



Ventilator-Associated Pneumonia in Dr. Soetomo General Hospital Surabaya

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ABSTRACT

Introduction: Ventilator-associated pneumonia (VAP) is one of the most common nosocomial infections in the intensive care unit (ICU). Mechanically ventilated patients have a higher risk of VAP. VAP can increase morbidity, mortality, and treatment costs. However, Indonesia lacks data about VAP. The objective of this study was to find out the characteristics of VAP in Dr. Soetomo General Hospital, Surabaya, in the period of August 2017 until August 2018.

Methods: This was a cross-sectional study by assessing medical records of the patients in ICU. The variables observed in this study were age, gender, outcome, length of stay in the ICU (LOS_{ICU}), and primary diagnosis. The inclusion criteria were the patients who have been using mechanical ventilation at least 2 x 24 hours in the ICU and confirmed VAP. The data were analyzed descriptively by using Microsoft Excel 2016.

Results: A total of 18 VAP patients were diagnosed. VAP patients were dominated male (55.6%). The mean of LOS_{ICU} was 22.83 ± 11.24 days, and the mortality rate of VAP patients was high (55.6%). 30% of VAP patients had Guillain-Barre Syndrome (GBS) as the primary diagnosis, and 16.65% had Congenital Heart Disease (CHD).

Conclusion: Most VAP patients were male and had prolonged stays. The mortality rate of VAP patients was still high. GBS was the most frequent of primary diagnoses in patients with VAP and also CHD.

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Introduction

The hospital is one of the healthcare places, but on the other hand, the hospital can also be a source of infection. The infection is known as healthcare-associated infections (HAIs).¹ HAIs or nosocomial infections are infections that occur in patients in hospitals and other health services.¹ The criterion which includes HAIs is a patient has been admitted to the hospital or the other Healthcare place at least 2 x 24 hours. The existence of these infections can lead to increased morbidity, mortality, and also treatment cost.²

Healthcare-associated infections (HAIs) consist of several types, such as central line-associated bloodstream infection (CLABSI), catheter-associated urinary tract infection (CAUTI), surgical site infection (SSI), and ventilator-associated pneumonia (VAP). Data about these HAIs get less public attention.¹ The data only shows the prevalence of HAIs in developed countries (high income) and developing countries (low and middle income). However, both developing and developed countries show a similarity that the largest contributor to the incidence of HAIs is in the intensive care unit (ICU).¹

ICU is highly associated with the use of invasive devices that potentially can cause infection. Infections in the hospital as a result of the use of ventilators are most often in the ICU.³ This infection is called VAP. VAP can occur after 48 hours of installation of endotracheal intubation (early-onset). In addition, VAP can also occur after five days of endotracheal intubation installation (late-onset). Therefore, there is a risk of VAP in patients receiving mechanical ventilation.⁴ In Indonesia, the data about the VAP is still very limited, so the aim of this study was to determine the prevalence of VAP in the ICU of Dr. Soetomo General Hospital, Surabaya.

Methods

This was descriptive study using a cross-sectional design. The study was conducted in the ICU of Dr. Soetomo General Hospital, Surabaya, and Medical Record

Center of Dr. Soetomo General Hospital, Surabaya, from August 2017 to August 2018. The population in this study was all patients using mechanical ventilation in the ICU of Dr. Soetomo General Hospital Surabaya from August 2017 to August 2018. The sample used were patients using mechanical ventilation in the ICU of Dr. Soetomo General Hospital, Surabaya, from August 2017 to August 2018, which met the criteria for inclusion and exclusion of samples.

The inclusion criteria for this study were the patients have been using mechanical ventilation at least 2 x 24 hours in the ICU, the patients have been confirmed VAP. Exclusion criteria in this study were that patients already diagnosed with pneumonia before the installation of mechanical ventilation in the ICU, the patient was diagnosed with pneumonia during the use of a mechanical ventilator for less than 2 x 24 hours in the ICU, the patient from another hospital that already used a mechanical ventilator. A total sampling method was used in the sampling technique.

