Hanaa Mohammed

بسم اللّه الرحمن الرحيم

مركز الشبكات وتكنولوجيا المعلومات

قسم التوثيق الإلكتروني

Safaa Mahmoud

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم باللّه العظيم أن المادة التي تم توثيقها وتسجيلها

علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

The Use of Lung Ultrasound in the Diagnosis of Weaning-Induced Pulmonary Oedema in Mechanically Ventilated Patients

Thesis

Submitted For Partial Fulfillment of Master Degree in Master Degree in Intensive Care

By

Mohammed Atef Mohammed Abd El-Gileel

MBBCh, 2013, Faculty of Medicine, Alexandria University

Under supervision of

Prof. Dr. Diaa Abd El-khalek Akl

Professor of Anesthesia, Intensive Care and Pain Management
Faculty of Medicine, Ain Shams University

Prof. Dr. Mona Refaat Hosny

Professor of Anesthesia, Intensive care and Pain management
Faculty of Medicine, Ain Shams University

Dr. Ahmed Abd El-dayem Abd El-hak

Lecturer of Anesthesia, Intensive Care and Pain Management
Faculty of Medicine, Ain Shams University

Faculty of Medicine
Ain Shams University
2021

سورة البقرة الآية: ٣٢

Acknowledgment

First and foremost, I feel always indebted to **ALLAH**, *the Most Kind and Most Merciful.*

I'd like to express my respectful thanks and profound gratitude to **Prof. Dr. Diaa Abd El-khalek Akl,** *Professor of Anesthesia, Intensive Care and Pain Management, Faculty of Medicine, Ain Shams University for his keen guidance, kind supervision, valuable advice and continuous encouragement, which made possible the completion of this work.*

I am also delighted to express my deepest gratitude and thanks to **Prof. Dr. Mona Refaat Hosny,** *Professor of Anesthesia, Intensive Care and Pain Management, Faculty of Medicine, Ain Shams University, for her kind care, continuous supervision, valuable instructions, constant help and great assistance throughout this work.*

I am deeply thankful to **Dr. Ahmed Abd El-dayem Abd El-hak,** *Lecturer of Anesthesia, Intensive Care and Pain Management, Faculty of Medicine, Ain Shams University, for his great help, active participation and guidance.*

Mohammed Atef

List of Contents

List of Abbreviations

Abb.	Full term
A/C	Assisted control ventilation
ACE	Angiotensin-converting enzyme
AGNB	Aerobic gram negative bacteria
ARDS	Acute respiratory distress syndrome
ATP	Adenosine triphosphate
BAL	Broncho-alveolar lavage
BNP	B-type natriuretic peptide
CFU	Colony forming unit
C_{LT}	Compliance of the lungs and thorax
CNS	Central nervous system
COPD	Chronic obstructive pulmonary disease
CPAP	Continuous positive airway pressure
CPIS	Clinical pulmonary infection score
DVT	Deep venous thrombosis
ECMO	Extra-corporeal membrane oxygenation
EELV	End expiratory lung volume
EILV	End inspiratory lung volume
EVLW	Extravascular lung water
GIT	Gastrointestinal tract
H2RA	Histamine 2 receptor antagonist
HAP	Hospital acquired pneumonia
HFOV	High frequency oscillatory ventilation
IE	Inspiratory to expiratory ratio
ICU	Intensive care unit
ITP	Intra thoracic pressure
IVAC	Infection - related ventilator - associated complications
LV	Left ventricle
LVEDP	Left ventricular end-diastolic pressure

List of Abbreviations Cont...

