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CLINICAL CHARACTERISTICS, PARACLINICAL FINDINGS, AND TREATMENT OUTCOMES OF PATIENTS WITH VENTILATOR-ASSOCIATED PNEUMONIA IN THE INTENSIVE CARE UNIT OF MILITARY HOSPITAL 175

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ABSTRACT

Objective: To describe the clinical and paraclinical characteristics and evaluate treatment outcomes of patients with ventilator-associated pneumonia (VAP).

Subjects and Methods: This is a cross-sectional descriptive study conducted on 76 patients diagnosed with ventilator-associated pneumonia, treated in the Intensive Care Unit at Military Hospital 175 from November 2023 to December 2024.

Results: Among the 76 patients studied, late-onset VAP (≥5 days) accounted for a higher proportion (63.2%) compared to early-onset VAP (<5 days) (36.8%). The majority were male (65.8%) with a mean age of 62.3 ± 14.1 years. Common comorbidities included diabetes mellitus (18.4%) and chronic obstructive pulmonary disease (COPD) (11.8%). Most patients had cerebral hemorrhage (59.2%) and required intubation due to coma (60.5%). Clinical signs included fever (72.4%), leukocytosis (76.3%), hypoxemia (PaO_2/FiO_2 <200 in 51.3%), with a mean Glasgow Coma Scale score of 9.1 ± 2.5 and SOFA score of 5.1 ± 2.4. Gram-negative bacteria were predominant, with Klebsiella pneumoniae (22.4%), Pseudomonas aeruginosa (19.7%), and Acinetobacter baumannii (18.4%) being the most frequently isolated pathogens. The average duration of mechanical ventilation was 8.2 ± 2.6 days, and ICU stay was 10.5 ± 3.1 days. The clinical stabilization rate was 63.2%. Late-onset VAP was significantly associated with age ≥65 years (p=0.012), leukocytosis (p=0.048), elevated procalcitonin (p=0.004), hypoxemia (p=0.001), and multidrug-resistant (MDR) bacteria (p=0.003).

Conclusion: Late-onset VAP accounted for the majority of cases (63.2%), predominantly affecting elderly patients and associated with MDR Gram-negative bacteria. Risk factors such as hypoxemia and elevated procalcitonin were significantly related. The findings highlight the critical need for stringent infection control measures in patients requiring prolonged mechanical ventilation.

Keywords: Ventilator-associated pneumonia, intensive care, chronic obstructive pulmonary disease.

1. INTRODUCTION

Ventilator-associated pneumonia (VAP) is defined as pneumonia that develops after a patient has been intubated and received mechanical ventilation for ≥48 hours, in the absence of clinical symptoms or radiographic evidence of pneumonia at the time of hospital admission. VAP is a subtype of hospital-acquired pneumonia (HAP), frequently encountered in intensive care units (ICUs), accounting for approximately 25–50% of cases among mechanically ventilated patients and 10–25% of all hospitalized patients with prolonged hospital stays [1]. In ICUs, VAP significantly increases the duration of mechanical ventilation, length of hospital stay, and overall treatment costs. Moreover, it is a leading cause of severe complications such as multiple organ dysfunction syndrome (MODS) [2]. Patients at higher risk of developing VAP include the elderly, those with

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chronic conditions such as chronic obstructive pulmonary disease (COPD), individuals with severe underlying diseases, deep coma, or those undergoing invasive procedures such as catheterization, drainage, and hemodialysis [3]. At 175 Military Hospital, particularly in the ICU, the annual number of critically ill patients requiring mechanical ventilation is substantial. Among them, many patients present without pulmonary involvement upon admission but subsequently develop pneumonia after a period of intubation and ventilation. This progression worsens their clinical condition, prolongs treatment duration, and increases the risk of mortality. Given this clinical reality, we conducted this study to describe the clinical and paraclinical characteristics and evaluate treatment outcomes of patients with ventilator-associated pneumonia in the Intensive Care Unit of Military Hospital 175.

2. SUBJECT AND METHOD

2 .1. Subject

This study was conducted on 76 patients who underwent endotracheal intubation and mechanical ventilation in the Intensive Care Unit (ICU) of Military Hospital 175 from November 2023 to December 2024.

- Inclusion Criteria

Patients diagnosed with Ventilator-Associated Pneumonia (VAP) according to the 2021 CDC or ATS/IDSA guidelines.

Received mechanical ventilation for ≥48 hours.

Age ≥18 years.

Provided informed consent to participate in the study.

- Exclusion Criteria

Patients with community-acquired pneumonia (CAP) or hospital-acquired pneumonia (HAP) prior to intubation or within <48 hours after intubation.

Patients with end-stage malignancy or those with predicted mortality within 48 hours following VAP diagnosis.

Patients who did not consent to participate in the study.

