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Original Research Article

Multidrug resistance *Acinetobacter* species in ventilator associated pneumonia patients in MICU

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ABSTRACT

Background: Ventilator associated pneumonia (VAP) is defined as pneumonia that develops 48-72 hours after endotracheal intubation and is characterized by the presence of a new or progressive infiltrate, symptoms of systemic infection, respiratory distress, and the microbiological discovery of a causal agent. There is a substantial attributable death rate linked to VAP caused by *Acinetobacter* species.
Methods: A hospital-based retrospective study was conducted from June 2023 to June 2024 at GMCH, Aurangabad. Six hundred thirteen (613) endotracheal aspirate samples were obtained from patients admitted in intensive care unit. Semi-quantitative processing of the samples was done using accepted microbiological methods. According to CLSI guidelines, antimicrobial susceptibility testing was done.
Results: Out of 613 samples, organism isolated were *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Klebsiella pneumonia*, and *Enterobacter cloacae*. Thirty-seven (37) VAP cases were found from 613 samples; sixteen (16) of them (43%) developed VAP as a result of multidrug resistant (MDR) *Acinetobacter baumannii*. Eleven (69%) of the sixteen VAP cases exhibited minocycline sensitivity. Nine out of 16 VAP cases (56%) had a fatal outcome as a result of the MDR *Acinetobacter* species.
Conclusions: According to this study, minocycline is the most effective drug against MDR *Acinetobacter* species. To lower mortality and morbidity in VAP patients, it is important to identify the organism and follow IPC procedures, which include hand hygiene techniques, bundle care approach, disinfections, screening of the patient's environment, development of an antimicrobial stewardship program, and frequent surveillance.

Keywords: *Acinetobacter spp*., Multidrug resistant, Minocycline, Ventilator associated pneumonia

INTRODUCTION

Ventilator associated pneumonia (VAP) is defined as pneumonia that develops 48-72 hours after endotracheal intubation and is characterized by the presence of a new or progressive infiltrate, symptoms of systemic infection, respiratory distress, and the microbiological discovery of a causal agent. Ventilator-associated pneumonia (VAP), a common and dangerous side effect of critical illness, is related with a longer length of stay in the hospital or intensive care unit as well as an increased mortality risk.[1]

The classification of VAP is suggested by American Thoracic Society (ATS) i.e. a) early onset: ventilator-associated pneumonia that appears four days after the start of mechanical ventilation and endotracheal intubation; b) late onset: ventilator associated pneumonia that develops four days following the start of mechanical ventilation and endotracheal intubation. This classification aids in the identification of the relevant organism and guides the course of our initial empirical antibiotic therapy.[2]

Acinetobacter is a gram-negative, aerobic, nonfermenting coccobacillus that is found in the natural environment. It is becoming more and more important in nosocomial infections, especially VAP. Since *Acinetobacter species* have a higher fatality rate than other bacteria, they are

often the cause of late-onset VAP, which is defined as occurring more than five to seven days after hospital admission. Acinetobacter is a common cause of nosocomial pneumonia outbreaks and grows well in moist environments.[3,4]

A clinical diagnosis is made using two or more of the following criteria in addition to new or persistent infiltrates on chest radiography: as advised by the American Thoracic Society (ATS), (a) purulent tracheal secretions, (b) blood leukocytosis (>12×10^9 white blood cells/L) or leucopenia (<4×10^9 white blood cells/l), (c) temperature greater than 38.3°C.[5,12]

VAP is associated with a high rate of morbidity and death, increases the length of time a patient must stay in the intensive care unit, and is expensive to treat.[14] The benefits of early therapy with the appropriate antibiotics lessen the detrimental effects of insufficient antibiotic treatment on the patient's prognosis.[5] The current study sought to isolate, identify, and quantify bacteria from endotracheal aspirates of clinically suspected VAP patients as well as perform antibiotic susceptibility tests in order to stop the spread of multidrug-resistant (MDR) *Acinetobacter species* in VAP cases.

METHODS

A hospital based retrospective study was carried out from June 2023 to June 2024 at GMC, Aurangabad.

Inclusion criteria

Patients under mechanical ventilation for >48 hours and clinically suspected cases of ventilated associated pneumonia

Exclusion criteria

Patients under mechanical ventilation for <48 hours and upon admission, radiological and clinical symptoms suggestive of pneumonia.

A total of 613 endotracheal aspirate samples were obtained from patients admitted in intensive care unit. Patients were screened for following criteria for diagnosis of VAP: 1) chest radiographs showed new or persistent pulmonary infiltrates that could not be properly explained 2) fever 3) leukocytosis 4) oxygenation: PaO_2/FiO_2, and 5) purulent respiratory secretions. To determine the prevalence of *Acinetobacter* VAP, bacteriological analysis was performed on endotracheal aspirates from the suction traps of these patients. A routine microbiological method was used to process the aspirates.

Gram staining, colony shape, and biochemical tests such as urease, catalase, and oxidase activity, citrate reduction, and the triple sugar iron test were used to identify the species of *Acinetobacter*. In accordance with the Clinical and Laboratory Standards Institutes (CLSI) guidelines 2023, antimicrobial susceptibility testing for the following antimicrobial drugs was conducted on Muller Hinton agar using the disc diffusion method. Following drugs were used for AST pattern:

Ampicillin sulbactam (10 µg), ceftazidime (30 µg), ciprofloxacin (5 µg), gentamicin (10 µg), tobramycin (10 µg), co-trimoxazole (25 µg), imipenem (10 µg), meropenem (10 µg), piperacillin tazobactam (100/10 µg), amikacin (30 µg), minocycline (30 µg).

