ORIGINAL RESEARCH PAPER

Medical Microbiology

RETROSPECTIVE STUDY OF EXTREME DRUG RESISTANT ACINETOBACTER BAUMANNII ISOLATED FROM CLINICAL SAMPLES

KEY WORDS: *Acinetobacter baumannii*, antibiotic resistance, critical care unit

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ABSTRACT

Background: *Acinetobacter* species specifically *A. baumannii* is increasingly becoming resistant to most antimicrobial agents recommended for treatment. This study aimed to determine the antimicrobial susceptibility pattern of *A.baumannii* isolated from patients in Gautam Budha Nagar. **Material and Methods:** This was a retrospective study based on VITEK 2 (BioMérieux) electronic records capturing identification and antimicrobial susceptibility of *Acinetobacter* isolates from patient samples analyzed between Jan 2021 and Mar 2023 at GIMS Hospital, Gautam Budha Nagar. **Results:** A total of 450 *A.baumannii* were recored. 73.1% of the isolates tested were extreme drug resistant (XDR). Among the 450 isolates, 153 (34%) were from sputum and 176(39%) from the critical care unit. *A. baumannii* was the most frequently isolated species with high resistant high level of resistance to cephalosporins (91%), ciprofloxacin (96%), and meropenem (76%). It showed susceptibility to colistin only. **Conclusion:** *A. baumannii* is resistant to commonly administered antibiotics. There is need for continuous antimicrobial resistance surveillance especially in health care facilities and strengthening of antibiotic stewardship programmes which will contribute to enhancement of infection control policies.

INTRODUCTION

Acinetobacter baumannii has become a relevant threat to public health worldwide. These are the most challenging pathogens belonging to the ESKAPE group (the acronym ESKAPE includes six highly virulent and antibiotic-resistant nosocomial pathogens and precisely, they are *Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter* species), is one of the main causes of nosocomial infections with the highest mortality rates, such as pneumonia, blood infections, meningitis, UTIs, as well as skin and wound infections. *A. baumannii* infections are often difficult to treat because of the growing spread of multidrug-resistant strains globally.[1]

Numerous studies have documented that *Acinetobacter* species have a noteworthy capacity for long-term survival (even in dry conditions) on various equipment like respirators and other inanimate surfaces in the hospital environment including telephone handles, door push plates, patient charts, tabletops, hospital floor, hospital sink traps, bed linen, etc [2]. The *Acinetobacter* species, belongs to the *Acinetobacter calcoaceticus-Acinetobacter baumannii* (ACB)[3]. Over time *Acinetobacter* species have acquired resistance to almost all classes antimicrobial agents. *Acinetobacter baumannii* is most common species isolated from clinical samples. The spectrum of antibiotic resistance of these organisms makes them a threat in the hospital environment, as documented by recurring outbreaks, and has created major challenges for healthcare management worldwide. [4]

Thus, the present study aimed to assess the current status of antimicrobial susceptibility among the clinical isolates of *A. baumannii* recovered from different clinical specimens obtained from in-patients and the out-patient department of a teaching hospital.

MATERIALAND METHODS:

This was a retrospective study conducted in a 300-bed teaching hospital, in Greater Noida, India by the Department of Microbiology. We analyzed laboratory records of *A. baumannii* from various clinical specimens analyzed between Jan 2021 and March 2023. All the samples were processed during routine diagnostic workups from both inpatient and outpatient departments. Identification of *A. baumannii* and antimicrobial susceptibility results were recorded from the VITEK-2 antimicrobial susceptibility system.

Identification of Acinetobacter isolates was done using a VITEK-2 Gram Negative identification card (GN83). Clinical specimens sputum, pus, HVS, blood, and urine were analyzed according to the 2023 Clinical and Laboratory Standards Institute guidelines (CLSI M100-S33). The panel of antibiotics tested included amikacin (30 µg), ceftazidime (30 µg), cefotaxime (30 µg), cefepime (30 µg), piperacillin (100 µg), ciprofloxacin (10 µg).[5] The study included all *Acinetobacter* species isolated from various specimens of all ages and different wards and ICUs. Specimens with incomplete patient demographic details were excluded from the study.

