RESEARCH

ASSESSMENT OF UTILITY OF THE ONE-TIME HACOR SCORE AS A PREDICTOR OF WEANING FAILURE FROM MECHANICAL VENTILATION

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Abstract

Background: The aim is to assess utility of the one-time HACOR score as a predictor of weaning failure from mechanical ventilation. **Materials and Methods:** One hundred twelve patients in age ranged 18- 70 years of either gender on invasive mechanical ventilation who were ready for weaning admitted to ICU were enrolled. Patients were given spontaneous breathing trial (SBT) on pressure support ventilation (PSV) of 8 cm H2O, FiO2 <0.5, positive end-expiratory pressure (PEEP) ≤5 cm H2O, minute ventilation <10 L/minute, PaO2/FiO2 ratio ≥150 mm Hg, absence of hemodynamic instability, off sedation and awake with a good cough and absence of electrolyte abnormalities. The total duration of SBT was 120 minutes. At the end of 30 minutes duration of SBT, ABG was analyzed, and the HACOR score was recorded. **Result:** Out of 112 patients, there were 68 males and 44 females. Causes of mechanical ventilation found to be trauma in 8, cardiac in 14, respiratory in 38, neurologic in 10, septic in 26, hemorrhagic shock in 9 and poisoning in 7 cases. The difference was significant (P< 0.05). The mean ventilator days between successful weaning and failed weaning was 3.2 days and 4.8 days, SOFA score was 3.5 and 5.1, CCI score was 3 each and HACOR score was 2.4 in successful weaning and 6.5 in failed weaning. The difference was significant (P< 0.05). HR (beats/min) score as per HCOR 0 was seen in 65 and 28, score 1 in 3 and 12, pH (arterial blood) score as per HCOR 0 was seen in 42 and 18, score 2 in 20 and 12, score 3 in 6 and 7 and score 4 was seen in 0 and 7. GCS score 0 was seen in 50 and 15, score 2 in 14 and 14, score 5 in 2 and 10 and score 10 was seen in 2 and 5. PaO2/FiO2 ratio score 0 was seen in 50 and 29, score 2 in 10 and 6, score 3 in 5 and 4, score 4 in 3 and 2, score 5 in 0 and 3. RR (breaths/min) score 0 was seen in 60 and 10, score 1 in 8 and 12, score 2 in 0 and 18, score 3 in 0 and 2 and score 4 was seen in 0 and 2 among successful weaning and failed weaning respectively. The difference was significant (P< 0.05). HACOR score, SOFA score and days of ventilator support were significant predictor of failed weaning (P< 0.05). **Conclusion:** A HACOR score ≥5 is a predictor of weaning failure. This score may be useful as a weaning strategy in the intensive care unit.

INTRODUCTION

Since its first clinical application in the 1920s, the mechanical ventilator has been continually developed and has become one of the most common therapeutic modalities used for critically ill patients in the intensive care unit (ICU).[1] The mechanical ventilator has improved survival rates and has shortened the length of stay of patients who are unable to breathe without assistance in the ICU, by providing adequate oxygenation and ventilation until improvement in the patient's respiratory distress.[2] To maximize the benefits of the ventilator and minimize the risk of complications in critically ill patients, it is important to avoid both premature extubation and unnecessary prolongation of MV.[3]

The HACOR score consisting of heart rate (HR), acidosis (pH), consciousness [Glasgow Coma Scale (GCS)], oxygenation, (PaO2/FiO2), and respiratory rate (RR).[4] Among the various indices to predict weaning failure, minute ventilation recovery time (MVRT) and rapid shallow breathing index (RSBI) are commonly used. These rely considerably on the measurement of ventilatory parameters.[5] The ventilatory measurements either require substantial

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training to be evaluated (like MVRT) or lack the multisystem approach essential for weaning. Weaning failure has multi-systemic causes. The causes are interlinked, involving respiratory, neurologic, and cardiac causes.[6] Considering this, we selected present study to assess utility of the One-time HACOR score as a predictor of weaning failure from mechanical ventilation.

MATERIALS AND METHODS

One hundred twelve patients in age ranged 18- 70 years of either gender on invasive mechanical ventilation who were ready for weaning admitted to ICU were enrolled after obtaining approval from ethical review committee of the institute. All were recruited in the study with the written consent from patients' family.

