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Profile of ventilator-associated pneumonia bundle implementation in the intensive care unit Dr. Soetomo general academic hospital surabaya in period of January-February 2025

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Abstract

Ventilator-Associated Pneumonia (VAP) is the second most common cause of Health care Associated Infection (HAIs) cases in the United States. It is responsible for 25% of infection cases in Intensive Care Units. One way to prevent VAP is by doing a VAP bundle. most common infection in mechanical ventilated patient. Patients with mechanically ventilated ETT or tracheostomy are at risk for mucociliary movement and mucus secretion changes due to micro-aspiration around the cuff and tracheal tissue reaction to foreign bodies. In addition, installing ETT will inhibit the cough and gag reflex, which are the respiratory system's defenses from pathogenic microorganisms. VAP bundles as evidence-based interventions defined are grouped to encourage consistency of this practice in the ICU because if it is consistent in carrying out this bundle intervention, it can reduce VAP rates. In Indonesia, the VAP prevention and control bundle implementation is listed in the Regulation of the Minister of Health of the Republic of Indonesia, Number 27 of 2017, concerning Guidelines for Infection Prevention and Control.

Keywords: Ventilator-associated pneumonia; Bundle cares; Intensive care unit; Surabaya; Dr. Soetomo General Academic Hospital

1. Introduction

Risk of getting infection by using mechanical ventilator increases 6-21 times. It causes an increase in average time spent in ICU, increase medical cost and the risk of death. VAP is defined as Pneumonia in a patient after using a mechanical ventilator 48- 72 hours in patient without history of pneumonia before. the most common infection in mechanical ventilated patient. Patients with mechanically ventilated ETT or tracheostomy are at risk for mucociliary movement and mucus secretion changes due to micro-aspiration around the cuff and tracheal tissue reaction to foreign bodies. The incidence of VAP varies based on the location and the diagnostic criteria used. VAP events worldwide are reported to affect 5-40% of patients receiving invasive mechanical ventilation for more than 48 hours. The worldwide incidence of VAP is 15.6%, as determined by local researchers. The proven incidence rate is 13.5% in the United States (US), 19.4% in Europe, 13.8% in Latin America, and 16.0% in Asia Pacific [1].

VAP bundles as evidence-based interventions defined are grouped to encourage consistency of this practice in the ICU because if it is consistent in carrying out this bundle intervention, it can reduce VAP rates. Elevating the head of the patient's bed to 30-45 degrees, cessation of daily sedation and daily assessment of readiness for extubating, Peptic ulcer

prophylaxis, Prophylaxis for (DVT) deep vein thrombosis, Oral cleansing with chlorhexidine. The bundle includes cleaning hands every time the health worker does activity on the patient, namely by using the five steps of hand hygiene, positioning the bed between 30-45 degree if there are no contraindications such as head trauma or spinal cord injury, maintaining oral hygiene or oral hygiene every 2-4 hours using 0.02% chlorhexidine base antiseptic and brushing teeth every 12 hours to prevent plaque, manage oropharyngeal and tracheal secretions, perform daily sedation and extubating assessments, provide peptic ulcer disease prophylaxis, and provide prophylactic deep vein thrombosis (DVT) [2,3]. Considering that the VAP mortality rate at Doctor Soetoro Hospital is still high, the researchers wanted this research to be conducted to determine the level of compliance with VAP bundle implementation in the ICU at Dr. Soetoro Hospital as a step to prevent VAP. The expected VAP bundle implementation compliance rate ranges from 90%-95% to significantly reduce the VAP incidence.

2. Material and methods

This study is a descriptive study with direct observation to obtain profile implementation of the VAP bundle for patients with mechanical ventilators in the Intensive Care Unit of Dr. Soetoro General Academic Hospital Surabaya in period of January-February 2025. The data collecting subjects was taken using total sampling technique. The administration of the VAP bundle in this study began after the sample was placed on mechanical ventilation, namely from day 0 to day 3. Each implementation of the VAP bundle was recorded on the Data-collecting form. Supervisors and Residents accompany observations. Researchers observed the points of implementing the VAP bundle in the ICU room, whether appropriate or not. The VAP bundle observed in this study based on the Indonesian Ministry of Health Regulation of the Minister of Health of the Republic of Indonesia Number 27 of 2017 concerning Guidelines for Infection Prevention and Control consisted of elevation of the patient's head 30-45 degrees, Oral hygiene using chlorhexidine 0.02% and brushing teeth, daily sedation management, peptic ulcer prophylaxis, Deep Vein Thrombosis (DVT) prophylaxis, tracheal and oropharyngeal secretion management. The researcher observed every day with the time of research at 09.00 AM in the ICU Dr. Soetoro General Academic Hospital Surabaya. The inclusion criteria are Patient with mechanical ventilators for more than 48 hours, the patient's age is at least 18 years old, Patient with mechanical ventilator from day 0. The exclusion criteria is the patient/patient's family refused to do the research. The number of samples obtained in this study was 20 patients, which met the inclusion and exclusion criteria.

