ORIGINAL RESEARCH

Assessment of antibiotic resistance pattern in *Acinetobacterbaumannii* isolated from hospitalized patients of a teritiary care center

[1]Dr. Manish Purohit, [2]Dr. D.K.Mendiratta, [3]Dr.Vijayashri Deotale, [4]Dr. P.Narang

[1]Associate Professor, Department of Microbiology, MGM Medical College, Indore, Madhya Pradesh, India
[2,3,4]Professor, Department of Microbiology, MGIMS, Sevagram, Wardha, Maharashtra, India

Corresponding Author
Dr. Manish Purohit
Associate Professor, Department of Microbiology, MGM Medical College, Indore, Madhya Pradesh, India
Email: mainshpurohit75@yahoo.co.in

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ABSTRACT
Acinetobacter species which are widely distributed in nature and in the hospital environment are frequently associated with opportunistic infections in debilitated/immunosuppressed patients, those with serious underlying diseases as also those subjected to invasive procedures and treated with broad-spectrum antimicrobial agents, especially in intensive care units. This study aimed to evaluate antimicrobial sensitivity of *A.baumannii* against commonly used antibiotics. 130 isolates of *A.baumannii* from different clinical specimens were isolated and processed for antimicrobial sensitivity using Kirby Bauer disc diffusion method. Highest sensitivity was found for Imipenem and Meropenem (74.8%)followed by Netilmycin (65.9%)and Amikacin (43.1%) .

Keyword: Carbapenamase, Acinetobacter, Resistance

INTRODUCTION

Acinetobacterbaumannii is a Gram-negative cocco-bacillus and one of the most opportunistic pathogens responsible for serious infections in hospitalized patients. It emerged as one of the most troublesome pathogen for health care institutions globally (1) [(3)], as it resists desiccationand hard to eradicate, once established in hospital settings(2).The most important features of A. baumannii are its ability to persist in the hospital environment and rapidly develop resistance to a wide variety of antibiotics. *A.baumannii*is known to cause nosocomial infections like septicemia, bacteraemia, pneumonia, wound sepsis, endocarditis, meningitis and urinary tract infections(2) and in the light of its numerous intrinsic and acquired mechanisms of drug resistance, it is a cause of concern for treating physician. Although the antibiotic resistance in *Acinetobacter* is caused by multiple mechanisms, one growing factor leading to resistance is the production of carbapenamases(3-5) which hydrolyzecarbapenems ,the lastresort in β-lactams, with highest efficacy and broad spectrum of activity against this organism(2)

The study of resistance to this group of antimicrobials to treatment infected patients with *A.baumannii* is therefore essential. *A. baumannii* possesses mechanisms of resistance to most of antibiotic classes, as well as a great propensity for developing mechanisms of drug resistance rapidly.Todate,some strains of *A.baumannii* have become almost resistant to all currently available antibacterial agents and thus, empirical treatment choices are extremely limited (6).Therefore this study was plan to assess the antimicrobial resistance pattern of *A.baumannii* isolates from our tertiary care center.

AIM

This study was aimed to assess the antibiotics resistance pattern of*A.baumaanii*isolated from various clinical samples.

MATERIAL & METHODS

Study Design &Duration: It was a cross sectional study conducted over period of two year from a tertiary care hospital of Central India.

Source of Organism: *Acinetobacterbaumanii* isolated from all samples in our Bacteriology laboratory during study period, like blood , Urine, Sputum, Tracheal secretion, Pus, Pleural fluid, Biopsy material,CSF etc were included in the study .

Study center: Study was conducted in Department of Microbiology of Mahatma Gandhi Institute of Medical Sciences, Sevagram (MS).

Procedure: All samples were inoculated on Blood agar and MacConckey agar and incubated at 37ºC for 24 hrs. Culture growth was examined after 24 and 48hrs and Isolation and identification of *Acinetobacerbaumannii*was done using, Colony morphology, Gram staining morphology, Motility testing and standard biochemical tests. Antimicrobial sensitivity testing of isolates was done using Kirby Bauer disc diffusion method as per CLSI M100 2009 guidelines.