Patients were given spontaneous breathing trial (SBT) on pressure support ventilation (PSV) of 8 cm H2O, FiO2 <0.5, positive end-expiratory pressure (PEEP) ≤5 cm H2O, minute ventilation <10 L/minute, PaO2/FiO2 ratio ≥150 mm Hg, absence of hemodynamic instability, off sedation and awake with a good cough and absence of electrolyte abnormalities. The total duration of SBT was 120 minutes. At the end of 30 minutes duration of SBT, ABG was analyzed, and the HACOR score was recorded. The HACOR score calculation was done as follows- HR ≤120 beats/minute as 0 point and ≥120 beats/minute as 1 point. pH ≥7.35 as 0 point, 7.30–7.34 as 2 points, 7.25–7.29 as 3 points, and <7.25 as 4 points. GCS 15 as 0 point, 13–14 as 2 points, 11–12 as 5 points, and ≤10 as 10 points. PaO2/FiO2 ≥201 as 0 point, 176–200 as 2 points, 151–175 as 3 points, 126–150 as 4 points, and 101–125 as 5 points. RR ≤30 breaths/minute as 0 point, 31–35 breaths/minute as 1 point, 36–40 breaths/minute as 2 points, 41–45 breaths/minute as 3 points, and ≥46 breaths/minute as 4 points.

The results were compiled and subjected for statistical analysis using Mann Whitney U test. P value less than 0.05 was set significant.

RESULTS

Out of 112 patients, there were 68 males and 44 females [Table 1].

Table 1: Patients distribution

Total- 112		
Gender	**Male**	**Female**
Number	68	44

Table 2: Cause of mechanical ventilation

Cause	**Number**	**P value**
Trauma	8	0.05
Cardiac	14	
Respiratory	38	
Neurologic	10	
Septic	26	
Hemorrhagic shock	9	
Poisoning	7	

Table 3: Assessment of variables between successful weaning and failed weaning

Variables	**successful weaning (68)**	**failed weaning (44)**	**P value**
Ventilator days	3.2	4.8	0.05
SOFA score	3.5	5.1	0.04
CCI score	3	3	1
HACOR score	2.4	6.5	0.01

Table 4: Comparison of variables in HACOR scoring

Variables	**Score as per HACOR**	**Successful weaning (68)**	**Failed weaning (44)**	**P value**
HR (beats/min)	0	65	28	0.04
	1	3	12	
pH (arterial blood)	0	42	18	0.02
	2	20	12	
	3	6	7	
	4	0	7	
GCS	0	50	15	0.01
	2	14	14	
	5	2	10	
	10	2	5	
PaO2/FiO2 ratio	0	50	29	0.02
	2	10	6	
	3	5	4	
	4	3	2	
	5	0	3	
	6	0	0	
RR (breaths/min)	0	60	10	0.01

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	1	8	12	
	2	0	18	
	3	0	2	
	4	0	2	

Table 5: Univariate logistic regression analysis to predict failed weaning

Variables	Odds ratio (OR) [95% CI]	P value
CCI	1	0.17
HACOR score	2.73	0.01
SOFA score	1.24	0.02
Days of ventilator support	1.4	0.05

Causes of mechanical ventilation found to be trauma in 8, cardiac in 14, respiratory in 38, neurologic in 10, septic in 26, hemorrhagic shock in 9 and poisoning in 7 cases. The difference was significant (P< 0.05) [Table 2].

The mean ventilator days between successful weaning and failed weaning was 3.2 days and 4.8 days, SOFA score was 3.5 and 5.1, CCI score was 3 each and HACOR score was 2.4 in successful weaning and 6.5 in failed weaning. The difference was significant (P< 0.05) [Table 3].

HR (beats/min) score as per HCOR 0 was seen in 65 and 28, score 1 in 3 and 12, pH (arterial blood) score as per HCOR 0 was seen in 42 and 18, score 2 in 20 and 12, score 3 in 6 and 7 and score 4 was seen in 0 and 7. GCS score 0 was seen in 50 and 15, score 2 in 14 and 14, score 5 in 2 and 10 and score 10 was seen in 2 and 5. PaO2/FiO2 ratio score 0 was seen in 50 and 29, score 2 in 10 and 6, score 3 in 5 and 4, score 4 in 3 and 2, score 5 in 0 and 3. RR (breaths/min) score 0 was seen in 60 and 10, score 1 in 8 and 12, score 2 in 0 and 18, score 3 in 0 and 2 and score 4 was seen in 0 and 2 among successful weaning and failed weaning respectively. The difference was significant (P< 0.05) [Table 4].

