



Usefulness of Pet/Ct in Preoperative Staging of Nsclc Patients

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Abstract

Aim: To evaluate the usefulness of integrated positron emission tomography and computed tomography (PET/CT) in preoperative staging of patients with non-small cell lung carcinoma (NSCLC).

Methods: Twenty nine histopathologically proven patients of NSCLC having CT based staging were subjected to PET/CT imaging. PET/CT was done 60 min after the intravenous injection of ¹⁸F-FDG. Whole body imaging (base of skull to mid thigh region) was performed in all patients.

Results: Based on staging, disease was considered as nonresectable if staging \geq IIIB.

Of the 29 patients studied, CT showed resectable disease in 21 & nonresectable in 8 patients; PET/CT showed resectable disease in 15 & nonresectable in 14 patients. By PET/CT findings, 7 patients were changed from resectable to non-resectable group and one patient from non-resectable to resectable group. Hence, in 27.5% (8/29) of patients, change in management was achieved.

PET/CT upstaged 12 patients (41.3%), downstaged 3 patients (10.3%) & confirmed staging in 14 patients (48.3%) compared to CT. Upstaging was done by the finding of nodal status in 6 and metastases in 6 patients. PET/CT downstaged 3 patients. (One suspected liver metastasis was found to be benign; mediastinal nodal involvement was ruled out in two patients). PET/CT was found to be more useful in the evaluation of nodal status and metastasis involvement which are the major determinants of respectability in patients with NSCLC.

Conclusion: PET/CT showed excellent utility in the initial staging of patients with NSCLC. PET/CT changed the management, by deferring futile surgery, in approximately 24% of the patients. PET/CT should be considered mandatory in all patients considered to have resectable NSCLC.

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Introduction

Lung cancer is a common disease with 1.3 million new cases per year worldwide and is a leading cause of death in many countries. Non small cell lung cancer (NSCLC) accounts for 75–80% of these cases [1]. Optimal staging is important in order to determine the best possible therapeutic option, to clarify operability and to have an idea about the outcome of the patient. Staging of NSCLC is based on tumour size and location (T-stage), nodal involvement (N-stage) and the presence or absence of metastases (M-stage) [2]. Computed tomography (CT) is the standard imaging technique for the investigation of lung cancer in most centres. Multi-detector CT (MDCT) is the current technological standard technique that can provide improved information about transpleural tumour growth, pleural involvement and mediastinal and chest wall invasion.

Positron emission tomography (PET) scanning with radiolabeled [¹⁸F]-2-fluoro-deoxy-D-glucose (FDG) imaging has shown substantial promise in the recent past in aiding the noninvasive preoperative staging of lung cancer. [3-5] FDG-PET imaging uses the radiolabeled FDG tracer as a glucose analog with comparable uptake in metabolically active cells. The positron-labeled molecule is transported into cells via glucose transporters. Once inside the cell, it is phosphorylated by hexokinase and essentially is trapped in the cell. Due to their high proliferation rate, tumor cells have an increased glucose metabolism, a characteristic that is exploited by FDG-PET imaging. FDG-PET imaging has been reported [3,6] to have superior sensitivity, specificity, and accuracy in the detection of mediastinal nodal involvement compared to those of thoracic CT imaging. It also has proven to be effective in the detection of distant metastases on whole-body imaging, thereby identifying unresectable disease and directing patient management [7,8].

Integrated positron emission tomography (PET)/computed tomography (CT) is an anatomo-

Table 1: Upstaging by PET/CT.

PATIENT no	CT	PET/CT	RESECTABILITY
1	T3N0M0	T3N3M0	R to N
2	T2N0M0	T2N3M1	R to N
3	T2N0M0	T2N2M0	R
4	T2N0M0	T2N2M0	R
5	T2N0M0	T2N3M1	R to N
6	T3N0M0	T3N3M0	R to N
7	T4N0M0	T4N3M1	N
8	T3N0M0	T3N2M0	R
9	T2N0M0	T2N3M1	R to N
10	T2N0M0	T2N2M1	R to N
11	T2N0M0	T2N2M0	R
12	T2N0M0	T2N2M1	R to N

metabolic imaging modality that has recently been introduced to clinical practice and combines two different techniques: CT, which provides very detailed anatomic information; and PET, which provides metabolic information. One of the advantages of PET/CT is the improved image interpretation. This improvement can result in the detection of lesions initially not seen on CT or PET, a more precise location of lesions, a better characterisation of the lesion as benign or malignant and a better differentiation between tumour and surrounding structures. Initial studies demonstrate better results for PET/CT in the staging of lung cancer in comparison with PET alone, CT alone or visual correlation of PET and CT [9,10].