3. Results and discussion

Throughout the period of research in January-February 2025 it is found that there are 20 patients that meet the inclusion and exclusion criteria in the ICU of Dr. Soetoro General Academic hospital.

Table 1 Distribution and frequency of patients with mechanical ventilators on ICU Dr. Soetomo General Academic Hospital based on diagnosis

Diagnosis	Frequency	%
Surgical	6	30
Medical	14	70

According to the Table 1 there are 14 patients (70%) medical patients is administered to the ICU using mechacal ventilators. While there are six patients administered is from surgical (30%).

Table 2 Compliance of Implementing VAP bundle to patients with mechanical ventilators

Implementing VAP bundle in ICU patient	n	%
Complied	1	5
Not complied	19	95
Total	20	100

According to Table 2 patient whom received the full component of VAP bundle in three days is one patient (5%). While 19 patients did not receive the full VAP bundle in three days which categories as not complied.

Table 3 Implementation of each VAP bundle component activity to patients with mechanical ventilators that received for all three days

Bundle Component	n	%
Implementation of oral hygiene	20	100
Cleaning with chlorhexidine	20	100
Brushing teeth	0	0
Implementation of head up 30-45 degree	20	100
30-45 degree	20	100
<30 degree or >45 degree	0	0
Implementation of secretion management	20	100
Closed suction system	20	100
Subglottic suction system	0	0
Other suction system	0	0
Implementation of ulcer disease prophylaxis	20	100
Proton pump-inhibitor	14	70
H2RA	0	0
Implementation of dvt prophylaxis	20	100
LMWH	1	5
Implementation of daily sedation management	20	100
Sedation break	12	60
Not sedated	4	20

From Table 3 it is found that 20 patients (100%) receive oral hygiene using chlorhexidine. For head up component it is also found that 20 patients (100%) head in bed position is put to 30-45 degree. For the secretion management it uses close suction system in all of 20 patients (100%) observed. While the stress ulcer prophylaxis using *proton-pump inhibitor* (PPI) in 16 patients there is 14 patients that receive this component for all three days and there are two patients received PPI in two days. *Low Molecular Weight Heparin* (LMWH) is given to one patient that receive this component. Daily sedation intervention component there is 12 patients received sedation break daily in all three days, while there is 4 patients that did not receive sedation break in one days and four patients already not sedated in one of the three days.

The expected VAP bundle implementation compliance rate ranges from 90%-95% to significantly reduce the VAP incidence based on several studies. Increasing the VAP bundle rate to 90% from 40.7% obtained 2.34 risk reduction, significantly lowering VAP incidence from 62,4/1000 ventilator days to 25.7/1000 ventilator days Two ICU Hospital in Syria with reached target 95% VAP bundle implementation compliance rate reducing the VAP Incidence 30 to 6.4 per 1000 ventilator days in hospital one, from 12 to 4.9 per 1000 ventilator days in hospital two [2]. Research from Saudi Arabia with a total of 9,099 ventilator days and 14,521 patient days 24 VAP events were diagnosed. Between 2010 and 2013, ventilator bundle compliance rose from 90% to 97% [4]. The VAP rate, however, dropped from 3.6 (per 1000 ventilator days) in 2010 to 1.0 in 2013 (P for trend = 0.054).

The VAP bundle compliance rate in the ICU Dr. Soetomo General Academic Hospital Surabaya obtained during this research is 5%. The result from this study is below the higher compliance rate of 90%-95% it is caused by the DVT prophylaxis component which only one patient (5%) received the pharmacological prophylaxis using LMWH, However the non-pharmacological dvt prophylaxis is implemented in 100% of the patient. Moreover, the VAP bundle compliance is still performed differently in various hospital [5]. A cross-sectional study showed that an ICU in the General Hospital in Medan has a compliance rate of 0%. Another study in Ethiopia with 300 patients, the VAP bundles rate was 70% [12]

In this study the compliance implementation of the VAP bundle component, which is oral hygiene with chlorhexidine, is 100% complied. The result from this study is also in line with a prospective study with 687 patients throughout two years, where oral hygiene was performed 100% complied [11].

