Vilma Muñoz[1,2], Lucía Calvo[2], María Fernanda Ramírez[2], Marcela Arias[2], Mario Villota[2], Esther Cecilia Wilches-Luna[1,2], Rodolfo Soto[3]

Ventilatory weaning practices in intensive care units in the city of Cali

Prácticas de destete ventilatorio en las unidades de cuidado intensivo de la ciudad de Cali

1. Escuela de Rehabilitación Humana, Facultad de Salud, Universidad del Valle - Cali, Colombia.
2. Sociedad de Fisioterapeutas Respiratorios - SOFIRE SAS - Cali, Colombia.
3. Universidad del Valle, Facultad de Salud - Cali, Colombia.

ABSTRACT

Objective: Early weaning from mechanical ventilation is one of the primary goals in managing critically ill patients. There are various techniques and measurement parameters for such weaning. The objective of this study was to describe the practices of ventilatory weaning in adult intensive care units in the city of Cali.

Methods: A survey of 32 questions (some multiple choice) evaluating weaning practices was distributed to physiotherapists and respiratory therapists working in intensive care units, to be answered anonymously.

Results: The most common strategy for the parameter set was the combination of continuous positive airway pressure with pressure support (78%), with a large variability in pressure levels, the most common range being 6 to 8cmH_2O. The most common weaning parameters were as follows: tidal volume (92.6%), respiratory rate (93.3%) and oxygen saturation (90.4%). The most common waiting time for registration of the parameters was >15 minutes (40%). The measurements were preferably obtained from the ventilator display.

Conclusion: The methods and measurement parameters of ventilatory weaning vary greatly. The most commonly used method was continuous positive airway pressure with more pressure support and the most commonly used weaning parameters were the measured tidal volume and respiratory rate.

Keywords: Weaning; Ventilator weaning/methods; Respiration, artificial

INTRODUCTION

Ventilatory support is recognized as one approach for managing acute respiratory failure; however, ventilatory support increases the risk of complications, with increased mortality, length of hospital stay and costs.[1-3] Therefore, it is important to remove mechanical ventilation as soon as the patient's condition permits. A great percentage of these patients may be released at the first spontaneous breathing trial; however, 24% do not pass the test on the first attempt,[4,5] necessitating more elaborate weaning processes that require more than 41% of the total duration of mechanical ventilation in this process.[6]

In past decades, weaning a patient from mechanical ventilation was mainly based on the clinical judgment and experience of the treating physician.[7] The evidence indicates that employing standardized weaning protocols or

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Corresponding author:
Vilma Muñoz Arcos
Carrera 70 # 18 - 75. Clínica Amiga Comfandi
Cali, Colombia
E-mail: vilma.munoz@correounivalle.edu.co

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guidelines helps to decrease the total duration (days) on mechanical ventilation by a mean of 25%: 78% for the total duration of the weaning and 10% for hospital days in intensive care.[8]

Although ventilator weaning has been much studied over the past 20 years, there is still no consensus on the ideal method or on the measurement parameters that best predict tolerance.

The increase in intensive care services have generated increased demand for personnel management of critically ill patients. Managers of ventilatory care are professionals in not only the medical field but also (less frequently) physical therapy, respiratory therapy and nursing.

This fact suggests that the variability of the concepts is much higher than has been reported in the international literature.[9-12]

The objective of the present research was to describe the ventilatory weaning practices in adult intensive care units (ICU) in the city of Cali (Colombia).

METHODS

The study followed a descriptive cross-sectional design. It was classified as an investigation without risk according to resolution Nº 008430 of October 4, 1993, of the Ministry of Health and Social Protection and was approved by the Ethics Committee of the *Universidad del Valle* (certificate of approval Nº 019-012) and by the coordinators, physiotherapy providers and respiratory therapists of the hospitals that participated in the research. The study was based on the implementation of the survey conducted by researchers Soo Hoo and Louis Park,[9] which consists of 32 multiple-choice questions. This survey was designed to describe the demographics of the professionals at the participating hospitals and the methods and criteria for weaning from mechanical ventilation. To implement the questionnaire, permission was sought from the authors for Spanish translation and cultural adaptation. Subsequently, the survey was translated and adapted to the environment, and a new translation into English was sent to the authors, who gave approval for its use.

The surveys were given to the coordinators of intensive care services in hospitals that agreed to participate in the study. The questionnaires were answered anonymously by 134 professionals. After three weeks, the researchers conducted survey reviews.

Population and sample

The population consisted of 180 professionals in physiotherapy and respiratory therapy. Convenience sampling was performed in 19 of 22 hospitals in the city of Cali that agreed to participate in the study.

