

Role of high-resolution Ultrasound in Assessment of Pleural Effusion

Thesis

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radiology*

By

Usama Nahi Hamdi

Supervised by

Dr.Mohammed Abed-El-Aziz Ali

Professor of Radiodiagnosis
Faculty of medicine
Ain Shams University

Dr.Salma Fathy Abdel Kader

Lecturer of Radiodiagnosis
Faculty of medicine
Ain Shams University

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List of Abbreviations

ADA	adenosine deaminase .
AMA	American medical association.
ANOVA	analysis of variance.
ARDS	acute respiratory distress syndrome
ASD	atrial septal defect.
AUC	area under the curve
C	cervical vertebrae.
CA	carcinoma
CABG	coronary artery bypass graft.
CCUS	critical care ultrasonography
CHF	congestive heart failure.
Cm	centimeter
CR	chest radiography
CSF	cerebrospinal fluid.
CT	computed tomography.
CW	chest wall
CXR	chest X-ray
D	diaphragm.
DA	diagnostic accuracy
e.g	Example
EVLW	extra vascular lung water.
ER	emergency department
FIO2	fraction of inspired oxygen

h	hour
Hct	hematocrit
HF	heart failure
IBM	international business machine
ICU	intensive care unit.
ICR	intercostal space
i.e	example.
K	cartilage .
Kg	kilogram.
K.S	kolmogorov-smirmov .
L	left.
L	lung.
LDH	lactate dehydrogenase.
LR	logistic regression analysis.
LUS	lung ultrasound
M	motion.
M	muscle
MET	metastases.
MEG/dl	milligram per deciliter.
MHz	megahertz
ml	Milliliter
MM	Millimeter
MR	mitral regurgitation
MRI	magnetic resonance image

N	number in study.
n	number affected
NPV	negative predictive value
P	line of the pleura
P	predictive value.
PA	posteroanterior view
PaO₂	Partial Pressure of Oxygen in Arterial Blood.
PE	pleural effusion.
PF	pleural fluid
PP	parietal pleura.
PPV	positive predictive value
P value	predictive value
R	right.
R	Pearson correlation coefficient
R²	square of the correlation coefficient
RT	right.
SD	standard deviation.
Sep	the maximum distance between parietal and visceral pleura in end expiration.
SLE	systemic lupus erythematus
SPSS	statistical program for social science.
SVC	superior vena caval syndrome
T	thoracic vertebrae
TB	tuberculosis

U	unit
UK	united kingdom
U per L	unit per liter
U/L	unit over liter
U pre ml	unit per milliliter
US	Ultrasonography
vol	Volume
VP	visceral pleura
Vs	versus
Y	year

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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, but recently ultrasound become an invaluable resource in 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*)

Over the last decade ultrasonography has played a major role in the management of patient with pleural effusion , the advent of affordable and portable us has made bedside procedure possible not only in hospital rooms but in intensive care unit and emergency department(*Liu and, Liang 2010*).

The major advantages of thoracic US include its mobility, dynamic properties, low cost, lack of radiation, and short examination time (*Mayo and Doelken, 2006*).

As opposed to other imaging techniques such as computed tomography, 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 (*Islama and Tonnb, 2009*)

Although ultrasound imaging may appear to be a complex technique, for the trained clinician who has learned the different ultrasound patterns it is a valuable tool in the study of thoracic disease. It is up to pulmonologists and radiologists to move forward together in the understanding of sonography and to integrate it progressively into routine clinical practice. (*Vollmer and Gayete, 2010*).

Furthermore, US is increasingly used to guide interventional procedures in the diagnosis and treatment of pleural effusion (*Nicolaou et al .,2007*)

AIM OF THE WORK

The aim of our study is to evaluate the clinical applications of high resolution ultrasound and to emphasize the diagnostic value of ultrasound and its diagnostic performance in the imaging of pleura , And to compare its diagnostic accuracy with chest x-ray for assessment of pleural effusion.

ANATOMY

THORACIC CAGE:

It is the framework of the wall of the thorax and formed by vertebral column behind, the ribs and intercostal space on either side or the sternum and costal cartilage in front (*Snell, 2012*). The thoracic skeleton is an osteo-cartilaginous frame around the principal organs of respiration and circulation. It is narrowed above, broad below, flattened anteroposteriorly and longer behind. It is uniform in horizontal section due to the forward projection of the vertebral column (*standing S.,2008*).

The thoracic inlet is reniform in shape, about 5cm anteroposteriorly and transversely about 10 cm. Its plane slopes down and forwards, bounded by the first thoracic vertebral body behind, the superior border of the manubrium sterni in front and first rib on each side (*standing S.,2008*).

The thoracic outlet is limited behind by the twelfth thoracic vertebral body, the twelfth and eleventh ribs laterally and in front by the tenth to seventh ribs, which ascend to form the infrasternal angle. The outlet is wider transversely and oblique, sloping down towards the back, and is closed by the diaphragm which forms a floor to the thoracic cavity (*Standing S., 2008*).

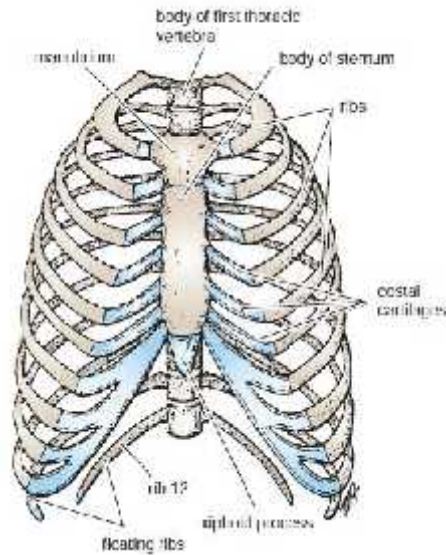


Figure 1: Anterior chest wall. Quoted from (Snell, 2012).

A. STERNUM:

The sternum has:

1. A “manubrium” opposite T3 and T4 vertebrae, which articulates with the clavicle and with one and one half costal cartilages.
2. A “sternal angle”, which is a secondary cartilaginous joint and lies opposite T4/T5 disc space.
3. A “body” opposite T5-T9 vertebrae, made up of 4 vertebrae, which articulate with five and one half costal cartilages.
4. A “xiphoid process”, which remains cartilaginous well into adult life (*Snell, 2012*).

B. RIBS:

There are 12 pairs of ribs – 7 true, 3 false, and 2 floating. Occasionally a normal subject has only 11 pairs. A typical rib has a head, neck, tubercle and shaft. The head has two facets for articulation with vertebral bodies. These costovertebral joints are synovial joints (*Snell, 2012*).

A ligament to the transverse process of the vertebra above attaches the neck of the rib. The tubercle has a facet for articulation with its own transverse process. This costo-transverse joint is also synovial joint. It has also a no particular part for ligament attachment (*Naidu and Rajesh, 2010*).

The shaft has a posterior angle and a much less prominent anterior angle. It has a subcostal groove that is much more prominent posteriorly. This lodges the intercostal vessels and nerves (*Naidu and Rajesh, 2010*)