2.2. Methods

- Study Design: This was a cross-sectional descriptive study.

- Sample size: A convenience sampling method was employed, including all patients diagnosed with ventilator-associated pneumonia (VAP) from November 2023 to December 2024, who met the inclusion and exclusion criteria. A total of 76 patients were included in the study.

2.3. Data Collection and Processing Methods

- Study variables:

+ Demographic and clinical data: Age, sex, primary diagnosis at hospital admission, relevant medical history, indication for endotracheal intubation, vital signs (heart rate, blood pressure, temperature), and Glasgow Coma Scale (GCS) score at the time VAP was suspected.

+ Paraclinical characteristics:

++ Hematology: Complete blood count (white blood cell count, neutrophil percentage, platelet count).

++ Biochemistry: Serum creatinine, total bilirubin, albumin, and procalcitonin (when VAP was clinically suspected).

++ Arterial blood gas analysis: including PaO_2/FiO_2 ratio.

++ Microbiology: Sputum culture results, bacterial identification, and antibiotic susceptibility testing.

- Treatment outcomes:

Time of VAP onset, duration of mechanical ventilation, length of ICU stay, total hospitalization duration, and clinical outcomes (discharged, transferred within the hospital, referred to another facility, death, or discharge against medical advice).

Total number of patients requiring mechanical ventilation and total number of ventilator days.

2.4. Data Processing and Statistical Analysis

All collected data were entered and stored using Microsoft Excel 365. Descriptive statistics (mean, standard deviation, percentage) were performed using SPSS version 22.0. Associations between variables were analyzed using the Chi-square test. A p-value < 0.05 was considered statistically significant.

3. RESULTS

Table 1. Epidemiological and general clinical characteristics of the study population (n = 76)

Indicators		Number (n)	Percentage (%)
Mean age (Mean ±SD)		62.3 ± 14.1	
Gender	Male	50	65.8
	Female	26	34.2

Indicators		Number (n)	Percentage (%)
VAP onset timing	Early-onset (<5 days)	28	36.8
	Late-onset (≥5 days)	48	63.2
Common comor bidities	Diabetes mellitus	14	18.4
	Chronic obstructive pulmonary disease (COPD)	9	11.8
Primary diagnosis on ICU admission	Intracerebral hemorrhage	45	59.2
	Ischemic stroke	14	18.4
	Myocardial infarction	7	9.2
	Other	10	13.2
Reason for endotracheal intubation	Respiratory failure	23	30.3
	Coma	46	60.5
	Cardiac arrest	7	9.2

The study population had a mean age of 62.3 ± 14.1 years, with males accounting for 65.8%. Late-onset VAP (≥5 days) was more common (63.2%) than early-onset VAP (36.8%). The most prevalent comorbidities were diabetes mellitus (18.4%) and chronic obstructive pulmonary disease (COPD) (11.8%). Intracerebral hemorrhage was the most frequent primary diagnosis upon ICU admission (59.2%). The main reasons for endotracheal intubation were coma (60.5%) and respiratory failure (30.3%).

Table 2. Clinical and paraclinical characteristics of patients with ventilator-associated pneumonia (VAP)

Parameters	Number (n)	Percentage (%)
Fever	55	72.4
Leukocytosis	58	76.3
Elevated procalcitonin	36	47.4
PaO_2/FiO_2 < 200	39	51.3
Glasgow Coma Scale (Mean ± SD)	9.1±2.5	
SOFA Score (Mean ± SD)	5.1±2.4	

Patients with ventilator-associated pneumonia (VAP) exhibited a high incidence of fever (72.4%), leukocytosis (76.3%), and hypoxemia (PaO_2/FiO_2 < 200: 51.3%). The mean Glasgow Coma Scale score was 9.1 ± 2.5, and the mean SOFA score was 5.1 ± 2.4, indicating a moderate severity of illness.

Table 3. Microbiological Results from Respiratory Specimens

Isolated Pathogens	Frequency (n)	Percentage (%)
Klebsiella pneumoniae	17	22.4
Pseudomonas aeruginosa	15	19.7
Acinetobacter baumannii	14	18.4
Escherichia coli	8	10.5
Stenotrophomonas maltophilia	6	7.9

Gram-negative bacteria were predominant, with Klebsiella pneumoniae (22.4%), Pseudomonas aeruginosa (19.7%), and Acinetobacter baumannii (18.4%) being the most commonly isolated pathogens.

Table 4. Treatment Outcomes

Parameters	Value
Duration of mechanical ventilation (days)	8.2 ± 2.6
Length of ICU stay (days)	10.5 ± 3.1
Length of hospital stay (days) (mean ± SD)	11.5 ± 5.7
Treatment outcomes, n (%)	
Stable (discharged or transferred)	48 (63.2%)
Severe condition/Death	28 (36.8%)

The average duration of mechanical ventilation was 8.2 ± 2.6 days, and the length of ICU stay was 10.5 ± 3.1 days. The proportion of patients who were stable (63.2%) was higher than that of the severe/death group (36.8%).

