

## Factors That Contribute To The Failure Of Ventilatory Weaning In Critical Patients: A Review

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### Abstract

Mechanical ventilation aims to replace spontaneous breathing with artificial respiration, inflating the airways with volumes of air and generating pressure within the lungs. Weaning from ventilation should occur as early as possible. It can be performed slowly, gradually, using several techniques, among which the following stand out: the T-Tube technique, synchronized intermittent technique and pressure support technique. This study aims to verify, through literature review, the main factors that contribute to the failure of ventilator weaning in critically ill patients. For this purpose, a literature review of the last twenty years was carried out, except for classic literature relevant to the topic, researched on the sites: Medline , Scielo , Lilacs , Pubmed and Literatures of the IESRIVER faculty library, using the terms: “weaning mechanical ventilation” and “factors that predispose to weaning failure”. It can be shown through this study that factors such as age, fatigue, muscle atrophy, cardiac dysfunction, nutritional factors, advanced age, emotional factors and prolonged mechanical ventilation are factors that can lead to failure during an attempt at weaning. Most studies concluded that the T-tube technique is the most effective, since it is quite simplified and allows the patient to have periods of effort and rest, which improves muscle strengthening and guarantees successful weaning, but it is up to each team to decide the best method to be used, always giving priority to the patient.

**Keywords:** mechanical respirator weaning , mechanical ventilation; interactive ventilatory support

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## INTRODUCTION

The number of critically ill patients admitted to the service of Intensive Care Units (ICU's) has been growing in recent times, due to new existing technologies and also because of the multiple factors that can trigger respiratory failure.

The use of high pressure values and inappropriate methods can damage the lungs, which can generate a series of deleterious effects caused by life support, contributing to functional decay, and increasing hospital expenses, exposing the patient to a series of risks. and increasing the mortality rate, making it necessary to wean from mechanical ventilation as soon as possible.

Weaning can be understood as the transition from supportive breathing to spontaneous breathing, and it is noteworthy that before starting it, a hemodynamic evaluation associated with factors related to the patient's prognosis is considered extremely important, and the multidisciplinary team needs to develop strategies by which they can guarantee support for the patient in cases of unsuccessful and relapsed weaning.

Failure to wean is extremely serious, leading to a worsening of the patient's prognosis, deterioration of respiratory function and increased mortality, making it necessary to carry out a thorough evaluation and recommend protocols through which to reduce the number of failures within ICUs .

Thus, the study in question aimed to highlight, through a literature review, the main factors that contribute to the failure of weaning from ventilation, in addition to presenting the factors that predispose to weaning and also to expose the main ventilation methods in critically ill patients in ICUs .

## METHODOLOGY

This is a bibliographic review that had as a source of research for a bibliographic survey, collections of publications in Portuguese, Spanish and English in scientific articles published in the last twenty years, dissertations, theses and books through the Medline , Scielo , Lilacs , Pubmed , in addition to volumes from the IESRIVER faculty library , except those classic literatures referring to the subject.

The keywords used for the research will be: weaning from mechanical ventilation” and “factors that predispose to weaning failure”. After collecting the

bibliographic material, the step of analysis and interpretation of information for discussion and description of the proposed theme

## RESULTS AND DISCUSSION

A total of studies were found, of which were used, were excluded by and were not related to the proposed theme, they were in duplicate etc

The main techniques used for weaning according to the analyzed studies were: T-tube technique, synchronized intermittent technique and pressure support technique.

In these studies, it was shown that factors such as age, fatigue, muscle atrophy, cardiac dysfunction, nutritional factors, advanced age, emotional factors and prolonged mechanical ventilation are factors that can lead to failure during weaning attempts.

In the studies by Azevedo Jose et al;1998, which was a prospective randomized study, with a sample of 72 patients, submitted to mechanical ventilation for 24 hours and with clinical, gasometric and respiratory mechanics criteria for weaning initiation, the patients were divided into three groups (SIMV, PSV and SIMV+PSV), which revealed that the SIMV + PSV technique was successful in 26 patients, and failure in 2 patients of the sample, this technique had a good performance compared to the PSV group used alone, its success rate was 26 patients and failure in 9 nine, thus being able to show as results that its use in conjunction guarantees greater benefits, as one eliminates the problem of the other, since in the PS method it eliminates one of the main problems imposed by SIMV, which is the resistance caused by the endotracheal tube, providing an increase in the work of breathing, and the SIMV method solves the problem imposed by PS which is the dependence of adequate regulation of the respiratory stimulus when weaning begins.

The studies by David CMN (2004) showed that the SIMV+PSV technique is one of the most used techniques in hospitals today.

Esteban et al;1997 produced a prospective, randomized and multicentered study, with a sample of patients on mechanical ventilation for more than 48 hours, with clinical patterns for the beginning of weaning. Through a random distribution, the patients underwent weaning from the T Tube, the other group in a ventilation support of 7 cmH<sub>2</sub>O of pressure, in which the patients of the T Tube group

composed of 246 patients, of these, 192 were approved for weaning and 36 were re-intubated, in the other PS group composed of a sample of 238, 205 were ex-intubated and 38 were re-intubated again, proving that the T-tube method is an adequate method for weaning, and they had no problems when returning to hospital spontaneous ventilation.