This study used secondary data obtained from patients' medical records in the ICU of Dr. Soetomo General Hospital Surabaya. Data were analyzed descriptively by using Microsoft Excel 2016. Data were presented in table form, which contains data on the frequency and percentage.

Results

The total number of the samples was 18 patients who met the inclusion and exclusion criteria. The patient characteristics include age, sex, LOS_{ICU}, and outcome, as listed in Table 1. Variation age VAP patients in Dr. Soetomo General Hospital, Surabaya, was vast. The youngest age of the VAP patients was one year old. In comparison, the oldest age was 83 years old. In this study, the VAP patients were primarily male. From the study also, the LOS_{ICU} of patients with VAP was very varied. The shortest LOS_{ICU} was six days, and the longest was 44 days. The mortality occurred in more than 50% of the patients with VAP.

Table 1. Characteristics of patients with VAP

Parameter	N	Mean ± SD	Median	Range
Age (years old)		31.83 ± 22.871	29.5	1 - 83
Sex (%)				
Male	10 (55.6%)			
Female	8 (44.4%)			
LOS_{ICU} (days)		22.83 ± 11.24	20	6-44
Outcome (%)				
Survived	8 (44.4%)			
Death	10 (55.6%)			

Source: Research data, processed

The Primary Diagnosis of Patients with VAP

The patients with VAP had varying primary diagnoses when admitted to the ICU of Dr. Soetomo General Hospital Surabaya. However, from those primary diagnoses, 16,67% of 18 patients with VAP had the same diagnosis. GBS was the most frequent diagnosis in patients with VAP. In addition, there were some patients with the same group of diseases, namely congenital heart disease.

Table 2. The primary diagnosis

Diagnosis Utama	N
Guillain-Barre Syndrome (GBS)	3 (16.67%)
Tetralogy of Fallot (TOF)	1 (5.55%)
Patent Ductus Arteriosus (PDA)	1 (5.55%)
Atrial Septal Defect (ASD)	1 (5.55%)
Coronary Artery Disease (CAD)	1 (5.55%)
Myasthenia Gravis	1 (5.55%)
Abdominal pregnancy	1 (5.55%)
Posterior fossa tumor	1 (5.55%)
Cerebral tumor	1 (5.55%)
Focal brain injury	1 (5.55%)
Cerebral infarction	1 (5.55%)
Bilateral dislocation C5/C6 + Compression Fracture of T3/T4 Thoracic Vertebrae	1 (5.55%)
Fracture of C5/C6 Cervical Vertebrae + First Lumbal Vertebra	1 (5.55%)
Pulmonary TB relapse	1 (5.55%)
Pulmonary atelectasis	1 (5.55%)
Retro/Parapharyngeal abscess	1 (5.55%)

Discussion

Characteristics of Patients with VAP

The mean \pm SD of the age of patients was 31.83 ± 22.871 . The mean age of patients with VAP was younger than a previous study by Saragih, *et al.* with a median of 45 (in the range of 18-86 years old of age).⁵ It can be caused by a sampling period that may affect the distribution of age. In addition, there are other studies with a mean age of patients with VAP that was not much different from this study, with a mean of 34.⁶

In this study, the patients with VAP were predominantly men. Some studies also showed the same results, the percentage of patients with VAP more dominant males than females. In a study conducted at Hamad General Hospital, Qatar, from 106 patients with VAP, 80.2% were male patients. In addition, the research about Epidemiology and Outcomes of Ventilator-Associated Pneumonia in a Large US Database retrieved of data from January 1998 until June 1999, acquired 842 patients, and 64.1% of all patients were male.⁷ There is also a study conducted in a tertiary hospital ICU province of Al-Qassim, Saudi Arabia period

January 2017 to July 2017. The result was from 69 patients with VAP in ICU showing that 78% were male patients.⁸ While in Indonesia, the study conducted in the ICU of Dr. Cipto Mangunkusumo National General Hospital with the subject of VAP patients in 2003-2012, resulted in 201 patients with VAP and 53.7% of those patients with male sex.⁵ Knowing the results of these studies and also by looking at the time of the study, the male gender is more often than female.

