

Role of Multislice CT in the Diagnosis of Cystic and Cavitory Lung Lesions

Essay

*Submitted for Partial Fulfillment of Master Degree
in Radiodiagnosis*

By

Magda Ahmed EL-Sayed Musa

M.B., B.Ch.

Faculty of Medicine

Ain shams University

Supervised By

Prof. Dr. Maha Mohammed Abdel-Raouf

Professor of Radio-Diagnosis

Faculty of Medicine

Ain Shams University

Dr. Yasser Ibrahim Abdel-Khalk

Lecturer of Radio-Diagnosis

Faculty of Medicine

Ain Shams University

**Faculty of Medicine
Ain Shams University
2012**



فَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا
إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ
الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم

سورة البقرة (الآية ٣٢)



*First of all I would like to thank our Almighty **ALLAH** for his great help and support during this work.*

*Then I would like to express my deep gratitude to **Prof. Dr. Maha Mohammed Abdel-Raouf**, Professor of Radiodiagnosis, Faculty of Medicine Ain Shams University for his valuable guide, encouragement and supervision through my work.*

*Also I would like to express my thanks and great appreciation to **Dr. Yasser Ibrahim Abdel-Khalik**, Assistant lecturer of Radiodiagnosis, Faculty of Medicine Ain Shams University for his great help, efforts and kind advice and supervision on my essay.*

Finally, I would like to thank members of my family for their help and support.



Magda Ahmed

List of Contents

<i>Subject</i>	<i>Page</i>
List of Abbreviations	I
List of Tables	IV
List of Figures	V
Introduction	1
Aim of the Work	4
Review of Literature	
Chapter (1): Gross anatomy of the lung	5
Chapter (2): CT anatomy of the lung	21
Chapter (3): Pathology of cystic and cavitary lung lesions.....	34
Chapter (4): Multislice CT principles and technical considerations	63
Chapter (5): CT appearance of cystic lung lesions	89
Chapter (6): CT appearance of cavitary lung lesions....	97
Chapter (7): Illustrative cases	128
Summary and Conclusion	140
References	143
Arabic Summary	\

List of Abbreviations

AA	Ascending aorta
ACS	American Cancer Society
aer	Azygo-esophageal recess
AIDS	Acquired Immune Deficiency Syndrome
AIP	Average Intensity Projection
ARo	Aortic Root
AxV	Axillary Vein
B	Beam
BAC	Broncho Alveolar Carcinoma
BI	Bronchus Intermedius
BSA	Body Surface Area
Bv	Bronchocephalic Veins
CCAM	Congenital Cystic Adenomatoid Malformation
COPD	Chronic Obstructive Pulmonary Disease
CT	Computed Tomography
Cm	Centimeter
C	Central
C	Collimeter
cl	Clavicles
DA	Descending Aorta
DAS	Data Acquisition System
D	Dimension
DE	Detector Element
E	Echinococcus
E	Esophagus
FOV	Field Of View
GE	General Electric

GI	Gastrointestinal
HRCT	High Resolution Computed Tomography
HIV	Human immune deficiency viruse
HU	Hounsfield Unit
ILS	Intralobar pulmonary sequestration
ELS	Extralobar pulmonary sequestrations
IV	Intravenous
IVC	Inferior Vena Cava
Kvp	Kilovolt Potential
LA	Left atrium
LPA	Left Pulmonary Artery
LLLB	Left Lower Lobe Bronchus
LMSB	Left Main Stem Bronchus
LULB	Left Upper Lobe Bronchus
LV	Left Ventricle
m	Manubrium
MIP	Maximum Intensity Projection
MinIP	Minimum Intensity Projection
MLB	Middle Lobe Bronchus
mm	Millimeter
MPA	Main Pulmonary Artery
MPAD	Main Pulmonary Artery Diameter
MPR	Multipplanar Reformation
MSCT	Multislice Computed Tomography
NHL	Non Hodgkin Lymphoma
NSCLC	Non Small Cell Lung Carcinoma
Pmj	Pectoralis major Muscle
Pmn	Pectoralis minor Muscle
PoT	Pulmonary Outflow Tract

P	Peripheral
RA	Right Atrium
RCS	Retro Crural Space
BLLB	Right Lower Lobe Bronchus
RLL	Right Lower Lobe
RMB	Right Main Bronchus
RML	Right Middle Lobe
RMSB	Right Main Stem Bronchus
ROI	Region Of Interest
RPA	Right Pulmonary Artery
RUL	Right Upper Lobe
RV	Right Ventricle
S	Staphylococcus
SVC	Superior Vena Cava
SD	Standard Deviation
Sec	Second
SCC	Squamous Cell Carcinoma
SCLC	Small Cell Lung Carcinoma
SSD	Shaded Surface Display
St	Sternum
TB	Tuberculosis
T	Trachea
T	Tube
VOI	Volume Of Interest
VRT	Volume Rendering Technique
Vs	Versus
WG	Wegener's Granulomatosis
WHO	World Health Organization

List of Tables

Table No.	Title	Page
Table (1)	Current ACCP/AJCC Staging System for Lung Cancer	53