In studies evidenced by Brochard *et. al*, 1994, composed of 109 patients on mechanical ventilation, dividing the patients into 35 units for T-tube, 43 units for SIMV, and 31 units for PSV, and thus obtained as a result that the PSV method had the lowest number of failures with only 8%, the T-tube method 33%, and the SIMV 39% of failure.

Assunção et al, 2006, carried out a study with the objective of evaluating the use of the T-tube method in 49 patients on mechanical ventilation for more than 24 hours, all of whom were submitted to the T-tube technique, which resulted in: weaning occurred in 79, 2%, re-intubation in 31.6%, with a time between 8.7 hours, thus concluding that it is a fast and effective technique in 80% of cases, but the rate of re-intubation was high, due to muscular effort.

In the study by Jounieux et al 1994, they compared two methods of weaning in COPD patients who required mechanical ventilation due to acute respiratory failure, a sample composed of 19 patients, who were divided into two groups, group 01 ( SIMV + PSV), and the Group 02 the use of (SIMV alone) did not observe any difference in terms of success, in relation to time group 01 (SIMV + PSV) was reduced more quickly compared to SIMV alone.

There are several weaning methods, so it is up to each unit to stipulate the best protocol, which is capable of reducing hospitalization time and failures, some factors are responsible for an unsuccessful discontinuation ( GAMBAROTO, 2006).

According to Costa (1999) some factors may be related to the failure of weaning in patients on Mechanical Ventilation, among them are: respiratory muscle fatigue, muscle atrophy, age, sex, emotional factors, ventricular dysfunctions and pathologies.

Pathologies are the biggest factors that cause weaning failure, so Oliveira, et al (2010) carried out a descriptive quantitative research, in the medical ICU of the Hospital das Clínicas of the Universidade Federal de Goiás, with a sample of 152 medical records, in the year 2006, in order to reach the main factors that contributed to the failure of weaning, in which 6 patients suffered the failure,: through the study it showed that the main causes of failure were: older age group , male sex (66.5 for male

and 62.5 for female), high rates of associated pathologies such as: pneumonia, renal failure and neoplasms, this study did not influence the weaning rate, the length of stay in the ICU, the mode of weaning, and physical therapy ( OLIVEIRA; ALMEIDA; BOSCHETT EI AL., 2010).

As for failure correlated with sex, studies by Kollef et al., (1998), carried out a prospective cohort , in ICUs physician and surgeon from two university teaching hospitals affiliated with 357 patients, with the aim of relating gender with outcome for patients requiring mechanical ventilation. He tries to explain this difference since the largest number is in males, there is controversy when comparing with studies by Epstein et AL,1999, in their prospective observational study, with a sample of consecutive patients admitted to the SAMU service and mechanically ventilated during a minimum of 12 hours. In order to evaluate the difference between the mortality rate between men and women on mechanical ventilation, it is concluded that there is no difference in the mortality rate related to gender in patients on Mechanical Ventilation, this difference is still not well known, with few correlated studies.

Hypoxemia is considered as a factor that leads to weaning failure, because respiratory failure makes it impossible for the respiratory system to perform its functions, which are the maintenance and oxygenation of the patient, as a result , the venous blood that returns to the lungs is not oxygenated, not performing the elimination of carbon dioxide, this changes in the patient's blood gas analysis ( KNOBEL et al, 1994)

Bouso et al (2006) in their studies evaluated the relationship between dead space and tidal volume as a predictive factor of weaning failure in children on mechanical ventilation, it was a cohort study by which children aged 1 to 15 days were included. , in Mechanical ventilation , concluded that several factors can influence VD/VT rates.

Freitas et al (2006) evaluated 60 patients prospectively for 24 months, in > 48 hours on mechanical ventilation, patients were divided into success and failure groups, in which they were analyzed and compared, reaching the conclusion that hypoxemia is an indicator by which it leads to failure .

According to Gambaroto (2006) the failure of weaning is due to several factors, including the inability of the muscles to generate and perform contractions during inspiration, resulting from muscle weaknesses. These weaknesses are one of the complications to which the patient on mechanical ventilation is exposed, since the

muscles of inspiration are replaced by positive pressures, resulting in weakening of the muscles responsible for the work of breathing, failing during contraction, the individual is unable to perform spontaneous breathing (PIRES et al., 2000; GUYTON.Hall et al,2002).

