The Role of Dual Modality Positron Emission Tomography/ Computed Tomography (PET/CT) Imaging in Diagnosis and Staging of Non Small Cell Lung Cancer

Essay
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BY

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التطبيقات الحديثة للا نبعاث البوزيترونى المقطعى والأشعة المقطعية المبرمجة فى تشخيص وتحديد مراحل تطور أ ورا م ا لخلايا ا لغير صغيرة فى ا لرئة

بحث

مقدم كجزء متمم للحصول على درجة

الماجيستير فى الأشعة التشخيصية

مقدمة من الطبيبة

شيروت فكرى عبد السلام

بكالوريوس الطب والجراحة

تحت إشراف

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Sherwitt Fikry Abd-Elsalam

To

My Parents and my Husband

With

Love and Gratitude

List of Abbreviations

Abbreviation		Full name
BGO	**:**	Bisthmus Germinate Oxide.
Br	:	Brachiocephalic vein.
CL	:	Clavicle.
Cm	**:**	Centimeter.
CNS	:	Central nervus system.
CT	**:**	Computed tomography.
2D	**:**	Two dimensions.
3-D	**:**	Three dimensions.
e.g.	**:**	For example.
FDG	**:**	Flurodeoxyglucose.
F18 FDG	**:**	Flourine 18 flurodeoxyglucose
Fig.	**:**	Figure.
HRCT	**:**	High resolution computed tomography.
HU	**:**	Hounsfield unite.
Kev	**:**	Kilo electron volt.
LOR	**:**	Line of response.

List of Abbreviations

Abbreviation		Full name
LSO	**:**	Lutetium oxyorthosilicate.
LT.	**:**	Left.
M	**:**	Manubrium.
mCi	**:**	milli Curi.
Mev	**:**	Mega electron volt.
mg	**:**	Milligram.
MRI	**:**	Magnetic resonance imaging.
mSV	**:**	Milli siverte.
N	**:**	Neutron.
NSCLC	**:**	Non small cell lung cancer.
P	**:**	Proton.
PET	**:**	Positron emission tomography.
PET/CT	**:**	Positron emission tomography/computed tomography.
Pmj	**:**	Pectoralis major muscle.
Pmn	**:**	Pectoralis minor muscle.
ROI	**:**	Region of interest.
RSPV	:	Right superior pulmonary vein.

Abbreviation		Full name
RT.	**:**	Right.
SUV	:	Standared uptake value.
T	:	Trachea.
U/S	:	Ultrasonography.

Aim of the Work

The aim of this study is to highlight the role of PET/CT in the diagnosis and staging of non-small cell lung cancer (NSCLC).

Contents

Introduction

Lung cancer is the leading cause of tumour-related deaths ***(Jemal et al., 2002)***. Non-small cell lung cancer (NSCLC) accounts for about 80% of bronchogenic malignancies. As defined by the American Joint Committee on Cancer (AJCC), tumour staging is considered to be the most important factor that helps determine the NSCLC prognosis ***(Brundage et al., 2002)***.

The choice of therapy options is based on the tumour stage. Hence, the accurate determination of the tumour size, potential infiltration of adjacent structures, and mediastinal lymph node involvement, and the detection of distant metastases are of central importance ***(Haura and Davies, 2001)***.

Conventional chest radiograph, computed tomography (CT), Magnetic resonance imaging (MRI), radionuclide scintigraphy, and positron emission tomography (PET) all have been used for NSCLC staging ***(Barker and Silvestri, 2002)***.

Positron emission tomography is a non-invasive nuclear medicine study that has been in existence for almost 30 years, but has been gaining acceptance in oncologic imaging rapidly during the past years ***(Staneley et al., 2002)***. The basis of tumour imaging with PET is a specific uptake mechanism of

positron emitting radiopharmaceuticals ***(Bombardieri and Crippa, 2001)***.

Although CT can accurately assess tumour size and infiltration of adjacent structures, PET has been shown to be more sensitive and specific in the detection and characterization of metastases to mediastinal lymph nodes ***(Pieterman et al., 2000)***.

Imaging by PET can provide functional data about the imaged structures rather than the morphological (anatomical) ones that can be gained by CT ***(Townsend, 2001)***. Accurately fused functional and morphologic data sets are now generated by recently available dual-modality PET/CT imaging systems ***(Bever et al., 2002)***.

