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Anatomy

ANTIBIOTIC SUSCEPTIBILITY PATTERN OF NON-FERMENTATIVE BACTERIA ISOLATED FROM CASES OF VENTILATOR- ASSOCIATED PNEUMONIA IN A TERTIARY CARE HOSPITAL.

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ABSTRACT

OBJECTIVE: The study aims to detect the antibiotic susceptibility pattern of non-fermenters isolated from cases of Ventilator-Associated Pneumonia (VAP) in the Intensive Care Unit(ICU) of a tertiary care Hospital.

MATERIALS AND METHOD: The study was conducted in the Department of Microbiology on 130 patients admitted in the Medicine ICU with clinical suspicion of VAP.

RESULT: A large number of non-fermenters were multi-drug resistant. The highest sensitivity of both of these was towards the carbapenems(66.7% in Acinetobacter spp and 88.9% in Pseudomonas aeruginosa) . These were also the predominant MDR(multi-drug resistant) pathogens isolated.

CONCLUSION: Both the nonfermenters stood out to be most sensitive to the carbapenems,

KEYWORDS : VAP, ICU, *Acinetobacter spp. Pseudomonas aeruginosa* .

INTRODUCTION

Ventilator Associated Pneumonia (VAP) ,is defined as pneumonia occurring in patients admitted to critical care units for more than 48 hours after endotracheal intubation and initiation of mechanical ventilation ,including pneumonia developing even after extubation[1].The condition should not be present at the time of admission and within 48 hours thereafter.

Pneumonia is an infection of the pulmonary parenchyma. At present it is categorized as either Community-Acquired Pneumonia(CAP) or Health Care-Associated Pneumonia(HCAP).HCAP is further classified into Hospital-Associated Pneumonia(HAP) and Ventilator-Associated Pneumonia(VAP [2].VAP is the second most common nosocomial infection after urinary tract infection, the incidence of which ranges between 25-30%. It also has the highest fatality rate amongst nosocomial infections[3]. India has a crude mortality rate of 67.4% in ICU patients suffering from pneumonia, with 40% of the mortality in these patients attributable to infection alone.[4] Mortality is more commonly associated with certain conditions like resistant microorganisms, blood stream infections and inadvertent use of empiric anti microbials. VAP is frequently associated with patients suffering from ARDS.

MATERIALS AND METHODS

This study was conducted in the Department of Microbiology, IMS and SUM Hospital over a period of 18 months;130 patients admitted in the Medicine ICU of the hospital with clinical suspicion of Ventilator Associated pneumonia were included in the study.Exclusion criteria included Paediatric patients, presence of lung infiltration prior to intubation or within 48 hours of intubation.and patients diagnosed to have lower respiratory tract infections at the time of admission.

Collection & processing of sample:

The Endotracheal Aspirates were collected non- bronchoscopically using a 22 inch 14F suction catheter fitted with a mucus extractor. Processing was commenced within an hour of receipt of the samples and semi- quantitative cultures were done according to standard laboratory procedure. Antibiotic Susceptibility testing was done by discs manufactured by HiMedia Laboratories Private Limited on Mueller Hinton agar by the Kirby-Bauer's disc diffusion method.

RESULTS

The present study was conducted by the department of Microbiology on patients from the MICU (Medicine Intensive Care Unit) of IMS & SUM Hospital, Bhubaneswar. A total number of 625 patients were put on mechanical ventilation during the study period. Out of these 625 patients, 130 were included in the study according to inclusion criteria. Of these 130 patients, significant pathogens were recovered from 113 patients. A total of 119 bacteria were isolated from these patients.

Thus, out of the total of 625 patients on mechanical ventilation, 113 developed VAP, which was about 18.08%.

Among the 113 patients, 80 were males and 33 were females. Thus the percentage of males was 70.8% and that of females was 29.2%.

