

THE ROLE OF ELECTRICAL CARDIOMETRY AS A PREDICTOR OF WEANING FROM MECHANICAL VENTILATION IN CARDIAC PATIENTS

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INTRODUCTION

Mechanical ventilation (MV) is an important tool in ICU to deal with respiratory failure. Acute decompensated heart failure is a cause of admission to ICUs with respiratory failure. Pulmonary edema is a sign of respiratory failure among patients, increasing the need of MV. The diagnosis of HF is based on the presence of symptoms and signs, ECG, Natriuretic peptide level and assessment of EF by echocardiography. Diuretics are recommended to reduce the congestion, by achieving and maintaining euvoemia with the lowest diuretic dose. ITP and volume changes during respiratory cycle affect the performance of the heart. Measurement of the TFC depends on the impedance cardiography phenomenon; which changes according to the resistance of thoracic contents to electric current. Lung congestion is a cause for weaning failure in cardiac patients. High TFC value could be an indirect measure of lung congestion and / or hypervolemia, which is a risk factor for failed weaning.

AIM OF THE WORK

The aim of the work was to study the role of electrical cardiometry as a predictor of weaning from mechanical ventilation in cardiac patients with reduced ejection fraction.

PATIENTS AND METHODS

This observational comparative prospective cohort study was conducted on eighty patients, with reduced EF and mechanically ventilated, eligible for weaning from MV, admitted to critical care units in AMUH. All patients included in the study were subjected to complete evaluation including history taking, physical examination, neurological examination, necessary laboratory investigation, and radiological investigations. Patients younger than 18 years, with pleural effusion, pneumothorax, decompensated liver failure, on renal replacement therapy and pregnant female are excluded from the study. The thoracic fluid content was observed and recorded; 5 minutes before starting spontaneous breathing trial, 1 hour after extubation, daily every 8 hours post extubation for 48 hours. Patients were divided into two groups failed weaning and successful weaning from MV at the end of the study.

Results

Table 1: Comparison between the two groups according to TFC

TFC kΩ ⁻¹	5 min pre	1 hour post	8 hours post	16 hours post	24 hours post	32 hours post	40 hours post	48 hours post
Total (n = 80)	(n=80)	(n=80)	(n=80)	(n=80)	(n=78)	(n=64)	(n=54)	(n=45)
Min.	25.0	27.0	33.0	33.0	35.0	36.0	39.0	44.0
Max.	70.0	78.0	98.0	134.0	134.0	134.0	137.0	70.0
Mean	45.73	50.46	59.88	67.99	74.62	70.23	63.70	51.91
± SD.	11.51	13.86	19.60	27.33	33.96	33.06	30.47	7.68
Group I (n = 35)	(n=35)	(n=35)	(n=35)	(n=35)	(n=33)	(n=19)	(n=9)	(n=--)
Min.	39.0	45.0	63.0	72.0	89.0	98.0	122.0	--
Max.	70.0	78.0	98.0	134.0	134.0	134.0	137.0	--
Mean	54.46	62.06	79.86	96.17	112.30	119.32	129.44	--
± SD.	7.81	9.83	8.71	14.12	12.85	9.10	5.29	--
P ₀		0.002*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	--
Group II (n = 45)	(n=45)	(n=45)	(n=45)	(n=45)	(n=45)	(n=45)	(n=45)	(n=45)
Min.	25.0	27.0	33.0	33.0	35.0	36.0	39.0	44.0
Max.	58.0	62.0	77.0	73.0	65.0	70.0	67.0	70.0
Mean	38.93	41.44	44.33	46.07	46.98	49.51	50.56	51.91
± SD.	9.10	8.95	8.13	7.96	7.17	7.17	7.24	7.68
P ₀		<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
P	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	--

SD: Standard deviation

p: p value for comparing between **Group I** and **Group II** patients

p₀: p value for Post Hoc test (**adjusted Bonferroni**) for ANOVA with repeated measures for comparison between **5 min** and each other periods

*: Statistically significant at p ≤ 0.05

Table 2: Validity (AUC, sensitivity, specificity) for TFC (5 min pre, 1 hour post) to predict group II (n = 45) from group I (n = 35)

TFC	AUC	P	95% C.I	Cut off#	Sensitivity	Specificity	PPV	NPV
5 min pre	0.895	<0.001*	0.829 – 0.961	≤45	77.78	80.0	83.3	73.7
1 hour post	0.933	<0.001*	0.884 – 0.983	≤45	75.56	94.29	94.4	75.0

AUC: Area Under a Curve

CI: Confidence Intervals

PPV: Positive predictive value

#Cut off was choose according to Youden index

p value: Probability value

NPV: Negative predictive value

*: Statistically significant at p ≤ 0.05

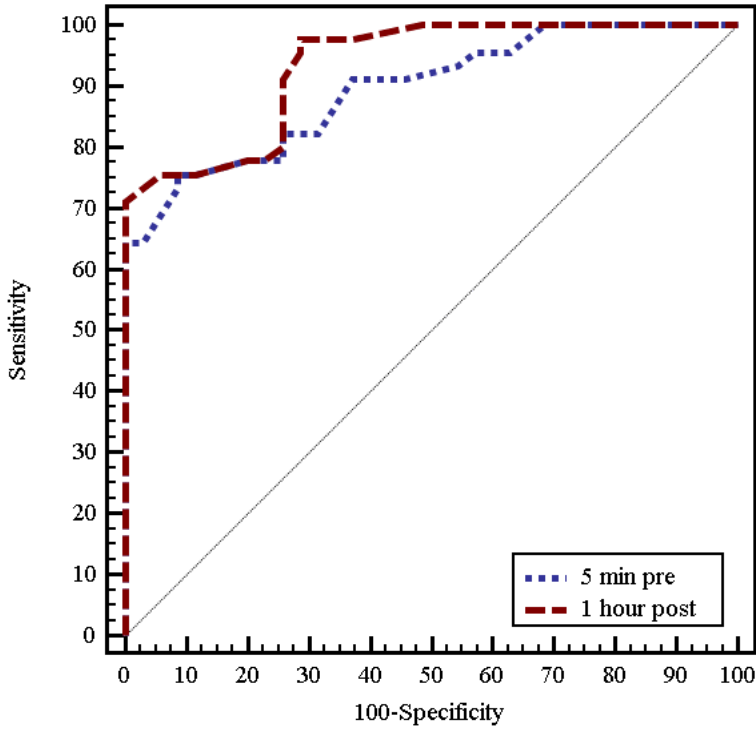


Figure: ROC curve for TFC (5 min pre, 1 hour post) to predict group I (n = 35) from group II (n = 45)

Conclusion

- From the results of this study, we concluded that high TFC is associated with failed weaning from mechanical ventilation in critically ill cardiac patients with reduced EF.
- Thoracic fluid content showed excellent ability for predicting weaning outcome in critically ill cardiac patients with reduced EF.