Abb.	Full term
MDR	Multidrug resistant
MERS	Middle East respiratory syndrome
MRSA	Methicillin resistant staphylococcus aureus
NIV	Noninvasive ventilation
PA	Pulmonary artery
PaCO2	Carbon dioxide arterial pressure
P_{Alv}	Alveolar pressure
PaO2	Oxygen arterial pressure
PAOP	Pulmonary artery occlusion pressure
P_{AP}	Pulmonary artery pressure
PCT	Procalcitonin
PCV	Pressure controlled ventilation
P_{Dmax}	Maximal voluntary Trans-diaphragmatic pressure
P_{Dtidal}	Trans-diaphragmatic pressure change during inspiration
PEEP	Positive end expiratory pressure
PLR	Passive leg raising
P_{MCF}	filling pressure
P_{MSF}	Mean systemic filling pressure
P_{PL}	Pleural pressure
P_{PV}	Pulmonary venous pressure
P_{RA}	Right atrial pressure
PSB	Protected specimen brush
PSV	Pressure support ventilation
PTI	Pressure time index
R_{aw}	Airway resistance
RR	Respiratory rate
RV	Right ventricle

List of Abbreviations Cont...

Abb.	Full term
RVR	Resistance of venous return
SARS	Severe acute respiratory syndrome
SAT	Spontaneous awakening trials
SBT	Spontaneous breathing trial
$ScvO_2$	Central venous oxygen saturation
SDD	Selective decontamination of digestive tract
SIMV	Synchronized Intermittent Mandatory Ventilation
SvO_2	Mixed venous oxygen saturation
TDI	Tissue Doppler imaging
T_i/T_{tot}	Fraction of the ventilator cycle spent in inspiration
Ti	Inspiratory time
TP	Trans pulmonary
TTE	Transthoracic echocardiography
V	Relaxation volume
V_A	Alveolar ventilation
VAC	Ventilator associated conditions
VAE	Ventilator associated events
VAP	Ventilator associated pneumonia
V_{CO2}	Carbon dioxide production
VCV	Volume controlled ventilation
V_D	Dead space ventilation.
VIDD	Ventilator-induced diaphragm dysfunction
VILI	Ventilator induced lung injury
V_{O2}	Oxygen consumption
VT	Tidal volume
WOB	Work of breathing
XDR	Extremely drug resistant

List of Tables

List of Tables Cont...

List of Figures

List of Figures Cont...

Introduction

The development of modern medicine has imposed a new approach both in anesthesiology and in intensive care. Key features of the critically ill patient are severe respiratory, cardiovascular or neurological derangements, often in combination, reflected in abnormal physiological observations. All these changes converge towards the establishment of pulmonary or extra-pulmonary respiratory failure requiring mechanical ventilatory support. In the current conception, mechanical ventilation does not represent a curative method for respiratory pathology, however, it represents a bridge therapy ensuring the rest and preservation of respiratory muscles, improves gas exchange and assists in maintaining a normal pH until the recovery of the patient [(1)].

Oxygen delivery impairment and hypoxia were the most important targets in respiratory management for decades. Mechanical ventilation supports gas exchange, maintains acid-base balance, and alleviates the work of breathing associated with an acute pulmonary or systemic injury, without being considered a unimodal treatment for acute respiratory failure[(1)]. It represents only a small part of a complex life support strategy related to etiological treatment, sedation management,

minimizing complications, avoiding ventilator associated pneumonia and sarcopenia

An important goal in the early phase of mechanical ventilation is adequate sedation with or without muscular blockade, to avoid "fighting with the ventilator"; lung-protective ventilation can be aided by using neuromuscular blockers[1]. Patient-ventilator desynchronizes were frequently associated with poor outcomes [2].

Prolonged mechanical ventilation injures the respiratory muscles and the diaphragm. Ventilator-induced diaphragm dysfunction (VIDD) is a pathological condition that occurs in critically ill patients secondary to diaphragm inactivity, leading to its rapid atrophy and contractile dysfunction [1, 3]. VIDD occurrence in mechanical ventilated patients represents a challenge for intensivists, due to difficulties related to weaning from the ventilator. After years of research in this field, muscle protective ventilation strategies represents the best choice for maintaining optimal levels of inspiratory muscle effort and preventing patient-ventilator desynchronizes [1, 3].