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PREVALENCE AND RESISTANCE PATTERN OF ACINETOBACTER SPECIES IN TERTIARY CARE HOSPITAL

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ABSTRACT **BACKGROUND:** Acinetobacter are ranked second after Pseudomonas aeruginosa among the nosocomial, aerobic, non – fermentative, gram negative bacilli pathogens. It has been designated as a "red alert" human pathogen, generating alarm among the medical fraternity, arising largely from its extensive antibiotic resistance spectrum. This phenomenon of multidrug-resistant (MDR) pathogens has become a cause for serious concern with regard to both nosocomial and community-acquired infections. Hence, the present study was undertaken to know its prevalence and antibiotic resistance pattern in our hospital. **MATERIALS AND METHOD:** All the clinical samples received at Microbiology laboratory, McGan hospital, Shivamogga between January 2015 and December 2015 was considered for the study. Acinetobacter were identified and further speciated by following conventional method. Antibiotic susceptibility pattern of all the isolates was determined according to CLSI guidelines. **RESULT:** A total of 100 Acinetobacter species were isolated from the clinical specimens. Out of 100 Acinetobacter isolates, different species isolated were A.baumannii (69), A. lwoffii (17), A.calcoaceticus (08), A. haemolyticus(05) and A.junii (01). Acinetobacter species isolated showed highest sensitivity to Meropenem(67%)followed by Imipenem(60%)and least sensitivity to Piperacillin-Tazobactam(11%) and Cefipime(11%). Out of 100 Acinetobacter isolates, 87% isolates showed multi-drug resistance (MDR). **CONCLUSION:** Our study reconfirms the high prevalence of Acinetobacter species in the clinical setting. The study thus infers that clinical isolates of Acinetobacter should not be neglected but considered as an important pathogen and treated according to the sensitivity report.

KEYWORDS : Acinetobacter, Acinetobacter baumannii, MDR

INTRODUCTION

Acinetobacter are Gram negative, strictly aerobic, coccobacilli, commonly present in soil and water as free living saprophytes. They are isolated as commensals from skin and throat. There have been frequent changes in their taxonomy so that their pathogenic role is understood only recently. They have emerged as an important nosocomial pathogen involved in outbreaks of hospital infections. [1,2]

Currently there are 25 genomospecies described in genus *Acinetobacter* where, Genomospecies 1-*Acinetobacter calcoaceticus*, 2- *Acinetobacter baumannii*,4- *Acinetobacter hemolyticus*,5- *Acinetobacter junii*, 7- *Acinetobacter johnsonii*, 8- *Acinetobacter lwoffii*, 12- *Acinetobacter radioresistens*. Most of the remaining genomospecies of *Acinetobacter* are unnamed. Among the above, *Acinetobacter baumannii* is the most important pathogen commonly isolated in the clinical specimens.[3]

Hospital-Acquired Pneumonia especially following mechanical ventilation, Community-Acquired Pneumonia, bloodstream infection during hospitalization , wound infection, more commonly in burns patients ,urinary tract infection following catheterization and Nosocomial, postneurosurgical meningitis 26 are the common infections caused by *Acinetobacter* species.[4,5,6]

Various resistance mechanisms noted in *Acinetobacter baumannii* are: production of class A, class B and class D beta lactamases, penicillin binding proteins (PBP) , porin and outer membrane protein modifications, efflux pump mechanism, expression of aminoglycoside modifying enzymes and production of biofilm.[5,6]

With the above ever- increasing list of resistance determinants that can rapidly nullify most of the therapeutic armamentarium, A.baumannii is considered the paradigm of multi-resistant (MDR) bacteria. 'MDR Acinetobacter spp.' shall be defined as the isolate resistant to at least three classes of antimicrobial agents — all penicillins and cephalosporins (including inhibitor combinations), fluroquinolones, and aminoglycosides, though there is no internationally accepted single definition like that for M.tuberculosis.[7]

Hence this study was conducted to investigate the prevalence and resistance pattern of *Acinetobacter* species in our tertiary hospital, so as to design the guidelines regarding measures to prevent spread of the resistant strains in the hospital.

