Original Research Article

Antibiotic Resistant Pattern of threatening pathogen *Acinetobacter baumannii* in a tertiary care hospital

Monika Mavani[1], Kajal Parmar[2], Dhwani Patel[3*], Tanuja Javadekar[4], Vidya S Date[5]

[1,2,3]Resident Doctor, SBKS MI & RC, Vadodara, Gujarat, India
[4]Professor and Head, Dept. of Microbiology, SBKS MI & RC, Vadodara, Gujarat, India
[5]Professor, Dept. of Microbiology, SBKS MI & RC, Vadodara, Gujarat, India
[*]Corresponding author email: **pateldhwani434@yahoo.com**

International Archives of Integrated Medicine, Vol. 11, Issue 2, February, 2024.
Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**
Received on: 11-2-2024 **Accepted on:** 20-2-2024
Source of support: Nil **Conflict of interest:** None declared.

DOI: **10.5281/zenodo.10693950**

How to cite this article: Monika Mavani, Kajal Parmar, Dhwani Patel, Tanuja Javadekar, Vidya S Date. Antibiotic Resistant Pattern of threatening pathogen *Acinetobacter baumannii* in a tertiary care hospital. Int. Arch. Integr. Med., 2024; 11(2): 13-17.

Abstract

Introduction: *Acinetobacter* species are aerobic gram-negative bacteria that are ubiquitous in nature. Being a multidrug-resistant and an invasive pathogen, *Acinetobacter baumannii* is one of the major causes of nosocomial infections in the current healthcare system. It has been recognized as an agent of pneumonia, septicemia, meningitis, urinary tract and wound infections, and is associated with high mortality. We aimed this study to evaluate resistance pattern of a threatening pathogen i.e., *Acinetobacter baumannii.*

Materials and method: The present study was conducted in Microbiology Department of SBKSMIRC, Dhiraj Hospital, Waghodia, Gujarat during May 2022 to December 2022. This study included all *Acinetobacter* baumannii isolated from all ages and microbiological specimens which were referred to Central Microbiology Laboratory of Dhiraj Hospital. The Non-Lactose fermenting, oxidase negative organisms are kept in VITEK 2 automated system for identification and sensitivity. All isolates identified as Acinetobacter baumannii were included in the study.

Results: This study included a total of 52 isolates of *A.baumannii*. Out of which 33% were respiratory samples (sputum, Endo-tracheal secretions), 33% were pus samples, 11% were urine samples and 23% were included in other (blood, CSF, Body fluids). The most resistant drug was ceftriaxone (88.46%). Tigecycline was found to be 100% sensitive.

Conclusion: This study concludes that Tigecycline is the only drug which is most sensitive for *A. baumannii* and other higher drugs such as Polymixin B, Colistin etc. shows less resistance. *Acinetobacter* infection would remain a therapeutic challenge in our hospital and health care settings due to the increasing rate of *Acinetobacter* species with traits of MDR and resistance to high potent antimicrobial agents.

Key words

Antibiotic resistant pattern, *Acinetobacter baumannii*, Tigecycline.

Introduction

Acinetobacter species are aerobic gram-negative bacteria that are ubiquitous in nature. Being a multidrug-resistant and an invasive pathogen, *Acinetobacter baumannii* is one of the major causes of nosocomial infections in the current healthcare system. It has been recognized as an agent of pneumonia, septicemia, meningitis, urinary tract and wound infections, and is associated with high mortality. *Acinetobacter baumannii* is the species most commonly isolated. Pathogenesis in *A. baumannii* infections is an outcome of multiple virulence factors, including porins, capsules, and cell wall lipopolysaccharide, enzymes, biofilm production, motility, and iron-acquisition systems, among others. Such virulence factors help the organism to resist stressful environmental conditions and enable development of severe infections. Parallel to increased prevalence of infections caused by *A. baumannii*, challenging and diverse resistance mechanisms in this pathogen are well recognized, with major classes of antibiotics becoming minimally effective [1]. We aimed this study to evaluate resistance pattern of a threatening pathogen i.e., *Acinetobacter baumannii*.

