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Research Article

Incidence, Risk Factors, and Outcome of Ventilator-Associated Pneumonia in an Intensive Care Unit

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ABSTRACT

Background: Ventilator-Associated Pneumonia (VAP) is one of the most common nosocomial infections that occurs after intubation in patients with mechanical ventilation.
Methods: This cross-sectional descriptive study was conducted in a group of patients admitted to the ICU with a sample size of 120 patients. patients were visited daily at the beginning of admission to the ICU and the study began by considering the entry and exit criteria. To achieve the research objectives, researchers visited the ICI department daily and identified eligible patients. Also, in this study, the demographic profile form of the patients was designed, and their information was completed by the researchers according to the information in the patients' clinical records. The questions of the demographic profile form were completed using an interview with the patient's companion and a study of the patient's hospitalization records. The data from this study were entered into SPSS version 18 and analysed using chi-square, regression, Mann-Whitney and other statistical tests.
Results: According to the findings, 120 patients admitted to the ICU were included in the study, of which 48.3% were male and 51.7% were female. The incidence of VAP in 24 patients (20%) was reported. most of the VAP Group patients were male with a rate of 70.8%, age group 70-80 years with a rate of 66.7%, a history of smoking with a rate of 100% and consciousness above 9 with a rate of 70.8%. Also, in patients with VAP, 91.7% of patients with cancer and 41.7% of patients with rheumatoid arthritis had comorbidities, which was significant compared to the No-VAP Group (P value<0.05).
Conclusion: Given the high prevalence of VAP and its role in patient mortality, preventive interventions are recommended to reduce the incidence of VAP.

Introduction

Patients are admitted to the hospital for various reasons, including traffic accidents, trauma, chronic diseases such as cancer, diabetes, cardiovascular diseases, neurological diseases, or oral and dental diseases. Hospitalization is done with the aim of improving the patient's physical condition, but in some cases, due to reasons such as the patient's vulnerability due to physical conditions caused by the disease and the lack of proper hygiene conditions in the hospital, the patient becomes infected with a hospital-acquired infection [1-3].

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A patient gets hospital-acquired infections, also called healthcare-associated infections, at least 48 hours after being admitted to the hospital and getting care. These infections were not there when the patient was admitted, and they were not in a state of incubation for these infections [4-6]. Hospital-acquired infections are common in hospitals and can cause long hospital stays, death, and high costs for both the patient and the healthcare system. The rate of hospital-acquired infections varies by department, with the highest rate reported in the intensive care unit [7-9].

Pneumonia is an important cause of mortality and morbidity in patients, and its diagnosis is made based on clinical examinations and with the help of paraclinical findings such as chest radiography and clinical tests of the patient [10]. Ventilator-Associated Pneumonia (VAP) that occurs after intubation in patients with mechanical ventilation [11]. VAP is the most important acquired infection in the ICU [12-14].

Various factors are effective in the development of VAP. Some of these factors are losing the ability to cough, pharyngeal secretions building up behind the tracheal tube, airway cilia not working properly, lying flat for a long time, not being able to move, using dirty tools to suction pulmonary secretions, and staff members spreading antibiotic-resistant organisms to patients [12–13]. Also, many host-related risk factors play a role in the development of VAP, including medical history, male gender, immunocompromised status, neurosurgery, burns, thoracic surgery, ulcer disease, cardiac surgery, and re-intervention [15-17].

Antibiotic resistance in the ICU has increased dramatically in recent years, and it is likely that frequent use of antibiotics, the severity of the patient's clinical condition, and differences in infection control methods are effective in antibiotic resistance [12]. To prevent antibiotic resistance in the first place, the patient should be prevented from getting an infection. In fact, if a patient hospitalized in the hospital does not have any clinical symptoms of a nosocomial infection, then there is no need to take antibiotics [18-20]. The aim of this study was to determine the prevalence and factors affecting ventilator-associated pneumonia in patients hospitalized in the ICU.

