CORRELATION BETWEEN THE FDG UPTAKE OF PRIMARY TUMOUR AND METASTATIC MEDIASTINAL LYMPH NODES IN NON SMALL CELL LUNG CARCINOMA

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ABSTRACT

BACKGROUND

FDG-PET/CT is the current imaging modality of choice in the workup of patients with Non-Small Cell Lung Carcinoma. Mediastinal Lymph nodal status is an important indicator in the staging and prognostication of patients with Lung carcinoma. Optimal therapeutic options are decided on the nodal status.

The aim of the study is to evaluate the relationship between the FDG uptake in the primary tumour and metastatic mediastinal lymph nodes.

MATERIALS AND METHODS

We retrospectively analysed PET/CT data of 35 patients with histopathologically proven non-small cell lung carcinoma. SUV max in the primary tumour and mediastinal lymph nodes were measured and then statistically evaluated.

RESULTS

There was moderate positive linear correlation between the FDG uptake in the primary tumour and mediastinal lymph nodes. Only four patients did not have any mediastinal lymph node metastases.

CONCLUSION

In non-small cell lung carcinoma, FDG uptake in a mediastinal lymph node is directly proportional to the uptake within the primary tumour.

KEYWORDS

18 Fluro 2 Deoxy-Glucose Positron Emission Tomography- Computed Tomography (FDG-PET/CT), Non-Small Cell Lung Carcinoma (NSCLC), Maximum Standardised Uptake Value (SUV max).

HOW TO CITE THIS ARTICLE: Murali A, Periyakaruppan G, Raj B, et al. Correlation between the FDG uptake of primary tumour and metastatic mediastinal lymph nodes in non small cell lung carcinoma. J. Evid. Based Med. Healthc. 2018; 5(34), 2459-2462. DOI: 10.18410/jebmh/2018/507

BACKGROUND

In current clinical practice, 18 Fluro 2 Deoxy-Glucose Positron Emission Tomography- Computed Tomography (FDG-PET/CT) is widely and routinely used non-invasive diagnostic method in the evaluation and staging of Non-Small cell lung carcinoma (NSCLC). The ability to provide functional metabolic information in addition to anatomic information by FDG-PET/CT scores ahead of standalone Computed tomography (CT) or Magnetic Resonance imaging (MRI). Numerous studies have demonstrated that the superior diagnostic performance of FDG-PET/CT to contrast enhanced CT and MRI.[1-3] Maximum Standardized uptake value (SUV max) is a semiquantitative measure of the FDG uptake by the structures.

Staging of disease is important is deciding the line of treatment.[4] The AJCC TNM classification is the present standard for staging lung cancer patients. The system evaluates for the location and extent of primary tumour (T); extension of the tumour to the hilar or mediastinal lymph nodes (N); and the presence or absence of metastases (M).[5] FDG-PET/CT outperforms other non-invasive imaging methods in detecting metastases in normal-sized lymph nodes.[6] According to the recent guidelines FDG -PET/CT is preferred in the work-up for mediastinal and distal metastases.

The aim of our study was to look for any linear correlation between the FDG uptake in the primary tumour and mediastinal lymph nodes in cases of Non-Small cell lung carcinoma, and to look at the capability of FDG uptake of primary tumour in predicting the incidence of metastatic mediastinal lymph nodes.

Financial or Other, Competing Interest: None.
Submission 24-07-2018, Peer Review 28-07-2018,
Acceptance 11-08-2018, Published 14-08-2018.
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DOI: 10.18410/jebmh/2018/507

MATERIALS AND METHODS

Patients

We retrospectively analysed the FDG-PET/CT of 35 patients with histopathologically proven patients Non-Small Cell Lung Carcinoma who came had come to our institution (Sri Ramachandra Medical Centre, Chennai, India) for pre-treatment staging. Patients who had prior neoadjuvant chemotherapy or radiotherapy were excluded from our study.

FDG-PET/CT Imaging

Patients were asked to fast at least 6 h before the FDG-PET-CT scan. All patients had a glucose level below 180 mg/dl and were injected intravenously with 0.22 mCi (8.14 MBq)/kg (5-8 mCi/260-320 MBq) FDG. At 60–90 min after the injection, data were acquired from the vertex to the upper thigh. The first CT scan was performed using 120 kV, 130mA and a 3-mm section thickness. Immediately after CT, a PET scan (Siemens Biograph Horizon; Siemens Medical Solutions, Inc., Malvern, PA, USA) was performed for about 7 mins, with seven to eight bed positions and 1 min/position. PET images were reconstructed iteratively with CT data for attenuation correction, using an inline integrated Siemens Esoft Workstation system.

Image Analysis

Images were then transferred to Workstation (Siemens Syngovia workstation, Siemens Medical Solutions, Inc., Malvern, PA, USA). Computerized tomography integrated positron emission tomography fusion images in transaxial, sagittal, and coronal planes were evaluated. Maximum standardised uptake values (SUV max) were based on the hottest pixel within the region of interest (ROI) drawn around the primary tumour and mediastinal lymph node on an attenuation-correction/ PET-CT fused image. Absence of lymph node was recorded as 0.

Data and Statistical Analysis

Data was exported on to a Microsoft excel sheet. Analysis of the data was done using Pearson's correlation coefficient.

RESULTS

Clinical Data

Of the 35 patients with NSCLC, involvement of the mediastinal lymph nodes was seen in 31 patients. Age group varied from 35 to 77 years. 25 patients were male and 10 were female.

