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Analysis of Factors Affecting the Weaning of Mechanical Ventilation at ICU RSUD Prof. Dr. Margono Soekarjo Purwokerto

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ABSTRACT

The weaning of mechanical ventilation is a complex process and depends on many factors. The failure to wean mechanical ventilation may lead to prolonged duration of mechanical ventilation, which may increase the risk of ventilator associated pneumonia (VAP), morbidity, mortality, increased hospital costs and lower quality of hospital services. In the year 2016, in ICU RSUD Prof.Dr.Margono Soekarjo Purwokerto, in average there is a 20% failure of mechanical ventilation, if not followed up will adversely affect the patient. Factors investigated in this study included patient, nurses, collaboration and organization. The purpose of this study is to analyze the factors that affect implementation of the weaning of mechanical ventilation in ICU Room Prof.Dr.Margono Soekarjo General Hospital Purwokerto.

The method used in this research was descriptive quantitative analytic design with cross sectional approach on 47 mechanical ventilation weaning activities. The sample selection was conducted by accidental sampling technique. Measurements for nurses were carried out using validated values including knowledge, experience and collaboration. While the observation sheet included the implementation of standard operating procedures for mechanical ventilation weaning, collaboration, patients APACHE II score and weaning results.

The result of bivariate test showed that there were influence of patient (0.000), nurse (0,021), collaboration (0,024) and organization (0,011) to mechanical ventilation weaning activity. The result of logistic regression test showed that the patient was the most influential factor on mechanical ventilation weaning activity with 87% probability.

Nurses should pay more attention to patients especially with high APACHE II scores (≥20) because of the risk of mechanical ventilation weaning failure. Assessment of weaning readiness must be carried out daily with appropriate assessment. While hospitals need to revise policies on mechanical ventilation weaning procedure and continue education and training programme related to patients criticality and collaboration.

Introduction

The weaning of mechanical ventilation is a complex process and depends on many factors. Its failure may cause a negative impact to the patient, the family and the hospital for prolonging the duration of mechanical ventilation that could lead to increase the risk of *ventilator associated pneumonia*, morbidity, mortality, expand hospital cost and lessen the quality of hospital services (Seneffet al., 2000; Evaet al., 2006; Hsuet al., 2013). The weaning of mechanical ventilation failure risk was influenced by diseases process, PaO_2, FiO_2, *positive end-expiratory pressure* (PEEP), pH, Hb, level of consciousness, body temperature, heart function, lung function, airway clearance, nutrition status, sedative agent medicine or paralysis agent, also patient's psychologist condition(Boles et al.,2007; Purnawan& Saryono, 2010).

Hanafie (2006) stated that the weaning failure related to airflow resistance escalation, decrease of obedience, or respiratory muscles exhaustion. The other factors that provoke weaning mechanical ventilation failure were influenced by respiratory center, respiratory muscles strength and respiratory muscles load (Boles et al., 2007; Purnawan & Saryono, 2010).

There are several factors to notice that can reduce the weaning failure; the patient, the nurses, the collaboration and the organization. Atic et al., 2007 in the research, stated that the condition of a patient with APACHE score < 20 will be easier to executed the weaning mechanical ventilation comparing to those with APACHE score ≥ 20. The same research was supported by Tseng et al., 2012 if the APACHE score > 23 the patient will be harder to performed the weaning mechanical ventilation.

The nurse's knowledge are necessarily required to assess the patient's clinical condition because it would certify an optimal patient management in weaning mechanical ventilation implementation process (Kydonaki et al.,2016). It is also entail the nurse's experience in weaning proceeding (Lavelle, C. & Dowling, M., 2011) and experience in managing the patient's emotional reaction which arise during the weaning process (Crocker, 2002; Chen et al., 2009). The less experience nurse will needed more time to assess the weaning mechanical ventilation process (Kydonaki et al., 2016).

The effective collaboration among nurses and doctors, supportive teamwork and mutual respect among team members are considered before performing a patient's weaning assessment (Weavind et al., 2000; Taylor, 2006; Ambrosino et al., 2010; Lavelle et al., 2011; Tingsvik et al., 2015). Even though the doctors made the decision in weaning mechanical ventilation, the implementation required the collaboration among nurses and doctors. Doctors are taking roles in making the diagnosis and treatment while nurses are doing the monitoring during weaning process based on the weaning mechanical ventilation protocol (Taylor, 2006).