Positioning patient head $30°$- $45°$ can prevent aspiration in patients in the ICU. Patients with ventilators in the ICU will be given sedation so that secretions do not occur periodically. This condition will result in colonization of the oropharynx and stomach. Another study using the Randomized Controlled Trials (RCT) method showed a difference in the incidence of VAP in 214 patients with HOB mechanical ventilation of $45°$ with $<30°$, respectively 15.96% and 26.64% [3]. It is proven that positioning the head elevation at $30°$- $45°$ is more effective in preventing VAP. Positioning the head in a semi recumbent position $30°$ -$45°$ prevents gastric aspiration leading to lung parenchyma [10]. The position of elevating the shoulders and head can prevent oropharyngeal and gastrointestinal aspiration [7]. The result of this study with 100% of the patients positioned in $30°$-$45°$ degrees is in line with the other research. The semi-recumbent position is recommended for patients using mechanical ventilation to avoid VAP.

Based on the study results, it was found that the health workers had carried out secretion management well. This is in line with research conducted [7], where it was found that the results of secretion management were 100% carried out to prevent the accumulation of secretions in the endotracheal tube to prevent micro aspiration of oropharyngeal secretions. Micro aspiration is a major risk factor for VAP [8].

Stress ulcer prophylaxis compliance for three consecutive days in this study is in 14 patients (70%). Moreover, in it is also found that in first day and second day it is found 16 patients (80%) is given PPI as in omeprazole while the four patients (20%) that not given PPI is given antiemetic as in metoclopramide. Although in third day it is found that 14 patients (70%) given the PPI as in omeprazole and the other four patients still given the antiemetics while two patients did not receive pharmacological interventions. Based on retrospective cohort study from 2022 from 315 patients the use of SUP is rational with an average use of five days, PPI is superior to H2RA for SRMD prophylaxis. ICU Dr. Soetomo general academic hospital using PPI as the SUP.

Deep vein thrombosis prophylaxis in this study is done by pharmacological and non-pharmacological interventions, both of which are 5% and 100%. The one patient treated with the pharmacological intervention is also treated with the non-pharmacological intervention. Patient who at least receive one of the categories is 95% and 5% of patient did not receive any. The use of anti-DVT administration is contraindicated in patients with active bleeding [10]. The provision of anti-DVT is in line with the journal Intensive Care Med in 2022, which states that critical patients with ventilators in the ICU are at risk of thrombosis.

An overview of appropriate daily sedation management with correct planning for treatment, choosing appropriate sedation, interruption of sedation and practicing SBT is implemented in 100% patient in this study. However, for daily sedation break component itself is 60%. Constant sedation increases the risk of VAP by making patients overly drowsy and lengthening their stay in the intensive care unit. Interrupting or lowering a patient's daily sedation helps determine whether extubation criteria can be met. To reduce the risk of VAP from the installation of the ETT, extubation will be performed. The spontaneous awakening trial (SAT) strategy in conjunction with the spontaneous breathing trial (SBT) is now the most efficient way to shorten the extubation duration [9].

4. Conclusion

This study reveals that patients with mechanical ventilators in the ICU of Dr. Soetomo General Academic Hospital Surabaya in the period of January 2025-February 2025 from 20 patients observed there are more female gender in 12 patients (60%) than male gender eight patients (60%). It is also found that more medical patients in 12 (60%) than surgical patients in eight (40%). The average age for patient is 49,8 years old. The youngest patient observed is 18 years old and for the oldest patient observed is 88 years old. VAP bundle in the ICU of Dr. Soetomo General Academic has been done it is progressing but not yet optimal it is still not optimal as the compliance rate is 5% it is in one patient. In this study it is found that three out of six components are implemented with 100% compliance rate throughout this study. The components are oral hygiene, head up 30-45 degree and secretion management. Oral hygiene components already followed the updated guideline of using chlorhexidine rather than brushing teeth. However, for secretion management it is shown in updated studies using subglottic suction is far superior than other suction system to reduce VAP. In this study it is found that the suction system used is CTTS which better than OTTS but not as efficient as subglottic suction system. The stress ulcer prophylaxis implemented in 16 patients (80%) for first day and second day. However, in third day it is implemented in 14 patients (70%). Mainly patients receiving enteral feeding, pharmacologic SUP is not beneficial and combined interventions may even increase the risk of nosocomial pneumonia. The use of metoclopramide in 4 patients it is not considered as part of the SUP VAP bundle. It is necessary to increase the implementation of the

VAP bundle, especially in the implementation of stress ulcer prophylaxis and the implementation of prophylactic DVT following the patient's clinical condition.

Compliance with ethical standards

Disclosure of conflict of interest

There is no conflict of interest to be disclosed.

Statement of ethical approval

This research received ethical approval from the Health Research Ethics Committee of the Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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