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Research Article

The Effect of Close Suction to Prevent Ventilator-Associated Pneumonia Based on the Sequence Organ Failure Assessment Score (Sofa) and Clinical Pulmonary Infection Score

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Abstract.
The purpose of the study is to compare SOFA Score and CPIS by using close suction to prevent VAP. This is a quasi-experiment study without a control group. Close suction is used as an intervention. SOFA score and CIPS were used to evaluate VAP. The SOFA score assesses respiratory, platelet, liver, neurology, cardiovascular, and renal function. SOFA scores range from 0 to 24 and if the mean score ≥ 6 indicates the functioning organ is worse. CPIS evaluates body temperature, leucosis, sputum secretion, thorax photo, culture endotracheal secretion, and oxygen saturation. The CPIS score ranges from 0-12, more than 6 indicates the patient has VAP. This study included 20 ICU patients on ventilators. The collected data were analyzed using percentages, mean, and paired t-tests. The mean SOFA score before and after was 4.75 to 4.1 and CPIS 2.9 to 2.65 before and after providing close suction. The close suction is significant to prevent VAP (p-value < 0.00). Close suction is effective to prevent VAP in patients with ventilator mechanics, and VAP can be measured using the SOFA score and CPIS.

Keywords: close suction, CPIS, mechanic ventilator, ventilator-associated pneumonia, SOFA

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1. INTRODUCTION

Ventilator-associated Pneumonia (VAP) is caused by microorganisms from lower tract respiration and is often caused by mucus or secret aspirations of the oropharynx when the bacteria came from endemic bacteria in the digestive tract or exogenous pathogens originating from contaminated tools or health providers (1). VAP is a problem that occurs in the Intensive Care Unit (ICU) and continuously grows every year in patients who use a mechanical ventilator to help to breathe after being installed for 48 hours (2).

Patients who suffer from VAP always have fever or hypothermia, secretion production increases and the color became a purulent cough, and apnea/bradypnea, or tachypnea. Besides the culture of secret, blood, or pleural fluid there are bacteria referred to as the positive culture and there are lung infiltrates. Secretions and microorganisms that are sticky on the Endotracheal tube (ETT) patients will spread easily to the breath of the bottom and cause VAP (3).

VAP is one of the causes of death from nosocomial infections in critical patients. Patients undergoing a ventilator with VAP will take longer to be treated in the ICU and will also use antibiotics, increasing the cost of care (4).

One preventive can for VAP is to do a reduction in time for at-risk patients and hasten the early to do weaning off the ventilator (weaning), prevention of colonization secret in ETT aspiration, and prevention of microorganisms by using close suction and tracheostomy action and hasten positioned head up 30 to 45 degree and administering antibiotics. Other precautions that can be done with infection control in the ICU with doing educating all health teams in the ICU, handwashing before and after patient contact or action assembled, using the tool of self-protector as well as following survey procedures for microorganisms. Another prevention is reducing bacterial colonization of the upper digestive and respiratory tract. Activities to do decontaminate the digestive tract and/or pharyngeal with antibiotic use in enteral or parenteral and oral decontamination using oral antiseptic (5).

VAP can be prevented in some way i.e. positioning 30-40 degrees (6). The purpose of this act is to prevent the occurrence of aspiration of gastric and daily sedation interruption as well as the study patient's readiness to extubation because sedation directly can make the accumulation of secret and will take longer to use a ventilator. It also needs to use close suction/subglottic secretion drainage for drainage of secret from the endotracheal tube (ETT), resulting in the potential happens VAP. Regular/conventional suction will not be able to reach the location of the secret. Another way is to use avoidance schedule changes to substitute for a circuit because the frequent change would be a risk for infections occurring due to lead to the manipulation of the hose. It should be replaced if dirty or damaged and circuits must be new to every patient.

Based on research conducted at ICU Arifin Achmad Hospital, the VAP prevention is always done by the ICU nurse standard operating procedures since 2012 but still no incidence of VAP (7). In the years 2017 and 2018 year 0.013 there increased to 0.061 (8). According to a study related to ventilators (9) in 2017, patients who are admitted to the ICU with a bad score of sequences organ failure syndrome will use a ventilator longer. However scoring CPIS needs to be done within the distance of time 3 days

and his research on CPIS was conducted on 48 hours, days 5, 8, 11, and 14. The patient with Pneumonia when CPIS score ≥ 6 (10). Based on the conditions that occur the researchers are interested to make a new model to prevent VAP with the patient undergoing mechanical ventilator in ICU.

