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Original Research Article

Multidrug resistant *Acinetobacter baumannii* causing Ventilator associated respiratory infections at a tertiary care center of IndiaNupur Koul¹, Barnali Kakati^{1,*}, Sonika Agarwal², Garima Mittal¹¹Dept. of Microbiology, Himalayan Institute of Medical Sciences, SRHU, Jolly Grant, Dehradun, Uttarakhand, India²Dept. of Critical Care Medicine, Himalayan Institute of Medical Sciences, SRHU, Jolly Grant, Dehradun, Uttarakhand, India

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ABSTRACT

Background: A rise in Multidrug resistant *Acinetobacter baumannii* causing ventilator-associated respiratory infections (VARIs) is posing a therapeutic challenge for physicians and diagnosticians worldwide. Timely detection and reporting of these robust multidrug resistant (MDR) pathogens would be useful in not only guiding an appropriate empirical therapy but also in controlling the spread of these drug resistant strains in the ICUs and hospital.

Objective: To detect *Acinetobacter baumannii* in Endotracheal secretions of suspected cases of Ventilator-associated respiratory infections (VARIs) and report the antimicrobial sensitivity pattern for the same.

Study Design: Observational study conducted for a one year period in Department of Microbiology and ICU of tertiary care center for all suspected cases of VARIs above age of 18 years.

Result: The study showed that out of the 131 endotracheal samples received from suspected cases of VARI, *Acinetobacter baumannii* was isolated among 29.6% (45). Monomicrobial growth was found in 39 and Polymicrobial growth in 6 samples. Almost all isolates were found to be multidrug resistant. Drug resistance was found against Penicillin, Cephalosporins, Piperacillin-tazobactam and Fluroquinolones. These MDR pathogens were found sensitive to Tigecycline (26%), Tetracycline (16%) and Ampicillin-sulbactam (11%).

Conclusion: MDR *Acinetobacter baumannii* is a rising nosocomial pathogen commonly isolated from critically ill mechanically ventilated patients, timely detection of the same and reporting the drug sensitivity would ensure starting of an appropriate empirical therapy for management and a better prognosis for the patient.

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1. Introduction

Ventilator associated respiratory infections (VARIs) are regarded as the most common complication in mechanically ventilated patients.¹ This spectrum of respiratory tract infections develop following 48 hours or thereafter of mechanical ventilation.¹ A rise in multidrug resistant (MDR) gram negative *Acinetobacter baumannii* is globally posing a therapeutic and diagnostic challenge.²

Isolation of these MDR pathogens has been identified as an important predictor for increased mortality in the same.³ *Acinetobacter baumannii* is characterized by rapid development of resistance to majority of the antimicrobials.⁴

Isolation, identification and timely reporting of these MDR strains would prove beneficial in monitoring of regional and hospital epidemiology of the same and guide in an effective empirical management of the nosocomial infections such as VARIs caused by them.

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Our study was aimed at detection of these MDR *Acinetobacter baumannii* pathogen causing VARI and report the antimicrobial susceptibility pattern for the same.

2. Materials and Methods

2.1. Study setting

This was an observational study conducted in the Department of Microbiology and ICU of Himalayan Institute of Medical Sciences, Jolly Grant for a period of one year from December 2018 to November 2019 after obtaining approval from the ethics committee of the institute. Written and informed consent was taken from patient's first relative or their attenders.

2.2. Study method

Endotracheal aspirates collected under aseptic precautions in ICU and received in the Bacteriology lab were immediately subjected to Gram staining which was reported based on the gram reaction observed. Specimens were subsequently plated on Blood, MacConkey and Chocolate agar and kept for overnight incubation at 37°C. All specimens satisfying the microbiological criteria for VARI, i.e. with more than 25 polymorphonuclear cells per field were considered. VITEK-2 automated system was used to identify the isolates and determine the antimicrobial susceptibility and Minimum inhibitory concentration (MIC) for various antimicrobial drugs.

2.3. Case definition

Ventilator associated respiratory infections (VARIs) were suspected on development of respiratory tract infections following 48 hours or thereafter of mechanical ventilation. Both, Ventilator associated Tracheobronchitis and Ventilator associated Pneumonia (VAP) are included in this spectrum of infections.

2.4. Statistical methods

Statistical analysis of the obtained result was carried out using software Microsoft Excel 2007 and Statistical package for social sciences (SPSS) version 20. Tables and pie diagrams were used to depict the results. Frequency and percentage was used to express the qualitative data whereas quantitative data was expressed in terms of mean and standard deviation.

3. Results

During our study period of one year, 131 cases of VARIs were included. VARIs developed most commonly in the age group of 59-68 years of age. VARIs were seen most commonly among the male population, with a male:female

ratio of 3.8:1

3.1. Microbiology of VARI

A total of 152 isolates were obtained from the 131 endotracheal samples. Gram negative bacilli were the most common pathogens isolated from these samples. The predominant gram negative bacilli isolated was *Acinetobacter baumannii* (29.6%).

3.2. Growth type obtained from culture positive samples of endotracheal secretions

Figure 1 shows the growth type obtained from culture positive samples of endotracheal secretion from cases of VARI. Monomicrobial growth – 39 samples, Polymicrobial growth – 6 samples (Isolated along with *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Staphylococcus aureus* and *E.coli*).

