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

Thesis

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بسم الله الرحمن الرحيم

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم الحكيم

صدق الله العظيم

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List of Abbreviations

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

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).*** Fuorine 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 vertabra. 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).***