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BACTERIOLOGICAL PROFILE AND ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF ENDOTRACHEAL ASPIRATES FROM INTENSIVE CARE UNIT: A STUDY FROM TERTIARY CARE CENTRE - NORTH INDIA.

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ABSTRACT **Introduction:** Mechanical ventilation is a lifesaving procedure for many patients in ICU. Critically ill patients admitted to ICU are at higher risk of acquiring nosocomial infections. These organisms are potent biofilm producers and show multidrug resistance pattern leading to high mortality. Early endotracheal aspirates culture and antimicrobial susceptibility testing helps in the better outcome of the patients. **Material and Methods:** This study is retrospective analysis of bacteriological profile and antimicrobial susceptibility of ET aspirates from ICU over a period of 2 years. February 2021 to January 2023. All samples were processed as per standard Microbiological guidelines for endotracheal aspirates. Antimicrobial susceptibility was done by Kirby Bauer disk diffusion method as per CLSI guidelines. **Results and Discussion:** Out of 232 samples received, bacterial culture positivity was 196(84.5%). Gram negative bacteria were more predominant 204(87.6%), than Gram positive bacteria 29(12.4%). Most common Gram-negative bacteria was Acinetobacter baumannii 90(44.1%). Among Gram positive bacteria most common was *Staphylococcus aureus* 26(89.6%). Among gram negative bacteria maximum resistance was seen to Ceftazidime (87%), followed by Imipenem (78%) Least Resistance was seen to Levofloxacin (36.3%). Among gram positive isolates maximum resistance was seen to Penicillin (93%). Least resistance was seen to vancomycin and Linezolid **Conclusion:** Gram negative bacteria were predominant. Among gram negative bacteria most common was *Acinetobacter baumannii*. Gram negative bacteria were most resistance to Ceftazidime, among gram positive bacteria most common was *Staphylococcus aureus*. Gram positive bacteria were most resistance to Penicillin. The surge of multidrug resistant organisms in hospital-acquired respiratory pathogens is a major concern. Hence, rational use of antibiotics with strict adherence to antibiotic policies critical to control the emergence of drug-resistant strains.

KEYWORDS : Mechanical ventilation, Endotracheal aspirates (ET), Antibiotic susceptibility Test (AST).

INTRODUCTION

Mechanical ventilation is a lifesaving procedure for many patients in ICU, but can cause fatal consequences due to severe, persistent, resistant infections.1 Critically ill patients admitted to ICU are at higher risk of acquiring nosocomial infections.[2] Lower respiratory tract infections (LRTI) are the most common bacterial infections among mechanically ventilated patients accounts for 10-25% of all intensive care unit (ICU) patients and resulting in high overall mortality, which may range from 22%to 71%.[3]MDR pathogens such as MDR Gram-negative rods including extended-spectrum beta-lactamase (ESBL) producers, carbapenem-resistant organisms, and methicillin-resistant Staphylococcus aureus (MRSA) are the most common cause of mortality among mechanically ventilated patients.[2] These organisms are potent biofilm producers as they are encased in a polymeric matrix and show multidrug resistance pattern leading to high mortality.[4] The time of onset of pneumonia is an important risk factor for specific pathogens and outcome in patients with VAP. Early onset VAP, defined as occurring within first 4 days of hospitalization, usually caused by antibiotic-sensitive bacteria, that is, community acquired, whereas the late onset, that is, more than 5 days are associated with increased mortality in patients. Hence early endotracheal aspirates culture and antimicrobial susceptibility testing helps in the better outcome of the patients. VAP results from microaspiration, which is due to semiconscious state and supine position of patients. The Endotracheal aspirates (ET) tube prevents host defences to act by inhibiting the action of cilia, swallowing, and spontaneous coughing by the patients.[10]

The emergence of MDR pathogens is becoming a therapeutic challenge as the treatment alternatives are with poor outcome.[5] Information on bacterial pathogens related to mechanical ventilation causing lower respiratory tract infection and their antibiotic susceptibility patterns in hospitalized patients is inadequate in our region. Hence, the aim of this study was to determine the antimicrobial Susceptibility pattern among microorganisms isolated from patients require mechanical ventilation, so that rational antibiotic policies can be further developed in association with the clinicians.

