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# **Comparative Study between 18F-FDG PET Scan and Conventional CT in Assessment of Non-Small Cell Lung Cancer Patients After Treatment**

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**Abstract**---Background: Lung cancer is one of the most common malignancies worldwide. Hence, timely diagnosis and accurate staging of the carcinoma as well as strict follow up is critical for better prognosis. Imaging studies play a key role in post-treatment follow up of patients with lung cancer. Positron emission tomography (PET) scanning has developed as an important tool in the multi-disciplinary management of lung cancer. The combination of fluorine-18 fluorodeoxyglucose positron emission tomography (FDG-PET) and computed tomography (CT) has a great impact on the diagnosis, staging, and hence on the follow up of lung cancer patients compared to conventional CT study only. Methods: A retrospective comparative study conducted on 15 patients histopathologically proven to have NSCLC. Conclusion: <sup>18</sup>F-FDG PET scan had a superior role in monitoring tumor turn over in case of no appreciable time interval changes in its size according to the CT.

**Keywords**---Non-small cell lung cancer (NSCLC), Positron Emission Tomography (PET), Computed tomography (CT).

## Introduction

Lung cancer is the most common cause of cancer-related death in men and the second most common in women worldwide <sup>(1)</sup>. There are two main subtypes of lung cancer, small-cell lung carcinoma and non-small-cell lung carcinoma (NSCLC), accounting for 15% and 85% of all lung cancer, respectively. NSCLC is further classified into three types: squamous-cell carcinoma, adenocarcinoma, and large-cell carcinoma <sup>(2)</sup>.

Post-treatment follow-up in patients with NSCLC usually consists of a combination of physical examination, laboratory tests, and imaging. No single modality is simultaneously sensitive, specific, and cost-effective; thus, a combined approach is needed for the detection of tumor response to treatment and recurrence <sup>(3)</sup>.

Conventional CT is considered as a conditional and standard method of diagnosis, staging, and follow-up of lung cancer and provides excellent morphological information, but it has significant limitations in differentiating between benign and malignant residual lesions either in an organ or in lymph nodes. Also, it is difficult for it to evaluate the invasion of the chest wall or involvement of the mediastinum and differentiate tumors from post obstructive atelectasis correctly <sup>(4)</sup>.

<sup>18</sup>F-FDG PET is expected to improve accuracy and early diagnosis of progressive and recurrent disease because changes in cellular metabolism occur more rapidly than do changes in tumor size detected by CT alone. Routine evaluation with <sup>18</sup>F-FDG PET/CT defines the therapeutic response by quantifying the SUVmax within the tumor <sup>(3)</sup>. Also, <sup>18</sup>F-FDG PET is more sensitive than CT alone in monitoring for recurrence after treatment due to the superiority of <sup>18</sup>F-FDG PET in identifying extra-thoracic masses and a new hyper metabolic nodule in patients with many pulmonary nodules<sup>(5)</sup>.

## Aim of the study

Assessing the role of <sup>18</sup>F-FDG PET scan compared to conventional CT, in evaluation of NSCLC patients after treatment.

## Results

This study was conducted on 15 patients with the age of the selected patients was ranging from 33 – 81 years with a mean  $\pm$  SD of  $63.67 \pm 11.61$ . 4 patients were females (26.7%) while the rest 11 were males (73.3%) (Table 1). All were pathologically proven to have NSCLC; 11 patients were adenocarcinoma (73.3 %) and 4 patients were squamous cell carcinoma (26.7 %). The right lung was involved in 10 patients (66.7 %) while the left lung was involved in the remaining 5 patients (33.3 %). 8 patients received chemotherapy (CTH) only (53.3 %) and 7 patients received combined CTH and RTH (46.7 %) (table 2).

Table 1  
Demographic data of the studied patients

		<b>No. = 15</b>
Age	Mean±SD	63.67 ± 11.61
	Range	33 – 81
Sex	Female	4 (26.7%)
	Male	11 (73.3%)

Table 2  
Primary tumor data of the studied patients

<b>Primary lesion</b>		<b>No.</b>	<b>%</b>
Side	Right	10	66.7%
	Left	5	33.3%
Tumor location	Lower lobe	3	20.0%
	Middle lobe	4	26.7%
	Upper lobe	8	53.3%
Pathology results	Adenocarcinoma	11	73.3%
	Squamous carcinoma	4	26.7%
Treatment received	CTH	8	53.3%
	CTH&RTH	7	46.7%

The primary tumor size in CT and SUV uptake in <sup>18</sup>F-FDG PET were compared before and after treatment and there was no statistically significant difference found with P-value = 0.182 and 0.338 respectively (Table 3). However, more difference in the SUV range was noticed compared to the CT size which more accurately reflected the tumoral activity.