Methods

We conducted this cross-sectional descriptive study on a group of 120 ICU patients. Inclusion criteria included admission to the ICU due to one of the types of internal diseases, dependence of the patient's breathing on a ventilator, at least 18 years of age, and absence of illness during admission, such as pneumonia. The study excluded patients who died or discharged before 48 hours, patients with obvious maxillofacial trauma, and patients with penetrating chest injuries.

In this study, patients were visited daily at the beginning of admission to the ICU, and the study began by considering the entry and exit criteria. If a patient had shortness of breath, tachypnea, or a temperature of 36°C or 38°C after 48 hours in the ICU or while on a ventilator, they were checked for leukocytosis, leukopenia, purulent discharge from the trachea, new infiltration, or progression of previous discharge on chest x-ray, and/or abnormal respiratory sounds. The final diagnosis of VAP was based on the CDC's definition [21-24]. To achieve the research objectives, researchers visited the ICI department daily and identified eligible patients. Also, in this study, the demographic profile form of the patients was designed, and their information was completed by the researchers according to the information in the patients' clinical records. We completed the demographic profile form by interviewing the patient's companion and studying the patient's hospitalization records. These questions included the patient's age, gender, history of underlying diseases, type of underlying disease, duration of connection to the ventilator, duration of nasogastric tube, use of blood products, and GCS status. To adhere to research ethics, we fully provided the patient's physician with the data from this study for any decision-making. Additionally, we respected patient confidentiality, including the confidentiality of their information, when presenting the study's results. The data from this study were entered into SPSS version 18 and analyzed using chi-square, regression, Mann-Whitney and other statistical tests.

Results

The study included 120 ICU patients, 48.3% of whom were male and 51.7% were female. We reported the incidence of VAP in 24 patients (20%). According to the findings of (Table 1), most of the VAP Group patients were male, with a rate of 70.8%; in the age group 70-80 years, with a rate of 66.7%; with a history of smoking, with a rate of 100%; and with consciousness above 9, with a rate of 70.8%.

The findings in (Table 2) show the comparison of patients with VAP and the No-VAP group in terms of comorbidities. According to the findings, in patients with VAP, 91.7% of patients with cancer and 41.7% of patients with rheumatoid arthritis had comorbidities, which was significant compared to the No-VAP Group (P value < 0.05). According to the findings in (Table 3), most patients with VAP who died were male and had a history of smoking.

Table 1- Comparison of variables studied in patients with VAP and No-VAP Group.

Variable		Total	VAP Group	No-VAP Group	P value
Gender	Male	58(48.3)	17(70.8)	41(42.7)	0.013
	Female	62(51.7)	7(29.2)	55(57.3)	
Age	<50	8(6.7)	1(4.2)	7(7.3)	
	50-60	11(9.2)	-	11(11.5)	
	61-70	33(27.5)	1(4.2)	32(33.3)	0.010
	70-80	42(35)	16(66.7)	26(27.1)	
	>80	26(21.7)	6(25)	20(20.8)	
Use of blood components	Yes	12(10)	3(12.5)	9(9.4)	0.65
	No	108(90)	21(87.5)	87(90.6)	
Smoking history	Yes	71(59.2)	24(100)	47(49)	0.000
	No	49(40.8)	0(0)	49(51)	
Glasgow Coma Scale	<9	72(60)	7(29.2)	65(67.7)	0.000
	>9	48(40)	17(70.8)	31(32.3)	
Duration of connection to the ventilator	(days), M(SD)	13.24(4.01)	12.83(4.19)	13.34(3.98)	0.58
Duration of Nasogastric Tube	(days), M(SD)	17.2(5.28)	16.37(2.55)	17.40(5.76)	0.39

Table 2- Comparison of Comorbidities in patients with VAP and No-VAP Group.

