VARIABLES PREDICTING FOR DURATION OF MECHANICAL VENTILATOR ON ICU PATIENTS: RETROSPECTIVE STUDY

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Abstract

Objective: This study aims the predictor variables for the duration of a ventilator in ICU patients. **Method:** This is a retrospective study design with 36 respondents who were selected by purposive sampling technique. This research data is secondary data obtained from the medical records of patients from January until December 2019. The instrument utilized was the observation sheet to observe the predictor variables for the mechanical ventilator duration. The statistical tests applied were the Spearman correlation test, logistic regression test, and ROC curve. **Result:** Based on the results of logistic regression, it was found that GCS (OR 16.114 (1.537-168.895), p-value 0.020), FiO2 (OR 0.778 (0.34-17.711), p-value 0.003), MSOFA (0.481 (0.053- 4.331, p-value 0.009), and based on this result found SpO2 / FiO2 ratio (OR 26.369 (2.755-252.373), p-value 0.005) is the most influential predictor of ventilator duration. The sensitivity of the SpO2 / FiO2 ratio was 42%, specificity of 36.1% (AUC 0.824, p-value 0.001). **Conclusion:** The SpO2/FiO2 ratio is the most influential predictor of the duration of ventilator use on ICU patients.

Keywords: Duration of mechanical ventilator, ICU, predictor

Introduction

The use of mechanical ventilators is one of the efforts made to save lives of patients with respiratory failure, but the use of a ventilator for a long time can increase morbidity and mortality. Several factors can lead to prolonged mechanical ventilation.[1,2,3]

The length of time using a ventilator is an indicator of intensive care services in an intensive room, the use of a mechanical ventilator for a long time can increase health care costs. It is necessary to predict the use of a ventilator on the first day of a patient on a ventilator, several indicators can be used as predictors of ventilator use.[4] Based on several studies, several variables can be used as predictors of ventilator use are age, PaCO2, type of disease, and APACHE score. [5,6,7,8,9]

Prediction of ventilator use is challenging, often subjective, unreliable, and does not allow late decision making.

[4]Besides, until now there is no validated measuring instrument that could assess the various predictor variables of a prolonged mechanical ventilator. This requires nurses and doctors to be able to assess various variables that could predict the use of mechanical ventilators.

Method

This study was a diagnostic study with a retrospective study design to look at variables that could predict the period of time on ventilator use. The number of samples in this study was 36 respondents who were selected by purposive sampling technique that met the inclusion criteria. This research data was secondary data obtained from the medical records of patients treated from January until December 2019. The measuring instrument utilized was the observation sheet to see the characteristics of the respondents, as well as the predictor variables for the length of time on ventilator use. The statistical analysis applied

in this study was the Spearman test to see the relationship of each variable, the logistic regression test to assess the most influential predictor variables, and the specificity and sensitivity tests using the ROC curve.

Results

Based on the results of this study, it was found that the median age of patients admitted to the ICU was 52 years old, whereas the age of patients with the duration of fast ventilator use was 53 years and the median age of slow ventilator use was 48 years (P-value 0.400). The majority of respondents in this study were female (23 people), 11 female respondents had a prolonged duration of a mechanical ventilator (P-value 0.441). The majority of respondents with a neurosurgical diagnosis (16 people) were 6 respondents with a prolonged duration of a mechanical ventilator (P-value 0.438).

Table 1.
Characteristic of Respondent

Characteristic respondents	N (36)	Fast	Prolonged	P- value
Age (year), Median	52	53	48	0.400
gender (M/F)	13.23	5/12	8/11	0.441
Medical diagnosis				
Neurosurgery	16	9	7	
Cardiovascular Thoracic Surgery	4	2	2	
Surgical Oncology	8	4	4	0.438
Urological Surgery	1	0	1	
Dental and Oral Surgery	1	1	0	
General Surgery	6	1	5	
Oxygen saturation (SpO2) (%), Median	100	100	98	0.174
Blood pressure (mmHg)				
Median Systole	119.5	125	118	0.221
Median Diastole	72	74	71	0.119
Mean Atrial Pressure (MAP) (mmHg), Median	90.67	93	88	0.181
Using vasopressor				
Yes	5	2	3	1000
No	31	15	16	
GCS Median	13	13	12	0.004*
PaO2 (mmHg), Median	124.5	112	127	0.667
FiO2 (%), Median	40	50	40	0.003
Ratio SpO2/FiO2, median	246.25	250	200	0.005
Ratio PaO2/FiO2, median	282.36	297	282	0.153
Score MSOFA	5	4	5	0.009

