Effect of Respiratory Muscles Training in Weaning of Mechanically Ventilated COPD Patients

Thesis

Submitted for partial fulfillment of the master degree of ***Chest Diseases and Tuberculosis***

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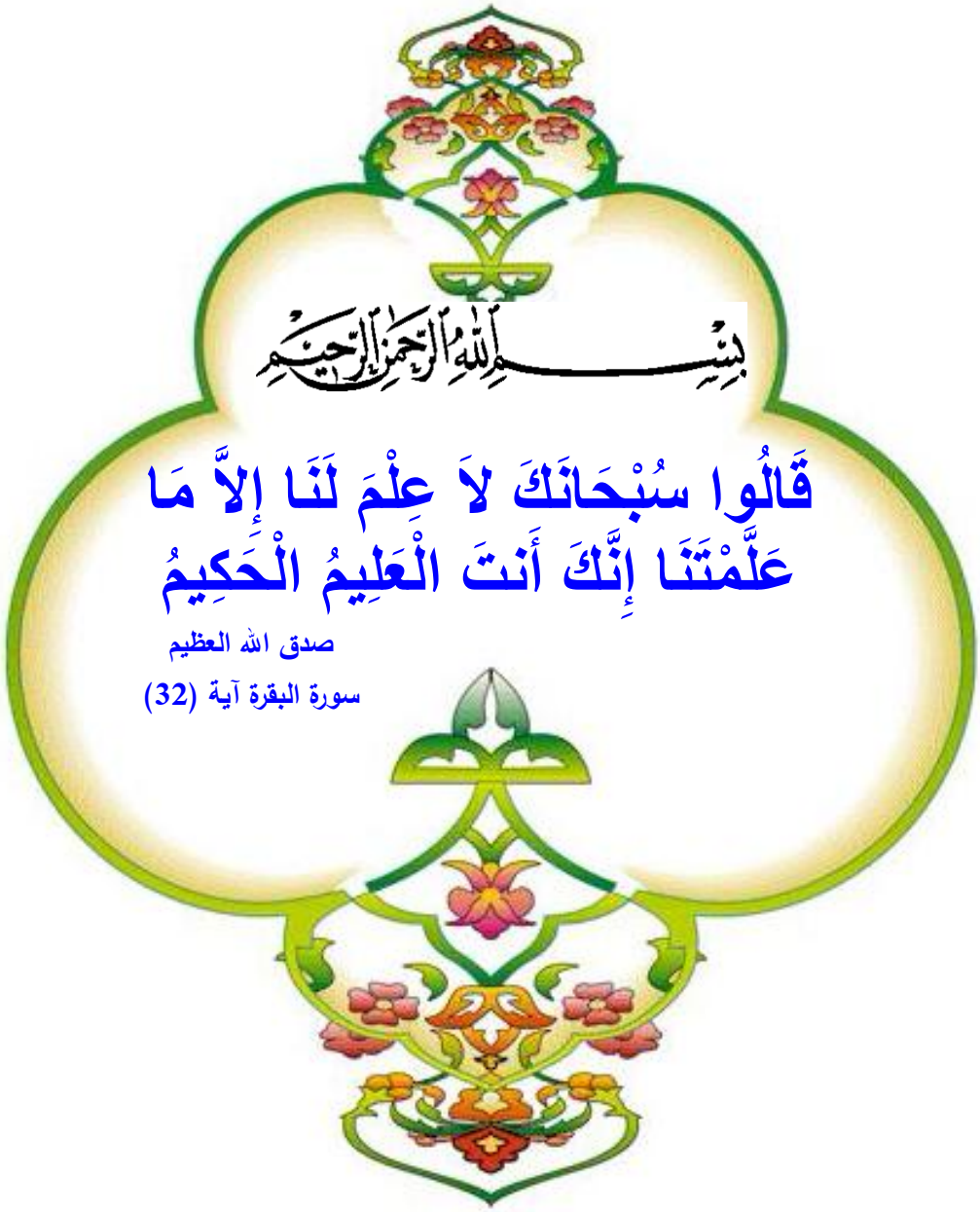
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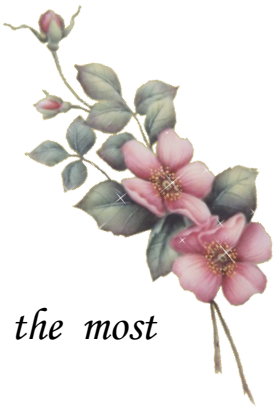
Acknowledgement