MATERIAL AND METHODS

A descriptive analysis of culture results of Endotracheal aspirates was performed at the Department of Microbiology at Dr. RPGMC Kangra at Tanda over a period of two years i.e. from February 2021 to January 2023 was done. Endotracheal aspirates were received in the laboratory and were inoculated on MacConkey and Blood agar plates and incubated aerobically at 37°C for 24 hours. Culture plates with colonies were considered for gram staining and identification is carried out by biochemical reactions.[6] Antimicrobial susceptibility testing was done according to the standard operational procedures, in vitro antimicrobial susceptibility testing was done on Mueller-Hinton agar (Hi-Media Lab Ltd, India) using Kirby-Bauer disc diffusion method. A suspension of the test organism was made in sterile normal saline and turbidity adjusted to 0.5 McFarland standards. The test organism was uniformly seeded over the surface of Mueller Hinton agar plates. The plates were allowed to dry for 15 minutes before application of antibiotic discs. The plates were incubated at 37°C for 16-18 hours. After incubation clear zones around the antibiotic discs were measured with a ruler and recorded in millimetres. Susceptibility and resistance data was interpreted according to Clinical laboratory Standards Institute guidelines and antimicrobial susceptibility was performed according to CLSI guidelines.[7]

RESULTS AND DISCUSSION

Out of 232 samples received of Endotracheal aspirates of clinically suspected lower respiratory tract infections, bacterial culture positivity was 196(84.5%) and rest were sterile (15.5%) (Fig1). In our study majority were males with Male to female ratio was 1.9:1(Fig2).

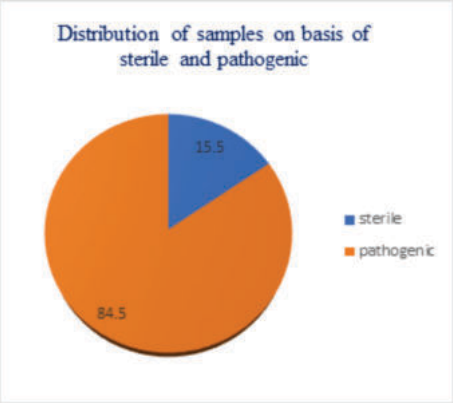

Fig-1 Distribution Of Samples On Basis Of Sterile And Pathogenic

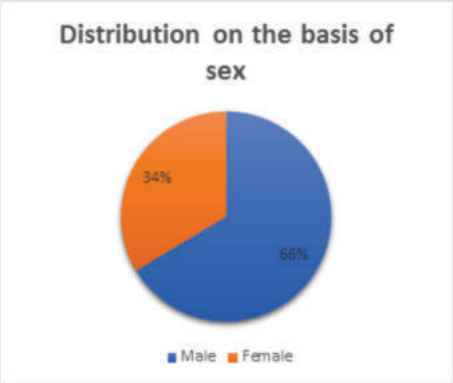

Fig 2 Distribution Of Samples On Basis Of Sex

Out of positive growth samples, on gram staining, gram negative bacteria as shown in fig3, were predominant 204(88%), to Gram positive bacteria 29(12%)

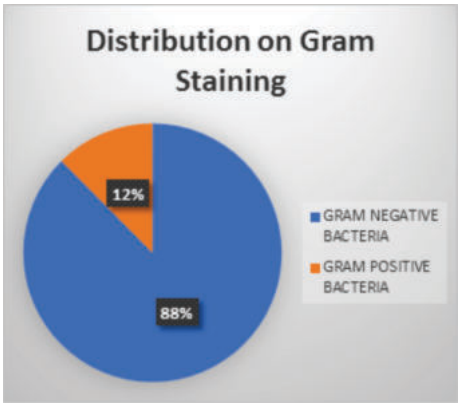

Fig 3. : Distribution On Gram Staining

Among Gram-negative bacteria most common were Acinetobacter baumannii 90(44.1%), Klebsiella pneumoniae 53(25.9%), *Pseudomonas aeruginosa* 38(18.6%). Among Gram positive bacteria most common was *Staphylococcus aureus* 26(89.6%). MRSA isolates were 14, MSSA 12 respectively. Enterococcus faecalis 2(6.8%), CONS 1 (3.4%). As shown in Table1, Fig4.

Table 1: Spectrum of Gram-negative isolates and Gram-positive isolates in ET secretions

		No. of isolates	Percentage
Gram Negative Bacteria	*Acinetobacter baumannii*	90	44%
	Klebsiella pneumoniae	63	30%
	Pseudomonas aeruginosa	38	18.6%
	Enterobacter spp	11	5.3%
	Escherichia coli	10	4.9%
	Citrobacter freundi	2	1%
Gram positive bacteria	MRSA	14	48.2%
	MSSA	12	41%
	Enterococcus	2	6.8%
	CONS	1	3.4%