RESULTS

Out of 613 samples received, 37 VAP cases were identified. Majority were gram negative bacilli, the organism being *Acinetobacter baumannii* followed by *Klebsiella pneumonia*, *Pseudomonas aeruginosa*, *Escherichia coli* and *Enterobacter cloacae* as shown in Figure 1.

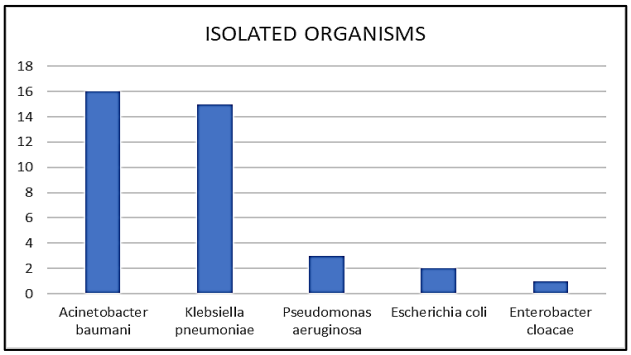

Figure 1: Gram negative organisms isolated from VAP cases.

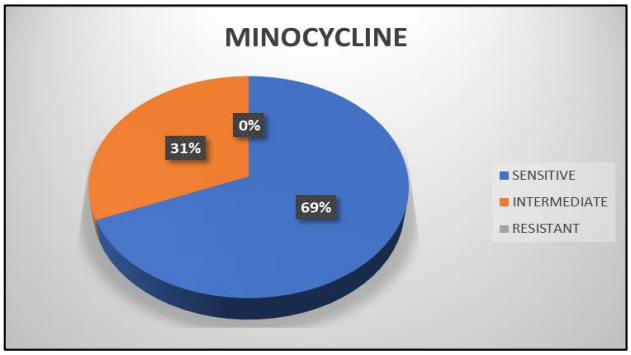

Figure 2: Sensitivity towards minocycline.

Out of 37 VAP cases, 16 developed VAP due to multidrug resistant *Acinetobacter baumannii*.

Out of 16 VAP cases, 11(69%) showed sensitivity towards minocycline and rest were intermediate to minocycline as shown in Figure 2.

Mortality in VAP cases due to multidrug *Acinetobacter* species is 56% i.e., out of 16 VAP cases 9 died as shown in Figure 3.

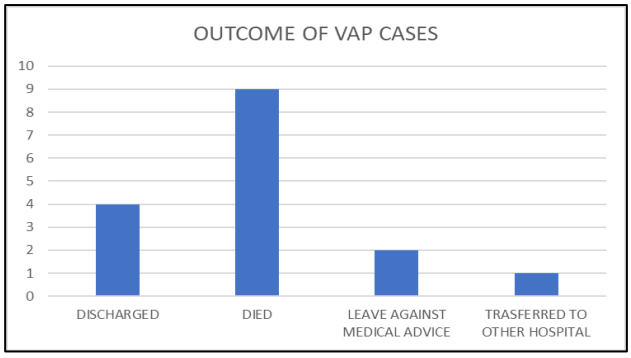

Figure 3: The outcome of VAP cases.

DISCUSSION

Nosocomial pneumonia (NP) is highly prevalent in patients on ventilators. These nosocomial acquired infections increase the length of hospital stays and the death rate of ICU patients.[13] Aerobic gram-negative coccobacilli called *Acinetobacter species* have become significant opportunistic infections, particularly in individuals who are very ill.[6]

Drug-resistant *Acinetobacter baumannii* infections have a high impact on the healthcare setting and are associated with increased morbidity and mortality in critically ill patients who develop VAP.[7,11] *Acinetobacter baumannii* was recognized worldwide as one of the most difficult to control nosocomial infections because of its ability to develop antibiotic resistance and survive long periods of time under dry conditions on inanimate objects in the hospital environment.[8,9] The incidence of this organism, particularly drug-resistant *Acinetobacter baumannii*, was also reported in other study done by Huang et al and Baraibar et al.[10,11] According to Huang et al 6.9% of VAP cases were by *Acinetobacter baumannii*. According to Baraibar et al, 8.1% of VAP cases were by *Acinetobacter baumannii*.[4,10]

In our study it was observed, 12 out of 16 VAP cases due to MDR *Acinetobacter baumannii* were males and 4 were females. Median age of VAP cases were 40 years. Patients were given broad spectrum antibiotic before the onset of VAP. The most frequently given antibiotics were third generation cephalosporins (ceftriaxone) followed by carbapenems (meropenem) and piperacillin tazobactam.[14] After the onset of VAP, the most used antibiotics were minocycline and colistin. In our study the patients who were diagnosed as VAP were mainly associated with organophosphorus poisoning followed by viral encephalitis and bilateral pleural effusion leading to respiratory failure. Various other risk factors associated with MDR *Acinetobacter* VAP include acute respiratory distress syndrome, large-volume lung aspiration, head trauma and neurosurgery. In our study we also observed that 10 out of 16 cases of VAP were not associated with Blood stream infection.[12] Rest 6 cases were associated with laboratory confirmed blood stream infection and organism isolated were *Klebsiella pneumoniae*, followed by *Pseudomonas aeruginosa* and *Enterococcus species*.

CONCLUSION

To conclude, VAP resulting from an MDR Acinetobacter is among the most terrible outcomes that can arise in a critical care environment. This presents significant challenges for selecting the appropriate antibiotic for the care of ill patients admitted to the intensive care unit (ICU). To prevent infections caused by these bacteria in patients admitted to ICU, a number of methods are essential. These include stringent infection control protocols, prudent antibiotic dosing, surveillance programs for antibiotic resistance, and drug cycling.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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