Impact of Integrated Use of Diagnostic Ultrasound Examinations in Respiratory Intensive Care Units

Thesis

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By

Mohammed Fathi Ahmed Ahmed El Bagalaty

M.Sc Ain Shams University

Supervised by

Prof. Taher Abd El Hamid El Naggar

Professor of Chest Diseases

Faculty of Medicine - Ain Shams University

Prof. Ashraf Mokhtar Madkour

Professor of Chest Diseases

Faculty of Medicine - Ain Shams University

Assist Prof. Nehad Mohammed Osman

Assistant Professor of Chest Diseases

Faculty of Medicine - Ain Shams University

Assist Prof. Ashraf Adel Gomaa

Assistant Professor of chest Diseases

Faculty of Medicine - Ain Shams University

Assist Prof. Ahmed Mohamed Osman

Assistant Professor of Radiology

Faculty of Medicine - Ain Shams University

Faculty of Medicine

Ain Shams University

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Mohammed Fathi Ahmed Ahmed El Bagalaty

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List of Abbreviations

ALI	**:**	Acute lung injury
ARDS	**:**	Acute respiratory distress syndrome
DVT	**:**	Deep venous thrombosis
EF	**:**	Ejection fraction
ER	**:**	Emergency room
ICU	**:**	Intensive care unit
IEC	**:**	Infective endocarditis
IJV	**:**	Internal jugular vein
LA	**:**	Left atrium
LV	**:**	Left ventricle
M/AVD	**:**	Mitral/Aortic valve disease
MS	**:**	Mitral stenosis
MPG	**:**	Mean pressure gradient
MVA	**:**	Mitral valve area
OHVS	**:**	Obesity hypoventilation syndrome
OSA	**:**	Obstructive sleep apnea
PHTN	**:**	Pulmonary hypertension
PHT	**:**	Pressure half time
PLAPS	**:**	Posterolateral alveolar and/or pleural syndrome
POCUS	**:**	Point-of-care ultrasonography
PPHTN	**:**	Primary pulmonary hypertension
PVC	**:**	Pulmonary venous congestion

RA	**:**	Right atrium
RV	**:**	Right ventricle
TB	**:**	Tuberculosis
TR	**:**	Tricuspid regurgitation
WBU	**:**	Whole-Body ultrasound

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Introduction

Rapid, accurate diagnosis and treatment are crucial and problematic for patients admitted to an intensive care unit (ICU). The inaccuracy of physical examination at admission to the ICU has been extensively reported.[1]

Different diagnostic imaging modalities have been developed, but most lack sensitivity, availability, and portability. Diagnostic accuracy can be increased when a brief echocardiographic study is added to extend the physical examination.[2]

Ultrasonography is an essential imaging modality in the ICU used to diagnose and guide the treatment of cardiopulmonary failure. Critical care ultrasonography requires that all image acquisition, image interpretation, and clinical applications of ultrasonography are personally performed by the critical care clinician at the point of care and that the information obtained is combined with the history, physical, and laboratory information. This allows for immediate integration of ultrasonography results with the history, physical examination, and laboratory results, yielding a powerful clinical synergy.[3]

Point Of Care Ultrasound (POCUS) is the real-time application of ultrasound on various anatomic parts or body organs for diagnostic or procedural purposes.[4]

POCUS in the hands of the clinician is a safe, rapid, non-invasive diagnostic technique, suitable for use at the bedside, that can help physicians to solve time-dependent focused clinical puzzles and greatly accelerate the differential diagnostic procedure. It is now utilized by health care professionals from nearly all specialties. [5]

The use of POCUS can immediately narrow differential diagnoses by building on the clinical information revealed by the traditional physical examination and refining clinical decision making for further management.[5]

Using POCUS to guide procedures has been found to reduce procedure-related complications, along with costs and lengths of stay associated with these complications. Despite several undisputed advantages of POCUS, barriers to implementation must be considered. [5]

