Role of Ultrasound in Diagnosis of Different Chest Diseases

Essay

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Contents

List of Abbreviations

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

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

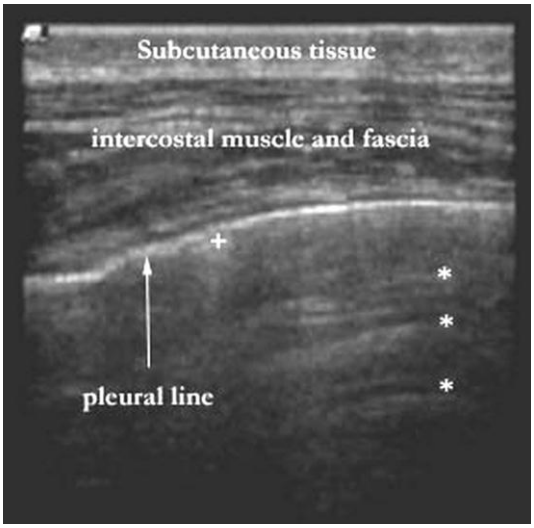
The Chest wall:

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 ***(Koh et 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)***.

Figure (1): Normal US appearance of the chest



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).***

<u>The Lung Parenchyma:</u>

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)***.

<u>The diaphragm</u>

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)***.