RESULT AND DISCUSSION

Infection due to *Acinetobacter baumannii* is a major challenge within the health care facilities and the community in general due to their high drug resistance even to the high potent drugs such as carbapenems.Due to the indiscriminate use of broad-spectrum antibiotics by people, we are witnessing high antibiotic resistance caused by this bacterium the proliferation of multiple antibiotic resistance genes. Various studies have shown that *Acinetobacter baumannii* is resistant to most Beta-lactam antibiotics and Quinolones, and its resistance to Aminoglycosides is increasing (7).

In our study most of the *A.baumannii*were isolated from Pus(32.31%)(Table-3) as also reportedby Preeti et al(8) (29%). SureshJoshi et al(2) thoughreported maximum isolationfrom urinary specimens(30.6%)followedby that from pus (27.5%) stated that statistically most significant isolation was from pus. Rubina lone et al(9)reported maximum isolation from urinaryspecimens(39.64%)followedbypus(29.45%),whereasK.K.lahirietal(10) reported maximum number(51.97%) of isolation from urine samples followed by that froms putum (12.5%) (Table-1).

In our study, the most effective antibiotics used against *Acinetobacterbaumannii* were Netilmycin and Imipenem/Mropenem, which had 65.9% and 74.8%% sensitivity, respectively, while the highest resistance was found for Cephalosporin group of antibiotics i.e 59.3% for Ceftriaxone, Ceftazidim and Ceftazidime. (Table-2) Goudarazi et al (4) studied susceptibility pattern of 221 clinical and 22 environmental isolates of *A.baumannii* and found rate of resistance to majority of commonly used antibiotics were more than 90%. Similar findings were reported by Yan et al, Aimsaad et al and Vahdani et al (11-13).

Carbapenem was used as a last resort of treatment against most of the multidrug resistant organism but resistance to these antibiotics is considerably increasing.In our study we have found 30.9% resistance toimipenem and Meropenemthat is comparable to study byBoroumand et al (14) who reported 24.6% resistance to Imipenem in their study.However a study by Faizbadi (15) from Iran reported 50.9% resistance to Imipenem among *A.baumannii.*Shali et al (16) from their study on *A.baumannii* reported highest resistance agaistAmpicillin (100%) while the lowest resistance to Imipenem (57.1%). A Very high resistance for Imipenem was reported by Goudarzi et al (4) i.e. 91.5% could be because of indiscriminate use of Antibiotic in their region.

Michael A. et al(17) high levels of resistance were observed for ceftazidime (75.9%), ciprofloxacin (64.4%), cefotaxime (90.8%), cotrimoxazole (70.1%), and meropenem (59.8%). Amongst third-generation cephalosporin in the present study, 59.3% of the isolates were resistant to ceftazidime. This is lower than reported by studies in China and Egypt which reported resistance levels of 83.98% and 89.0%, respectively.

In the present study, 57.7% of the isolates were resistant to ciprofloxacin. This is consistent with other studies in India (64.0%) and South Africa (65%)(18-19). Whilst, higher prevalence are reported in Egypt (88.8%) and Brazil (80%) (20-21), The prevalence rate of carbapenem resistance in *Acinetobacterbaumannii* has been found to vary from one country to another (22-23).In the present study, 30.9% *Acinetobacter* isolates were resistant to carbapenem (Imipenem&meropenem). This is lower than the previous studies in Ghana (66%), Pakistan (58.9%) and Nigeria (63.6%) (24-26). Whilst, studies by Hussein et al., (27) and Ren et al., (28) have reported carbapenem (imipenem) resistance of 58.26% in Iraq and 66% in China. Morfin-Otero *et al*., (29) and Rajput &Naik(30) in Mexico and India have reported a highercarbapenem (imipenem) resistance prevalence of 48% and 48.57%, respectively. The high resistance to meropenem may be due to the intrinsic ability of *Acinetobacter* to quickly utilize the efflux pumping mechanism or the capacity to acquire resistant determinants from the environment in response to selective pressure (31).

