Failure of spontaneous breathing trials in weaning of mechanically ventilated patient

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List of abbreviations

Abbreviation	meaning
ALI	Acute Lung Injury
APRV	Airway Pressure Release Ventilation
ARDS	Acute Respiratory Distress Syndrome
ARF	Acute Respiratoy Failure
CINMA	Critical Illness NeuroMuscular Abnormalities
CMV	Continous Mandatory Ventilation
COPD	Chronic Obstructive Pulmonary Disease
CPAP	Continous Positive Airway Pressure
CROP	Compliance,Respiration,Oxygenation,Pressure
Crs	Respiratory System Compliance
CSV	Continous Spontanous Ventilation
EVT	Expiratory Tidal Volume
FIO2	Fraction of Inspired Oxygen
FR	Frequency of Respiration
FRC	Functional Residual Capacity
FVS	Full Ventilatory Support
HR	Heart Rate
IBW	Ideal Body Weight
ICU	Intensive Care Unit
I:E ratio	Inspiration :Expiration ratio
IMV	Intermittent Mandatory Ventilation
ITPs	Intra Thoracic Pressures
LV	Left Ventricle
MI	Myocardial Infarction
MIP	Maximum Inspiratory Pressure
MMV	Mandatory Minute Ventilation
PaCO2	Partial Pressure of arterial Carbon dioxide
P A/C	Pressure Assisted/Controlled
PAOP	Pulmonary Artey Occlusion Pressure
PAV	Proportional Assist Ventilation
PC-CMV	Pressure Controlled-Continous Mandatory Ventilation
PC-IMV	Pressure Controlled-Intermittent Mandatory Ventilation
PC-IRV	Pressure Controlled-Inverse Ratio Ventilation

Abbreviation	meaning
PEEP	Positive End Expiratory Pressure
PImax	maximum Inspiratory Pressure
PO2	Partial Pressure of arterial Oxygen
Pplat	Plateau Pressure
P SIMV	Pressure Synchoranized Intermittent Mandatory Ventilation
PSV	Pressure Support Ventilation
PVR	Pulmonary Vascular Resistence
RR	Respiratory Rate
RSBI	Rapid Shallow Breathing Index
SBT	Spontanous Breathing Trial
SIMV	Synchronized Intermittent Mandatory Ventilation
SVO2	mixed Venous Oxygen Saturation
Ti	inspiratory Time
TOE	Trial Of Extubation
V A/C	Volume Assisted/Controlled
VC	Volume Controlled
VC-CMV	Volume Controlled-Continous Mandatory Ventilation
VE	Minute Ventilation
VS	Volume Support
VT	Tidal Volume
WOB	Work Of Breathing
ZEEP	Zero End Expiratory Pressure

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Introduction

Mechanical ventilation can fully or partially replace spontaneous breathing. It is indicated for acute or chronic respiratory failure, which is defined as insufficient oxygenation, insufficient alveolar ventilation, or both. **(Courey and Hyzy, 2010).**

Mechanical ventilation should be considered early in the course of illness and should not be delayed until the need becomes emergent. Physiologic derangements and clinical findings can be helpful in assessing the severity of illness. However, the decision to initiate mechanical ventilation should be based upon clinical judgment that considers the entire clinical situation. **(Slutsky , 1993).**

Weaning is the process of decreasing ventilator support and allowing patients to assume a greater proportion of their ventilation. It may involve either an immediate shift from full ventilatory support to a period of breathing without assistance from the ventilator (i.e., a spontaneous breathing trial [SBT]) or a gradual reduction in the amount of ventilator support. **(Scott , 2012).**

The weaning process is a key element of mechanical ventilation, occupying up to 50% of its total duration. Based on the overall duration of weaning as well as the number of spontaneous breathing trials required to liberate a patient from the ventilator, weaning was categorized into three groups (simple, difficult and prolonged weaning).(**Funk et al., 2010).**

Spontaneous breathing trials is one of the strategies employed to wean or liberate patients from mechanical ventilation, the daily spontaneous breathing trial—a period of unassisted breathing during which the patient is observed for signs of respiratory failure.**(Ely et al., 1996).**

Spontaneous breathing trials can be conducted in several different ways, and the ability of the trial to identify patients who are ready to breathe without the assistance of the ventilator is consistent regardless of method.