2. MATERIALS AND METHODS

a. Research Location

We conducted this study in the ICU Government hospital for almost 4 months. It is a teaching and reference ICU and hospital in Riau province. A surgical and medical case is admitted to the ICU based on the inclusion criteria of multiple organ dysfunction syndromes. The total number of beds is 8. The research was conducted for almost 4 months and the total sample is 20 respondents All patients used a ventilator for more than 48 hours and were selected by using convenience sampling with inclusion criteria: the CPIS sore for the first time admitted in ICU less than 6 and used a ventilator for more than 48 hours. The respondent who has contraindicated with head up and also diagnoses cancer and does chemotherapy as exclusion criteria.

The study was conducted after obtaining permission from the ethical committee of the Faculty of Medicine, University of Riau. Professional nurses perform close suction action. The suction action is performed after 100% oxygen is administered for 30 to 60 seconds and performed not more than 15 seconds to avoid hypoxia close suction catheter is inserted until it touches the Carina and is pulled about 1 to 2 cm to prevent injury before suctioning is performed. When the suction action is finished, the nurses irrigated the suction catheter with 0.9% sodium chloride to prevent the spread of bacteria from the secretion on the suction catheter's walls. The nurses did not open the patient's ventilator tube before suctioning so that oxygen is automatically given during the procedure, The other hand, the nurses who perform suction also have a very low risk of contamination of patients' secretion., as well a shorter working time.

b. Types and Sources of Data

There are three-part of data collected in this study. The first related to demographic data included sex, age, diagnosis, and blood glucose. The second part is the SOFA score consists of the functions of the liver, heart, lungs, kidneys, and neurological and bodily fluids. The data was taken two times the first time the patient was admitted and the second after 48 hours admitted to ICU. It is taken from the results of laboratory examinations, physical examinations, observation of the monitor, and the daily chart of the patient. The data involved Glow Coma Scale (GCS), and Mean Atrial Pressure (MAP).

The third is the CPIS score integrated to measure body temperature, production and culture secret, thorax photo, leucocyte, and oxygenation level based on the ratio of PaO2 with FiO2.

c. Data Collection Techniques

SOFA score and CPIS score are taken two times, namely, the first time when patients enter and the second when the patient was treated for more than 48 hours. The SOFA score is calculated from the functioning organ of the liver, cardiovascular, respiratory, kidney, neurology, and hematology. The liver can see from the test bilirubin and icteric, if the patient tested bilirubin the researcher used bilirubin but if not the researcher used the color of the skin icteric or not. Cardiovascular is measured by using MAP to measure blood pressure systole and diastole. The kidney function is seen by creatinine test and urine output in 24 hours. GCS is used to identify the function of neurology and platelet to see the hematology function. However, the respiratory function was measured by using PaO2/FiO2. The range score of each organ function is 0 to 4 and sums up to find the total score. The highest total score is 24. If the score of more than 6 means the patient occurs with sepsis. The CPIS score is measured before the patient is intubated and used as a ventilation mechanic and after 48 hours the patient is used close suction. The CPIS components measured are temperature, leucocyte count, secretion, FiO2, and Thorax photo. The range scores for each variable are 0 to 2 and the highest total score is 10. If the score of more than 6, the patient indicates ventilator-associated pneumonia

3. RESULTS

All 20 participants were adult patients who were admitted to ICU using a ventilator. Based on demographic characteristics, 55% were male and 40% were elderly and the cause of the use of mechanical ventilation was post craniotomy, laryngectomy, and laparotomy.

In the first entry, the ICU patient majority (65%) has abnormal blood glucose (low 15%; high 50% and after 48 hours become worse where the level low and high were increased (25% and 60%), which can be seen in table 1. The condition of SOFA when patients enter to ICU they have CPIS score <2 was 50% and increase after 48 hours used close suction became better become 65% but still occur VAP (5%). As well with SOFA scores < 6 from 80% become 90% but 2 patients (20%) had SOFA scores≥ 6. It means the patient still has organ failure and a high risk of septic. We can see the comparison between before and after the use of close suction to prevent ventilator-associated pneumonia we can see from table 2.

Table 1: Characteristic respondents.

No	Characteristic	Frequency	Percentage (%)
1.	Gender Male Female	9 **11**	45 55
2.	Age Late teens (17-25) Early adulthood (26-35) Late adulthood (36-45) Early elderly (46-55) Elderly(>56)	1 2 4 5 8	5 10 20 25 40
3.	Diagnose		
	Craniotomy	14	70
	Laryngectomy	2	10
	Laparotomy	4	20
4.	Blood glucose		
	The first 24 hours		
	Normal (108-200mg/dl) Low (< 108 mg/dl) High (> 200 mg/dl)	7 3 10	35 15 50
	After 48 hours		
	Normal (108-200mg/dl) Low(< 108 mg/dl) High (> 200 mg/dl)	3 5 12	15 25 60

Table 2: The comparison of SOFA, CPIS, and Blood Glucose (BG) before and after using close suction in 48 hours.

