Role of Multi-Detector Computed Tomography (MDCT) in Diagnosis of Pulmonary Nodules

Essay

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List of Abbreviations

2D	**:**	Two-Dimensional
3D	**:**	Three-Dimensional
AMPR	**:**	Adaptive multiple plane reconstruction
BAC	**:**	Broncho-Alveolar Carcinoma
CAD	**:**	Computer-aided diagnosis
cm	**:**	Centimeter
CMPR	**:**	Curved multi-planar reconstruction
CT	**:**	Computed Tomography
HRCT	**:**	High Resolution Computed Tomography
kV	**:**	Kilo-Volt
kW	**:**	Kilo-Watt
LA	**:**	Left atrium
Lt	**:**	Left
mAs	**:**	Milli-ampere.second
MDCT	**:**	Multi-Detector Computed Tomography
MinIP	**:**	Minimum-Intensity Projections
MIP	**:**	Maximum intensity projections
mm	**:**	Millimeter
MPR	**:**	Multi-planar reconstruction
PAVM	**:**	Pulmonary Arteriovenous Malformations
PPL	**:**	Primary pulmonary lyphoma
RPA	**:**	Right pulmonary artery

Rt	:	Right
S	:	Second
SCLC	:	Small cell carcinoma
SDCT	:	Single- Detector Computed Tomography
SPN	:	Solitary pulmonary nodule
T	:	Time difference
TB	:	Tuberculosis
V	:	Vein
V0	:	Initial volume
VDT	:	Volume Doubling Time
VR	:	Volume-rendering
Vt	:	Volume at time t
WG	:	Wegener's Granulomatosis
WHO	:	World health organization

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Introduction

The successful detection, characterization, and treatment of a myriad of lung diseases, including both primary and metastatic lung cancers, begin with the accurate identification of pulmonary nodules ***(Geoffrey et al., 2005)***.

Pulmonary nodules giving radiological images are either multiple or solitary. There are several disorders leading to the formation of the multiple pulmonary nodules such as metastatic malignancies, tuberculosis, parasitic diseases and abscesses ***(Genel et al., 2002)***.

A solitary pulmonary nodule (SPN) is radiologically defined as an intraparenchymal lung lesion that is < 3 cm in diameter and is not associated with atelectasis or adenopathy. The differential diagnosis of a SPN includes neoplastic, infectious, inflammatory, vascular, traumatic, and congenital lesions ***(Leef and Klein*, *2002)***.

Other benign etiologies for SPNs are rheumatoid nodules, intrapulmonary lymph nodes, plasma cell granulomas, and sarcoidosis ***(Abeloff et al.*, *2000)***.

CT of the chest is the imaging modality with the highest sensitivity for the detection of pulmonary nodules ***(Henschke et al., 2001)***. However, radiologist's sensitivity for the detection of small pulmonary nodules is unsatisfactory ***(Naidich et al., 1993)***.

The development of multi-detector row CT (MDCT) scanners has made it possible to acquire volumetric data of the lung with high spatial resolution which reduces partial-volume effects and allows better detection of smaller nodules ***(Fischbach et al., 2003)***. MDCT is a promising tool for improved evaluation of lung parenchyma as whole lung thin-section CT scans can be obtained within one breath-hold ***(Mitsuko et al., 2003)*** and its main advantages are shorter acquisition time than with conventional single–detector row CT and retrospective creation of both thinner and thicker sections from the same raw data ***(Takenori et al., 2003)***.

Several approaches have been proposed to improve pulmonary nodule detection by MDCT as maximum intensity projection (MIP) ***(Valencia et al., 2006)***, double independent reading ***(Wormann et al., 2005)***, monitor viewing using cine-mode which is the first step in providing 3D information to reduce perceptual errors ***(Peloschek et al., 2007)*** and computer assisted detection (CAD*)* software which can guide the radiologist to questionable structures, previous investigations using CAD with CT have showed an increase of pulmonary nodule detection sensitivity by radiologists ***(Lee et al., 2005)***.

Maximum intensity projection (MIP) and volume rendering (VR) represent two commercially available techniques for displaying a subvolume of the 3D data set ***(Peloschek et al., 2007)***.

Aim of the Work

The aim of this work is to highlight the role of Multi-detector computed tomography (MDCT) in diagnosis and evaluation of the pulmonary nodules.

Anatomy of the Lung

I) Normal gross anatomy of the lung:

The lungs are the essential organs of respiration. They are situated on either side of the heart and other mediastinal contents. Lung is free in its pleural cavity, except for its attachment to the heart and trachea at the hilum and pulmonary ligament respectively. Air enters and leaves the lungs via main bronchi, which are branches of the trachea ***(Standring et al., 2008)***.

Each lung has a half-cone shape, with a base, apex, two surfaces and three borders.

- The base sits on the diaphragm.
- The apex projects above rib I and into the root of the neck.
- The two surfaces-the costal surface lies immediately adjacent to the ribs and intercostal spaces of the thoracic wall. The mediastinal surface lies against the mediastinum anteriorly and the vertebral column posteriorly and contains the comma-shaped hilum of the lung through which structures enter and leave ***(Drake et al., 2007)***.

The three borders:-the inferior border of the lung is sharp and separates the base from the costal surface. The anterior and posterior borders separate the costal surface from the medial surface. Unlike the anterior and inferior borders, which are sharp, the posterior border is smooth and rounded **(Fig. 1)** ***(Drake et al., 2007)***.

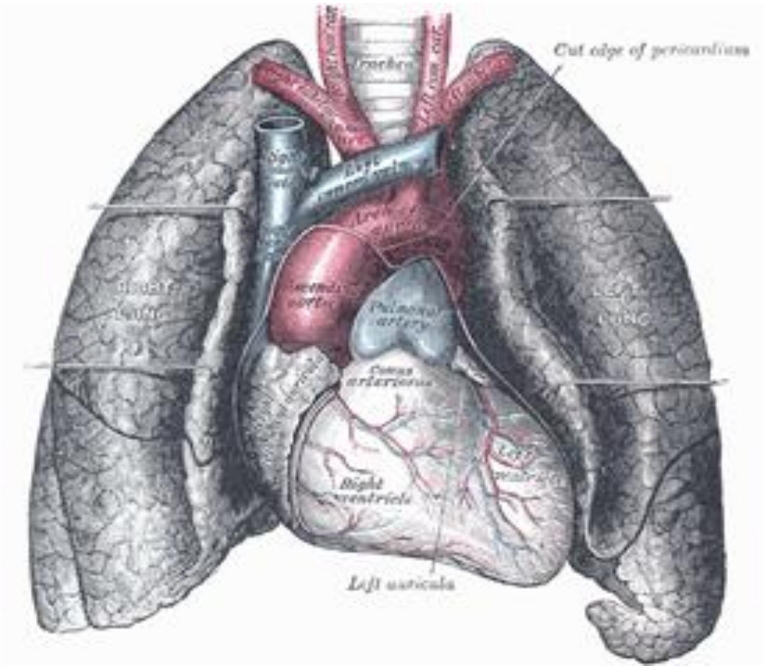

Fig (1): Showing: Front view of the lung ***(Quoted from Standring et al., 2008)***