



PET/CT in the Staging of Non-Small Cell Lung Cancer

Thesis

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

سببنا أنك لا تعلم لنا
إلا ما علمتنا إنك أنت
العليم العظيم

صدق الله العظيم

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List of Contents

Title	Page No.
List of Tables	i
List of Figures	iii
List of Abbreviations	vi
Introduction	1
Aim of the Study	4
Review of Literature	
Anatomy of Lungs	5
Technique	22
Pathology	44
Imaging Modalities of NSCLC	53
Role of PET/CT in TNM Staging of NSCLC	65
Patients and Methods	85
Results	90
Illustrative Cases	106
Discussion	117
Limitations	129
Conclusion	130
Summary	132
References	134
Arabic Summary	

List of Tables

Table No.	Title	Page No.
Table (1):	Bronchopulmonary segments.....	8
Table (2):	Nodal stations and zones in the IASLC lymph node map.....	16
Table (3):	Anatomic Definitions and boundaries of the IASLC Lymph Node Stations	17
Table (4):	Proposed standard patients preparation protocol for FDG PET and PET-CT	31
Table (5):	PET/CT Artifacts	34
Table (6):	Strengths, potential indications and limitations of the discussed imaging techniques of NSCLC.....	64
Table (7):	Eighth Edition of TNM staging of lung cancer	67
Table (8):	Shows age, sex and histopathological types of cases.....	90
Table (9):	Showing local extension of the tumour by CT versus PET-CT.....	92
Table (10):	Shows that CT detected 18 case of ipsilateral pulmonary nodules that also detected by PET/CT but only 9 of them showed high FDG uptake.....	93
Table (11):	Showing the sites of lymph nodes groups involvement in CT versus PET-CT.	95
Table (12):	Showing the sites of distant metastases by CT versus PET-CT.....	97
Table (13):	Showing that CT detected 9 cases of contralateral pulmonary nodules that PET/CT also detected them but only 3 of them showed high FDG uptake	98

List of Tables (cont...)

Table No.	Title	Page No.
Table (14):	Showing that CT detected 10 cases of pleural effusion that PET/CT also detected them but only 3 of them showed high FDG uptake and so be malignant pleural effusion	99
Table (15):	Showing T staging by CT and PET/CT.....	100
Table (16):	Showing N staging by CT and PET/CT.	101
Table (17):	Showing M staging by CT and PET/CT.....	102
Table (18):	Showing final staging of the patients by CT and PET/CT.....	103
Table (19):	Showing the number of operable and inoperable cases by CT versus PET-CT.....	104
Table (20):	Showing how PET-CT affects initial staging of the patients.	105

List of Figures

Fig. No.	Title	Page No.
Fig. (1):	Anatomy of the right lung	6
Fig. (2):	Anatomy of the left lung	7
Fig. (3):	Bronchopulmonary segments of the right lung,	8
Fig. (4):	Bronchopulmonary segments of the left lung,	9
Fig. (5):	Lung segments by CT in colors	11
Fig. (6):	Anatomic organization of tracheobronchial tree.....	13
Fig. (7):	Illustration shows the IASLC lymph node map	15
Fig. (8):	Stations 3a and 3p	18
Fig. (9):	Stations 2R, 2L, 3a, 3p, 4R, and 4L.....	19
Fig. (10):	Stations 5 and 6	19
Fig. (11):	Station 7.....	20
Fig. (12):	Stations 8 and 9	20
Fig. (13):	Stations 10R and 10L	21
Fig. (14):	Stations 11R and 11L	21
Fig. (15):	Uptake of 18F-FDG.....	24
Fig. (16):	Typical imaging protocol for combined PET/CT	28
Fig. (17):	FDG uptake in brown fat	30
Fig. (18):	Misregistration artifacts in head and neck.....	35
Fig. (19):	Dose Extravasation artifact.....	35
Fig. (20):	Attenuation correction artifacts	36
Fig. (21):	Truncation artifact	36
Fig. (22):	Squamous cell carcinoma, gross.....	48
Fig. (23):	Squamous cell carcinoma, microscopic	49
Fig. (24):	Adenocarcinoma, gross	50
Fig. (25):	Adenocarcinoma, microscopic	50
Fig. (26):	Large cell carcinoma, gross	51

List of Figures (cont...)