RESULTS

The study analyzed 450 *A.baumannii* isolates. The majority of the isolates were from male patients, 276 (61.33%%). The isolates were mainly from sputum (153; 34%), pus (126; 28%), HVS (86,19.1%), urine (72; 16%), and blood (13;3%) samples.

Most of the isolates were obtained from samples collected from the critical care unit (39.11%), internal medicine (18.22%), surgery (16.22%), OBG (11.33%), orthopedic (9.77%), and the least obtained from an emergency unit (5.33%). [Table 1] The antibiotic susceptibility testing shows 73.1% of *A. baumannii* to be pan drug resistant with susceptibility to colistin.

(Fig 1) Sputum, pus, and urine, showed maximum number of A.baumannii isolates with high level of resistance to cephalosporins (91%), ciprofloxacin (96%), and meropenem (76%).

Table 1: Demographic details of *A. baumannii* isolates (n = 450)

	Gender	**No. Of Acinetobacter**
1.	Male	276 (61.3%)
2.	Female	174 (38.6%)
	Sample	
3.	Sputum	153 (34%)
4.	Pus	126 (28%)
5.	HVS	86 (19.1%)
6.	urine	72 (16%)
7.	Blood	13 (2.8%)
	wards	
8.	ICU	176 (39.1%)
9.	Medicine	82 (18.2%)
10.	surgery	73 (16.2%)
11.	OBG	51 (11.3%)
12.	Ortho	44 (9.7%)
13.	emergency	24 (5.3%)

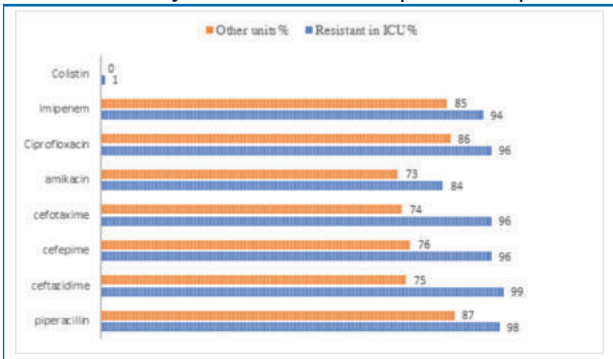

Fig 1: Antibacterial resistant pattern of *A.baumannii*

DISCUSSION

This study looked at extreme drug resistant *A.baumannii* from Jan 2021 and March 2023. We found, 450 *A.baumannii* from In-patients and out patients, and 61.3% were males. It was found that the number of male infected with *A.baumannii* was almost double the female infected with *A.baumannii*. This gender variations regarding bacterial infections consistent with other studies also.[6,7,8]

Our study found that 34% of *A.baumannii* was recover from respiratory samples followed by pus, other studies also reported higher prevalence of *A.baumannii* from respiratory samples and it can also recover from different sources including blood, and urine. [6,9,10,11] The reason behind this was Acinetobacter is a normal commensal of the upper respiratory tract but because of low immunity, severe illness of patients in ICU gave the best opportunity for the commensal to become a pathogen. With the help of their virulence factors, it invades the cells and reaches the lower respiratory tract or any other favorable region and causes infection. The rate of isolation from different clinical samples is mostly influenced by the differences in the sample types, antibiotic usage, previous history of specific site colonization, infection control practices, and a times the type of health facility.

In the present study, maximum isolates were isolated from ICUs (39.11%) followed by medicine, surgery, OBG, and orthopedic. Patients treated in ICUs are generally immunocompromised and are exposed to various medical and surgical interventions, thereby rendering them more prone to acquiring infection. Similar to our study, the frequency of *A. baumannii* isolation has been reported to be highest among ICU patients compared with other settings. [12,13,14] In contrast, a lower percentage, 11.4%, were isolated from ICU, as reported by Kaur et al. [15], in other studies, the *A. baumannii* strains in this study were commonly isolated from clinical samples of patients treated in the medical department compared with the intensive care unit.[16] This could be due to a significant difference in number of patients who had undergone medical intervention at these two departments. *Acinetobacter* infection occurs most frequently in critically ill patients particularly those admitted to ICUs as these patients usually require prolonged hospital stays, need repeated invasive procedures, and frequently receive treatment with broad-spectrum antimicrobials.