Respiratory mechanics is a result of the respiratory muscles, which when weakened, due to several factors, including mechanical ventilation, leads to respiratory failure and consequently fatigue that can be defined as a feeling of discomfort by which the patient is unable to breathing. There is a loss in the work capacity of the fibers due to physical efforts, that is, overload, fatigue can ensue due to the lack of the relationship between effort and rest, both factors can lead to failure because weaning requires muscle strength and adequate load (SANDOVAL et al ;2002;POLKEY and MOXAM, 2001)

Since malnutrition is a factor of great value, which can be correlated with muscle weakness and fatigue, due to poor nutritional support, the patient has muscle weakness and muscles that are more prone to fatigue, with a higher rate of acquiring infections, leading to patient to a new re-intubation process ( HERMETO et al., 2009; DANAGA et al., 2009; GAMBAROTO , 2006)

The longer the time of mechanical ventilation, the greater the failure rate, Assunção et al (2006) when conducting a study with a sample of 49 patients, proved that re-intubation occurred in 31.6%, the sample had a longer time in Mechanical Ventilation, ensuring a higher percentage of failure and mortality. All this is due to the complications that mechanical ventilator influences on the airways, such as acute respiratory distress syndrome (ARDS), tracheobronchitis, acute sinusitis, atelectasis, pneumothorax, pneumomediastinum and accidental extubation . Silva et al (2008) carried out a cohort study, composed of 29 children with heart disease who remained on mechanical ventilation, in which they concluded that the days of IMV were the main factors associated with failure during weaning.

Cardiac diffusions can be considered a predictive factor that generates failure, since IMV, through the use of PEEP, exerts a positive intrathoracic pressure, reducing venous return and guaranteeing an overload in the left ventricle , contributing to the reduction of cardiac output . ( RADY, et al, 1999; WONG , et al, 1999; LEMAIRE, et al, 1988; PASSOS; CASTILHO, 2000).

Nozawa.et al 2003, carried out a study evidencing the parameters of respiratory mechanics, oxygenations and cardiovascular alterations involved in weaning from

prolonged mechanical ventilation in tracheostomized patients after cardiac surgeries, with a sample composed of 45 patients in the postoperative period of cardiac surgery, of which 34 male and 11 female, who were on mechanical ventilation in the Surgical Intensive Care Unit of the Instituto do Coração of the HC/FMUSP for more than 10 days. They concluded that cardiac dysfunctions can cause changes in alveolar membranes, increasing pulmonary shunt and altering gas exchange and cardiopulmonary bypass time, which are factors that interfere with weaning from MV.

Age has a great influence on weaning, a study by Mantovani, Zuliani, Sano et al; 2007, with a sample of 40 men and 40 women with cholecystectomy under general anesthesia, with a mean age of 57.7, were evaluated some variables including age and body weight. The author concluded in his study that body weight and advanced age is one of the major factors for failure to wean, this happens due to loss of respiratory muscle mass, decreased elasticity and compliance of the lungs, decrease in elastin and collagen, the rib cage suffers a stiffening due to calcification of the ribs, causing a decrease in the residual capacity of the expiratory flow (MONTONAI et al; 2007., NOZAWA *et al.* 2003., PICOLO *et al.*, 2009; FREITAS FS et al., 2010).

To ensure a successful weaning, the patient must be informed about any procedure to be performed, what he may feel, since he is hospitalized in the unit, often with the use of sedatives, this changes emotional and behavioral factors. Psychological preparation to start weaning, anxiety is one of the main factors that needs to be worked on, the patient is afraid of going through a weaning process and not being able to bear it and, thus, increasing their length of stay in the ICU, this anxiety characterizes due to feelings of fear and apprehension, all this changes heart rate, respiratory rate, and blood pressure, these parameters must be controlled for the maintenance of weaning (COOK, MAUREEN et al; 2001)

When weaning is unsuccessful, the patient must return before 48 hours after weaning, as failure is one of the factors that most causes death in critically ill patients. At weaning, thus ensuring a good continuous assessment, evolving towards the success of weaning, protocols must be stipulated, reducing hospitalization time and hospital expenses (FREITAS et al, 2006., ESKANDAR, et al, 2007).

## CONCLUSIONS



In the literary survey, it was observed that there are multiple factors that interfere with the failure of weaning, highlighting among them: fatigue, muscle atrophy, cardiac dysfunctions, the nutritional factor, advanced age, emotional factors and prolonged time. of mechanical ventilation.

Regarding predictive indices, several factors must be evaluated to ensure successful weaning, such as resolution of the cause of respiratory failure, cessation or reduction of sedative drug use, normal state of consciousness, absence of sepsis, hemodynamic stability, corrected metabolic and electrolyte disorders, and good results from clinical and complementary exams.

Among the weaning methods used, it was concluded that the T-tube method is simple, easily accessible and guarantees the strengthening of the respiratory muscles. The PSV method is already a method widely used in ICUs , which manages to relieve inspiration, as the patient performs the flow, volume and frequency , being assisted whenever necessary. While the SIMV method is a method that does not guarantee much success in terms of weaning, because, even though it is a technique that requires little monitoring by the physical therapist, it can generate an overload in the respiratory muscles due to the endotracheal tube. Among the PSV and SIMV techniques, it is observed that both are complex and functional when used together, as one manages to reverse the negative points that the other proposes.

From this study, the importance of knowing the weaning failure factors and the predictive factors, which may allow the greatest success in the ventilatory weaning process, can be seen. However, it is necessary that new research be carried out, mainly field studies in ICU's to give greater credibility to the results found.

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