MATERIALS AND METHODS

This cross-sectional study was carried out in the Microbiology laboratory, McGan hospital, Shivamogga, between January 2015 and December 2015. The study was approved by the Institutional Ethical Committee of Shimoga Institute of Medical Sciences, Shivamogga.

All the pus, urine, blood and sterile body fluid samples received in our laboratory during the study period was included for the study. Samples which were leaked were excluded.

Identification of the isolate as *Acinetobacter* species was done based on the following: Non –Lactose fermenting colonies on Mac Conkey media, Lack of cytochrome oxidase activity, Positive catalase test, Gram's stain- Gram negative cocco-bacilli and Lack of motility.[3,8,9] Speciation of *Acinetobacter* was performed on the basis of growth at 37◦C and 44◦C, β- hemolysis on blood agar, glucose oxidation test, gelatin liquefaction, arginine hydrolysis and Citrate utilization tests done as per standard methods as depicted in table 1.[3,8,9]

Table 1: Speciation of Acinetobacter isolates

Acinetobacter species	Growth at 37◦C	Growth at 44◦C	hemolysis on blood agar	OF-glucose(oxidative)	Gelatin hydrolysis	Arginine dihydrolase	Citrate test
A.calcoaceticus	+	-	-	+	-	+	+
A.baumannii	+	+	-	+	-	+	+
A.haemolyticus	+	-	+	-	+	+	-
A.junii	+	-	-	-	-	+	+
A.johnsonii	-	-	-	-	-	+	+
A.lwoffii	+	-	-	-	-	-	-
A.radioresistence	+	-	-	-	-	+	-

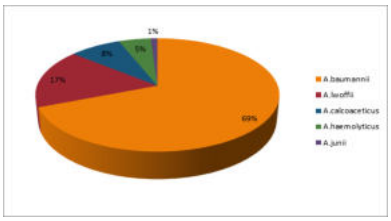
Antimicrobial susceptibility testing was performed by Kirby Bauer Disk Diffusion method and interpreted as per CLSI guidelines.(3,8,9)

RESULTS

A total of 100 Acinetobacter species were isolated during our 12 month

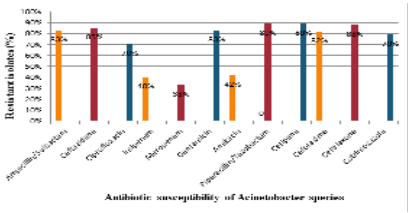
study period. Out of the 100 isolates , 59 were from blood, 31 were from pus and 10 were from urine. In these 100 samples, majority of the patients were of the age group 0-20yr (64%). 63(63%) were males and 37(37%) were female patients.

Out of 100 Acinetobacter speciesisolated, different species isolated were A.baumannii (69), A. lwoffii (17), A.calcoaceticus (08), A. haemolyticus(05) and A.junii (01) which is depicted in graph 1.



Graph 1: Pie chart showing different species of Acinetobacter species isolated

Resistance pattern of the isolates to different antibiotics is as follows: Ampicillin/Sulbactam(83%), Ceftazidime(85%), Ciprofloxacin(70%), Imipenem(40%), Meropenem(33%), Gentamicin(83%), Amikacin(42%), Piperacillin-Tazobactam(89%), Cefipime(89%), Cefotaxime(82%), Ceftriaxone(88%), Co-trimoxazole(79%).



Graph 2: Chart showing Antibiotic resistance pattern of *Acinetobacter* isolates

A total of 87 isolates showed ESBL production by screening test which were subjected to ESBL confirmatory test by combined disk diffusion method, out of which 82(82%) isolates showed ESBL production. Out of 100 *Acinetobacter* isolates, 87(87%) isolates showed multi-drug resistance.

DISCUSSION

Acinetobacter are an important nosocomial pathogen that causes wide range of infections especially in intensive care units. The ability of *Acinetobacter* to survive for extended periods on environmental surfaces is notorious and is likely important for transmission within the health care settings.

A. baumannii, the most important species of the genus appears to have the propensity for developing multiple antimicrobial resistances extremely rapidly. The emergence and quick dissemination of multiple drug resistant (MDR) *A. baumannii* and its genetic potential to carry and transfer diverse antibiotic resistance determinants pose a major threat in hospitals world-wide.