Significant for P value <0.005

Table 2.
The Variable that Most Influences the Duration of the Mechanical Ventilator

	Variable	Coefficient	*p*	OR (IK95%)
Step 1	GCS	2.968	0.019	19.456 (1.632-231.952)
	FiO2	-0.251	0.875	0.778(0.34-17.711)
	Ratio SpO2/FiO2	2.980	0.072	19.683(0.768-504.614)
	MSOFA	-0.667	0.579	0.513 (0.49-5.421)
	Constant	-1.895	0.295	0.150
Step 2	GCS	2.980	0.019	19.697 (1.642-236.256)
	Ratio SpO2/FiO2	3.168	0.006	23.756 (2.433-232.006)
	MSOFA	-0.732	0.514	0.481(0.053-4.331)
	Constant	-2.098	0.101	0.123
Step 3	GCS	2.789	0.020	16.114(1.537-168.895)
	Ratio SpO2/FiO2	3.272	0.005	26.369 (2.755-252.373)
	Constant	-2.613	0.14	0.073

Table 3
Sensitivity and Specificity Test

Variable	Cut off Value	Sensitivity	Specificity	AUC	*P value*
GCS	≥13	22.2%	8.3%	0.723	0.023
FiO2	≤ 40	33.3%	39%	0.797	0.002
Ratio SpO2/FiO2	≥246.25	42%	36.1	0.824	0.001

Discussion

The results showed that age, gender, medical diagnosis, oxygen saturation, blood pressure, MAP value, vasopressor use, PaO2 levels, and PaO2 / FiO2 ratio had no relationship. The results differed from several studies, where some showed age, gender, PaO2 levels, PaO2 / FiO2 ratio, vasopressor use had a relationship to prolonged mechanical ventilation. Differences in results of studies with several previous studies occurred from patient's ICU condition which changeable at any time. These changes could significantly affect the patient's condition, although based on the results of previous studies, this variable affected changes in this condition could affect prolonged mechanical ventilation. [8,10,11]

The variables that were predictors of prolonged mechanical ventilation in this study were GCS, FiO2 value, SpO2 / FiO2 ratio, and MSOFA score. This was in line with several previous studies. The GCS value was one of the indicators used in ventilator weaning. [12,13] Many factors caused prolonged mechanical ventilation, at the time the patient was treated initially, could prevent prolonged mechanical ventilation. [4] FiO2 value and SpO2 / FiO2 ratio indicated patient's respiratory function. The SpO2 / FiO2 ratio indicated organ failure, including lung function failure, influencing the

SOFA score, as well as a predictor of hypoxemia implementation.[14,15,16.] The results of this study also indicated that the SpO2 / FiO2 ratio was the variable that most influences the prolonged mechanical ventilator. Hypoxic indicates decreased PaO2 levels in the arteries. This decrease in oxygen levels in the blood could prevent the patient from being able to do ventilator weaning.

Conclusion

The results showed that the SpO2 / FiO2 ratio indicated that the SpO2 / FiO2 ratio was the most influential predictor of the duration of ventilator use on ICU patients. The results of the study are expected to be an indicator that can be applied to reduce the use of ventilators.

