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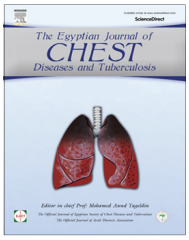

ORIGINAL ARTICLE

Evaluation of some predictors for successful weaning from mechanical ventilation

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KEYWORDS

Weaning predictors;
ABG;
Weaning indices

Abstract *Introduction:* Most international weaning researchers have attempted to find better indexes or parameters which can predict the weaning outcome in the best possible way.Our research attempts to confirm and find better weaning indexes and parameters.

Aim of the work: The aim of this study is to compare between the efficacy of some predictors in different weaning modes for successful weaning from mechanical ventilation.

Method: The study was carried out on 100 (70 males, 30 females) patients receiving mechanical ventilation, due to respiratory and non respiratory causes. Patients were divided into 4 groups according to the method of weaning: group (1) CPAP (n = 25), group (2) PSV (n = 25), group (3) SIMV (n = 25) and group (4) NPPV (n = 25). We used a 3 step protocol for weaning according to *Cleveland Clinical Journal of Medicine*. The following assessments were carried out on admission, during MV (before weaning) and during weaning: $PaCO_2$, pH, PaO_2, RSBI (Rapid shallow breathing index), CROP index, The CORE index, integrative weaning index (IWI).

Results: This study shows that the highest successes rate is in the *NPPV* group (92%) while the highest failure rate is in the *SIMV* group (36%). It also shows that there is non significant difference between the studied groups regarding PaO_2, $PaCo_2$ and PH before starting weaning (P value > .05). After starting weaning the highest value of PaO_2, PaCO2, and PH was in the NIPPV group and the lowest value was in the SIMV group. There is highly significant difference (P value < 0.001) between patients who succeeded and who failed weaning as regards CORE index and only significant difference regarding RSBI, while there is non significant difference as regards other indices(CROP, IWI).

Conclusion: ABG and RSBI can be used as good weaning predictors and the CORE index is better in predicting the weaning outcome than the CROP index, the IWI and the RSBI as their value is better in the NPPV group which expresses the highest success rate.

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Introduction

Weaning process requires a multidisciplinary care team, including the anesthesiologist, nurse, respiratory therapist, physical therapist, and nutritionists and nurses have the coordinating role in this team [1]. It is best to use predictor indexes to decide around weaning. Most international weaning researchers have attempted to find better indexes or parameters which can predict the weaning outcome in the best possible way. Yang and Tobin developed the Compliance, Respiratory Rate, Oxygenation, and Pressure (CROP = [Cdyn * MIP * (PaO_2/PAO_2)]/RR) index that yielded a positive predictive value of 0.71 and a negative predictive value of 0.70 [9]. One of the most accurate indexes is the rapid shallow breathing index (RSBI) or the f/Vt ratio that was introduced by Yang and colleagues, in1991 that had a positive predictive value of 0.85 [9]. In 2009, Nemer and coworkers reported a new integrative weaning index (IWI) that had a positive predictive value of 0.99 and a negative predictive value of 0.86. IWI = Cst rs * SaO_2/(f/TV) [3]. Delisle and co-workers sought to examine the added value of a new integrative index, the CORE index. The CORE index is a modification of the CROP index. The CORE index is calculated as: CORE index = [Cdyn × (PImax/P0.1) × (Pao2/PAo2)]/f [8]).

Aim of the work

The aim of this study is to compare between the efficacies of some predictors in different weaning modes for successful weaning from mechanical ventilation.

Subjects and methods

The study was carried out on 100 (70 males, 30 females) patients receiving mechanical ventilation, due to respiratory and non respiratory causes, in the intensive care unit to study different weaning predictors. All of them were put on controlled mode ventilation(CMV). Patients were divided into 4 groups according to the method of weaning: group (1) CPAP ($n = 25$), group (2) PSV ($n = 25$), group (3) SIMV ($n = 25$) and group (4) NPPV ($n = 25$). Only 4 patients underwent tracheostomy. All patients were subjected to: history taking, examination (general and local chest examination), Arterial blood gases (ABG): before and during weaning, Radiology: chest X-ray. We used a 3 step protocol for weaning according to *Cleveland Clinical Journal of* [4]:

Step 1: Assess readiness for weaning

Patients who meet the following satisfactory criteria are considered to be ready for weaning: Underlying disease process that necessitated ventilation has been resolved or improved; $SaO_2 \geqslant 90\%$ with $FiO_2 \leqslant 0.4$, $PaO_2 \geqslant 60$ mmHg, positive end-expiratory pressure $\leqslant 8$ cmH_2O, f/Vt ratio < 105, none or a minimal dose of vasoactive or sedative drugs administered, body temperature < 38.5 °C and hemoglobin $\geqslant 8$ g/dL [9].

Step 2:

If the patient seems ready for weaning, the next step is to give a short trial of spontaneous breathing either by T tube or pressure support. Patients who did not show signs of failure are extubated. If the trial failed (Difficult to wean) we shifted to Gradual discontinuation of ventilatory support using either pressure-support ventilation (PSV), intermittent mandatory ventilation (IMV), continuous positive airway pressure (CPAP) or non-invasive positive pressure ventilation (NPPV). The duration before weaning was not mentioned because it was not the same for every patient.

Step 3: Extubation

The decision to remove the endotracheal tube should be based on an assessment of airway patency and the ability of the patient to protect the airway [5].

Weaning outcome

The weaning predictors in the four methods of weaning (PSV, SIMV, CPAP, NIPPV) were compared according to weaning outcome, which was further divided into

Primary outcome

Weaning success rate

Secondary outcome

The following assessments were carried out on admission, during MV (before weaning) and during weaning:

Measures of gas exchange

$PaCO_2$, pH, PaO_2.

Measures of respiratory neuromuscular function

Spontaneous respiratory rate (F), Spontaneous tidal volume (V_T), Spontaneous minute volume (VE), PImax: By measuring the maximum inspiratory pressure generated during airway occlusion. The most negative value of three efforts was recorded.

Measures of respiratory mechanics

Static Compliance (C_s) = V_T/Pplat-PEEP, Dynamic Compliance (C_D) = V_T/Ppeak-PEEP.

Integrative indices

RSBI (Rapid shallow breathing index) [(F/V_T) (breathe per minute per Liter]. Where F is the frequency and VT is the tidal volume. RSBI < 105 breathe per minute per Liter is a good predictor for weaning. CROP index: This is an integrative index (which integrates compliance, respiratory rate, oxygenation, and maximum inspiratory pressure). It equals: $[C_D \times (PaO_2/PAO_2) \times PImax]/F$. CROP index >13 is a good predictor for weaning. The CORE index (dynamic compliance, oxygenation, rate, effort). CORE index = Cdyn × (PImax/P0.1) × (PaO2/PAO2)/f. CORE index >8 is a good predictor for weaning. Integrative weaning index (IWI) equals Cst rs × SaO_2/(f/TV). Where the Cst rs = static compliance of the respiratory system. IWI > 25 is a good predictor for weaning.