FDG uptake on PET/CT.

FDG uptake in the Primary tumour and the mediastinal lymph nodes are summarised in Table 1.

In the primary tumour, the highest FDG uptake in the SUV max of 25.5 and the lowest FDG uptake was SUV max 1.07 (Figure 1). In the mediastinal lymph nodes, the highest FDG uptake was 17.3 and the lowest FDG uptake in an identifiable lymph node was SUV max 2.23 (Figure 2).

The mean uptake in the primary tumour was 10.73 with SD 4.80. The mean uptake in mediastinal lymph node was 7.13 with SD 4.38.

The Pearson's correlation coefficient was 0.602, suggestive of moderate positive correlation between the uptake of FDG in the primary tumour and mediastinal lymph node.[7]

	SUV Max in Tumour	SUV Max in Lymph Node
1.	1.07	0
2.	4.3	5.48
3.	4.76	2.77
4.	4.93	2.23
5.	5.9	0
6.	6.19	0
7.	7.57	6.96
8.	7.92	4.2
9.	8.29	5.08
10.	8.52	8.48
11.	8.53	7.9
12.	8.54	7.76
13.	8.56	3.15
14.	8.83	7.07
15.	8.9	9.47
16.	9.05	7.64
17.	9.67	0
18.	9.97	6.49
19.	10.1	10.48
20.	10.67	8.5
21.	11	10.38
22.	11.1	3.49
23.	11.4	2.08
24.	12.28	8.9
25.	12.46	11.1
26.	13	9.93
27.	13.2	8.4
28.	13.26	13.44
29.	14.8	8.21
30.	14.8	8.09
31.	15	14
32.	17.68	17.3
33.	18	9.7
34.	20.14	15.78
35.	25.5	5.4
Mean	10.73971429	7.138857143
SD	4.807328649	4.387199811

Table 1. Annexure

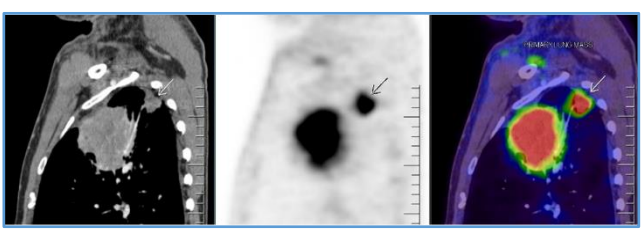

Figure 1. Sagittal CT, PET and PET/CT Fused Images Showing Two FDG Avid Mass Lesion in the Upper Lobe of the Lungs

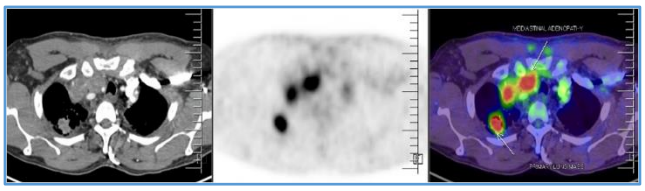

Figure 2. Axial CT, PET and PET/CT Fused Images showing FDG Avid Lymph Nodes in the Upper Paratracheal Region (2R Mediastinal Station)

DISCUSSION

The results indicate that there is a moderately positive correlation between the FDG uptake in the primary tumour and mediastinal lymph nodes.

Vesselle et al. demonstrated significant difference in the FDG uptake across different histologic subtypes and differentiation subtypes in NSCLC.[8] These differences were in relation to the Ki67 scores of the tumours. Lu G et al. found a positive correlation between the size of the tumour and FDG uptake in solid pulmonary lesions.[9] Hellwig et al. investigated and correlated a significant association between the FDG uptake and the size of the primary mass.[10] It is yet to be proven that FDG uptake in a mass is an independent predictor of survival.

N stage of the disease has therapeutic and prognostic implications, especially in patients with mediastinal nodal involvement and no extrathoracic disease.[2] Studies by Ozgul et al.[11] and Kumar et al.[12] found that an optimal cut-off of SUV max 2.5 could be used for distinguishing metastatic from benign lymph nodes. FDG-PET /CT is crucial in evaluating mediastinal nodal sites that are inaccessible to mediastinoscopy. Significant false-negative and false-positive findings have been observed in N-staging in lung cancer.[13,14]

Nambu et al. demonstrated that the likelihood of mediastinal lymph node metastases increased with an increase in the FDG uptake of the primary tumour, especially for lesion with a SUV max greater than 12. The probability was as high as 70 %, irrespective of the degree of FDG uptake in the mediastinal lymph nodes.[15] In the study by Higashi et al., they concluded FDG uptake by the primary tumour is a strong predictor of lymph node metastases.[16] Ozgul et al. observed higher incidence of lymph node metastases in adenocarcinoma (24%) than with squamous cell carcinoma.[10] In contrast, another study showed no significant difference in the frequency of incidence of lymph nodes involvement between adenocarcinoma and squamous cell carcinoma.[16]

Our study had limitations. The primary tumours were not divided according to their histological subtypes. Not all the mediastinal lymph nodes were sampled and proven for metastases.

CONCLUSION

In non-small lung carcinoma, FDG uptake by the primary had moderate correlation with the FDG uptake in mediastinal lymph nodes. Larger studies would help in estimating the potential predictive value of FDG uptake by tumour in predicting the incidence of mediastinal lymph node metastases.

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