First and foremost, thanks to ***ALLAH****, the most merciful and the greatest beneficent.*

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Last but not least, I dedicate this work to my family, whom without their sincere emotional support, pushing me forward this work would not have ever been completed.

Ahmed Mohammed Abdulfattah Hashem

Contents

List of Abbreviations

A/C	:	Assist Control Ventilation
ARDS	:	Acute Respiratory Distress Syndrome
ARF	:	Acute Respiratory Failure
ASV	:	Adaptive Support Ventilation
ATC	:	Automatic Tube Compensation
BP	:	Blood Pressure
CINMA	:	Critical Illness Neuromuscular Abnormalities
CLT	:	Cuff Leak Test
CMV	:	Controlled Mechanical Ventilation
COPD	:	Chronic Obstructive Pulmonary Disease
CPAP	:	Continuous Positive Airway Pressure
CROP	:	Compliance, Rate, Oxygenation and Maximal pressure integrated index
Crs	:	respiratory system compliance
ECG	:	Electrocardiography
ETT	:	Endotracheal Tube
f R	:	Respiratory Frequency
FIO_2	:	Fraction of Inspired Oxygen
FRC	:	Functional Residual Capacity
GCS	:	Glasgow Coma Scale
GOLD	:	Global Initiative For Chronic Obstructive Pulmonary Disease
Hb	:	Haemoglobin
ICU	:	Intensive Care Unit
IMT	:	Inspiratory muscle training
IMV	:	Intermittent Mandatory Ventilation
MIP	:	Maximal Inspiratory Pressure
MVV	:	Maximal Voluntary Ventilation
NAV	:	Neurally Adjusted Ventilatory Assist

List of Abbreviations (Cont.)

NIV	:	Non-Invasive Ventilation
NMD	:	Neuromuscular Disease
$P_{0.1}$	:	Airway Occlusion Pressure
PA-aO_2	:	Alveolar - Arterial Oxygen Tension Difference
$PaCo_2$	:	Partial Pressure of Carbon dioxide in the arterial blood
PAO_2	:	Alveolar Oxygen Tension
PAV	:	Proportional Assist Ventilation
Pdi max	:	Maximal transdiaphragmatic pressure
Pdi	:	Mean transdiaphragmatic pressure
PEEP	:	Positive End Expiratory Pressure
PEEPi	:	Intrinsic Positive End Expiratory Pressure
PO_2	:	Partial Pressure of Oxygen in the arterial blood
PSV	:	Pressure Support Ventilation
RSBI	:	Rapid Shallow Breathing Index
SaO_2	:	Hemoglobin Saturation with Oxygen
SBT	:	Spontaneous Breathing Trial
SIMV	:	Synchronized Intermittent Mandatory Ventilation
SVO_2	:	Mixed venous oxygen saturation
SWU	:	Specialized weaning units
TCD	:	Total Compartmental displacement
VC	:	Vital Capacity
VE	:	Minute Ventilation
VT	:	Tidal Volume
WOB	:	Work of Breathing

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Introduction

In intensive care, weaning is the term used for the process of withdrawal of mechanical ventilation to enable spontaneous breathing to be re-established. Inspiratory muscle weakness and reconditioning are common in patients receiving mechanical ventilation, especially that of prolonged duration and chronic obstructive pulmonary disease (COPD) patients. Inspiratory muscle training could limit or reverse these unhelpful sequelae and facilitate more rapid and successful weaning ***(Lisa et al., 2011)***.