Variable			Total	VAP Group	No-VAP Group	P value
Comorbidities, N (%)	Respiratory	Yes	34(28.3)	10(41.7)	24(25)	0.10
		No	86(71.7)	14(58.3)	72(75)	
	Neurological	Yes	56(46.7)	9(37.5)	47(49)	0.31
		No	64(53.3)	15(62.5)	49(51)	
	Hematology-oncology	Yes	76(63.3)	22(91.7)	54(56.3)	0.001
		No	44(36.7)	2(8.3)	42(43.8)	
	Diabetes	Yes	75(62.5)	17(70.8)	58(60.4)	0.35
		No	45(37.5)	7(29.2)	38(39.6)	
	Digestive and liver diseases	Yes	12(10)	3(12.5)	9(9.4)	0.65
		No	108(90)	21(87.5)	87(90.6)	
	Kidney diseases	Yes	34(28.3)	8(33.3)	26(27.1)	0.54
		No	86(71.7)	16(66.7)	70(72.9)	
	Rheumatoid Arthritis	Yes	27(22.5)	10(41.7)	17(17.7)	0.012
		No	93(77.5)	14(58.3)	79(82.3)	

Table 3- Comparison of variables studied in patients with VAP (according to living and dead patients).

Variable		Total	Death	Alive	P value
Gender	Male	17(70.8)	14(87.5)	3(37.5)	0.009
	Female	7(29.2)	2(12.5)	5(62.5)	
Age	<50	1(4.2)	-	1(12.5)	0.16
	50-60	1(4.2)	-	-	
	61-70	-	-	1(12.5)	
	70-80	16(66.7)	12(75)	4(50)	
	>80	6(25)	4(25)	2(25)	
Use of blood components	Yes	3(12.5)	2(12.5)	1(12.5)	1
	No	21(87.5)	14(87.5)	7(87.5)	
Smoking history	Yes	24(100)	16(100)	8(100)	-
	No	0(0)	0(0)	0(0)	
Glasgow Coma Scale	<9	7(29.2)	4(25)	3(37.5)	0.54
	>9	17(70.8)	12(75)	5(62.5)	
Duration of connection to the ventilator	(days)	12.83(4.19)	13.43(4.81)	11.62(2.38)	0.33
Duration of Nasogastric Tube	(days)	16.37(2.55)	17.06(1.87)	15.00(3.25)	0.06

Discussion

It is very important to examine health status and the factors affecting it [31-35]. The findings reported a 20% prevalence of VAP in ICU patients. Various studies have been conducted in Iran and abroad on the prevalence of VAP, which are mentioned. Amri Meleh et al. (Iran) conducted a prospective study that included 134 patients hospitalized in the ICU. Of the patients studied, 37 patients (equivalent to 27.6%) developed VAP, of which 18 (48.6%) died [25]. Also, in the study by Saberi et al. (Iran), 100 patients hospitalized in 3 ICU wards were studied, and it was shown that the incidence of VAP in this study was 19%. Also, factors such as age, GCS score, oral care, and staff training (in the field of infection control) were associated with the incidence of VAP [26]. The results of the above studies, which indicate an incidence of VAP in less than 50%, are consistent with the results of this study.

Studies conducted in other countries have shown that the prevalence of VAP is high. In a study by Chang et al. (Taiwan), 64.7% of 99 patients with VAP died. Also, factors such as long-term mechanical ventilation, repeat intubation, and gastrointestinal surgery were effective in causing VAP [27]. In a meta-analysis study by Wu et al., which examined the results of 10,478 patients participating in 15 published articles, the incidence of VAP after cardiac surgery was 10%. Also, risk factors included advanced age, COPD, renal disease, and vascular disease [28]. The results of the meta-analysis study are consistent with the results of this study, which reported a higher prevalence of VAP in older people.

This study reported a higher rate of VAP in men than in women. In the study by Afkhamzadeh et al. (Iran), 35.1% of men and 23.7% of women had VAP [29], which is consistent with this study. Regarding the underlying factors of patient hospitalization in ICU, it was shown that diseases such as respiratory, neurological, hematology-oncology, diabetes, digestive and liver diseases, kidney diseases, and rheumatoid arthritis were observed in patients with VAP, and in previous studies, the role of underlying diseases in the occurrence of VPA has been mentioned. So that in the study by Nadi et al. (Iran), diseases such as pulmonary diseases, heart diseases, and cancer were effective in causing pneumonia in patients hospitalized in ICU [30].

Conclusion

Given the high prevalence of VAP and its role in patient mortality, preventive interventions are recommended to reduce its incidence.

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