The weaning protocol allowed the legal aspects to nurses in weaning mechanical ventilation (Hansen et al., 2007), as for the fresh graduated nurses, the protocol is very useful considering the less experienced nurses (Carter et al., 2011). Furthermore, the weaning mechanical ventilation protocol could minimize morbidity, mortality, cost (Croft, 2007) and reduce the patient's hospitalized day.

The average number of weaning failure at the ICU of RSUD Prof.Dr.Margono Soekarjo Purwokerto in 2016 was 20%. It is higher than the research brought by Lima (2013) that the weaning mechanical ventilation failure was 17,5%. If there are not followed up upon this matter, it could give the negative impacts to the patient, the family and the hospital. Therefore it is necessary to do a research at the ICU of RSUD Prof.Dr.Margono Soekarjo Purwokerto. The factors inspected in this research were patients, nurses, collaboration and organization which are often affecting the weaning mechanical ventilation activity.

Method

This research is the analytic quantitative descriptive research and using the cross sectional design. The population in this research is the weaning mechanical ventilation activities performed by the nurses and doctors at the ICU

of RSUD Prof.Dr.Margono Soekarjo Purwokerto. The sampling technique was accidental sampling with 47 samples.

The research was taking place at the ICU of RSUD Prof.Dr.Margono Soekarjo Purwokerto after the ethical approval for this research released with number : 4201/25569/IV/2017.. The research's instruments were some validated questionnaires involving knowledge, experience and collaboration yang dikembangkan dari APACHE II, weaning protokol, dan lembar observasi kolaborasi. Didapatkan untuk uji validitas menggunakan Pearson Product Moment di atas nilai nilai r tabel 0,388 dan untuk nilai reliabilitas nilai aplha 0,90. While the observations sheet covering the standard procedure in weaning ventilation mechanic implementation, collaboration, patient's APACHE II score and weaning result. This research stage is the preparation stage by performing the inform consent to the patient or the patient's family whose been appointed to be doing the weaning ventilation mechanic and the weaning responsible nurse.

During the weaning ventilation mechanic process, the observation related to weaning protocol assessment, collaboration, patient's condition with APACHE II score and weaning ventilation mechanic result were conducted. The observation was done by the researcher helped by the researcher assistant. Later, the weaning assessment nurses were given some questionnaires involving knowledge, experience and collaboration. The data analysis in this research is the univariate analysis with frequency distribution, bivariate with *chi square* and multivariate with logistic regression.

Results

1. Univariate Analysis

Table 1 Patients Characteristic at ICU RSMS (N=47)

Category		Numbers (person)	Percentage (%)
Gender	Male	27	57,5
	Female	20	42,5
Age	<60 years	39	82,8
	≥60 years	8	17,2
APACHE II Score	High (≥ 20)	8	17
	Low (< 20)	39	83
Admitted to ICU	Surgery	40	85,1
	Medical	7	14,9

Table 2 Nurses Characteristic (N=47) and Doctors(N=8) at ICU RSMS

Nurses Characteristic	Numbers (person)	Percentage (%)
Age		
21-30 years	18	38
31-40 years	25	53
≥41 years	4	9
Gender		
Male	23	49
Female	24	51
Education		
D3	33	7
S1	14	3
Working period		
0-3 years	17	36
4-7 years	10	21
≥8 years	20	43

Doctors Characteristic	Numbers (person)	Percentage (%)
Age		
21-30 years	-	
31-40 years	6	75
≥41 years	2	25
Gender		
Male	6	75
Female	2	25
Working period		
0-3 years	1	12,5
4-7 years	3	37,5
≥8 years	4	50

2. Bivariate

Table 2 Analysis of the influenced factors in weaning ventilation mechanic activity

Variable	Sig (ρ value)
Patients	0,000
Nurse's knowledge	0,021
Collaboration	0,024
Organization	0.011

After bivariate analysis performed with 5% of significance level, it is obtained that the influenced factors in weaning ventilation mechanic activity are patients, nurse's knowledge, collaboration and organization.

