

Role of Ultrasound in Diagnosis of Different Chest Diseases

Essay

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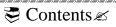
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List of Abbreviations

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A : Aorta

AOA : Aorta ascends

AP : Pulmonary artery

ART : Artery

BPS : Bronchopulmonary sequestration

Calc : Calcification

CCAM : Congenital cystic adenomatoid malformation

cm : Centimetre

COPD : Chronic obstructive pulmonary disease

CPAM : Congenital pulmonary airway malformation

CT : Computed tomography

CUS : Chest ultrasound

DMM : Diffuse malignant mesothelioma

E : Effusion

e.g. : Example

EFF: Effusion

F : French

FEAT: Fluorescein enhanced autofluorescence

G : Gauge

H : Hematoma

HHT : Hereditary hemorrhagic telangectasia

i.e. : Example

ICU : Intensive care unit

ILDs: Interstitial lung diseases

LMM : Localized malignant mesothelioma

M : Mass

List of Abbreviations

mm : Millimetre

mm Hg : Millimetre mercury

MR : Magnetic resonance

NETS: Neutrophil extracellular traps

NSCLC: Non small cell carcinoma

PAVMs: Pulmonary arteriovenous malformations

PE : Pulmonary embolism

PSP: Primary spontaneous pneumothorax

thoracoscopy

SCLC: Small cell carcinoma

SFT : Solitary fibrous tumour

SP : Spleen

SSP : Secondary spontaneous pneumothorax

ST : Sternum

TB: Tuberculosis

TLC: Total lung capacity

TNM: Tumour, node and metastasis

US : Ultrasound

VATS: Video assisted thoracoscopy

VC : Vena cava

WDPM: Well differentiated papillary mesothelioma

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Introduction

At one time it was thought that ultrasound could not be used in chest assessment. The main chest organs are filled with air which is not a good ultrasound conductor. Besides that, the ribs block ultrasound. However, ultrasound has become an invaluable resource in the assessment of abnormal chest, in which liquid and solid densities are interposed between the chest wall and the lungs, allowing excellent propagation of sound waves, making it possible to extend the use of ultrasound in the diagnosis of a number of pathologies (*Lichtenstein*, 2007).

Although the plain radiography and computed tomography remain undoubtedly the primary imaging modalities in the investigation of chest pathology, ultrasound can play an important complementary role, both in the diagnostic workup of a patient and in their subsequent management (*Zanobetti et al.*, 2011).

Its lack of ionizing radiation, bedside availability and dynamic imaging capacity afford ultrasound certain advantages over other techniques; particularly in the critical care setting where conventional radiography is often suboptimal (*Langolis*, 2007).

Examination of the chest is a rapidly developing application of ultrasound (US) and may be used to evaluate a wide range of peripheral parenchymal, pleural and chest wall diseases. The technique is particularly suited to bedside use in the intensive care unit, where suboptimal radiography may mask or mimic clinically significant

abnormalities and where differentiation of pleural from parenchymal changes can be challenging (*Reissig et al.*, 2011).

Furthermore, US is increasingly used to guide interventional procedures of the chest, such as biopsy and placement of intercostal chest drains (*Nicolaou et al.*, 2007).

Aim of Work

To highlight the use of ultrasonography in the diagnosis of different chest diseases and spotlight the advantages of chest ultrasound over other traditional chest imaging modalities particularly in critical patients.

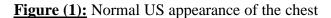
Normal sonographic anatomy of the chest

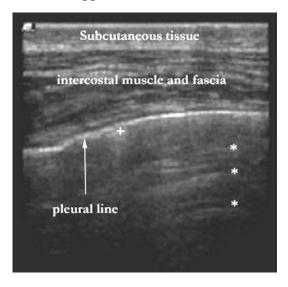
The Chest wall:

The normal chest wall appears as a series of echogenic soft tissue layers, representing the layers of muscles and the fascia planes. Below the soft tissue of the chest wall, the ribs appear as curvilinear structures on transverse scans, associated with posterior acoustic shadowing. When the ribs are scanned along the long axis, the anterior cortex should appear as a continuous smooth echogenic line (*Kohet al.*, 2002).

The Pleura:

At real-time imaging, the visceral and parietal portions of the pleura are seen to slide over each other .With a 3.5 MHz curvilinear probe, differentiation between the visceral and parietal portions may not be possible, and they usually appear as echogenic bands measuring up to 2 mm thick. With a high-resolution linear probe, the visceral and parietal portions of the pleura can be seen as two echogenic lines deep to the ribs (**Fig. 1**). The visceral pleura usually appears thicker than the parietal pleura (*Mathis*, *1997*).





a) Normal US appearance of the chest. Below the relatively echogenic subcutaneous tissue, the intercostal muscles appear hypoechoic but contain multiple echogenic fascia planes. The pleural interface appears as an echogenic line. The sharp change in the acoustic impedance at this interface results in reverberation artifacts (*), Vertical comet tail artifacts (+) can also be seen.



b) On the high-resolution scan, the visceral and parietal portions of the pleura can be resolved (*Quoted from Koh et al.*, 2002).

The Lung Parenchyma:

Beyond the pleura-lung interface, the lung is air-filled and does not allow further visualization of normal lung parenchyma. However, the large change in acoustic impedance at the pleura-lung interface results in horizontal artifacts that are seen as a series of echogenic parallel lines equidistant from one another below the pleural line and are called A-lines. In addition, vertically oriented "comet-tail" artifacts can also be normally seen, also called B-lines which results from the fluid-rich subpleural interlobular septae, which are surrounded by air. Hence, these artifacts appear closely spaced, separated from each other by an average distance of 7 mm (*Lichtenstein et al.*, 1999).

The diaphragm

The diaphragm is examined through the lower intercostal spaces and is seen as an echogenic line, 1 mm thick, above the liver and spleen. Normal downward movement of the diaphragm should be seen on inspiration. Ultrasonography can assess the characteristics of diaphragmatic movement such as amplitude, force and velocity of contraction, special patterns of motion and changes in diaphragmatic thickness during inspiration (*Matamis et al.*, 2013).