HACOR score, SOFA score and days of ventilator support were significant predictor of failed weaning (P< 0.05) [Table 5].

DISCUSSION

With an increase in the number of patients requiring mechanical ventilation and a shortage of intensivists, primary care physicians are also tasked with weaning. Weaning strategies are either dependent on complex ventilatory parameters or ultrasound measurements or are subjective.[7] The successful weaning process requires adequate functioning of airways, lungs, brain, heart, and diaphragm.[8] Unlike the HACOR score, most of the other weaning indices do not incorporate all these components.[9] The HACOR score, which is easy to calculate in resource-limited settings, has the ability to reflect this multiorgan dysfunction as per a stratified multisystem approach.[10,11] We selected present study to assess utility of the One-time HACOR score as a predictor of weaning failure from mechanical ventilation.

Our results showed that out of 112 patients, there were 68 males and 44 females. Causes of mechanical ventilation found to be trauma in 8, cardiac in 14, respiratory in 38, neurologic in 10, septic in 26, hemorrhagic shock in 9 and poisoning in 7 cases. Jung et al,[12] studied 387 adult patients who required postoperative MV. A low platelet count, an elevated delta neutrophil index, a delayed spontaneous breathing trial and the presence of postoperative shock were shown to predict early weaning failure from MV in the study population. Delayed SBT, a low platelet count, an elevated DNI, and the presence of postoperative shock are independent predictors of early weaning failure from MV in critically ill patients after emergency GI surgery.

We found that the mean ventilator days between successful weaning and failed weaning was 3.2 days and 4.8 days, SOFA score was 3.5 and 5.1, CCI score was 3 each and HACOR score was 2.4 in successful weaning and 6.5 in failed weaning. Chaudhuri et al,[13] determined the utility of the HACOR score in predicting weaning failure in resource-limited settings. The HACOR score was evaluated at 30 minutes of spontaneous breathing trial (SBT) in 120 patients. The total duration of SBT was 120 minutes. Out of 120 patients, 83 (69.2%) had successful weaning, whereas 37 (30.8%) had weaning failure. The median and interquartile range (IQR) of the HACOR score in the successful weaning group was 2 (0–3) and 6 (5–8) in the failed weaning group. There was a significant difference in each of the five components of the HACOR score between the successful and failed weaning groups (p <0.05). HACOR score ≥5 predicted failed weaning, sensitivity 83.8%, specificity 96.4%, area under the curve (AUC) 0.950, and 95% confidence interval (CI) [0.907–0.993], p <0.001. Multivariable logistic regression analysis showed that HACOR score ≥5 is an independent predictor of weaning failure.

We observed that HR (beats/min) score as per HCOR 0 was seen in 65 and 28, score 1 in 3 and 12, pH (arterial blood) score as per HCOR 0 was seen in 42 and 18, score 2 in 20 and 12, score 3 in 6 and 7 and score 4 was seen in 0 and 7. GCS score 0 was seen in 50 and 15, score 2 in 14 and 14, score 5 in 2 and 10 and score 10 was seen in 2 and 5. PaO2/FiO2 ratio score 0 was seen in 50 and 29, score 2 in 10 and 6, score 3 in 5 and 4, score 4 in 3 and 2, score 5 in 0 and 3. RR (breaths/min) score 0 was seen in 60 and 10, score 1 in 8 and 12, score 2 in 0 and 18, score 3 in 0 and 2 and score 4 was seen in 0 and 2 among successful weaning and failed weaning

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respectively. Our results showed that HACOR score, SOFA score and days of ventilator support were significant predictor of failed weaning (P< 0.05). John et al,[14] compared various weaning indices for their ability to predict weaning failure– CROP index (dynamic compliance, respiratory rate, oxygenation, and maximum inspiratory pressure), CORE index (dynamic compliance, oxygenation, rate, and effort), integrative weaning index (IWI), MVRT, and RSBI. Amongst all the indices, RSBI and MVRT had the highest AUC to predict weaning failure of 0.72 and 0.93, respectively. However, the AUCs were lesser as compared to the AUC of HACOR score in our study (0.950) to predict weaning failure.

CONCLUSION

A HACOR score ≥5 is a predictor of weaning failure. This score may be useful as a weaning strategy in the intensive care unit.

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