Anti-microbial Susceptibility Pattern of Non-fermenters:

A large number of non-fermenters were multi-drug resistant. The above figure shows that the highest sensitivity of *Acinetobacter spp* was towards the carbapenems(66.7% susceptibility to both imipenem and meropenem). This was followed by a fair degree of susceptibility to the aminoglycoside, amikacin(40% sensitivity). Among the quinolones, levofloxacin showed a greater susceptibility than ofloxacin(33.3% vs 15.6%).

Pseudomonas aeruginosa was also most sensitive to the carbapenems(88.9% sensitivity to both imipenem and meropenem).Significant susceptibility to Ceftazidime- Clavulanic acid(59.3%) and Piperracillin- Tazobactum(55.6%) were also seen.Both the nonfermenters were 100% resistant to Amoxycillin-clavulanic acid and ceftriaxone

Table9 : Antimicrobial susceptibility pattern of non-fermenter

Organism	AMC	CTR	CAZ	CAC	PIT	OF	LE	AK	GEN	IPM	MRP
Acinetobacter spp(n=45)	S – 0 R - 45	S – 0 R – 45	S – 0 R - 45	S – 5 R - 40	S- 12 R- 33	S- 7 R- 38	S- 15 R- 30	S- 18 R- 27	S- 9 R- 36	S- 30 R- 15	S- 30 R- 15
Pseudomonas aeruginosa (n=27)	S- 0 R- 27	S- 0 R- 27	S- 12 R- 15	S- 16 R- 11	S- 15 R- 12	S- 9 R- 18	S- 12 R- 15	S- 13 R- 14	S- 10 R- 17	S- 21 R- 6	S- 21 R- 6

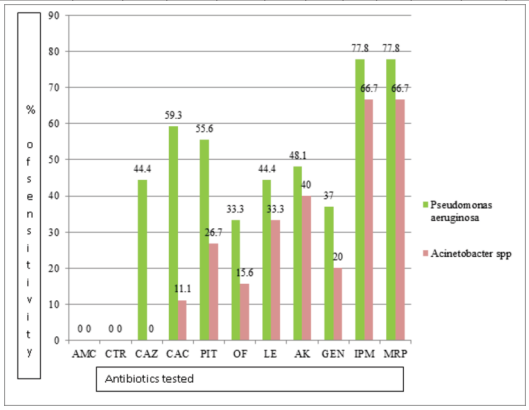

Fig 27 : Antimicrobial Susceptibility pattern of non-fermenters.

(AMC- Amoxycillin- Clavulanic acid, CTR- Ceftriaxone,CAZ-Ceftazidime,CAC- Ceftazidime-Clavulanic acid,PIT- Piperracillin-Tazobactum, OF- Ofloxacin,LE- Levofloxacin,AK- Amikacin,GEN-Gentamicin,IPM- Imipenem,MRP- Meropenem.

Extended Spectrum Beta Lactamase production by the Gram negative bacilli.

The maximum number of ESBL- producing strains was generated by *Klebsiella pneumonia.* Out of a total of 22 isolates of the bacteria, 17 were ESBL producers. Four out of the six isolates of *Escherichia coli* were ESBLproducers. Out of the 12 isolates of *Citrobacter freundii*, 7 were ESBL producers. The single isolate of *Proteus mirabilis* was not an ESBL producer.

Among the non-fermenters, 24 and 13 isolates *of Acinetobacter spp* and *Pseudomonas aeruginosa* , respectively, produced ESBL.

The percentage of ESBL produced by all the organisms as a whole was 54.6%. The ESBL generated by the individual organisms is shown in the table below.

Organism	Total No.of isolates	No.of positive isolates	%of positivity
Acinetobacter spp	45	24	53.3%
Pseudomonas aeruginosa	27	13	48.1%

Thirteen out of fifteen *Acinetobacter spp* resistant to carbapenems were Metallo-Betalactamase (MBL) producing. Out of the six isolates of *Pseudomonas aeruginosa* resistant to carbapenems, four were MBL positive.