A.baumannii isolated from clinical samples are emerged as multiple drug resistant organism. MDR *A. baumannii* become a challenge for clinicians. In that case carbapenem are drug of choice for the treatment of infections associated with MDR *A.baumannii.* In the present study 73.1% of *A.baumannii* isolates were resistant to six classes of antibiotics i.e. XDR they are only susceptible or intermediate to colistin. In contrast to the present study, Sannathimmappa et. al. recorded 67% of MDR *A. baumannii out* of which 22% were XDR strains.[16]

In the present study, *A.baumannii* show a high resistance rate when compared to other study conducted by Neetu et al. [12] reported comparatively less resistant to piperacillin (55%), followed by ceftriaxone (46%) and ceftazidime (46%). Rahbar *et al*. [17] also reported 90.9% resistance for ceftriaxone and piperacillin and 84.1% resistance for ceftazidime. The unrestricted and unjudicial use of broad-spectrum cephalosporins is the cause of the emergence of resistance of these drugs. These drugs are easily available in community pharmacies and prescribed by quakes.[18]

Sohail M et al.[19] reported high resistant for fluoroquinolones (97%) as compared to our study 96% and 86% of resistance were found in ICU and wards for ciprofloxacin respectively. In the study, aminoglycosides were also found highly resistant. In this study, 84% and 73% resistance were observed to tobramycin in ICU and other units respectively. While Plege Y et al. reported only 47.5% and 35% and of resistant to gentamycin and amikacin.[20]

The Meropenem Yearly Susceptibility Test Information Collection (MYSTIC) program reported that 16% and 18% of resistance rate for imipenem and meropenem respectively against *A.baumannii* in 1997-2000. And this resistance was subsequently increased to 43.4% and 42.5% for meropenem and imipenem respectively in 2006 report. [21,22]

However, an overwhelming increasing trend of carbapenem resistance ranging from 50 to 100% reported worldwide is of serious concern because it drastically limits the therapeutic options.[8,23,24] In our study, 94% and 85% of *A.baumannii* isolated from the ICU and other wards were resistant against imipenem respectively, it was higher when compared with a report from other studies.[25,26,27,28] The most probable explanation for this increasing trend is incorrect use of antibiotics to treat viral infections, misdiagnosis of diseases, inappropriate doses of antibiotics, inappropriate treatment duration (less or more than been recommended time), arbitrary use of antibiotics, prescription of antibiotics by quakes, inappropriate formulation, and low quality of some of antibiotics.

Our study reported 99-100% of susceptibility for colistin against *A.baumannii.* According to our data, culture results showed that the use of colistin, carbapenems, or the combination of both could be a treatment options; where the literature also suggests the use of colistin as part of empirical coverage in ICU. [29]

Antimicrobial Therapy, one of the key aspects in establishing a successful clinical management. As a result, the current findings will help to add localized stewardship recommendations for *A.baumannii* antibiotic interactions to the Spectra of Activity. It will also minimize the expenditures associated with medical errors, incorrect prescribing, and prolonged hospitalization of patients. A limitation of this study is the lack of genotypic identification and determination of MIC values of antibiotics. This data is from a single medical facility. Therefore, multicenter research is recommended in the future for better outcome. This study focused on *A.baumannii* isolates. To build an antibiotic policy, full data set of resistant strains is required for future research.

CONCLUSION

Extreme drug-resistant Acinetobacter baumannii poses a significant threat to healthcare settings, leading to adverse clinical outcomes and limited treatment options. This retrospective study and literature review underscore the importance of surveillance, infection control, and research efforts to combat this emerging public health challenge.

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