PET/CT represents the most efficient and accurate approach to NSCLC staging, with a profound effect on therapy and hence, patient prognosis than either PET data alone or CT data alone ***(Antoch et al., 2003)***.

Anatomy of the Chest

Development of the Lungs:

A longitudinal groove, known as the laryngotracheal groove, develops in endodermal lining of the floor of the pharynx. The margins of this groove fuse and form the laryngotracheal tube ***(Snell, 2004)***.

The laryngotracheal tube then divides distally into the right and left lung buds, where each lung bud consists of an endodermal tube surrounded by splanchnic mesoderm and from this, all the tissues of the corresponding lung are derived ***(Snell, 2004)***.

Each lung bud divides into three lobes and then into two, corresponding to the number of main bronchi and lobes found in the fully developed lung .Each main bronchus then divides repeatedly until the terminal bronchioles and alveoli are formed ***(Snell, 2004)***.

Topographical Anatomy:

The right and left lungs lie in the corresponding halves of the thorax. They are separated from each other by the structures in the mediastinum ***(Singh, 2002)***.

Each lung has a narrow upper end (apex), inferior surface (base), rounded (lateral or costal) surface and (medial) surface. The costal surface meets the medial surface in front at the anterior border and behind at the posterior border while the costal and medial surfaces end below in an inferior border by which they are separated from the base ***(Singh, 2002)***.

The surface of the lung is free all round and is covered by pleural (visceral layer) except at an area of the medial surface called the hilum ***(Singh, 2002)***.

Lobes and Fissures (Fig1):

1. ***Right lung:*** The right lung is slightly larger than the left and is dividd by the oblique and horizontal fissures into three lobes; the upper, middle and lower lobes. The horizontal fissure runs horizontally across the costal surface at the level the fourth costal cartilage to meet the oblique fissure in the mid axillary line, while the oblique fissure runs from inferior border upward and backward across the medial and costal surfaces until it cuts the posterior border about 6.25 cm below the apex ***(Corne et al., 2003)***.
2. ***Left lung:*** The left lung is divided by a similar oblique fissure into two lobes; the upper and lower ; there is no

horizontal fissure in the left lung ***(Snell, 2004)***.

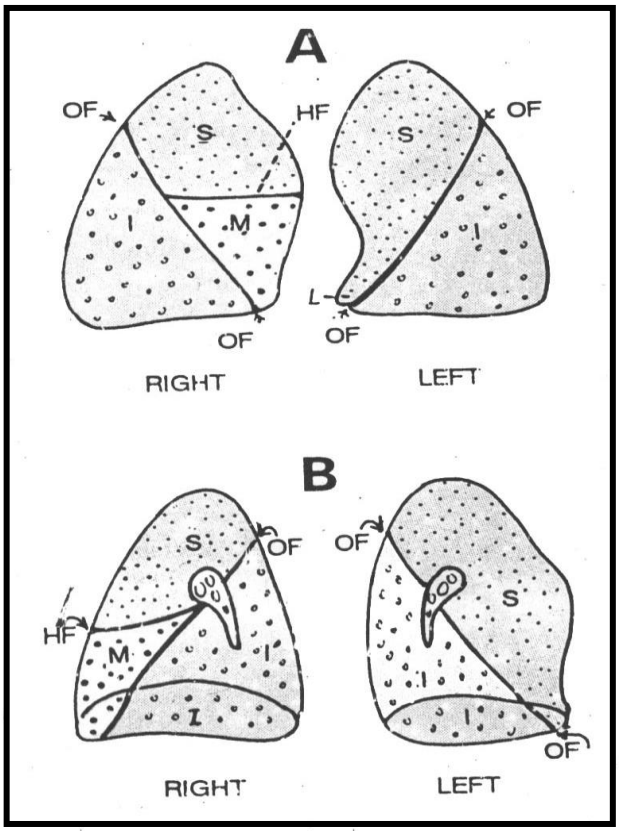

***Fig.* (1): Fissures and lobes of lungs.**

A= Anterior aspect B= Medial aspect S=Superior lobe
M= Middle lobe I=Inferior lobe L=Lingula
OF=Oblique fissure HF= Horizontal fissure

(Quoted from Singh, 2002)

<u>Bronchopulmonary segments& intrapulmonary bronchi</u>

<u>Fig. (2):</u>

The lobes are further divided into segments, the main