



## View point

# Integrative weaning index (IWI): A respiratory therapy view point

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### Abstract

Weaning is a process of gradual discontinuation from ventilatory support. It is necessary to wean the patients from mechanical ventilation as early as possible. Delay in weaning can cause ventilator associated infection and diaphragmatic atrophy. There are various weaning indexes, readiness screening test available for the critically ill patients. A new index named Integrative weaning index (IWI) is being used recently by most of the clinicians and has found to be successful. The principle of IWI is to integrate the three important components of breathing in a single equation which includes respiratory mechanics, oxygenation and breathing pattern.

**Key words:** Integrative weaning index, Mechanical ventilation, Oxygenation, Weaning

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Mechanical ventilation is required for patients with respiratory failure. Patients who are on mechanical ventilation for many days often develop ventilator associated infections. Therefore it is necessary to wean the patients as early as possible. Approximately 90% of critically ill patients require some form of weaning to remove invasive ventilator support and this process occupies 40% of required mechanical ventilation time. Weaning decisions based only on expert clinical judgment are not always correct. Premature discontinuation causes severe stress on the respiratory and cardiovascular systems which delays the process of weaning and leads to diaphragmatic atrophy<sup>1</sup>.

Extubation period is one of the most challenging aspect for intensive care teams. Timely recognition of return to spontaneous ventilation is essential for reducing the cost, morbidity and mortality<sup>2</sup>.

The most effective method for weaning a patient from mechanical ventilation follows a systemic ap-

proach that includes a daily assessment of weaning readiness, with interruption of sedation infusion and spontaneous breathing trials. Protocols and checklists are implemented to ensure consistent application of key elements of evidence based practice<sup>3</sup>.

A majority of studies of weaning protocols applied by the non-physician healthcare providers suggest faster weaning and shorter duration of ventilation and intensive care unit (ICU) stay and some suggest failed extubations and ventilator associated pneumonia rates<sup>4</sup>.

Several weaning predictors were studied in an attempt to evaluate the outcome of removing ventilator support. However none of them have presented good results in assessing the outcome of extubation<sup>5</sup>.

Recently a new weaning index was created which is known as Integrative weaning index (IWI). This index evaluates respiratory mechanics, oxygena-

tion and respiratory pattern in an integrated manner. It reflects accuracy for weaning failure and is found to be superior as compared to all other predictors. The principle of IWI is to integrate the three important components of breathing in a single equation which includes respiratory mechanics, oxygenation and breathing pattern. Static compliance of respiratory system ( $C_{statrs}$ ) and saturation of arterial oxygen ( $SaO_2$ ) are directly proportional to weaning success and rapid shallow breathing index (RSBI) also known as frequency/tidal volume ( $F/V_t$ ) value is inversely proportional to weaning success have been incorporated in the equation. Value of more than or equal to 25 indicates as the predictor of success from mechanical ventilation<sup>6</sup>.

$$IWI = \frac{C_{statrs} \times SaO_2}{F/V_t}$$

Esteban et al conducted a similar study and differentiated four methods of weaning and concluded that among all the indices of weaning IWI was the best index for predicting weaning success<sup>7</sup>.

On the basis of the scale proposed by Swets, integrative weaning index was shown to be highly accurate and reliable index for successful weaning of patients from mechanical ventilation<sup>8</sup>.

Madani et al assessed validity of IWI for discontinuation from mechanical ventilation in Iranian ICU. It was studied in six ICU patients with different characteristics and sensitivity of 94.59 and accuracy of 92.5 were obtained and could prove persistence of successful weaning in a 48 hour period with an accuracy of 90%<sup>9</sup>.

In a latest study, the physicians evaluated a cohort with 479 subjects in the ICU. Patients younger than 18 years, tracheostomized or with neurologic diseases were excluded, resulting in 331 subjects. Subjects  $\geq 70$  years old were considered elderly, whereas those  $< 70$  years old were considered non-elderly. Besides the conventional weaning indexes, we evaluated the performance of the integrative weaning index (IWI). The probability of successful weaning was investigated using relative risk and logistic regression.

Prevalence of successful weaning in the sample was 83.7%. There was no difference in mortality between elderly and non-elderly subjects<sup>11</sup>.

This study was performed to investigate the IWI power in predicting the success and failure of the SBT outcome in patients under mechanical ventilation, hospitalized in Imam Reza Educational Hospital in 1 year.

Given the findings of the current study and previous reports, it can be concluded that weaning indices which only evaluate one function usually have low accuracy. Therefore, the IWI which can evaluate main functions such as RR-tidal volume ratio ( $RR/V_t$ ), compliance, RR, oxygenation and the CROP index (Compliance, Resistance, Oxygenation, Pressure Index), has higher accuracy and can be considered as a more objective index compared to the indices used by physicians in predicting success or failure<sup>12</sup>.

Weaning is a complex process of discontinuing ventilator support from mechanical ventilation. Patients who are on ventilator for many days often go into ventilator associated pneumonia. Weaning requires certain readiness criteria such as organ system assessment, weaning indices and clinical condition of the patient. Patient can be extubated either from a ventilator or after giving spontaneous breathing trial. The only difference between the two are that patient parameters can be monitored on ventilator whereas clinician has to monitor the vital signs and patient's overall condition on spontaneous breathing trial.

According to respiratory therapy point of view, there are several weaning indexes which predict the weaning success. Indices such as RSBI, CROP, CORE (dynamic compliance, oxygenation, rate, effort) indexes have been extensively used in intensive care units. We emphasize on using integrative weaning index while weaning the patient. Integrative weaning index has three major components: respiratory mechanics, oxygenation and breathing pattern. Static compliance and  $SaO_2$  are directly proportional to weaning success and RSBI is inversely proportional to weaning success.

Seeing all the facts and evidence based practice, we can surely say that integrative weaning index is definitely a useful index in weaning the patients from mechanical ventilation.

The predictor of successful weaning and extubation depends upon several factors which can be associated along with integrative weaning index.

Contrary to this, there is very less literature available on integrative weaning index.

More studies on integrative weaning index will definitely help the clinicians to use this new index in improving weaning rates.

### Abbreviations

IWI = Integrative weaning index

$C_{statrs}$  = Static compliance of respiratory system

SaO<sub>2</sub> = Saturation of arterial oxygen  
 F/Vt = Frequency/tidal volume also known as rapid shallow breathing index (RSBI)  
 CROP = Compliance, respiratory rate, oxygenation, pressure values  
 CORE = Dynamic compliance, oxygenation, rate, effort  
 RR = Respiratory rate  
 RR/Vt = Respiratory rate divided by tidal volume  
 SBT = spontaneous breathing trial

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