Many patients will not pass a spontaneous breathing trial on their first attempt.**(Girard et al, 2008**

Aim of the work

The aim of this work is to study spontaneous breathing trials as a method of weaning of mechanically ventilated patient .

Overview of Mechanical Ventilation

* Introduction

Mechanical ventilation is a life support treatment. A mechanical ventilator is a machine that helps people breathe when they are not able to breathe enough on their own. The mechanical ventilator is also called a ventilator, respirator, or breathing machine. Most patients who need support from a ventilator because of a severe illness are cared for in a hospital's intensive care unit ***(Tobin, 2001).***

Although mechanical ventilation is a key component of intensive care, unfamiliar jargon and technical detail render it confusing and formidably difficult for many clinicians. The rapidity and complexity of change in this area of respiratory medicine in recent years adds to the problem. Most of the current literature and nearly all the controversy in mechanical ventilation apply to only a small fraction of the patients who are intubated and ventilated in acute care hospitals. This small fraction consists of those with severe respiratory failure due to acute diffuse lung injury—acute lung injury (ALI) or the acute respiratory distress syndrome (ARDS)—and also those with severe obstructive lung disease (COPD or asthma). For the other 80 or 90 percent of ventilated patients the issues are much less difficult ***(Pierson, 2004).***

A ventilator can be life saving, but its use also has risks. It also doesn't fix the primary disease or injury; it just helps support a patient until other treatments become effective. Doctors always try to help patients get off the ventilator at the earliest possible time. "Weaning" refers to the process of getting the patient off the ventilator. Some patients may be on a ventilator for only a few hours or days, while others may require the ventilator for longer. Some patients never improve enough to be taken off the ventilator completely ***(Tobin, 2008).***

***Technical aspects of mechanical ventilation**

A ventilator is simply a machine, a system of related elements designed to alter, transmit, and direct energy in a predetermined manner to perform useful work. We put energy into the ventilator in the form of electricity (energy =

volts x amps x time) or compressed gas (energy=pressure x volume). That energy is transmitted or transformed (by the ventilator's drive machine) in a predetermined manner (by the control circuit) to augment or replace the patient's muscles in performing the work of breathing ***(Chartburn, 2006).***

Muscle pressure is the imaginary transrespiratory pressure generated by the ventilatory muscles to expand the thoracic cage and the lungs. Muscle pressure is said to be imaginary because it does not directly measurable. Ventilator pressure is the transrespiratory pressure generated by the ventilator during inspiration. The combined muscle and ventilator pressure causes volume and flow to be delivered to the patient. Simply the patient's muscle effort increase lung volume by decreasing pressure relative to atmospheric pressure, whereas the ventilator increase lung volume by increasing pressure relative to atmospheric pressure. Total pressure results from the patient pulling gas into the lung and the ventilator pushing gas into the lung.***(Chatburn and Branson, 2009).***

Phases Variables

The interaction of a patient with a ventilator occurs essentially under two settings: the ventilator delivers a controlled breath, regardless of the patient's desire or delivery of ventilator support can be coordinated with patient effort. Over the last 25 years, increasing emphasis has been placed on ensuring patient synchrony with the ventilator. If the ventilator is to function in synchrony with the patient, it must respond rapidly to patient inspiratory effort without imposing considerable work or effort ***(Chatburn, 2006).***

A control variable is the primary variable that the ventilator manipulates to cause inspiration. There are only three variables that the ventilator can control: **pressure**, **volume**, and **flow**. Because only one of these variables can be the independent variable, the others are dependent variables. In other words, only one variable can be controlled at a time, a ventilator must function as either a pressure, volume, or flow controller. Time is implicit in the equation of motion and in some cases will serve as a control variable***(Chartburn and Volsko, 2009).***