List of Figures

Figure No.	Title	Page
Figure (1)	Lung lobes and pleura	6
Figure (2)	The bronchial tree	12
Figure (3)	Bronchopulmonary Segments	14
Figure (4)	Pulmonary arteries	16
Figure (5)	Pulmonary veins	16
Figure (6)	Frontal view of the lung and heart	20
Figure (7)	Mediastinal divisions	20
Figure (8)	Axial CT images of the normal lungs and airways.	21
Figure (9)	Pulmonary segment	26
Figure (10)	Major fissure	28
Figure (11)	Minor fissure	29
Figure (12)	Azygos lobe fissure	29
Figure (13)	Inferior accessory fissure	30
Figure (14)	Left brachiocephalic vein	30
Figure (15)	Aortic arch	31
Figure (16)	Left pulmonary artery	32
Figure (17)	Pulmonary arteries	32
Figure (18)	Retrocrural space	33
Figure (19)	CT gantry with an x-ray tube	64

Figure No.	Title	Page
Figure (20)	Detector array designs	66
Figure (21)	Section collimation in multi-detector row CT	71
Figure (22)	Anisotropic and isotropic data	74
Figure (23)	Maximum intensity projection	78
Figure (24)	Coronal MIP image	81
Figure (25)	Congenital cystic adenomatoid malformation	90
Figure (26)	Congenital cystic adenomatoid malformation	91
Figure (27)	Bronchogenic cyst	92
Figure (28)	Bronchogenic cyst	93
Figure (29)	Pulmonary sequestration	94
Figure (30)	Intra-lobar sequestration	95
Figure (31)	Infected intralobar sequestration	96
Figure (32)	Pulmonary tuberculosis	102
Figure (33)	Pulmonary tuberculosis	103
Figure (34)	Lung abscess	104
Figure (35)	Lung abscess	106
Figure (36)	Pulmonary hydatid disease	107
Figure (37)	Cavitating bronchogenic carcinoma	111
Figure (38)	Cavitating adenocarcinoma	111
Figure (39)	Broncho-alveolar carcinoma	113

Figure No.	Title	Page
Figure (40)	Hodgkin's lymphoma	116
Figure (41)	Low grade non Hodgkin's lymphoma	118
Figure (42)	Nodular sclerosis Hodgkin's lymphoma	118
Figure (43)	Cavitating metastasis	120
Figure (44)	CT of Bullous Emphysema	122
Figure (45)	Rheumatoid lung nodul	123
Figure (46)	Wagner granulomatosis	124
Figure (47)	Wegner granulomatosis	125
Figure (48)	Sarcoidosis.	127

Introduction

Cysts and cavities are commonly encountered abnormalities on chest radiography and chest computed tomography. Occasionally, the underlying nature of the lesions can be readily apparent as in bullae associated with emphysema. Other times, cystic and cavitory lung lesions can be a diagnostic challenge. In such circumstances, distinguishing cysts (wall thickness ≤ 4 mm) from cavities (wall thickness > 4 mm or a surrounding infiltrate or mass) and focal or multifocal disease from diffuse involvement facilitates the diagnostic process (**Ryu et al., 2003**).

Other radiological characteristics, including size, inner wall contour, nature of contents, and location, when correlated with the clinical context and tempo of the disease process provide the most helpful diagnostic clues. Focal or multifocal cystic lesions include blebs, bullae, pneumatoceles, congenital cystic lesions, traumatic lesions, and several infectious processes, including coccidioidomycosis, *Pneumocystis carini* pneumonia, and hydatid disease (**Ryu et al., 2003**).

Malignant lesions including metastatic lesions may rarely present as cystic lesions. Focal or multifocal cavitory lesions include neoplasms such as bronchogenic carcinomas and lymphomas, many types of infections or abscesses, immunologic disorders such as Wegener granulomatosis and rheumatoid nodule, pulmonary infarct, septic embolism,

progressive massive fibrosis with pneumoconiosis, lymphocytic interstitial pneumonia, localized bronchiectasis **(Ryu et al., 2003)**.

Some Diffuse involvement with cystic or cavitary lesions may be seen in pulmonary lymphangioleiomyomatosis, pulmonary Langerhans cell histiocytosis, honeycomb lung associated with advanced fibrosis, diffuse bronchiectasis, and, rarely, metastatic disease. High-resolution computed tomography of the chest frequently helps define morphologic features that may serve as important clues regarding the nature of cystic and cavitary lesions in the lung **(Ryu et al., 2003)**.

Multislice (or multidetector array) CT scanners are capable of acquiring several tomographic slice in a single rotation of the X-ray tube and detector assembly, multislice scanning offers many clinical benefits such as reduced examination times particularly in examinations where voluntary or involuntary patient motion is a problem. The routine use of narrow slices result in improved z-axis resolution and is a particular benefit in examinations employing 3D reconstructions. The ultimate long term aim of all CT manufactures is likely to be the image of the whole trunk in a single rotation **(Lewis, 2001)**.

Multislice CT represent the next break through in CT technology, multislice CT scanner provide a huge gain in performance that can be used to reduce scan time, sectional

collimation, or increase scan length substantially (**Prokop and Galanski, 2003**).

Nowadays interventional CT has a big role in the diagnosis of cystic and cavitary lung lesions as Percutaneous catheter drainage of intrathoracic collections has developed as a natural extension of similar interventional radiologic procedures in the abdomen. The advent of interventional CT, which allow detection and characterization of pleural and parenchymal collections, combined with advances in drainage catheter design and interventional techniques, have made imaging-guided management of intrathoracic collections a safe and effective alternative to traditional surgical therapy. This article begins with a review of the etiology, pathophysiology, diagnosis, and treatment of parapneumonic pleural effusion, which remains the most common indication for image-guided percutaneous drainage. Subsequent sections consider issues related to percutaneous drainage of malignant pleural effusion, lung abscess, and pneumothorax (**Shaw et al., 2008**).

Aim of the Work

The aim of this study is to highlight the role of multislice CT of the chest in diagnosis of cystic and cavitary lung lesions.