Impact of Lung Imaging on Clinical Decision Making in Critically ill Patients

An Essay

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List of Abbreviations

AP	:	Antero-Posterior
ARDS	:	Acute respiratory distress syndrome
BLUE	:	Bedside Lung Ultrasonography in Emergency
CAP	:	Community acquired pneumonia
CT	:	Computed tomography
CTA	:	Computed tomography angiography
HRCT	:	High-resolution CT
CXR	:	Chest X-Ray
CPE	:	Cardiogenic pulmonary edema
CO_2	:	Carbon dioxide
COPD	:	Chronic obstructive pulmonary disease
HCAP	:	Healthcare-associated pneumonia
ICU	:	Intensive care unit
MRI	:	Magnetic resonance imaging
MRA	:	Magnetic resonance angiography
NPE	:	Non-Cardiogenic pulmonary edema
O_2	:	Oxygen
PA	:	Postero-anterior
Pco_2	:	Partial pressure of carbon dioxide
PE	:	Pulmonary embolism
Po2	:	Partial pressure of oxygen
US	:	Ultrasound
VPW	:	Vascular pedicle width

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Introduction

Lung imaging plays a central role in the management of critically ill patients with respiratory problems as acute respiratory failure, ARDS, traumatized patient and hemodynamic therapy in shocked patient. Bedside chest radiography, ultrasonography, computed tomography (CT) and magnetic resonance imaging (MRI) are essential aids in both diagnosis and evaluation of responses to therapy ***(Morris et al.2013).***

The role of chest X-Ray is very useful in the management of patients with respiratory failure and in detecting a lot of respiratory problems associated like pneumothorax and pleural effusion.Chest radiography findings are an integral part of the diagnosis, follow up and positioning of tubes and lines ***(Rubinowitz et al., 2007).***

Lung ultrasound (LU) has emerged in recent years as a powerful diagnostic tool, and as such it is increasingly used in patients managed in intensive care units (ICUs) as a bedside non-invasive test with an excellent safety profile so can be performed repeatedly. Lung ultrasound identifies (with high diagnostic accuracy) the most common pathological abnormalities of the respiratory system

encountered in these patients. Indeed, this technique has a diagnostic accuracy in identifying pneumothorax, consolidation, interstitial syndrome, and pleural effusion. So therefore, it may be considered an alternative to bed side CXR and thoracic CT for critically ill patients .In addition, it has been shown that on appropriate clinical grounds, LU may be of help in the diagnosis of pneumonia and in the follow up its course ***(Lichtenstein et al., 2008*)**.

Computed tomography (CT) chest is widely used to clarify radiographic abnormalities detected by CXR. Advantages of chest CT compared with CXR are the ability to distinguish superimposed structures due to cross sectional imaging with superior assessment of tissue density, permitting accurate assessment of the size and density of pulmonary nodules and improved identification of abnormalities adjacent to the chest wall, such as pleural disease. The use of IV contrasts helps to distinguish vascular from nonvascular structures, which is especially useful in assessing hilar and mediastinal abnormalities. Also CT angiography helps to detect pulmonary emboli ***(Longo et al., 2013).***

A variety of other imaging techniques like Magnetic Resonance Imaging (MRI) of the chest are used less commonly to assess respiratory diseases ***(Longo et al., 2013).***

Aim of the Essay

This essay aims to highlight the different types of lung imaging studies in critically ill patients and their importance in diagnosis and clinical decision making in ICU.

Chapter One
Anatomy of Chest and Pathogenesis in Respiratory Failure

Good knowledge of lung anatomy is mandatory to understand the features of lung diseases because it permits a better understanding of distribution of the diseases in the lung. Differential diagnosis of lung disease can indeed be narrowed when one is able to decide whether the disease very likely is located in or around the airways, the blood vessels, the lymphatics or the lung interstitium. The anatomical organization of lung consists of the bronchial tree, the pulmonary blood vessels, the lymphatics and the interstitium. It is important in using and interpreting different methods of scanning the lungs ***(Verschakelen and Wever, 2007)***.

The thoracic cage

The thoracic cage is formed by the sternum and costal cartilages in front, the vertebral column behind and the ribs and intercostal spaces laterally. It is separated from the abdominal cavity by the diaphragm and communicates superiorly with the root of the neck through the thoracic outlet ***(Faiz and Moffat, 2002).***

The airways

The trachea is 10-20 cm length . It lies slightly to the right of the midline and divides at the carina into right and left main bronchi. The carina lies under the junction of the manubrium sterni and the second right costal cartilage. The right main bronchus is more vertical than the left. The right main bronchus divides into the upper lobe bronchus and the intermediate bronchus, which further subdivides into the middle and lower lobe bronchi. However, the left main bronchus divides into upper and lower lobe bronchi only. Each lobar bronchus further divides into segmental and subsegmental bronchi. There are about 25 divisions in all between the trachea and the alveoli. There are approximately 300 million alveoli in each lung ***(Faiz and Moffat, 2002).***