Table 3  
Comparison between lesion size and SUV before and after treatment

		<b>Before</b>	<b>After</b>	<b>Test value</b>	<b>P-value</b>	<b>Sig.</b>
		<b>No. = 15</b>	<b>No. = 15</b>			
Lesion size in CT (cm)	Mean±SD	4.93 ± 2.92	4.14 ± 2.75	-1.403	0.182	NS
	Range	1.5 – 11.8	0 – 10			
Lesion SUV in PET	Mean±SD	9.39 ± 5.90	7.79 ± 4.51	-0.992	0.338	NS
	Range	2.3 – 21	1.89 – 16			

P-value >0.05: Non-significant (NS); P-value <0.05: Significant (S); P-value < 0.01: highly significant (HS)

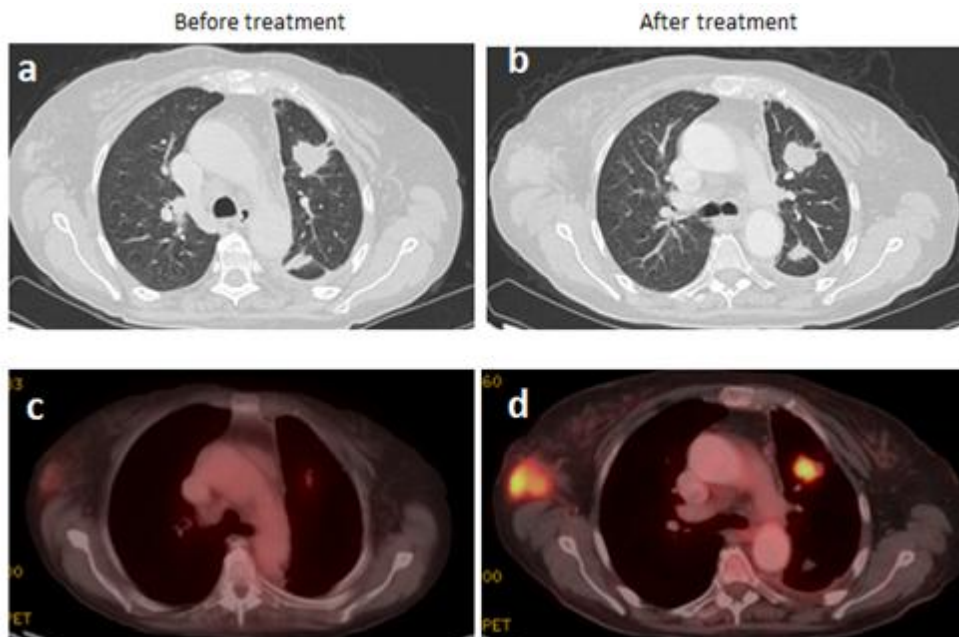


Figure 1. 70-year-old female patient pathologically proven to be adenocarcinoma of the left lung; initial CT showed left upper lobar lobulated mass lesion measuring 2.4x1.9 cm (a) PET scan confirming the presence of low grade metabolically active left lung lesion ( c ). Upon follow up CT shows almost no size change as regard the primary tumor size being 2.4x2 cm (b) yet PET scan showed considerable increase in metabolic activity of the primary lesion being of SUVmax 6.8 (d).

## Discussion

Our study was conducted on 15 patients with NSCLC unfit for radical surgery, we compared the conventional CT and  $^{18}\text{F}$ -FDG PET scan findings before and after receiving the appropriate treatment according to each case, we found that the primary tumor size showed no statistically significant difference as regards the size and SUV before and after treatment. However, we noticed more difference in the SUV range than that seen regarding the size showing more or less better information as regard the tumor activity after treatment. This is close to the study of Tawfik M. et al, **2020** (6) that found a considerable change in the tumor activity after treatment with no considerable size changes of the solid tumors.

Although the CT is widely applied to evaluate the treatment response for solid tumors, but it is known to have limitations because it depends on the morphologic changes. Now with increasing use of the targeted therapy, such as anti-angiogenic therapy in clinic, a new evaluation method is necessary to effectively monitor the response of this therapy.  $^{18}\text{F}$ -FDG PET is considered to overcome such limitations and more suitable for assessment of therapeutic effect because it can better reflect the intrinsic nature of malignant tumor.

Also the study of Ding et al., done on 2014 (7) conducted on 44 patients that demonstrated that the percentage changes of SUVmax after treatment for NSCLC monitored by PET were higher than the percentage changes of diameter by CT. But like our study there was no statistically significant results were obtained in 44 patients' data with paired *t*-test. The selection bias should be responsible for this inconformity because of the negative data of progression patients. To our knowledge there is no research that proposed the similar problem although a considerable proportion of assessment result was progression in clinic.

Many studies have confirmed that <sup>18</sup>F-FDG PET can monitor the metabolic changes of tumors after treatment when the morphologic changes on CT images can not be detected. The data of most patients in this study also support this viewpoint in which the reduction percentages of diameter were lower than that of SUVmax on PET/CT images. Limitations in this study included the retrospective nature of patient data collection, the number of target lesion and the different cycles' interval of PET/CT review.

### **Conclusion**

<sup>18</sup>F-FDG PET helps in early detection of the metabolic changes of the tumor and hence proper modification of the treatment strategy with better patient/treatment outcome.

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