Inclusion criteria

The participants were physiotherapists and respiratory therapists who worked in adult ICUs, were responsible for managing mechanical ventilation and weaning processes, agreed to be part of the study and signed their informed consent.

Exclusion criteria

Surveys with incomplete information were excluded.

Analysis

Data were tabulated using Microsoft® Excel® 2011 for Mac, version 14.2.0 (120402). A descriptive analysis in which proportions for qualitative variables were calculated was performed.

RESULTS

Of 180 surveys distributed in 19 different ICU in Cali, 136 were completed, and of these, 134 (74%) were analyzed (two were discarded because they were completed by physiotherapists who worked in pediatric ICU); 44 surveys (24.4%) were not returned (Figure 1).

The study involved 19 hospitals: 2 public and 17 private. Of these institutions, 43% had 100 inpatient beds, and only one reported a capacity greater than 400. The number of beds in the area reporting more intensive care was between 11 to 24 beds (38%). Most of the facilities corresponded to general ICU (78%). The specialty of the physicians who most often handled mechanical ventilation varied, the most common being subspecialty internists (47%).

In Cali, respiratory care services in ICU were performed by physiotherapists and respiratory therapists. The most frequent number of patients per shift, carried per professional, was in the range of 5-9 patients (63%). Of the participants in this study, 8% were respiratory therapists, and 92% were physiotherapists. The most common educational background was represented by physiotherapists trained in the management of critically

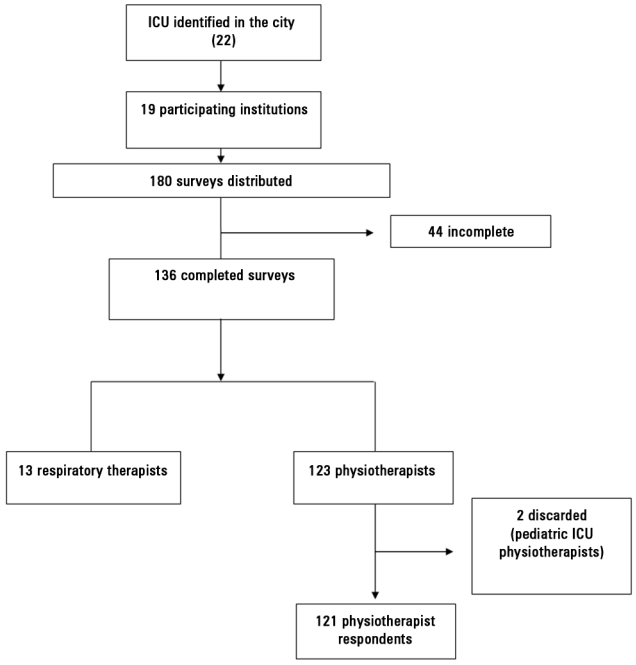

Figure 1 - Sample flow chart. ICU - Intensive care unit.

ill patients (48%). A small percentage of the participants were specialized: 3% in the group of respiratory therapists and 8% in the group of physiotherapists. With regard to clinical experience, 58% of professionals had 5 years of experience in the area (Table 1).

Table 1 - Description of the professionals involved in the weaning process

Professionals	N (%)
Physiotherapists	
Graduate physiotherapists	13 (10)
Trained physiotherapists (certified)	59 (45)
Specialized physiotherapists (critical care, cardiopulmonary)	28 (21)
Specialized physiotherapists in other fields	7 (5)
Respiratory therapists	
Graduate respiratory therapists	6 (5)
Trained respiratory therapists (certified)	3 (2)
Specialized respiratory therapists (critical care, cardiopulmonary)	2 (2)
Respiratory therapists in other fields	2 (2)
Experience (years)	
<1	15 (11)
1 to 5	77 (59)
11 to 19	8 (6)
6 to 19	31 (24)

With respect to obtaining weaning parameters (or criteria for extubation), over half (56%) of the professionals surveyed reported that they required no medical order to measure these parameters. The tests were performed daily (98%), and 86% responded that the data could be obtained at any time of day (Table 2).

Table 2 - Weaning parameters

	N (%)
Expected time for recording parameters (minutes)	
<1	6 (5)
1-2	11 (8)
3-5	16 (12)
6-10	13 (10)
11-15	13 (10)
>15	52 (40)
Variable duration of time	20 (15)
Method for conducting spontaneous breathing trial	
T in T*	21 (16)
CPAP	7 (5)
PS	34 (26)
CPAP+PS	101 (78)
Measured weaning parameters	
HR	86 (64)
TºC	31 (23)
RR	126 (93)
VC	125 (93)
BP	69 (51)
VM	90 (67)
PIP	69 (51)
RR/VC	67 (50)
SaO_2	122 (90)
VC	26 (19)
Compliance	47 (35)
Other	17 (13)

TT - T-tube; CPAP - continuous positive airway pressure; PS - pressure support; HR - heart rate; TºC - body temperature; RR - respiratory rate; VT - tidal volume; BP - blood pressure; VM - minute ventilation; PIP - peak inspiratory pressure; RR/VC - Tobin index; SaO_2 - arterial oxygen saturation; VC - vital capacity. * in the TT, non-compliance is measured.