The high antibiotic resistance of this bacterium is associated with the proliferation of multipleantibiotic resistance genes. Various studies have shownthat *Acinetobacter baumannii* is resistant to most Betalactamantibiotics and Quinolones, and its resistance to

Aminoglycosides is increasing. On comparing antimicrobial sensitivity of A.baumannii in relation of Carbapenem sensitivity we have found a higher resistance to commonly used antimicrobial among *A.baumanni* which were found resistant to Carbapenem(Table-3).

Similar findings were also reported by byHarsha et al that all Carbapenem resistant isolates of Acinetobacter

were resistant to piperacillin (PI), piperacillin + tazobactam (PIT), ciprofloxacin (CIP), ceftazidime (CAZ), cefepime (CPM) (32).

In a study by Durgesh Gopalrao all carbapenem resistant isolates of Acinetobacter were found resistant to Ampicillin, Piperacillin, Piperacillin/Tazobactam, Cefazolin, Cephalothin, Cefoperazone, Cefotaxime, Ceftriaxone, Ceftazidime, Ceftazidime/Clavulanic acid and cefepime. In his study Sensitivity to Amikacin was 77.84% and 28.4% among carbapenem sensitive and Carbapenem resistant isolates where as we have found 58.7% and 15.8% sensitivity for same. Sensitivity to Amikacin was 65.72% and 14.3% among carbapenemsensitive and Carbapenem resistant isolates where as we have found 57.6% and 17.6% sensitivity for same. (33)

The imipenem-resistant isolates also show resistance to other groups of antibiotics, which is a unique problem with MBLs that show a broad-spectrum resistance profile. The genes encoding MBLs are often procured by class 1 (sometimes class 3) integrons. Other gene cassettes within the integrons confer resistance to other antibiotics such as fluoroquinolones, aminoglycosides and co-trimoxazole. Integrons are, in turn, embedded in transposons, resulting in a highly transmissible genetic apparatus that can be transferred between bacteria. (34)

Table-1 Sample wise distribution of *A.baumannii (n=130)*

Sample	Total sample received	No. of isolates (%)
Pus (wound discharge)	3016	42(32.31)
Blood	6996	21(16.15)
CSF	1487	14(10.77)
Tracheal aspirate	375	14(10.77)
Urine	15292	13(10.0)
Drain	277	8(6.15)
Ascitic fluid	449	5(3.84)
Cervical swab	3895	5(3.84)
Pleural fluid	611	3(2.30)
Sputum	649	3(2.30)
Biopsy	193	2(1.53)
Total	**33240**	**130**

Table-2 Sensitivity Profile of *Acinetobacter baumannii* (n=130)

	Sensitive		Resistant	
Antibiotic	**Number**	**%**	**Number**	**%**
Amikacin	53	43.1	70	56.9
Ceftazidime	50	40.7	73	59.3
Ceftriaxone	50	40.7	73	59.3
Cefpirome	52	42.3	71	57.7
Cefotaxime	50	40.7	73	59.3
Netilmycin	81	65.9	42	34.1
Ciprofloxacin	52	42.3	71	57.7
Imipenem	92	74.8	38	30.9
Meropenem	92	74.8	38	30.9

Table-3 Antimicrobial sensitivity of Acinetobacter baumannii in relation to Carbapenem sensitivity

Antibiotic	Carbapenem Resistant (n=38)		Carbapenem Sensitive (n=92)	
	Number of sensitive Isolates	**%**	**Number of sensitive Isolates**	**%**
Amikacin	6	15.8	54	58.7
Ceftazidime	5	13.2	52	56.5
Ceftriaxone	5	13.2	52	56.5
Cefotaxime	6	15.8	53	57.6
Cefpirome	5	13.2	52	56.5
Netilmycin	18	47.4	70	76.1
Ciprofloxacin	6	17.6	53	57.6

CONCLUSION

Antibiotic resistance is increasing and there is a need for active surveillance to detect antimicrobial resistance towards commonly used antbiotic against *A.baumannii*. It will help in adopting appropriate measure to timely control the spread of resistance. Strict infection control practices are required to control the development of drug resistance, reducing patient stay to hospital and and minimizing cost of treatment. Carbapenems is last resort to treat MDR

pathogen and therefore it should be used judiciously. To prevent spread of drug resistance effective antibiotics should be used as per the antibiotic-sensitivity report.

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