3. Multivariate

Table 4.11 Final Modeling

Variable	B	SE	Wald	OR (95% CI)	ρ value
Patients	1,833	4,515	2,839	9,147 (3,011-12,118)	0,013
Nurse's knowledge	3,572	7,388	3,140	3,272 (1,446-7,311)	0,026
Collaboration	0,089	1,516	4,703	1,093 (0,056-21-336)	0,047
Organization	3,689	7,388	2,562	1,058 (0,196-6,376)	0,036
Constanta	-7,266	14,777	0,000	1	0,000

*significant at α=0,05

After logistic regression analysis performed, the most influenced factor in weaning ventilation mechanic activity is the patient (with highest OR). In conclusion, the patient's clinical condition evaluated by APACHE II score will affect the weaning ventilation mechanic activity by 87%.

Discussion

In this research, the patient factor effect on the weaning ventilation mechanic activity could cause by the respondent characteristic with APACHE II score ≥20, elder and surgical history. It is in line with the Atic et al., (2007) research that the patient with APACHE II score ≥20 will be easier to performed the weaning ventilation mechanic than the patient with the APACHE II score ≥ 20.

The older patient has risk in weaning ventilation mechanic and could prolong the ventilation mechanic consumption, mostly to the post surgery. This was provoked by respiratory muscles weakness, ventilation disturbance that caused hypoxemia and hypercarbia, electrolyte and fluid imbalanced, atelectasis can also occur since surfactant production were lessen (Entilation et al., 2002).

The presence of disturbance in neuromuscular can affect the ability to initiate respiration or to control the airway secretion and respiratory muscles strength (Souter & Manno, 2013). While the patient with intracranial surgery tend to have an extubation failure or a long drawn in ventilation mechanic consumption and has more risk to have a post surgery complication such as lung function disturbance, resurgery, tracheostomy, and takes a longer period at the ICU(Vidoto et al., 2011).

The statistic test result showed the influence of nurse's knowledge in weaning ventilation mechanic activity. The nurse knowledge are necessarily required to assess the patient's clinical condition because it would certify an optimal patient management in weaning mechanical ventilation implementation process (Kydonaki et al.,2016). Based on knowledge, nurses will be able to performed properly a

weaning ventilation mechanic (Haugdahl & Storli, 2012 ; Rose et al., 2014; Sciences, 2016).

The result did not show the influence of nurse's experience in weaning ventilation mechanic activity. This result was different from Lavelle, C. & Dowling, M. (2011) which stated that the decision to asses a weaning ventilation mechanic, other than knowledge, is also required the nurse's experience in weaning assessment besides in managing the patient's emotional reaction which arise during the weaning activity (Crocker, 2002; Chen et al., 2009). The difference was created by inappropriate numbers of nurses compared to the patient numbers, so that all of the nursing service activities were executed by all the nurses, the fresh graduated and the experienced nurses, by prioritizing the coordination among nurses and doctors.

The statistic test result showed the influence of collaboration in weaning ventilation mechanic activity. This is in line with the research by Kydonaki et al. (2016) that the collaboration among nurses and doctors encourage the weaning ventilation mechanic success. The communication failure was considered as a bad example of collaboration among the health nursing professional and posed as the main cause of the accidental danger in all the health service network. There are proves showed that the effective collaboration among professional leads to a better outcome for ICU patient (Rose, 2014).

The statistic test result showed the influence of organization in weaning ventilation mechanic activity. This is in line with the research by Rose et al., (2014) which stated that the success in weaning ventilation mechanic assessment was also supported by the weaning protocol, clear role or practice scope in each profession, organization structure or pactice environment. The applied of weaning ventilation mechanic protocol could reduce the duration of ventilation mechanic installation and increase the service quality (Goodman Sheila, 2006; Kydonaki et al., 2014). The weaning ventilation mechanic based on protocol has the legal aspect for nurses and would provide the positive impact for the patient (Hansen et al., 2007).

Conclusions

The influence factors of weaning ventilation mechanic activity at the ICU RSUD Prof.Dr.Margono Soekarjo Purwokerto are patients, nurse's knowledge, collaboration and organization. The most influence factor of weaning ventilation mechanic activity of these four is the patient.

The nurse should considerate the patient especially those with high APACHE II score (≥ 20) because there are risk in weaning ventilation mechanic failure. APACHE II was evaluating in first 24 hours since the patient admitted to the ICU. The weaning preparation evaluation should be performed everyday with the proper assessment by the nurses. Meanwhile the hospital should revise the policy of weaning ventilation mechanic procedure also continue the education and training program related to critical nursing and collaboration.

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