The ventilatory mode most commonly used was continuous positive airway pressure (CPAP) plus pressure support (PS) (78%); however, variety was observed in the levels of CPAP and PS applied, the most common values being 6 to 8cmH_2O.

The time most frequently cited for logging the expected variables was greater than 15 minutes (40%),

and the data most reported by the professionals in charge of weaning were, in order, the tidal volume (TV), respiratory rate (RR) and oxygen saturation, with more than 90%.

Only half (49.6%) of the participants used the Tobin index (RR/vital capacity [VC]) and maximal inspiratory pressure (MIP) (51%). In analyzing the question, "How is the MIP measured?", 23% of respondents (31) were unaware of the measurement, although for the question of what were the most frequent weaning parameters, they referred to the MIP. Consequently, questions related to the topic were discarded for the analysis.

Among those who knew the test, the most common method of obtaining measurements was through the ventilator software (47%). The maneuver was performed three times in 52% of cases, and the majority (63%) reported the highest value of the test. The most quoted occlusion time for testing was 2 to 4 seconds (Table 3).

Table 3 - Measurement of the maximum inspiratory pressure

	N (%)
Method	
Using ventilator software	61 (47)
Known measurement but not performed on service	39 (30)
Manually, using a manometer	17 (13)
Unknown measurement and not performed on service	11 (8)
Using an esophageal balloon/pulmonary unit monitoring practice	2 (2)
Airway occlusion time (seconds)	
<1	8 (13)
2-4	26 (43)
5-10	15 (25)
11-15	4 (7)
16-20	8 (13)
Number of measurements	
Three	34 (52)
Two	15 (23)
One	14 (22)
Other	2 (3)
Value considered	
Highest value obtained	49 (63)
An average of the values obtained	21 (27)
Only one value	7 (9)
Other	1 (1)

The measurements of TV and RR were obtained from the records reported on the ventilator display in most cases, 84% and 86%, respectively (Table 4).

Table 4 - Methods used for measuring the weaning parameters

	N (%)
RR	
Digital display on the ventilator	114 (86)
Direct observation	13 (10)
Digital display on the patient monitor	4 (3)
Other	1 (1)
VT	
Digital display on the ventilator	109 (84)
Measurement module on the ventilator	19 (15)
Calculated by VM/RR	2 (2)
VM	
Digital display on the ventilator	108 (83)
Other	2 (15)
Measurement module on the ventilation within the first minute	20 (2)

RR - respiratory rate; VT - tidal volume; VM - minute ventilation.

DISCUSSION

After completion of this study, it was possible to describe the ventilatory weaning practices in some of the adult ICU in Cali. Similar to the work originally performed by Soo Hoo and Park,[9] great variability in the responses of the study participants was observed.

Respiratory care in Cali is a broad term, which includes the functions of professional physiotherapy and respiratory therapy in patients with pulmonary disease or at risk for acquiring the disease at different stages of evolution.[10-13]

In Colombia, the standard for human resources in different ICUs requires, among others, physical and/or respiratory therapists to be present so that there is 24-hour coverage.

The results of the present study demonstrated that respiratory care in Cali is conducted by physiotherapists and respiratory therapists, with a predominance of the later. With respect to postgraduate degrees in Brazil,[10-12] over 80% of physiotherapists had postgraduate degrees. An unlikely situation is presented in Cali, where only 8% of physiotherapists and 3% of respiratory therapists have postgraduate specialization. This might be explained by the fact that, in Colombia, only three universities offer specialized programs for physiotherapists in the area of critical care. Regarding the requirement for medical orders to measure weaning parameters, 56% of respondents stated that orders are not required, and 100% reported that weaning and extubation were conducted only during daylight hours. In this regard, Tischenkel et al.[14] found that extubation

performed in the evening hours was not associated with an increased risk of reintubation or with an increased length of the hospital stay.