Fig. No.	Title	Page No.
Fig. (27):	CT and MPR for clarification of chest wall invasion by lung mass.....	55
Fig. (28):	CT and MIP for better detection of lung nodule	56
Fig. (29):	CT and Virtual bronchoscopic view for tumor lesion in left main stem bronchus	57
Fig. (30):	CT and Virtual bronchoscopic view for tumor lesion in left main stem bronchus with enlarged LN and associaed external compression	58
Fig. (31):	Diffusion weighted magnetic resonance imagingfor right upper lobe nodule	59
Fig. (32):	Integrated positron emission tomography (PET)/computed tomography (CT) for better detection of lung mass	61
Fig. (33):	Anatomic drawing illustrating the T1 descriptors	69
Fig. (34):	Anatomic drawing illustrating the T2 descriptors	70
Fig. (35):	Anatomic drawing illustrating the T3 descriptors	71
Fig. (36):	Anatomic drawing illustrating the T4 descriptors	72
Fig. (37):	Anatomic drawing illustrating the N descriptors	73
Fig. (38):	Anatomic drawing illustrating the M1a descriptor.....	74
Fig. (39):	Anatomic drawing illustrating the M1b descriptor.....	75
Fig. (40):	Anatomic drawing illustrating the M1c descriptor.....	76
Fig. (41):	Adenocarcinoma in situ (Tis) with groung glass nodule.....	77

List of Figures (cont...)

Fig. No.	Title	Page No.
Fig. (42):	Poorly differentiated squamous cell carcinoma with agtelactatic lung	78
Fig. (43):	N descriptors in moderately differentiated squamous cell carcinoma	79
Fig. (44):	False-negative FDG PET/CT findings in normal-sized lymph nodes in LCC	80
Fig. (45):	Poorly differentiated squamous cell carcinoma with adrenal mets	81
Fig. (46):	Pleural metastases in poorly differentiated adenocarcinoma	82
Fig. (47):	Bone metastases moderately differentiated lung adenocarcinoma	83
Fig. (48):	Extrathoracic nodal metastases in lung adenocarcinoma	84
Fig. (49):	Pie chart showing gender of the patients	91
Fig. (50):	Pie chart showing histological types of the studied lesions.....	91
Fig. (51):	Bar chart showing local extension of the tumour by CT versus PET-CT.....	94
Fig. (52):	Bar Chart: Showing the sites of lymph nodes groups involvement in CT versus PET-CT.....	96
Fig. (53):	Bar Chart Showing the sites of distant metastases by CT versus PET-CT.....	99
Fig. (54):	Bar Chart showing T staging by CT and PET/CT.....	100
Fig. (55):	Bar Chart showing N staging by CT and PET/CT.....	101
Fig. (56):	Bar Chart showing M staging by CT and PET/CT.....	102
Fig. (57):	Bar Chart Showing the number of operable and inoperable cases by CT versus PET-CT.....	104
Fig. (58):	Bar chart showing how PET-CT affects initial staging of the patients.	105

List of Abbreviations

Abb.	Full term
<i>2D.....</i>	<i>Two dimensional</i>
<i>3D.....</i>	<i>Three dimensional</i>
<i>BAT.....</i>	<i>Brown adipose tissue</i>
<i>CECT.....</i>	<i>Contrast enhanced Computed Tomography</i>
<i>CT.....</i>	<i>Computed tomography</i>
<i>DWI.....</i>	<i>Diffusion weighted images</i>
<i>EBUS.....</i>	<i>Endobronchial Ultrasound</i>
<i>EBUS-TBNA.....</i>	<i>Endobronchial Ultrasound -guided transbronchial needle aspiration</i>
<i>EUS.....</i>	<i>Endoscopic Ultrasound</i>
<i>FDG.....</i>	<i>Fluorodeoxyglucose</i>
<i>GLUT.....</i>	<i>Glucose transporter</i>
<i>IASLC.....</i>	<i>International Association for the Study of Lung Cancer</i>
<i>LCC.....</i>	<i>Large cell carcinoma</i>
<i>LN.....</i>	<i>Lymph node</i>
<i>MIP.....</i>	<i>Maximum intensity projection</i>
<i>MPR.....</i>	<i>Multiplanar reconstruction</i>
<i>MRI.....</i>	<i>Magnetic resonance imaging</i>
<i>NCCN.....</i>	<i>National Comprehensive Cancer Network</i>
<i>NSCLC.....</i>	<i>Non small cell lung cancer</i>
<i>PET.....</i>	<i>Positron emission tomography</i>
<i>SBRT.....</i>	<i>Stereotactic body radiation therapy</i>
<i>SCC.....</i>	<i>Squamous cell carcinoma</i>
<i>SUV.....</i>	<i>Standardized uptake value</i>
<i>Tc99mMDP.....</i>	<i>Technetium-99m methylene diphosphonate</i>
<i>VATS.....</i>	<i>Video-assisted thorascopic surgery</i>
<i>VB.....</i>	<i>Virtual bronchoscopy</i>