No	Variable	Mean		Mean	Lower	Mean	Upper	P value
		Before	After	Before	After	Before	After	
1.	SOFA	4.75	4.1	3.6	2.97	5.89	5.22	0.00
2.	CPIS	2.9	2.65	2.09	1.9	3.7	3.38	0.00
3.	Blood glucose	138.8	142.35	123.28	119.28	154.4	165.4	0.00

The results showed that the SOFA, and CPIS scores after 48 hours were decreased but the condition of blood glucose getting an increase, however, there were some patients to be better the mean lower become lower and some patients still have bed conditions. According to the result, we conclude that there were significant differences before and after 48-hour patients admitted to ICU SOFA, CIPS, and blood glucose. It means that close suction could prevent VAP and reduce organ failure.

4. DISCUSSION

Patients who used a ventilator in the ICU majority were male with an average age of 52 years old and were caused by sepsis, neurology, cardiac, renal, respiratory, overdosage, organophosphate, and poisoning (11). The level of blood glucose fluctuates and rather

rises in the 48 hours and the SOFA and CPIS are generally getting well, but there were patients who still changed to a not-good score. From 20 patients we saw that the mean lower before and after 48 hours was still normal and the upper was high in the range of 154.4 to 165.4. The highest blood glucose in this study was Eclamsy post-section Cesaria and the lowest was in the craniotomy case. After 48, the lower blood glucose in a patient with Thoracotomy and the highest was Craniotomy. It occurs cause of the administration of Steroids inpatient post-operation and almost all patient is elderly and their age is more than 40 years old. It is much closer to the function of endocrine organs, so the nurse should be controlling blood glucose for the patient who uses mechanical ventilation. In a critical condition such as patient sepsis, the blood glucose always fluctuates, and more often increases caused by stress or metabolism are not good (12). In ICU Arifin Achmad Government Pekanbaru, the blood glucose routine checks at least every 6 hours if the patient's condition is not severe. They check blood glucose to defend the patient's condition to prevent complications from hypo or hyperglycemia. CPIS score describes the condition of lung infection when used as a mechanical ventilator. To observe or monitor potential respiratory infection among patients undergoing a mechanical ventilator can use CPIS score to control infection regularly every 48 hours (13). CPIS score can interpretation of VAP by measuring 5 components: body temperature, leucocyte account, color or production of secretion, thorax photo, and index of oxygen. In addition, taking CPIS measures can predict ventilator-associated pneumonia and change patient conditions to be good or worse (14). It can be made easier to determine the type of antibiotic. The SOFA score after 48 hours among patients with a ventilator is decreased (15). The average SOFA score when entering to admit ICU was 4.75 and after 48 hours it decreased to 4.1. The upper before and after use close suction was 5.89 to 5.22. It means that until 48 hours the patient didn't have sepsis, but the score was still near 6. However, the nurse needs more awareness of the patient to prevent organ failure and sepsis (16). In this study to measure the level, the function was modified to use skin observed because the bilirubin sometimes didn't do and the researcher only saw the color skin was icteric no. On the other hand, renal function is also measured by calculating the total urine production of the patient in 24 hours. The creatinine didn't check. Because the laboratory test for all of the organ functions didn't check every 48 hours. The other study found that the length of using a ventilator will a high risk of sepsis, and organ failure will increase and the SOFA score can be used as a tool to wean patients from the ventilator (17). SOFA scores can be used to judge organ failure in ICU (18). When a patient has a SOFA score of less than 5.5, the nurse can do weaning and can continue to do extubation, and

can continue by the extubation process. A supporting study from Madan et al also said that SOFA scores can predict severe conditions and organ failure by using minimal data to prevent VAP (19). Close suction is a kind of Bundle VAP to prevent VAP. By close suction, suctioning performed didn't change every day and it is optimal for patients to need suction for a longer period because the close suction is safe to use until 5 days and has the advantage to reduce VAP. They performed the same with open suction needed to provide hyperoxygenation to reduce (20).

5. CONCLUSION

The SOFA score can be used as a basis by nurses to wean ventilators of patients and the VAP can prevent by using close suction. In addition, close suction also prevents hypoxia and accelerates the work of nurses.

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6. CONFLICT OF INTEREST

No conflict in this study.

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