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Negative Inspiratory Pressure as a Predictor of Weaning Mechanical Ventilation

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Introduction

Mechanical ventilation (MV) is a widely used resource within intensive care units (ICUs) for the maintenance of the lives of critically ill patients. However, its prolongation is associated with several complications, such as pneumonia, hemodynamic disorders, lung injury and diaphragmatic dysfunction; the latter defined as the set of structural and functional alterations produced by the inactivity of the diaphragm muscle during MV [1,2].

Several investigations developed since the 1990s on the impact of MV have been able to show changes in the diaphragm as a consequence of the prolonged use of positive pressure in the airway [2-5]. These changes reduce and modify the correct diaphragmatic functioning, making the weaning process more complicated and delayed due to the difficulty for the patient to spontaneously assume ventilatory work [2,3]. This translates into an increase in the number of hospital stay days, and consequently, costs in health services [6,7].

For all of the above, early ventilatory weaning is established as one of the main objectives in the management of the critical patient and its initiation should be considered from the moment the cause of the use of ventilatory support improves [8]. The success of weaning is defined as the maintenance of spontaneous breathing for at least 48 hours after discontinuation of MV. If the need to return to artificial ventilation arises during this period, it may be thought that weaning has failed [9]. It is considered that approximately 55% of the patients manage to pass this process without difficulties [10]; However, between 20 and 30% of the patients who are weaned from the ventilator present respiratory complications after extubation, requiring the reinstatement of the artificial airway [11].

Weaning failure can be due to several factors, summarized in four groups: alterations in gas exchange, hemodynamic instability, respiratory pump failure and psychological dependence on the ventilator [12]. This fact occurs in many cases because weaning is based on clinical judgments and individualized styles, behaviors that favor the prolongation of MV time [13]. Herein lies the importance of establishing a protocol of weaning and extubation systematically, integrally and preferably universal within the ICUs.

However, most of these criteria are not always statistically reliable because they present low sensitivity and specificity, and may give rise to the appearance of false positives and false negatives. In summary, precise parameters included within the weaning protocol do not always exist to predict the success or failure of weaning and extubation [11].

One of the predictors that has been contemplated in recent years to estimate the success of weaning is the maximum inspiratory pressure, commonly known as PIM, defined as maximum pressure that can be generated against an occluded airway for 20 seconds from the capacity Functional residual; In this sense, can be considered as a direct marker of inspiratory muscle function, and in particular, of diaphragmatic force [14].

The first time we talked about IMP measurement in critically ventilated patients was in 1973, when Sahn and Cols.la included within the extubation criteria, along with the value of minute ventilation and maximum voluntary ventilation. The research concluded that patients with values >30cm H20 are able to maintain their mechanical ventilation spontaneously [15]. On the other hand, in 1975 Feeley et al. [16] reported that the inspiratory force should be ≥20cm H20 to interrupt assisted ventilation.

In 1993, Strickland and Hasson developed an automatic weaning stool system for postoperative patients. Within the inclusion criteria to begin weaning, they added the Negative

Inspiratory Force (NIF) denomination that until then had not been handled to refer to maximal inspiratory pressure [17].

Yang and Tobin performed a prospective study where they established the predictive indexes of the results of ventilatory weaning, taking NIF as one of them. In their research, they determined that inspiratory pressure is a better predictor of failure than of weaning success [18]. In contrast, Ebeid and Cols. Deduced in 2013 that NIF is a good predictor of weaning success [19].

It has been established that a NIF ≥-20 or -25cm H2O is adequate to initiate ventilatory weaning; With a NIF>-30cm H2O, there is a 93% chance of successful weaning [20,21], and on the contrary, with a NIF of >-15 or >-10cm H2O, patients are unable to breathe on their own (twenty-one). Parallel to this, values of -33cm H20 with a 50% mortality decrease -28cm H20 with 42% and -26cm H20 with 32% respectively have been associated [22].

Recently, we conducted a study with Colombian population, considering the measurement of NIF as a parameter of evaluation of diaphragmatic dysfunction in MV, which is being submitted for publication, considering that its use in patients submitted to MV is possible thanks to its Incorporation into state-of-the-art mechanical fans. The measurement is done by an invasive technique, simple and well tolerated by the patients. Thus, the value of NIF is presented as an effective alternative to take into consideration, both to assess the degree of diaphragmatic injury, to initiate weaning and to perform extubation.

Although NIF seems to be the most adequate measure to quantify the degree of pulmonary dysfunction in patients with ventilatory support, depending on the probability of success or failure of weaning, the information that can be found on its application within critical care remains limited and discordant, Which makes it necessary to carry out more research in which NIF is considered as a parameter of evaluation for respiratory dysfunction within a structured battery or as a potential extubation criterion.

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