In the present study, a total of 100 *Acinetobacter* species were isolated from various 1852 clinical samples. Out of these, 59 were from blood, 31 were from pus samples and 10 were from urine samples.

The majority of blood samples were from ICU, where out of 59 blood samples, 33(55.9%) were from NICU, 12(20.3%) were from PICU and 4(6.8%) from MICU. Thus, ICU samples accounted for 83.1% (49) of the blood samples and 49% (49) of the total samples. This high percentage of *Acinetobacter* infection in intensive care units is said to be due to various reasons like use of endotracheal tube, intravascular catheters, urinary catheters which can result in colonization by opportunistic bacteria like Acinetobacter and also due to the biofilm forming property of Acinetobacter on the devices in ICU[10]. Similar observation of high prevalence of Acinetobacter infection among ICU patients was noted by Nahar A et al[10], and Tripathi PC et al[1].

In our study, male and female ratio observed was 1.7:1. Though this high rate of infection among males remains unexplained, similar finding was seen in other studies also. In the study by Tripathi CP et al[1], male to female ratio was 1.2:1 and in the study conducted by Mahajan G et al[11], the ratio was found to be 1.4:1. High pervalence of *Acinetobacter* infection among males was also reported in studies by Prashanth et al[13] and Joshi et al[12], where male patients accounted for 58% and 51% of the total sample in their studies respectively.

The present study clearly reveals the high prevalence of *A.baumannii* as compared to other *Acinetobacter* species. This is in concordance with other studies and also literature where *A. baumannii* is considered as the most clinically relevant species of the genus *Acinetobacter* held responsible for nosocomial infections as well as community acquired infections caused by the genus.[5,12,13,14]

Highest sensitivity was noted with Carbapenems(60%-67%) followed by Aminoglycosides (58%).This pattern of resistance is not in line with study by Dheepa et al[16], Nahar A et al[10], Gurung J et al [15] where all have reported more than 50% resistance to carbapenems and aminoglycosides. However the same pattern of resistance was noted with study by Tripathi et al [1] and Rodriguez-Bano J et al[17] where both the studies have reported maximum sensitivity to carbapenems followed by aminoglycosides.

High prevalence of multidrug resistant *Acinetobacter* species (87%), is in line with other studies like study by Ayenew Z et al[18] who observed 71.6% MDR rate and Dent LL et al[19] who have recorded 72% MDR rate.

Sources for colonization or infection with multidrug-resistant *Acinetobacter* species in hospitalized patients are: Hands of the hospital staff , Respiratory therapy equipment , Food (including hospital food) ,Tap water , Infusion pumps , Mattresses, pillows, bed curtains and blankets in vicinity of infected patients , Soap dispensers , Fomites like bed rails, stainless steel trolleys, door handles, telephone handles, tabletops , Hospital sink traps and Hospital floor.[20-25]

Risk factors for colonization or infection with multidrug-resistant *Acinetobacter* species: Prolonged length of hospital stay, Exposure to an intensive care unit (ICU), Receipt of mechanical ventilation ,Colonization pressure , Exposure to antimicrobial agents esp., carbapenems, colistin.[20-25]

Carbapenems have resulted in the best therapeutic response for infections caused by MDR *A baumannii* .[26] For carbapenem-resistant *A baumannii* (XDR *Acinetobacter* spp.), tigecycline and colistimethate are two of the most frequently used alternative agents. But emergence of resistance to these alternatives is also on rise which has left us with less theaurapetic options[27].

CONCLUSION

Acinetobacter species infections are spreading rapidly in a hospital setting with the threat of emergence of resistance to the current therapeutic options. As the organism can survive well in hospital environment and acquire resistance at a faster rate, it becomes a very important task to put in all control measures like: Standard precautions – including hand hygiene measures and monitoring of its compliance , Contact barrier precautions , Environmental cleaning and disinfection protocols , Surveillance – Passive as well as Active surveillance , Antimicrobial stewardship Program – Implementation and monitoring , Regular training programs on infection control policies and procedures , to be followed all the time to decrease spread of infection and emergence of MDR strains.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORS' CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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None

DATA AVAILABILITY

All datasets generated or analyzed during this study are included in the manuscript.

ETHICS STATEMENT

This article does not contain any studies with human participants or animals performed by any of the authors.

Ethical committee clearance obtained.

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