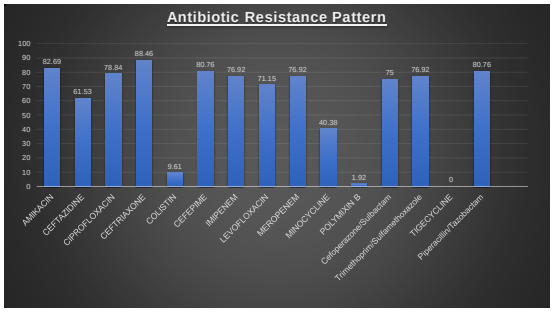
Materials and methods

The present study was conducted in Microbiology Department of SBKSMIRC, Dhiraj Hospital, Waghodia, Gujarat during May 2022 to December 2022. This study included all *Acinetobacter baumannii* isolated from all ages and microbiological specimens which were referred to Central Microbiology Laboratory of Dhiraj Hospital. All the clinical specimens collected and transported to microbiology laboratory as per standard protocols. The specimens studied were urine, respiratory samples (sputum, endo-tracheal aspirate and bronchoalveolar lavage), blood, pus, body fluids (pleural fluid, cerebrospinal fluid etc) and stool. Specimens were plated using appropriate culture media (Mac-Conkey agar, Blood agar, Chocolate agar and Cysteine Lactose Electrolyte Deficient (CLED) (**Photograph – 1**). Standard culture methods were used and the isolates, both Gram positive and Gram negative were processed for identification and antibiotic sensitivity tests by the VITEK 2 Compact system (BioMe´rieux, Marcy l'Etoile, France), following CLSI guidelines. Samples were subjected to microscopy (Gram stain of direct smear) and plates will be incubated for 24 hours at 37ºC and next day colony characteristics will be noted. On next day the Gram stain and Motility from the significant isolated colonies was observed. *A. baumannii* colonies are 1-2mm, domed, mucoid and non-lactose fermenting on MacConkey agar. It was kept in VITEK 2 (**Photograph – 2**) for further identification and AST.

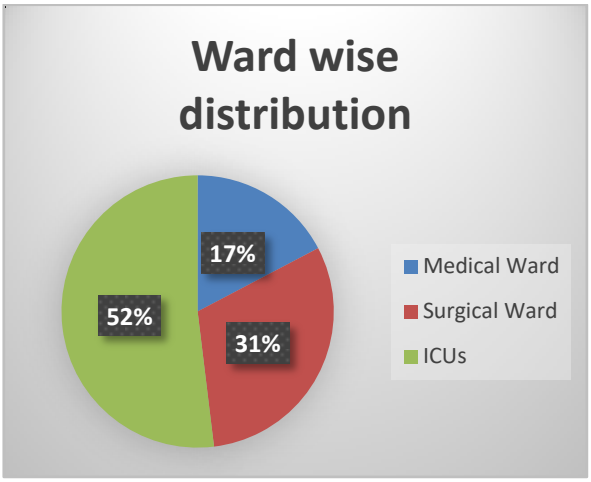
Photograph - 1: *Acinetobacter baumannii* colonies on MacConkey Agar.

Photograph - 2: VITEK 2.

Photograph – 3: Antibiotic resistance Pattern.



Photograph – 4: Ward wise distribution of *A. baumannii*.



Results

During the study period 52 positive samples for *A. baumannii* were isolated from a total of 1068 positive culture samples, thus the prevalence rate was 4.86% in Dhiraj General Hospital. In Dhiraj General Hospital, *A. baumannii* was found majorly in ICUs (52%), followed by Surgical wards (31%) and Medical wards (17%). *Acinetobacter* was predominantly found in Respiratory samples (33%) and Pus samples (33%) followed by Others (Blood, CSF, Body fluids) (23%) and least in Urine (11%). The most resistant drug was ceftriaxone (88.46 %). Tigecycline was found to be 100% sensitive. Of the 30 *A. baumannii* isolates from the blood, 26 (86.6%) were proven for their pathogenic status and in the remaining 4 patients who showed no symptoms of blood stream infection (BSI), the culture positivity may have been due to contamination with *A. baumannii* colonized on skin during sample collection. The most resistant drug was ceftriaxone (88.46 %). Tigecycline was found to be 100% sensitive. Other drugs resistance percentage is as follows: Amikacin (82.69%), Ceftazidime (61.53%), Ciprofloxacin (78.84%), Colistin (9.61%), Cefepime (80.76%), Imipenem (76.92%), Levofloxacin (71.15%), Meropenem (76.92%), Minocycline (40.38%), Polymixin B (1.92%), Cefoperazone/ Sulbactum (75%), Trimethoprim/ Sulfamethoxazole (76.92%), Piperacillin/ Tazobactum (80.76%) (**Photograph – 3, 4**).

Discussion

In the present study prevalence rate of *Acinetobacter baumannii* was found to be 4.86%. *A. baumannii* was isolated from different wards and ICUs and rate varied as Medical Wards (17%), Surgical Wards (31%) and ICUs (52%). In an international study on the prevalence of infections in ICUs in 75 countries, the isolation rate of *Acinetobacter* (8.8%) [2] was significantly lower than that of the ICUs (52%)in our hospital. Many authors have reported predominance of *A. baumannii* in respiratory samples [3] and same is found in our study(33%), the other equivalent predominance was found to be in pus samples (33%) followed by others (Blood, CSF, Body fluids) (23%) and least in Urine (11%). Among the gram-negative isolates from the respiratory secretions *A. baumannii* was the most common. Studies similar to this, were carried out by Pedersen, et al. [4] where the maximum isolates were