Table 5. Association between late-onset ventilator-associated pneumonia (VAP) and selected clinical and paraclinical factors (n=76)

Factors	Late-onset VAP (n=48)	Early-onset VAP (n=28)	p-value
Age ≥ 60	34 (70.8%)	12 (42.9%)	0.012
Leukocytosis	40 (83.3%)	18 (64.3%)	0.048

Factors	Late-onset VAP (n=48)	Early-onset VAP (n=28)	p-value
Elevated procalcitonin (PCT)	29 (60.4%)	7 (25.0%)	0.004
PaO_2/FiO_2 ratio < 200	33 (68.8%)	6 (21.4%)	0.001
Multidrug-resistant bacteria	26 (54.2%)	4 (14.3%)	0.003

Late-onset ventilator-associated pneumonia (VAP) was significantly associated with age ≥60 (p=0.012), leukocytosis (p=0.048), elevated procalcitonin (p=0.004), hypoxemia (PaO_2/FiO_2 < 200) (p=0.001), and multidrug-resistant bacteria (p=0.003).

4. DISCUSSION

In our study, the analysis of epidemiological, clinical, and microbiological characteristics of 76 patients with ventilator-associated pneumonia (VAP) showed that the mean age was 62.3 years, with males accounting for 65.8%. This finding is consistent with previous studies indicating that elderly patients, particularly those aged 60 and above, are at higher risk of developing VAP [4]. Furthermore, our study identified a statistically significant association between late-onset VAP (≥5 days) and advanced age, with a markedly higher incidence of late-onset VAP among patients aged 60 years or older (p=0.012).

An important prognostic factor related to the severity of VAP in our patient cohort was the presence of comorbidities, especially diabetes mellitus (18.4%) and chronic obstructive pulmonary disease (COPD) (11.8%). These conditions have been shown to increase the risk of VAP due to their detrimental effects on respiratory function and the consequent increased need for endotracheal intubation [5], [6], [7]. Notably, the primary diagnosis upon admission to the intensive care unit (ICU) was intracerebral hemorrhage (59.2%), indicating that patients with neurological injury are at high risk for respiratory complications. This observation aligns with the common occurrence of respiratory issues in stroke patients and underscores the necessity of implementing preventive measures against VAP in this vulnerable population [8].

Clinically, common manifestations included fever (72.4%), leukocytosis (76.3%), and marked hypoxemia, with 51.3% of patients exhibiting a PaO_2/FiO_2 ratio below 200. The moderate severity of illness was reflected by an average SOFA score of 5.1 ± 2.4, while the low Glasgow Coma Scale scores further indicated altered consciousness, particularly in comatose patients, which significantly influences prognosis, findings that are consistent with previous reports describing VAP patients [8].

Our microbiological analysis revealed a predominance of Gram-negative bacteria, with the three most frequently isolated pathogens from respiratory specimens being Klebsiella pneumoniae (22.4%), Pseudomonas aeruginosa (19.7%), and Acinetobacter baumannii (18.4%). These results highlight the pressing concern over the spread of multidrug-resistant (MDR) organisms, especially in cases of late-onset VAP, necessitating the development of rational antibiotic treatment strategies based on culture and susceptibility testing in hospital settings [6], [9]. Moreover, analyses showed that late-onset VAP was significantly associated with leukocytosis (p=0.048), elevated procalcitonin levels (p=0.004), and MDR bacterial infections (p=0.003), emphasizing the diagnostic and therapeutic importance of these markers in ICU management [5], [10].

Regarding treatment outcomes, the average duration of mechanical ventilation was 8.2 days, and the mean ICU length of stay was 10.5 days, reflecting the substantial burden VAP imposes on healthcare systems. The rate of clinical stability (discharge or transfer) was 63.2%, whereas the rate of mortality or severe deterioration was 36.8%, consistent with prior studies reporting high mortality associated with late-onset VAP caused by resistant pathogens [5], [7], [10]. These findings underscore VAP as a significant challenge in critical care, necessitating particular emphasis on effective preventive measures, stringent infection control, and judicious antibiotic stewardship.

5. CONCLUSION

Ventilator-associated pneumonia (VAP) represents a significant challenge in critical care, particularly among elderly patients with comorbidities. Late-onset VAP is associated with multidrug-resistant bacterial infections and poorer prognosis. The predominance of Gram-negative bacteria underscores the importance of early microbiological diagnosis and appropriate antibiotic use. Enhancing infection prevention and control measures is essential to improve treatment outcomes in mechanically ventilated patients.

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