More male patients who had VAP than female patients have associated with their immune system function. If the terms of the patient's condition since admission to the ICU until the treatment period, the difference in the immune response can be influenced by the patient's primary diagnosis, comorbidity, therapy, and duration of treatment. Due to researchers' limited amount of data, these conditions are still insufficiently representative to be strong evidence of the number of male patients with were more than female.

Another study has stronger evidence is about the differences in the regulation of sex hormones in men and women. Sex hormones that play a major role in regulating the immune system are estrogen and testosterone. Therefore, in a female who has reached puberty, immune dimorphism can occur. This condition makes them have a higher immunoglobulin than males, so it is more resistant to infection.⁹

The mean of LOS_{ICU} Patients with VAP in the ICU Dr. Soetomo General Hospital was 22.83 days with a standard deviation of 11.24. A previous study also obtained similar results with a case-control design study from September 2012 to August 2013. The result was that the patients with VAP have longer LOS_{ICU} than patients who were non-VAP. The mean \pm SD of LOS_{ICU} in VAP patients was 20.1 ± 10 .¹⁰ Data about LOS_{ICU} be longer in patients with VAP was also found in research conducted by Eagye, *et al.* with a mean \pm SD of 24.6 ± 19.0 LOS_{ICU}.¹¹ From those previous studies, the VAP can increase the length of ICU stay (LOS_{ICU}).

VAP is one of the most common nosocomial infections in the ICU and has a high mortality rate. In this study, it was found mortality in patients with VAP by 55.6%. Another study also stated that the acute exacerbation of COPD patients with VAP has higher mortality (47.8%) than acute exacerbation of COPD patients without VAP.¹² The high VAP mortality rate of 68.4% was also found in a study conducted in one North Indian tertiary hospital.¹³

The Primary Diagnosis of Patients with VAP

Guillain-Barre Syndrome (GBS) is the most frequent primary diagnosis in patients with VAP. GBS is a neuromuscular disease. This disease is included in autoimmune disease because the immune system attacks the peripheral nervous system (demyelination of nerve fibers) with symmetrical characteristics. GBS causes progressive muscle weakness, paralysis with or without sensory or autonomic symptoms. This muscle weakness can lead to respiratory failure and can become emergencies. Therefore, the patients need a supporting

device like a ventilator and also require intensive care. A study conducted in Minnesota showed that 54 patients from 60 patients with GBS who use mechanical ventilation were transferred to specialized neurological ICUs.¹⁴ The patients with GBS require the longer installation of mechanical ventilation so that the risk of VAP is also higher. This is consistent with a study that showed that pneumonia is significantly related to the duration of mechanical ventilation installation, especially more than 14 days.¹⁵

In addition, there were some patients (16.67%) with the same group of diseases, namely congenital heart disease. VAP also be the most frequent nosocomial infection in pediatric patients with a critical illness. In patients with congenital heart disease, especially post-surgery, the incidence of VAP increases. The main cause is the longer use of mechanical ventilation.¹⁶ Besides that, there is an assumption that the presence of multiple congenital abnormalities is identical to the immunodeficiency condition so that the nosocomial infections are also getting easier to occur.¹⁷

The limitation of this study is the method of retrieving data that still relies on medical record data which is a different secondary data per patient regarding the completeness of the data.

Conclusion

Most VAP patients were male and had prolonged stays. The mortality of VAP patients was still high. GBS was the most frequent diagnosis in patients with VAP. In addition, there were some patients with the same group of diseases, namely congenital heart disease.

CONFLICT OF INTEREST

The author stated there is no conflict of interest in this study.

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