Lung Ultrasonography as Tool for Follow Up of Ventilated Neonates for Prediction of Weaning Readiness

Thesis

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بسم الله الرحمن الرحيم

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم الحكيم

صدق الله العظيم

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Ayah Mohamed Zaki Shabana

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List of Abbreviations

Abb.	Full term
AIS	*Alveolar Interstitial Syndrome*
ARDS	*Acute Respiratory Distress Syndrome*
AUC	*Area Under The Curve*
BLUE	*Bedside Lung Ultrasound in Emergency*
BPD	*Broncho-Pulmonary Dysplasia*
BPM	*Breath Per Minute*
BW	*Birth Weight*
CPAP	*Continuous Positive Airway Pressure*
CRP	*C- Reactive Protein*
CXR	*Chest X-Ray*
DTF	*Diaphragmatic Thickening Fraction*
ETT	*Endotracheal Tube*
F group	*Failure Extubation Group*
FALLS	*Fluid Administration Limited by Lung Sonogrophy*
FiO_2	*Fractioned Inspired Oxygen,*
HRCi	*Heart Rate Characteristics Index*
IQR	*Inter-Quartile Range*
IT	*Inspiratory Time*
IVH	*Interventricular Hemorrhage*
Lt D.Excursion	*Left Diaphragmatic Excursion,*
Lt D.Exp. Thick.	*Left Diaphragm Expiration Thickness*
Lt D.Insp. Thick	*Left Diaphragm Inspiration Thickness*
Lt DTF	*Left Diaphragmatic Thickening Fraction*
LUS	*Lung Ultrasound*
MABP	*Mean Arterial Blood Pressure*
MAP	*Mean Airway Pressure*
MAS	*Meconium Aspiration Syndrome*
NEC	*Necrotizing Enterocolitis*
NIPPV	*Non Invasive Positive Pressure Ventilation*
NIV	*Non Invasive Ventilation*
NPV	*Negative Predictive Value*

List of Abbreviations cont...

Abb.	Full term
PCO_2	*Partial Pressure Carbon Dioxide*
PDA	*Patent Ductus Arteriosis*
PEEP	*Positive End Expiratory Pressure,*
PIP	*Positive Inspiratory Pressure,*
PO_2	*Partial Pressure Of Oxygen*
POC-LUS	*Point-Of-Care Lung Ultrasound*
PPV	*Positive Predictive Value*
PSV	*Pressure Support Ventilation*
PTV	*Patient Triggered Ventilation*
PvCO2	*Partial Pressure Venous Carbon Dioxide,*
RDS	*Respiratory Distress Syndrome*
ROC curve	*Receiver Operating Characteristic Curve*
RR	*Respiratory Rate*
RSBI	*Rapid Shallow Breathing Index*
Rt D.Excursion	*Right Diaphragmatic Excursion*
Rt D.Exp. Thick	*Right Diaphragm Expiration Thicknes.*
Rt D.Insp. Thick	*Right Diaphragm Inspiration Thickness*
Rt DTF	*Right Diaphragmatic Thickening Fraction*
S group	*Successful Extubation Group*
SAFE	*Sonographic Algorithm For Life Threatening Emergencies*
SBT	*Spontaneous Breathing Trials*
TTN	*Transient Tachypnea Of Newborn*
VAP	*Ventilator Associated Pneumonia*
VIDD	*Ventilator-Induced Diaphragmatic Dysfunction*

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INTRODUCTION

Despite many advances in mechanical ventilation and respiratory support, neonatologists lack objective tool to help in decision making for timely weaning ***(Singh et al., 2018).***

Early weaning from ventilation is the key to prevent ventilator-induced lung injury and the long-term complications of prolonged mechanical ventilation in neonates. No universally validated nor accepted measure occurs to determine readiness for weaning. Decisions to extubate are often taken subjectively based on clinical judgment, which lead to extreme variations in extubation practice and adverse effects such as extubation failures, airway injury and increased risk for atelectotrauma ***(Singh et al., 2018).***

Point-of-care sonography definition is an ultrasound examination that the clinician perform and interpret at the bedside ***(El-Halaby et al., 2016).*** As ***Moore and Coople (2011)*** speculated the theme of the "ultrasound stethoscope" is moving fast from theory to reality.

Lung ultrasound (LUS) can detect reduction in its parenchymal aeration and decide whether it is of respiratory, cardiac, or diaphragmatic origin. This reduction is quantified through lung ultrasound score, a scale which values range from 0 to 36 points, calculated from the sum of the grades assigned to different aeration patterns observed in every examined area of the lung ***(Llamas-Álvarez et al., 2017).***

The use of ultrasound in adults for visualization of the diaphragm is well established. In the last 15 years, several indices of diaphragm function have been established for patients on mechanical ventilation to evaluate diaphragmatic dysfunction, to track changes in diaphragmatic function and thickness over time, and to assess if these indices are useful to predict successful weaning from mechanical ventilation ***(Turton et al., 2019).***

Ultrasound is used for bedside evaluation of diaphragmatic excursion and thickness in children, which can help pediatricians and intensivists verify a normal moving diaphragm ***(El-Halaby et al., 2016).***

AIM OF THE WORK

The objectives of this study were:

1. To determine whether lung ultrasound score and diaphragm ultrasound parameters can be used as a predictor for extubation success in neonates

2. To compare between lung and diaphragm ultrasound versus spontaneous breathing trial to predict extubation failure.