DISCUSSION AND CONCLUSION

Johanson WG Jr, Pierce AK, Sanford JP, Thomas GD et al[5] defined ventilator-associated pneumonia as nosocomial pneumonia in a patient on mechanical ventilator support by endotracheal tube or tracheotomy for more than 48 hours. A recent multicentric European study[6] has shown that pneumonia is now the most common infection acquired in the intensive care unit (ICU) and when acquired during mechanical ventilation it has an associated mortality of 24% to 71 %.[7,8] In a study done at the John Hopkins School of Public Health (***Jaimes et al.,*** 2006), the incidence of VAP was 22.2 %[9]

In our case, the incidence was 18.08%, which corroborated with the studies of VAP incidence of 17% by Cook D J et al.,[10]and another study by Joseph et al [11], which showed an incidence of 18%.

In the present study, *Acinetobacter spp* was the most common isolate(37.8%) followed by *Pseudomonas aeruginosa(22.7%), Klebsiella pneumonia(18.5%), Citrobacter freundii(10.2%), Escherichia coli (5.00%), Staphylococcus aureus(5.00%) and Proteus mirabilis(0.80%).* Similar findings were reported by Dey et al [12] where *Acinetobacter spp* was the commonest organism (48.94%). An increased incidence of *Acinetobacter spp* was also found in a study by Rajashekhar et al [7]

Production of ESBL(Extended Spectrum Beta Lactamase) is an area of concern ,in cases of Gram negative bacilli, Though , mainly produced by *Klebsiella spp and Escherichia coli*, its existence in other Gram negative bacteria is not negligible. In the present study, 77.3% of *Klebsiella pneumonia, 66.7% 0f Escherichia coli,58.3% of Citrobacter freundii, 53.35 0f Acinetobacter spp* and *48.15 of Pseudomonas aeruginosa* werw ESBL producers.

Abbot et al. (2006) also noted that local infection control measures may alter infection rates, particularly with *Acinetobacter spp* because it is present in the water supply of many hospitals, and infection control measures can influence infection rates[13]

Accurate diagnosis of VAP is difficult, but because of the increasing problem of multi-resistant pathogens in many ICUs and the resultant high morbidity associated with the condition it, constitutes an urgent challenge as well as a rational basis for the clinical fraternity to address the issue of diagnosis of VAP (***Brusselaers et al***, 2011)[14]

American Thoracic Society[15] has stated the guideline to empirical antibiotic choices. These guidelines are divided into those for patients at risk for VAP caused by multidrug-resistant organisms and those for patients without such risk. In the absence of risk factors for multidrug-resistant bacteria, the clinician should choose empirical therapy for *Streptococcus pneumoniae, Haemophilus influenzae, methicillin-sensitive Staphylococcus aureus* and antibiotic sensitive Gram-negative enteric organisms. Antibiotic choices include ceftriaxone, quinolones (levofloxacin, moxifloxacin, orciprofloxacin), ampicillin/sulbactam, or ertapenem .When risk factors for multidrugresistant organisms are present the clinician must consider not only the organisms listed above but also *Pseudomonas aeruginosa, Klebsiella, Enterobacter, Serratia, Acinetobacter, Stenotrophomonas maltophilia, Burkholderia cepacia, and methicillinresistant*

Staphylococcus aureus. Empirical therapy is broadened to include (i) either an antipseudomonal cephalosporin (cefipime or ceftazadime), an antipseudomonal carbepenem (imipenem or meropenem), or a β-lactam/β-lactamase inhibitor(piperacillin-tazobactam) plus (ii) an antipseudomonal fluoroquinolone (ciprofloxacin or levofloxacin) or an aminoglycosides (amikacin, gentamicin, or tobramycin) plus linezolid or vancomycin. As appropriate antibiotic use is associated with improved outcomes in VAP, accurate selection of antimicrobial agents represent important clinical goals worth pursuing (***Craven and Hjalmarson,*** 2010)

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