In this study, 87% of respondents used the combination of CPAP and PS, with widely varying levels of pressure, the most frequent values being in the range of 6 to 8 cmH_2O for both parameters. These data differ from the work of Soo Hoo and Park,[9] in which CPAP was the most common mode and in which only 9 (8.8%) respondents reported using CPAP and PS with varying levels of pressure. In Brazil, the results are not uniform. According to Rodrigues et al.,[10] in the city of São Paulo, the most common procedure is PS (91%), with large variations in the pressure levels (6-12 cmH_2O). Mont'Alverne et al.[12] found that more than half of respondents used the T-tube (TT) in public (56%) and private (58%) hospitals. According to the study of Gonçalves et al.,[11] TT or PS (38%) were the most used modes. In all of these studies, much variability was observed in the pressure levels, independent of the modality used: CPAP, PS or a combination of the two. The ideal values when using CPAP, PS or a combination of these is controversial, as is indicated by surveys in Brazil, Los Angeles and Cali.[9-12]

The professionals surveyed responded that TV and RR were the most utilized measurements for recording ventilatory weaning parameters in Cali-results that were similar to studies conducted in Los Angeles and Brazil.[9-12] In this study, 100% of respondents obtained VC and RR data from the ventilator *display*. The literature recommends that registration of the RR be by direct observation because many efforts of the patient cannot be served by the ventilator and are not registered. This condition is more important in patients who are difficult to wean, especially with diseases such as chronic obstructive pulmonary disease.[15,16]

For the measurement of parameters such as minute volume, RR/VC, compliance, VC and MIP, much variability was observed in the responses. Epstein[17] notes that there are many factors affecting reliability and the way in which the parameters are measured, including interobserver variations and the time and mode for the measurements.

In Cali, only half of the participants in this study reported registration of the MIP as a parameter for weaning, and most used ventilator software for this measurement. These data differ from those reported by Soo Hoo et al.,[9] where MIP was a common parameter log (>90%) and almost 90% used a gauge to measure it. Furthermore, Bucharles et al.[12] reported that 89.5% of respondents from private hospitals used the MIP and that 100% recorded this measurement using a pressure gauge. MIP was not often used in hospitals in the Federal District[11] and São Paulo[10] (Brazil).

Marini et al.[18] refer to PIP values as the best measurement when a manometer with a unidirectional expiratory valve closure time of 20 seconds is used. The results of this study showed that only 10% of respondents use occlusion times between 16 and 20".

Regarding the waiting time for registering weaning parameters during spontaneous breathing trials, the results of this study showed that the highest percentage of professionals used times higher than those reported in the literature; the largest range was 15 minutes, which was the most quoted value (44%). These data differ significantly from reports by Soo Hoo,[9] where most professionals recorded after 1-2 minutes of waiting (44%); Rodrigues et al.,[10] between 6 to 10 minutes (28%); and studies by Brochard[4] and Esteban,[5] between 2 and 3 minutes, respectively.

Although the response rate to the questionnaires was high, the results cannot be extrapolated to the entire population because a significant number of respiratory therapists worked at the two institutions that were not part of the study.

Finally, the variability found in the responses stresses the necessity for education and training of physiotherapists and respiratory therapists involved in decision-making and implementation of ventilatory weaning so that the multidisciplinary team managing the critically ill patient can act based on the best evidence available.

CONCLUSION

The methods and measurement parameters of ventilatory weaning vary greatly. The most common method used by physiotherapists and respiratory therapists in Cali is continuous positive airway pressure with pressure support, and the weaning parameters most commonly used are the measured tidal volume and respiratory rate.

More research substantiating the techniques used in the process of ventilatory weaning is required.

RESUMEN

Objetivo: El destete temprano de la ventilación mecánica es uno de los objetivos primordiales en el manejo del paciente crítico. Existen diversas técnicas y parámetros de medida para realizarlo. El objetivo de esta investigación fue describir las prácticas del destete ventilatorio en unidades de cuidado intensivo adulto en la ciudad de Cali.

Métodos: Una encuesta de 32 preguntas; algunas de múltiple escogencia, que evaluaron las prácticas del destete, fue distribuida entre los fisioterapeutas y terapeutas respiratorios que trabajaban en unidades de cuidado intensivo, para ser respondida de forma anónima.

Resultados: La estrategia más frecuente para el registro de parámetros fue la combinación de presión positiva continua con presión de soporte (78%), con gran variabilidad en los niveles de presión, siendo el rango más frecuente de 6 a 8cmH_2O. Los parámetros de destete más registrados fueron: el volumen corriente (92,6%), la frecuencia respiratoria (93,3%) y la saturación de oxígeno (90,4%). El tiempo de espera más frecuente para el registro de los parámetros fue >15 minutos (40%). Las medidas se realizaron preferentemente con el *display* del ventilador.

Conclusion: Existe una gran variabilidad sobre los métodos y la medición de los parámetros de destete ventilatorio. El método más utilizado fue presión positiva continua en la vía aérea más presión de soporte y los parámetros de destete más usados fueron la medición del volumen corriente y la frecuencia respiratoria.

Palabras clave: Destete; Desconexión del ventilador/ métodos; Respiración artificial.

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