Most importantly, the utility of POCUS depends on the experience and skills of the operator, which are affected by the availability of training and the cost of ultrasound devices. Additional system barriers include availability of

templates for documentation, electronic storage for image archiving, and policies and procedures for quality assurance and billing. Integration of POCUS into the practice of internal medicine and ICU is an inevitable change that will empower internists and intensivists to improve the care of their patients at the bedside.[5]

The role of the point of care ultrasonographer is not to replace expert level consultation by radiology or cardiology services, but to recognize the need for these services when the critical care team determines that consultative service is required.[3]

The standard **Point of care Whole-Body ultrasound (WBU)** examination includes thoracic, cardiac, limited abdominal, and an evaluation for DVT. Other elements of ultrasonography are used when clinically indicated ***Figure(1)*** .[3]

Laursen et al used a point-of-care multiorgan approach to guide management of patients with respiratory symptoms and compared this with standard of care to see which approach led to a more accurate diagnosis. They found that the combination of cardiac, thoracic, and diagnostic vascular ultrasonography led to accurate diagnosis in their patients.[6]

In addition, using this WBU approach leads to a decrease in overall utilization of other testing and therefore a decrease in cost. [7]

NO particular order is recommended for the examination because this may be driven by the clinical presentation. For example, if the patient presents with acute respiratory failure, there is logic to starting with the lungs. Conversely, with shock presentation, the cardiac examination may be first.[3]

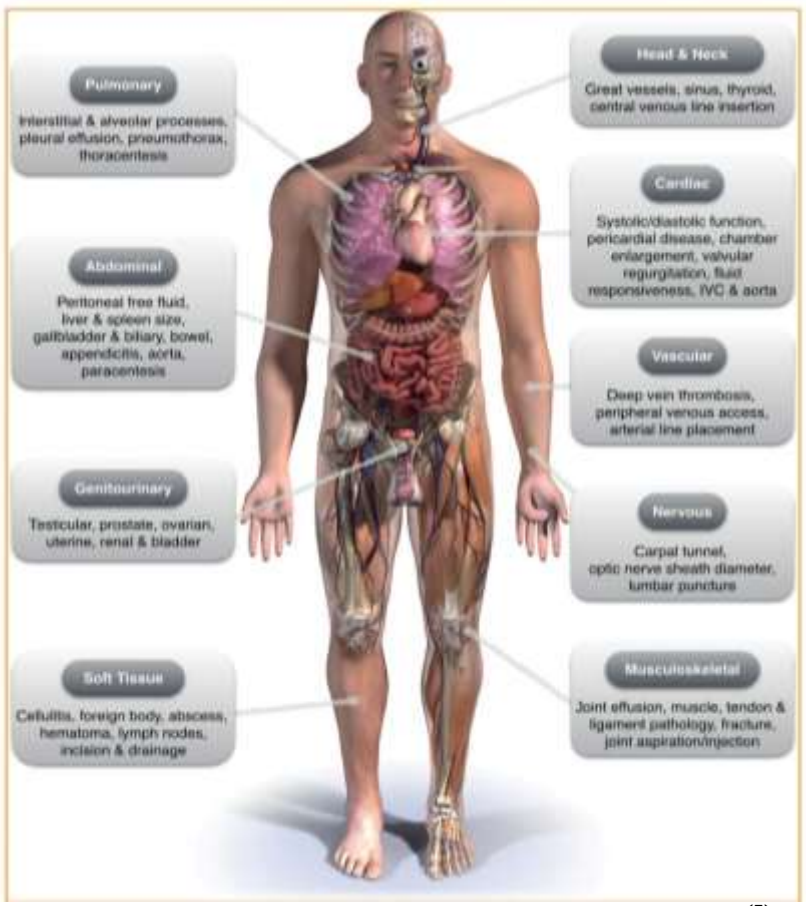

Figure (1): Point of care Ultrasound applications. [5]