3.3. Antimicrobial susceptibility pattern

Table 1 depicts the Antimicrobial susceptibility pattern for isolates of *Acinetobacter baumannii*. Maximum Drug resistance was seen for Piperacillin (100%), Cephalosporins (100%), followed by Piperacillin-tazobactam (98%) and Fluoroquinolones (96%). They were found sensitive to Tigecycline (26%), Tetracycline (16%) and Ampicillin-sulbactam (11%).

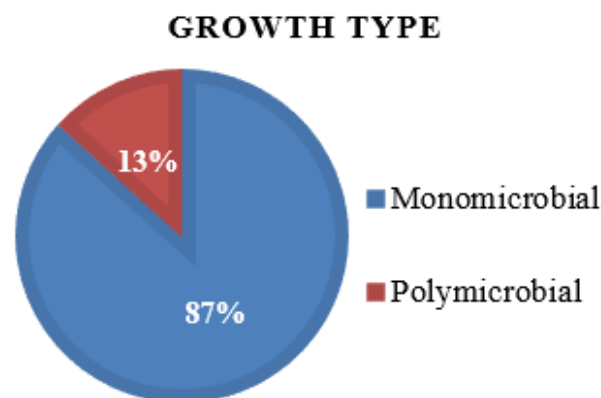


Fig. 1: Growth type obtained from culture positive samples of endotracheal secretion from cases of VARI.

4. Discussion

Multidrug resistant *Acinetobacter baumannii* have become increasingly common in ICUs over the past two decades.⁵ *Acinetobacter baumannii* is considered as a prevailing

Table 1: Antimicrobial susceptibility pattern for *Acinetobacter baumannii* obtained from endotracheal secretions from cases of VARI

Isolates Susceptibility	<i>Acinetobacter baumannii</i> (n = 45)		
	S(%)	I(%)	R(%)
Ampicillin	-	-	45(100)
Cefuroxime	-	-	45(100)
Ceftriaxone	-	1(2)	44(98)
Ceftazidime	-	-	45(100)
Cefepime	-	-	45(100)
Amoxicillin-clavulanate	-	-	45(100)
Cefoperazone-sulbactam	3(7)	4(9)	38(84)
Ampicillin-sulbactam	5(11)	-	40(88)
Piperacillin	-	-	-
Piperacillin-tazobactam	1(2)	-	44(98)
Aztreonam	-	-	-
Imipenem	3(7)	-	42(93)
Meropenem	2(4)	-	43(96)
Ertapenem	-	-	45(100)
Gentamicin	2(4)	1(2)	42(93)
Amikacin	2(4)	1	43(96)
Ciprofloxacin	2(4)	-	43(96)
Levofloxacin	2(4)	-	43(96)
Tetracycline	7(16)	-	38(84)
Tigecycline	12(26)	3(7)	30(67)
Chloramphenicol	2(4)	-	43(96)
Cotrimoxazole	3(7)	-	42(93)
Colistin	45(100)	-	-

pathogen causing VARI leading to high mortality.⁶ In our study we found that in out of 152 isolates obtained from 131 samples, *Acinetobacter baumannii* was isolated in 29.6% and was the most commonly isolated gram negative bacilli. It represents a major pathogen of VARI in ICUs and is frequently found to be MDR.⁷ Similar results were reported by Ray U et al, with MDR *Acinetobacter baumannii* (40%) being most commonly isolated gram negative bacilli.⁷ Nseir et al also observed preponderance to GNBs including *Acinetobacter baumannii* (18%) being among the most frequent isolates.⁸

In our study all isolates of *Acinetobacter baumannii* were found resistant to one or more class of antimicrobial drugs i.e were found to be multi-drug resistant. VITEK-2 automated system was used to determine the antimicrobial sensitivity pattern of the isolates and identified as MDRs after interpreting the breakpoints as per the CLSI guideline.⁹ In our study isolates of *Acinetobacter baumannii* were found resistant to Penicillin (100%), Cephalosporins (100%), Carbapenem and Fluroquinolone (96%) class of antimicrobials. Similar to this, Phu et al reported high resistance to carbapenem group of antimicrobials.¹ Recently, resistance to even polymyxins and tigecycline has also been described in similar studies.¹⁰ In our study the MDR isolates were found sensitive to Tigecycline (26%), Tetracycline (16%) and Ampicillin-sulbactam (11%). Similar findings were reported by Rana G et al who found multidrug resistant isolates of *Acinetobacter*

baumannii resistant to ampicillin, amikacin, ciprofloxacin, cefotaxime and cefepime (100%).¹¹

5. Conclusion

Acinetobacter baumannii causing VARI have been found refractory to the currently available antimicrobial armory. Effective management of these nosocomial respiratory syndromes is challenged by rise in MDR *Acinetobacter baumannii*. Timely detection of these robust MDR pathogens would prove beneficial for effective empirical and individualized antibiotic therapy, serve epidemiological interests and aid in hospital infection control practices in reducing spread of drug resistant strains from hospital & ICU settings.

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7. Conflicts of Interest

The authors declare no potential conflict of interest with respect to research, authorship, and/or publication of this

article.

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None.

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