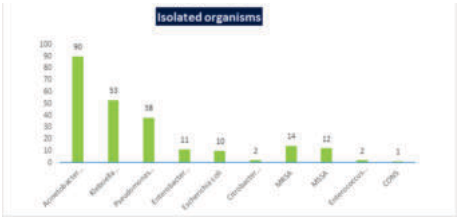

Fig4: Isolated Organisms

Among gram negative bacteria shown in Table 2, Fig5 maximum resistance was seen to Ceftazidime (87%), followed by imipenem (78%) Piperacillin-tazobactam (61%), Gentamicin (61%). Least resistance was seen to colistin 0% Levofloxacin (36.3%) Among gram positive isolates as shown in Fig6 maximum resistance was seen to penicillin (93%), followed by clindamycin (80%) cefoxitin (78%), cotrimoxazole 42%, Erythromycin (28%). Least resistance was seen to vancomycin and Linezolid. Tables

Table 2: Antibiotics resistance pattern of most common Isolates

Organisms	Antibiotics showing maximum resistance to	Antibiotics showing minimum resistance to
Acinetobacter baumannii	Ceftazidime (87%) Imipenem (78%) Piperacillin-Tazobactam (61%) Gentamicin (61%)	Levofloxacin (36.3%) Colistin
Klebsiella pneumoniae	Ceftazidime (74%) Gentamicin (64%) Piperacillin-tazobactam (58%)	Levofloxacin (40%) Imipenem (20%)
Pseudomonas aeruginosa	Imipenem (42%) Ceftazidime (39%) Gentamicin (39%) Levofloxacin (39%)	Piperacillin - tazobactam (24%)
Staphylococcus aureus	Penicillin (93%) Clindamycin (80%) Cefoxitin (78%) Cotrimoxazole (42%)	Erythromycin (28%)

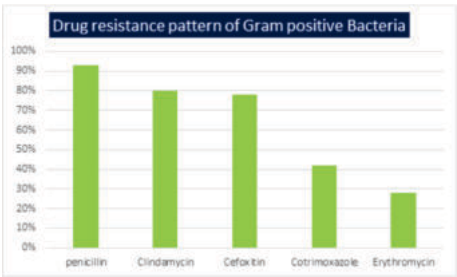

Fig5: Drug Resistance Pattern Of Gram-positive Organisms

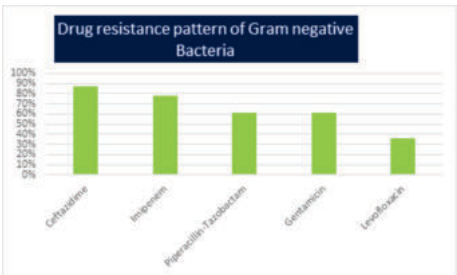

Fig6: Drug Resistance Pattern Of Gram-negative Bacteria

DISCUSSION

Health care associated infections (HCAI) continue to be a major cause of morbidity and device associated infections contributes a maximum towards Healthcare Associated Infections. The mechanical ventilation associated pneumonia can be caused due to endogenous or exogenous microorganisms. [8] In present study Gram negative bacteria were more

predominant than Gram positive bacteria. In our study showed 84.5% growth of endotracheal aspirates which is concordant with Vimal Shriram Rathod e.t al .[9]Gram negative organisms were more dominant than gram positive organisms. In this study Among negative organisms Acinetobacter baumannii was more predominant (44.1%), followed by Klebsiella pneumoniae (25.9%), Pseudomonas aeruginosa (18.6%). Among gram positive organisms Staphylococcus aureus was more predominant. This was in concordant with study conducted by Aishwarya Dilip Warang e.t al.[10] Gram negative bacteria showed maximum resistance to Ceftazidime, followed by Imipenem, piperacillin -tazobactam. Colistin showed maximum susceptibility (100%). This was according to findings obtained in study conducted by Ranjitha Shankare Gowda e.t al.[11] Various studies have shown that Gram negative organisms have become most common cause for healthcare associated infections throughout the world and as these are resistant to multiple classes of drugs lead to difficulty in treating the patients. Colistin, which is an old antimicrobial agent, is very active against these. There was least resistance to Colistin in our study. It appeared to be a good option, in the treatment of VAP developed with MDR pathogens.

CONCLUSION

Mechanical ventilation induced respiratory infections remains an important cause of mortality and morbidity rate worldwide; therefore, identification of the causative agents and their antibiotic susceptibility pattern will play a key role in selecting the suitable antibiotics for clinicians and will improve conditions.

The present study revealed gram negative bacteria as the major pathogens causing ventilation associated infections; therefore, by performing bundle care approach within the intensive care unit (ICU), the frequency of infections can be controlled. Besides the high degree of antibiotic resistance in hospitals, the major concern is ESBL and MBL in gram negative bacteria.

Methicillin resistance in gram positive bacteria also plays a major role in resistance of S. aureus.

The surge of multidrug resistant organisms in hospital-acquired respiratory pathogens is a major concern. Hence, rational use of antibiotics with strict adherence to antibiotic policies critical to control the emergence of drug-resistant strains.

Interest Of Conflict: There is no interest of conflict to disclose in this study.

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