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The Role of Ultrasonography in Respiratory Intensive Care Unit

An Essay

Submitted for partial fulfillment of Master Degree in General Intensive Care

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بسم الله الرحمن الرحيم

﴿قَالُواْ سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ﴾

صدق الله العظيم
سورة البقرة
آية رقم: (٣٢)

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List of Abbreviations

ACCP	**American College of Chest Physicians .**
AHRQ	Agency for Healthcare Research and Quality.
AIDS	**Acquired Immune Deficiency Syndrome.**
AQPS	**Aquaporin's.**
ARDS	**Acute Respiratory Distress Syndrome.**
C A	Carotid Artery
CBC	**Complete blood count.**
C I	Confidence Interval.
CmH2O	**Centimeter Water.**
COPD	**Chronic Obstructive Pulmonary Disease**
CT	**Computed Tomography.**
CVC	Central Venous Catheter.
CXR	**Chest x ray.**
ESR	**Erythrocyte sedimentation rate.**
EVLW	**Extra vascular lung water.**
FEV1	**Forced expiratory volume in 1st second.**
FNA	Fine Neddle Aspiration.
F V	Femoral Vein.
FVC	**Forced Vital Capacity.**
G/dL	**Gram per deciliter.**
HIV	**Human Immune Virus.**
ICU	**Intensive Care unit.**
I JV	Internal Jugular Vein
LDH	**Lactic acid dehydrogenase.**
M P E	**Malignant pleural effusion.**
MHz	**Megahertz.**
Ml	**Milliliter.**
Ml/kg	**Milliliter per Kilogram.**
M- mode	**M-mode.**
MRI	**Magnetic Resonance Imaging.**
NICE	National Institute for Clinical Excellence.
P-A	**Postero- Anterior.**
Pao2	**Partial pressure of oxygen in arterial blood.**
PICC	**Peripherally inserted central catheters.**
RICU	**Respiratory Intensive Care unit .**
R R	Relative Risk.
S C V	Subclavian Vein.
TB	**Tuberculosis.**
TLC	**Total lung capacity.**
TNM	**Tumor-Lymph Node-Metastasis.**
US	**Ultrasound.**

U S A	United States of America.
Ve-	**Negative.**
Ve+	**Positive.**
VEGF	**Vascular endothelial growth factor.**

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Acknowledgment

*First great thanks to "**Allah**" who gave me the power to complete this work , Without his care nothing could be achieved,*

I would like to express my deepest thanks, great respect and supreme gratitude to

***Prof. Dr. Hatem Said Abdel Hamid**,*

Professor of Anesthesia, Intensive Care and Pain Management Faculty of Medicine- Ain Shams University , for his constant and continuous encouragement and unlimited help. He gave me a lot of his time,

I would like to express deepest and most sincere thanks and gratefulness to

***Dr. Neveen Gerges Fahmi**,*

Ass. Professor of Anesthesia, Intensive Care and Pain Management Faculty of Medicine- Ain Shams University, for her generous support and advice throughout this work,

I would like to express my deepest thanks, great respect and supreme gratitude to

***Dr. Mayada Ahmad Ibrahim**,*

Lecturer of Anesthesia, Intensive Care and Pain Management Faculty of Medicine- Ain Shams University, for her constant and continuous encouragement and unlimited help. she gave me a lot of her time,

*I wish also to express my respective gratitude and great appreciation to **my Professors, my colleagues** in the Department of Anesthesia, Intensive Care and Pain Management Faculty of Medicine- Ain Shams University, for their great efforts, valuable advices and continuous help throughout this work.*

Introduction

Modern lung ultrasound (U.S) is mainly applied not only in critical care, emergency medicine, and trauma surgery, but also in pulmonary and internal medicine. Many international authors have produced several studies on the application of lung ultrasound in various settings ***(Elbarbary M,et al.,2010) .***

