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Original Research Article

Microbiological Profile and Clinical Outcomes of Inpatients with Ventilator: Associated Pneumonia

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Abstract

Introduction: In intensive care units, device-associated infections make up the bulk of healthcare infections (ICUs). Patients recovering from trauma are more likely to contract these infections, with ventilator-associated pneumonia (VAP) being the most prevalent. These infections can have major consequences, including increased morbidity, an extended hospital stay, and fatality. This study compares the clinicomicrobiological profiles of trauma patients with and without VAP in Level I trauma centres.

Method: At the Department of Medicine, Apollo Hospital, Bhubaneswar a 1-year retrospective assessment of a prospectively maintained database was done between January 2020 and December 2020. VAP and non-VAP patients were two categories into which the patients were divided. The criteria used by the Centers for Disease Control and Prevention to define VAP patients. The information was gathered and examined. Statistical information was examined using the SPSS version 21 program.

Results: In our research, we observed 395 (87%) non-VAP cases and 200 (13%) cases of VAP over the course of the study period. There were 210 ventilator days used by VAP patients in total, ranging from 3 to 80 days (median 41 days). The non-VAP category hospital stays ranged in length from 2 to 70 days (median 195.4 days). 60 (45%) individuals with VAP experienced in-hospital mortality. 85 (34%) patients with non-VAP have also experienced a fatal outcome. Gram-negative organisms were found in the fatal VAP patients, most frequently Acinetobacter spp. (13.20%).

Conclusion: Patients with VAP had a higher death rate compared to patients without VAP who were both receiving mechanical ventilation. To prevent VAP, it is imperative to identify it early, apply effective VAP preventive bundle methods, and follow strict infection control procedures.

Keywords: Antimicrobial, Infection, Mortality, Resistance.

Introduction

Infections related to healthcare have grown to be a major patient safety problem [1]. Ventilator-associated pneumonia (VAP) is a type of device-related infection that has serious consequences for patient outcomes in terms of linked morbidity, death, lengthened hospital stays, and increased treatment costs [2]. A significant type of hospital-acquired pneumonia known as VAP is pneumonia that develops in patients who have been on a mechanical ventilator for more than 48 hours

following tracheal intubation or tracheostomy. [3] The period of ventilation, the use of antibiotics in the past, the existence of chronic obstructive lung disease, coma, and local circumstances are just a few of the variables that affect the aetiology of VAP [4]. Another significant health concern is the prevalence of multidrug-resistant (MDR) organisms as a cause of VAP. Gram-positive bacteria like Staphylococcus aureus and Gram-negative bacteria like Pseudomonas aeruginosa, Escherichia coli, Klebsiella pneumoniae, and Acinetobacter spp. are the most typical pathogens that cause VAP [5,6]. The appropriate antibiotic therapy should be begun right once because delaying treatment can increase the mortality rate linked with VAP. VAP can be difficult to diagnose, which may cause its impact to be overestimated or underestimated. The goal of the current study was to evaluate the clinicomicrobiological characteristics of VAP and non-VAP patients, their hospital stays, and their future outcomes.

Method:

The current study was carried out in the Department of Medicine, Apollo Hospital, Bhubaneswar. It is a retrospective analysis of a year's worth of laboratory data. The study included all patients who had been admitted to intensive care units (ICUs) for more than 45 hours and those who were using a ventilator. Patients with acute respiratory distress syndrome and those who died or developed pneumonia within 45 hours of admission, as well as those who had pneumonia at the time of admission, were excluded from the study. The National Healthcare Safety Network (NHSN) definitions of the Centers for Disease Control and Prevention (CDC) were used to define VAP [7,8]. On specially created forms, data were prospectively collected daily from each patient admitted to the ICU. Infection control nurses in hospitals are completely committed to their work. At the conclusion of the month, the doctors and microbiologists validated all the forms to make sure they complied with the CDC/NHSN criteria for classifying HAIs. Over the course of a year, from January 2020 to December 2020, a total of 200 patients on ventilators were examined. The study included patients who met the diagnostic standards for VAP established by the CDC. Patients were classified as non-VAP if only their respiratory samples were positive for culture. Age, gender, trauma type, culture positivity, hospital length of stay, number of ICU days, number of days on a ventilator, and the final clinical result were among the factors used to assess the prospectively acquired data. The statistical analysis was done with the SPSS version 21 program (IBM, United States). The mean was used to express every value. It was considered statistically significant when $P < 0.04$ was used.

Results

200 (12%) occurrences of VAP and 395 (86%) non-VAP cases were noted in the study over the aforementioned time period. Males, 115 (86%) had a higher incidence of VAP than females, 15, had (14%). Patients who acquired VAP ranged in age from 2 to 86, with a median age of 44. Patients with neurotrauma 29, spinal trauma 16, pelvic trauma 2, thoracic trauma 6, abdominal trauma 8, thoracic trauma 6, and polytrauma 67 (50%) were among the many types of trauma cases that developed VAP patients. A total of 300 bronchoalveolar lavage (BAL) samples and 300 blood samples from patients with VAP were received at the microbiology lab of the center for culture.