obtained from sputum as 26.3%. Since *Acinetobacter* is a common commensal in the respiratory tract, it may be isolated without necessarily causing infection. Villers, et al. [5] have also reported a predominance of *A. baumannii* in tracheo-bronchial secretions as 24.8% to 48.8% and Suri, et al. [6] as 45.6% respectively in their studies. The ICU also showed the maximum yield of *A. baumannii* from the respiratory samples followed by pus. Siau, et al. [7] reported in their ICU isolates that respiratory tract was the most common site from which *Acinetobacter* was isolated. In the community, *A. baumannii* has been found to be associated with community acquired pneumonia, (in patients with COPD, renal failure, diabetes mellitus, heavy smokers or excessive alcohol consumers) or bacteremia in Australia and Asia, although rare in USA as evidenced by previous studies [8].

In our study, the most resistant drug was ceftriaxone (88.46%). Tigecycline was found to be 100% sensitive. Other drugs resistance percentage is as follows: Amikacin (82.69%), Ceftazidime (61.53%), Ciprofloxacin (78.84%), Colistin (9.61%), Cefepime (80.76%), Imipenem (76.92%), Levofloxacin (71.15%), Meropenem (76.92%), Minocycline (40.38%), Polymixin B (1.92%), Cefoperazone/ Sulbactum (75%), Trimethoprim/ Sulfamethoxazole (76.92%), Piperacillin/ Tazobactum (80.76%). This corresponds to other studies by Navon, et al. [9] where 66% of *Acinetobacter* were resistant to Tigecycline. Studies by Bijayini Behara, et al. [10] in India have shown only 42% susceptibility in *A. baumannii* isolates to Tigecycline respectively. However issues about the breakpoints for susceptibility in the disk diffusion tests and standardized guidelines for in vitro testing of Tigecycline need to be further evaluated. The antibiotic overuse reflected this propensity to treat *A. baumannii* infections based on bacteriological reports alone and not the patient in entirety. The resistance patterns detected in *Acinetobacter* could reflect the antibiotic misuse and lack of regulations on the over the counter sale in some parts of the World. Our study suggested that due to the increasing resistance of *A. baumannii*, we should judiciously use antibiotics by making an attempt to distinguish colonization from infections and treatment should be only given to the clinically confirmed *Acinetobacter* infections and not merely colonization.

Conclusion

Acinetobacter is an important nosocomial pathogen causing significant morbidity and mortality. Resistance isolates are increasing day by day, probably due to indiscriminate use of antibiotics in an health care setting. Reducing and restricting the use of antimicrobial to only those situation where they are warranted. At proper dose and for the proper duration is the most appropriate solution. The antimicrobial susceptibility testing should be done to help to chose appropriate antimicrobial drug for the treating *A. baumannii* infections in various wards. Implement a proper hand washing technique, education about spread of bacteria via hands and contaminated environment and develop infection control procedure would help in the control of these organism in hospital.

References

1. Tille, Patricia M., author. Bailey & Scott's Diagnostic Microbiology 15th edition, St. Louis, Missouri: Elsevier, 2014.
2. Vincent JL, Rello J, Marshall J, Silva E, Anzueto A, Martin CD, Moreno R, Lipman J, Gomersall C, Sakr Y, Reinhart K. EPIC II Group of Investigators. International Study of the Prevalence and Outcomes of Infection in Intensive Care Units. JAMA, 2009; 302(21): 2323–2329.
3. Jaggi N, Sissodia P, Sharma L. Acinetobacter baumannii isolates in a tertiary care hospital: Antimicrobial resistance and clinical significance. J Microbiol Infect Dis., 2012; 2(2): 57–63.
4. Pederson MM, Marso E, Picket MJ. Non fermentative bacilli associated with man

III pathogenicity and antibiotic susceptibility. Am J Clin Pathol., 1970; 54: 178-192.

5. Villers D, Espase E, Coste-Burel M, et al. Nosocomial Acinetobacter baumannii infections: Microbiological and clinical epidemiology. Ann Intern Med., 1998; 129: 182-189.
6. Suri A, Mahapatra AK, Kapil A., et al. Acinetobacter infection in neurosurgical intensive care patients. Natl Med J India, 2000; 13: 296-300.
7. H. Siau, KY Yuen, SSY Wong. The epidemiology of Acinetobacter infections in Hongkong, J Med Microbiol, 1996; 44: 340-347.
8. Glow RH, Moellering RC, Kunz LJ. Infections with Acinetobacter calcoaceticus (Herellea vaginicola): Clinical and laboratory studies. Medicine, 1997; 56: 79-97.
9. Navon-Venezia S, Leavitt A, Carmeli Y. High tigecycline resistance in multidrug resistant Acinetobacter baumannii. J Antimicrob Chemother, 2007; 59: 772-774.
10. Behera B, Das A, Mathur P, et al. Tigecycline susceptibility report from an Indian tertiary care hospital. Indian J Med Res, 2009; 129: 446-450.