Management of critically ill patients requires imaging techniques, which are essential for optimizing diagnostic and therapeutic procedures. The diagnosis and management of pneumothorax, pleural effusion and lung consolidation all require direct visualization of the lungs. To date, chest imaging has relied on bedside chest radiography and lung computed tomography (CT). In the Intensive Care Unit (ICU), bedside chest radiography is routinely performed on a daily basis and is considered as a reference for assessing lung status in critically ill patients. Limited diagnostic performance and efficacy of bedside portable chest radiography have been reported in several previous studies ***(Bélaïd Bouhemad1,et al.,2007).***

Although lung CT is now considered as the gold standard for the diagnosis and guiding therapeutic procedures in critically ill patients but to perform a lung CT scan requires transportation to the department of radiology, a risky procedure necessitating the presence of trained physicians and sophisticated cardio-respiratory monitoring. In addition helical multi-detector row CT exposes the patient to asubstantial radiation dose, which limits the repeatability of the procedure ***(MayoJR,et al.,2003).***

Recently, chest ultrasound can be used easily at the bedside to assess initial lung morphology in critically ill patients ***(Lichtenstein DA and Meziere.2005).***

Aim of the work

The aim of this study is to assess the value of chest ultrasonography in Respiratory Intensive Care Unit (R.I.C.U).

Chapter1
Chest ultrasonography

Background:

Until recently, the use of lung ultrasound (US) as a diagnostic tool was considered unjustifiable, on the grounds of conventional knowledge that lungs are filled with air, and that the US beam cannot normally pass through air-filled structures, this theory has been rejected and lung US is currently considered the fastest, non-invasive and sophisticated diagnostic approach in the Intensive Care Unit (ICU) and in other in-patient settings, It is associated with minimal complications and has low cost ***(Islam and Tonn, 2009).***

Ultrasound examination is a valuable method in diagnosis of various thoracic conditions including pleural or pericardial effusion, empyema, pneumothorax, pulmonary embolism, pneumonia and primary or metastatic lung cancer, ultrasound guidance during thoracocentesis or tube thoracostomy assures minimal complications, It can also assist with staging of lung cancer by defining the extension of thoracic wall invasion or by real-time ultrasound-guided biopsy of a supraclavicular lymph node, thoracic ultrasound is mostly used to locate a target organ or a disease-specific condition and is often used as a complement to other imaging such as chest radiograph, computed tomogram or magnetic resonance imaging ***(Islam and Tonn, 2009).***

Ultrasound is helpful to locate the best site for chest tube placement or the insertion of a trocar prior to thoracoscopy or to drain a complicated pleural effusion,also it can be used to localize parenchymal consolidation, tumor,chest wall,pleural masses or lymph nodes,intrathoracic invasion of tumor masses in addition to cardiac function may also be detected easily ***(Mathis et al., 2010).***

Advantages:

Ultrasound involves no ionizing radiation or nephrotoxic contrast dye exposure. As opposed to other imaging techniques such as computed tomogram (CT), magnetic resonance imaging (MRI) or even simple radiographs, ultrasound examination may be performed anywhere and on any critically ill patient as a preliminary examination or to further investigate an existing finding noted on other radiographic imaging ***(Mathis et al., 2010).***

Thoracic ultrasound has several advantages over traditional radiographic imaging of the pleura, including absence of radiation, better portability, real-time imaging, and the ability to perform dynamic imaging, also ultrasound is substantially better at determining the location of pleural fluid than bedside physical examination and, in experienced hands, is associated with a lower rate of complications during thoracentesis, in addition, ultrasound guidance increases the likelihood of a successful tap compared to using physical examination for guidance, as an example, in a study of 17 patients who had a failed thoracentesis without ultrasound imaging, thoracentesis with ultrasound was successful in 15 ***(Weingardt et al.,1994)***.

Ultrasound examination of the pleura is more sensitive than a plain chest radiograph at detecting the presence of pleural fluid and differentiating pleural fluid from lung consolidation, compared with computed tomography (CT), pleural ultrasound has a 95 percent sensitivity for detection of pleural disease in patients with a “white out” on plain chest radiograph, but is slightly less sensitive in detecting small amounts of fluid ***(Yu et al., 1993).***

Compared with CT scanning, ultrasound may better differentiate pleural fluid from pleural thickening and pleural masses ***(Feller and Kopman, 2006).***