Failure to wean from mechanical ventilation is a significant clinical and economic problem in 2003, approximately 30,000 patient's required mechanical ventilation (MV) support for more than 96 hours in the USA and the estimated cost of these episodes was $16 billion. The number of patients requiring long-term MV support is increasing five times as rapidly as the number of hospital admissions and many of these patients experience failure to wean.***(Daniel et al, 2011).***

Weaning failure resulting in prolonged ventilation is detrimental to the individual as it is associated with increased risk of respiratory muscle weakness, critical illness myopathy, nosocomial infection and airway trauma. Prolonged

mechanical ventilation is also associated with an increase in mortality, morbidity and intensive care unit (ICU) length of stay, as well as reduced functional status and quality of life. In addition prolonged mechanical ventilation is expensive, consuming a large fraction of hospital resources, with a healthcare burden that may continue after hospital discharge ***(Boles et al, 2007).***

Weakness or fatigue of the diaphragm and accessory muscles of inspiration is widely recognized as a cause of failure to wean from mechanical ventilation. Fatigue may be due to excessive load on the inspiratory muscles, which may result from increased airway resistance and/or reduced lung compliance. A reduction in the capacity of the respiratory muscle pump may also occur due to phrenic nerve injury, corticosteroids, endocrine or nutritional factors. There is increasing evidence to show mechanical ventilation itself may adversely affect the diaphragm's structure and function, which has been termed ventilator-induced diaphragmatic dysfunction. The combination of positive pressure ventilation and positive end-expiratory pressure may unload the diaphragm therefore subjecting it to changes in myofibrils length, which may account for its rapid atrophy. In addition, patients who undergo prolonged periods of ventilation demonstrate a decrease in

respiratory muscle endurance and are at risk of respiratory muscle fatigue ***(Choi et al, 2008).***

Criteria of weaning from mechanical ventilation:

Respiratory rate Less than 38 breaths/minute. Tidal volume 4-6 mL/kg. Minute ventilation 10-15 L/minute. Maximal inspiratory pressure -15 to -30cm H_2O. Rapid shallow breathing index (RSBI) 60-105. PaO_2/FiO_2 ratio >150-200. improving or normal appearing chest radiogram. Homodynamic stability without need for vasoactive drugs. conciousness and normal orientation. ability to initiate spontaneous breaths. pH > 7.25. arterial oxygen saturation >90% ***(Stawicki, 2007).***

Those unable to generate pressures of -20 cm H,O could not be successfully weaned because of respiratory muscle weakness ***(Thomas and Clanton , 1995).***

Pressure support ventilation will initially titrated at a level sufficient to achieve a respiratory rate of 20-30 breath/min and tidal volume more than 300ml ***(Tobin,2000)***.

Aim of the work

Assessment of the effect of respiratory muscles training in weaning of mechanically ventilated COPD patients admitted in respiratory ICU in Abassia chest hospital.

Chronic Obstructive Pulmonary Disease (COPD)

Definition:

IN 2011 Global Initiative For Chronic Obstructive Pulmonary disease (GOLD) defined chronic obstructive pulmonary disease (COPD) as a common preventable and treatable disease, is characterized by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles or gases. Exacerbation and co morbidities contribute to the overall severity in individual patients.

Burden of (COPD)

Epidemiology:

COPD is a leading cause of morbidity and mortality worldwide and results in an economic and social burden that is both substantial and increasing. COPD prevalence, morbidity, and mortality vary across countries and across different groups within countries but, in general, are directly related to the prevalence of tobacco smoking although in many countries, air pollution resulting from the burning of wood and other biomass fuels has also been identified as a COPD risk factor. The prevalence and burden of COPD are projected to increase in the coming decades due to continued exposure to COPD risk factors and the changing age structure of the world's population ***(Global Initiative for Chronic Obstructive Lung Disease, 2011).***