56 (42%) VAP patients had isolated BAL cultures that were positive, and 270 organisms were isolated from patient samples that were taken repeatedly. 23 (17%) VAP patients had isolated blood cultures that were positive, and 120 clinical isolates were found in the repeat

patient samples. 15 (11%) VAP patients had simultaneous BAL and blood culture positive results. There were 210 ventilator days used by patients with VAP overall, ranging from 3 to 80 days. Patients with VAP spent anywhere from 2 and 70 days in the hospital. These individuals ICU stays lasted somewhere between 4 and 90 days. **Table 1** provides a description of the organisms identified from both VAP and non-VAP patients.

Table 1: Bacterial isolates from patients with ventilator-associated pneumonia and individuals without ventilator-associated pneumonia

Gram- Stain Property	Organisms	VAP Patients (%)	Non-VAP Patients (%)
Gram-negative organisms	*Acinetobacter spp.*	45(60%)	144 (58.1%)
	Pseudomonas spp.	35 (16%)	128 (136%)
	Enterobacteriaceae	30 (14%)	78 (18.3%)
	Burkholderia spp.	6 (1.8%)	29 (4%)
	Stenotrophomonas spp.	2 (1%)	5 (0.7%)
	Chryseobacterium spp.	2 (1%)	1 (0.3%)
Gram-Positive organsims	*Staphylococcus aureus*	76 (4.5%)	9 (2%)
	Enterococcus spp.	7 (2%)	1 (0.3%)

The age range for non-VAP patients was 2 to 95 years, with 48.4 years being the median. In total, 114 (13%) women and 186 (85%) men made up the non-VAP category. In the non-VAP category, hospital stays ranged from 2 to 80 days. Clinical results Of the total patients, 63 (53%) were discharged, while 60 (45%) of those who developed VAP died. 85 (34%) patients with non-VAP have also experienced a fatal outcome. In this investigation, a high rate of antimicrobial resistance was identified, and the majority of the isolates were only responsive to tigecycline and colistin. Acinetobacter spp. (61%) and Enterobacteriaceae (35%), respectively, were the two most prevalent isolates among the 200 VAP patients. Gram-negative organisms were found in the fatal VAP patients, most frequently Acinetobacter spp. (13.20%).

Discussion:

Among patients in ICUs receiving mechanical ventilation, VAP is a significant hospital acquired infection (HAI). It is the most frequent HAI among patients receiving ventilator assistance and the second-most frequent HAI in the ICU. [9,10]. Due to several factors, including increased and prolonged use of invasive mechanical ventilation and unintentional antibiotic therapy, VAP has serious consequences, especially in critically ill trauma patients. These factors eventually result in a poor clinical outcome and steadily rising antimicrobial resistance. VAP still poses a significant risk to the health of 8% to 28% of patients using mechanical ventilation, despite significant advancements in treatment strategies and the widespread application of efficient procedures to clean respiratory equipment [11]. It is an expensive ailment that is hard to precisely diagnose. Its progression lengthens the patient's stay in the intensive care unit and is linked to a high risk of morbidity and mortality [12].

Its progression lengthens the patient's stay in the intensive care unit and is linked to a high risk of morbidity and mortality [12]. If the right antibiotics are provided in a timely manner, a positive outcome appears to be more probable. While it has been stated in other research that the incidence of VAP is 28%, 37%, and 38.5%, it was only 13% in this study [13‑15]. The reduced rates could be due to our extremely strict, bundle-based preventive

approach, which includes ongoing surveillance [6,16]. The majority of the patients in our study group were middle-aged people, with men (115, 86%) and women (15, 14%) making up the majority of the VAP patients; similar findings have been reported in several studies [17,18].

Similar to what has been reported in several previous research, we found that the majority of the pathogens causing VAP were Gram-negative bacteria such Acinetobacter baumannii (61%) and Enterobacteriaceae (35%) [19]. The clinical isolates that cause VAP vary depending on the length of mechanical ventilation, the antibiotic dose, the number of days on a ventilator, and the length of ICU hospitalisation. Patients undergoing airway intubation are more likely to have Gram-negative bacteria colonise their upper and lower respiratory tracts, leading to overgrowth and pneumonia. Numerous studies have demonstrated that MDR bacteria are spreading more widely in hospitals as a result of the heavy usage of antibiotics [20–22]. Since the patients in VAP cases were severely ill and required empiric medication before the results of culture and sensitivity were known, the use of antibiotics prior to the diagnosis of VAP was much higher in comparison to non-VAP cases. [23] The majority of the organisms in our investigation were MDR, with the majority of them only being responsive to tigecycline and colistin. These results imply that the most crucial approaches to managing the issue of MDR organisms in the ICU should be focused on ongoing monitoring of the presence of these organisms and avoiding excessive or prolonged use of any one antibiotic.

Conclusion:

In comparison to non-VAP patients, VAP patients have a greater mortality rate, an extended ICU stay, and more days on a ventilator. In every hospital context, additional VAP cases can be avoided by the use of appropriate antibiotics, prompt identification of VAP patients, good hand hygiene, and other healthy practices. Given the growing evidence of MDR bacteria in patients who develop VAP, knowledge of the sensitivity pattern of pathogens should direct the selection of antibiotics. Regular ICU fumigation and ventilator sterilization will lower the number of VAP cases.

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