بسم الله الرحمن الرحيم

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تم رفع هذه الرسالة بواسطة / مني مغربي أحمد

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى مسئولية عن محتوى هذه الرسالة.

ملاحظات: لا يوجد

Ultrasonographic Evaluation of Diaphragmatic Thickness Versus Excursion as a Predictor of Weaning in Mechanically Ventilated Patients

Thesis

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قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم الحكيم

صدق الله العظيم

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List of Abbreviations

Abb.	Full term
ALI	Acute lung injury
ALP	Autophagy-lysosomal pathway
BMI	Body mass index
CO2	Carbon dioxide
Creat	Creatinine
CRP	C-reactive protein
CT	Computed tomography
CVP	Central venous pressure
DD	Diaphragmatic dysfunction
DE	Diaphragmatic excursion
DM	Diabetes mellitus
DT	Diaphragmatic thickness
DTF	Diaphragmatic thickness fraction
ECG	Electrocardiography
FG	Failure group
HTN	Hypertension
ICU	Intensive care unit
K	Potassium
MAP	Mean arterial pressure
MRI	Magnetic resonance imaging
MV	Mechanical ventilation
Na	Sodium
NDD	Non diaphragmatic dysfunction
NIBP	Noninvasive blood pressure

List of Abbreviations Cont...

Abb.	Full term
PS	Pressure support
ROS	Reactive oxygen species
RR	Respiratory rate
RSBI	Rapid-shallow breathing index
RV	Residual volume
SBT	Spontaneous breathing trial
SGOT	Serum glutamic oxaloacetic transaminase
SGPT	Serum Glutamic Pyruvic Transaminase
TDI	Diaphragmatic thickness
TLC	Total lung capacity
UPS	Ubiquitin–proteasome system
US	Ultrasound
VAP	Ventilator-associated pneumonia
VIDD	Ventilator-induced diaphragmatic dysfunction
WBCs	White blood cells
ZAP	Zone of apposition
ZOA	Zone of apposition

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INTRODUCTION

The number of patients requiring mechanical ventilation has increased worldwide and the proportion of patients requiring prolonged mechanical ventilation has increased concomitantly ***(Shin et al., 2017).***

VAP is estimated to occur in 9-27% of all mechanically ventilated patients with highest risk being early in the course of hospitalization ***(Kalanuria et al., 2014).***

Timing is critical when determining if a patient can be successfully extubated. Premature discontinuation of mechanical ventilation may lead to increased cardiovascular and respiratory stress, CO2 retention and hypoxemia with up to 25% of patients requiring reinstitution of ventilator support. Unnecessary delays in weaning from mechanical ventilation also can be deleterious ***(Chittawatanarat et al., 2018).***

Complications such as ventilator associated pneumonia and ventilator induced diaphragm atrophycan be seen with short periods of mechanical ventilation thereby prolonging mechanical ventilation ***(DiNino et al., 2014).***

Attempts have been ongoing to devise tools that can accurately determine the ideal timing of extubation. Among these tools are measuring the minute ventilation, maximal inspiratory pressure, and tracheal occlusion pressure at 0.1s with variable degrees of success. Another predictive tool, the rapid-shallow breathing index (RSBI) has gained popularity as a more accurate index in predicting success of extubation, but this ability is limited in patients weaned through pressure support (PS) ***(Magalhaes et al., 2018).***

Preserved diaphragmatic function is very important during weaning process to regain spontaneous breathing process with the usual methods for diaphragmatic assessment like fluoroscopy, phrenic nerve conduction, and trans-diaphragmatic pressure measurements show a lot of limitations and disadvantages especially inside the ICU due to ionizing radiation exposure, not widely available methods and the need for patient transportation ***(Osman et al., 2017).***

Ultrasound has emerged as a cheap, widely available, free-from-radiation, bed-side tool for assessment of the characteristics of diaphragmatic movement, such as amplitude, force, and velocity of contraction, special patterns of motion, and changes in diaphragmatic thickness (TDI) during inspiration. Many of these parameters have been studied as a guidance in predicting the course of weaning from MV ***(Elbatran et al., 2020)***

Direct measures of diaphragm function as predictors of extubation success or failure have not been extensively evaluated. Motion of the diaphragm dome has been assessed using M mode ultrasound, and found to be useful in predicting extubation outcomes; however, imaging the dome does not directly visualize the diaphragm muscle itself and factors such as breath size, impedance of neighbouring structures, abdominal compliance, rib cage or abdominal muscle activity, and ascites will affect regional and global diaphragm motion of the tendinous dome of the diaphragm. This drawback can be circumvented by ultrasonography of the diaphragm in the zone of apposition (ZAP) using B-mode transducer as this approach allows for direct visualisation of the diaphragm muscle and assessment of its activity ***(DiNino et al., 2014).***

AIM OF THE WORK

The aim of this study was to assess the efficiency of diaphragm thickness and/or diaphragm excursion as measured by means of ultrasound as a predictor of extubation in mechanically ventilated patients in ICU.

REVIEW OF LITERATURE

I- Diaphragm

- ***Diaphragm anatomy:***

In adults, the diaphragm represents less than 0.5% of body weight, but it is the most important muscle in the human body after the heart. It is composed of a central non contractile tendon and two major muscular portions: the costal and crural diaphragm. An additional minor muscular portion is the sternal part of the diaphragm ***(Baaj et al., 2014).***

- ***Diaphragm Innervations:***

Innervation of the diaphragm is provided by the right and left phrenic nerves, which originate from cervical nerves C3–C5 and facilitate both sensory and motor function ***(Verlinden et al., 2018).***

The paired phrenic nerves are located posteriorly in the lateral compartment of the neck and travel anteriorly as they course through the thorax. The phrenic nerves run along the anterior surface of the pericardium before they reach the diaphragm, where they arborize on the superior and inferior surfaces ***(Laura et al., 2012).***

- ***Diaphragmatic dysfunction:***

Dysfunction can be classified as paralysis or weakness. It is often initially suggested by diaphragmatic elevation at chest radiography. The right hemidiaphragm is normally slightly higher than the left hemidiaphragm. In addition, the anterior and medial portions of the diaphragm are normally higher than the posterior and lateral portions ***(Laura et al., 2012).***

These findings should not be misinterpreted as signs of dysfunction. Elevation caused by paralysis or weakness typically involves an entire hemidiaphragm. In diaphragmatic dysfunction, the impaired hemidiaphragm may be thinned by atrophy of the muscle ***(Ricoy et al., 2019).***

In contrast to unilateral impairment, bilateral diaphragmatic dysfunction is usually symptomatic and may lead to ventilatory failure. In this situation, the accessory muscles of respiration must assume all the work of breathing ***(Aliverti et al., 2020).***

a- <u>Etiology</u>

There are many causes of weakness and paralysis of the diaphragm; these involve the entire neuromuscular axis. Central nervous system causes of diaphragmatic dysfunction include cervical spine trauma, degeneration and less commonly cervical spinal cord disease such as transverse myelitis, syrinx, and