Acknowledgement

References

1. Girou E, Schortgen F, Delclaux C, Brun-Buisson C, Blot F, Lefort Y, Lemaire F, Brochard L. Association of noninvasive ventilation with nosocomial infections and survival in critically ill patients. Jama. 2000 Nov 8;284(18):2361-7.
2. Esteban A, Anzueto A, Frutos F, Alía I, Brochard L, Stewart TE, Benito S, Epstein SK, Apezteguía C, Nightingale P, Arroliga AC. Characteristics and outcomes in adult patients receiving mechanical ventilation: a 28-day international study. Jama. 2002 Jan 16;287(3):345-55.
3. Zilberberg MD, de Wit M, Pirone JR, Shorr AF. Growth in adult prolonged acute mechanical ventilation: implications for healthcare delivery. Critical care medicine. 2008 May 1;36(5):1451-5.
4. Ghauri SK, Javaeed A, Mustafa KJ, Khan AS. Predictors of prolonged mechanical ventilation in patients admitted to intensive care units: A systematic review. International journal of health sciences. 2019 Nov;13(6):31.
5. Légaré JF, Hirsch GM, Buth KJ, MacDougall C, Sullivan JA. Preoperative prediction of prolonged mechanical ventilation following coronary artery bypass grafting. European journal of cardio-thoracic surgery. 2001 Nov 1;20(5):930-6.
6. Estenssoro E, González F, Laffaire E, Canales H, Sáenz G, Reina R, Dubin A. Shock on admission day is the best predictor of prolonged mechanical ventilation in the ICU. Chest. 2005 Feb 1;127(2):598-603.
7. Piotto RF, Ferreira FB, Colósimo FC, da Silva GS, de Sousa AG, Braile DM. Independent predictors of prolonged mechanical ventilation after coronary artery bypass surgery. Brazilian Journal of Cardiovascular Surgery. 2012 Oct 1;27(4).
8. Sanabria A, Gómez X, Vega V, Domínguez LC, Osorio C. Prediction of prolonged mechanical ventilation for intensive care unit patients: A cohort study. Colombia Médica. 2013 Sep;44(3):184-8.
9. Clark PA, Inocencio RC, Lettieri CJ. I-TRACH: Validating A tool for predicting prolonged mechanical ventilation. Journal of Intensive Care Medicine. 2018 Oct;33(10):567-73.
10. Cottereau G, Dres M, Avenel A, Fichet J, Jacobs FM, Prat D, Hamzaoui O, Richard C, Antonello M, Sztrymf B. Handgrip strength predicts difficult weaning but not extubation failure in mechanically ventilated subjects. Respiratory care. 2015 Aug 1;60(8):1097-104.
11. Muzaffar SN, Gurjar M, Baronia AK, Azim A, Mishra P, Poddar B, Singh RK. Predictors and pattern of weaning and long-term outcome of patients with prolonged mechanical ventilation at an acute intensive care unit in North India. Revista Brasileira de terapia intensiva. 2017 Jan;29(1):23.
12. Zhang J, Zhu J, Zhou S, Ma J, Fu H, Song Y, Xu J, Cao L, Dong M, Yan L, Wu X. Noninvasive mechanical ventilation in the weaning of AECOPD patients with respiratory failure: Modified glasgow coma scale score≥ 13 as the switching point. International Journal Of Clinical

And Experimental Medicine. 2019 Jan 1;12(6):7808-13.

13. El-Sarnagawy GN, Hafez AS. Comparison of different scores as predictors of mechanical ventilation in drug overdose patients. Human & Experimental Toxicology. 2017 Jun;36(6):539-46.

14. Murray JF, Matthay MA, Luce JM, Flick MR. An expanded definition of the adult respiratory distress syndrome. Am Rev Respir Dis. 1988 Sep 1;138(3):720-3.

15. Marshall JC, Cook DJ, Christou NV, Bernard GR, Sprung CL, Sibbald WJ. Multiple organ dysfunction score: a reliable descriptor of a complex clinical outcome. Critical care medicine. 1995 Oct 1;23(10):1638-52.

16. Le Gall JR, Lemeshow S, Saulnier F. A new simplified acute physiology score (SAPS II) based on a European/North American multicenter study. Jama. 1993 Dec 22;270(24):2957-63.