance on a global scale.

## 5. Conclusions

*Acinetobacter baumannii* has been representing large increases in clinical sample from lung, mainly from male patients, elderly interned in intensive therapy unit.

The resistance of antimicrobials considered as the last option can be observed in this study with the resistance to Polymyxin which was 8.75%, only the Tigecycline presented 100% susceptibility.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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