INTRODUCTION

Lung cancer is the leading cause of tumor related deaths worldwide, and non-small-cell lung cancer (NSCLC) represents about 80% of all lung cancers (*Jemal et al., 2001*). It is still a main contributor to the global cancer mortality burden (*Silvestri et al., 2013*).

The optimal treatment of NSCLC depends on accurate disease staging that based on the TNM system (*Nair et al., 2011*). TNM system includes tumor size, regional nodal involvement, and the presence of metastasis. Accurate evaluation of the presence or absence of metastases in mediastinal and hilar lymph nodes is a critical factor that determine operability and long-term survival in NSCLC patients. Surgical treatment can be expected in 70% of patients with N0 stage and up to 24% of patients with N2 stage; however, surgery is generally not indicated in patients with N3 stage cancer (*Konishi et al., 2003*).

Unfortunately, only 25% of patients will have resectable disease at presentation. Of those with stage I and II disease, 20 and 40%, respectively, will ultimately relapse with metastatic disease that was occult at the time of presentation (*Kelsey et al., 2009*).

Although X-ray chest radiograph was simple and convenient, its high rate of missed diagnosis making the credibility of clinical diagnosis was low (*Zhang et al., 2016*).

With the continuous development of medical research and clinical treatment level, multi-slice spiral CT imaging diagnosis technology is widely used in clinical diagnosis of malignant tumors (*Chen, 2016*).

It could achieve a comprehensive analysis on the lesion density, size, location, number, shape, edge, the surrounding details and the internal structure, which not only improve the detection rate, but also reduce the rate of misdiagnosis. In other words, this technique provided substantial basis for the diagnosis and treatment of primary lung cancer patients (*Harred et al., 2012*).

Although it provides anatomic information and it has poor sensitivity (approximately 50%) and specificity (approximately 85%) for detecting mediastinal tumor (*Silvestri et al., 2007*).

Malignant cells show high rates of glycolysis than most surrounding normal structures (*Dahlbom et al., 1992*). Fluorine 18 fluorodeoxyglucose (FDG) positron emission tomography (PET) has been introduced and developed as an effective modality for tumor staging in a variety of cancers (*Marom et al., 1999*). FDG PET images may be more sensitive than CT because alterations in tissue metabolism generally appear first

before the anatomical changes (*Shim et al., 2005*). However, PET has relatively poor spatial resolution, thus limits its anatomical localization of lesions (*Bruzzi and Munden, 2006*).

Integrated PET/CT provides information about anatomy and metabolism by combining morphological CT data and functional PET data (*Kim et al., 2006*).

¹⁸F-FDG PET/CT scanning is now a standard procedure for staging patients with NSCLC. (*NCCN, 2010*) and therefore implemented in various international guidelines for presurgical evaluation (*Silvestri et al., 2013*).

AIM OF THE STUDY

The aim of this study is to evaluate the diagnostic accuracy of 18F-FDG PET/CT in detecting metastases for staging in NSCLC patients.

Chapter (1)

ANATOMY OF LUNGS

The lungs are considered the essential organs of respiration. They are located on either side of the heart and other mediastinal structures, and occupy most of the thoracic cavity (*Strandring, 2016*).

The right lung is divided into superior, middle and inferior lobes by its oblique (major) and horizontal (minor) fissures (Fig 1). The superior, lengthier oblique fissure separates the inferior from the superior and middle lobes. It starts posteriorly at the level of fourth thoracic vertebra. It descends across the fifth intercostal space and follows the sixth rib to the sixth costochondral junction (*Strandring, 2016*). The shorter horizontal fissure separates the superior and middle lobes. It passes from the oblique fissure, near the mid-axillary line, horizontally to the anterior border of the lung, then passes posteriorly to the hilum on the mediastinal surface (*Strandring, 2016*). The horizontal fissure is usually visible on a frontal chest radiograph while the oblique fissure is usually visible on a lateral radiograph. The smaller middle lobe is wedged between the superior and inferior lobes (*Strandring, 2016*).