In this study, we compared the integrated PET/CT and CT as non-invasive diagnostic modalities in the initial staging of patients with NSCLC. Resectability of tumor based on the AJCC classification for NSCLC was applied and the change in patient management after PET/CT was observed.

Aim

To evaluate the usefulness of integrated positron emission tomography and computed tomography (PET/CT) in preoperative staging of patients with non-small cell lung carcinoma (NSCLC).

Methods

Twenty nine histopathologically proven patients of NSCLC having CT based staging were included in this study. These patients were subjected to PET/CT imaging within a week. PET/CT was done 60 min after the intravenous injection of ¹⁸F-FDG. Whole body imaging (base of skull to mid thigh region) was performed in all patients. CT was done using the standard protocol.

Based on TNM staging, disease was considered as nonresectable if staging \geq IIIB. Though some patients in stage-III A with N2 disease are considered as non-resectable by some surgeons, most of these patients are treated by surgery in our centre. Hence, nonresectability was applied to patients only with stage \geq IIIB disease.

Results

The TNM staging was framed for each patient based on CT and PET/CT findings; disease was considered as nonresectable if staging \geq IIIB. PET/CT upstaged 12 patients (41.3%), downstaged 3 patients (10.3%) & confirmed staging in 14 patients (48.3%) compared to CT. Upstaging was done by the finding of nodal status in 6 and metastases

Table 2: Downstaging by PET/CT.

PATIENT no	CT	PET/CT	RESECTABILITY
13	T2N2M0	T2N0M0	R
14	T2N2M1	T2N2M0	N to R
15	T2N2M0	T2N0M0	R

R: Resectable Disease; N: Non-resectable Disease

in 6 patients. PET/CT downstaged 3 patients. (One suspected liver metastasis was found to be benign; mediastinal nodal involvement was ruled out in two patients).

Out of the 29 patients studied, disease was found to be resectable in 21 patients & nonresectable in 8 patients as interpreted by CT. PET/CT showed resectable disease in 15 patients & nonresectable disease in 14 patients. The resectability of disease as interpreted by PET/CT and CT findings were compared in each patient, in whom there was change in staging (n=15) by PET/CT. The details are shown in tables 1&2. 7 patients were changed from resectable to non-resectable group and one patient from non-resectable to resectable group by PET/CT. Hence, in 27.5% (8/29) of patients, change in management was achieved.

Discussion

Out of the 29 patients, fifteen underwent surgery based upon the results of PET/CT. Though PET/CT changed staging in 51.6% (15/29) of patients, change in resectability was achieved only in 27.5% (8/29) of patients. Out of these, 7 patients (24%) were upstaged and surgery was deferred. In 2 patients, contralateral mediastinal lymph node was found & confirmed by biopsy. In 5 patients distant metastasis was found- adrenal involvement in 2 patients, liver involvement in 2 patients and in one patient, single rib involvement which was missed out on CT was found. Thus, futile thoracotomy had been avoided in these patients minimizing the morbidity due to unnecessary surgery. In the patient who was downstaged, suspected liver involvement (metastatic) by CT was diagnosed as benign by PET/CT and was also confirmed pathologically.

Out of the 21 patients who were classified as having resectable disease by CT, 7 patients were reclassified as having non-resectable disease by PET/CT. Thus, among patients with NSCLC considered having resectable disease by conventional diagnostic modalities like CT, 33% can still have non-resectable disease as inferred in this study.

In the remaining 7 patients (out of 15), there was no change in resectability. This is because, N2 disease was found in the patients with CT stage <IIIA and they remained in the resectable group. Distant metastasis was found in a single patient with T4 disease, who was already in the non-resectable group. In the downstaged group, N2 disease was ruled out in patients with CT stage IIIA.

In 14 out of 29 patients, the findings were essentially the same by both CT and PET/CT. These patients remained in the same group of resectability, (either resectable or non-resectable) before and after PET/CT.

In a similar study done by Nakamura et al. [11] 20 underwent surgery out of 50 consecutive patients. Discrepancies between the two staging methods were observed in 14 patients (28%). The stage assigned by PET increased in 12 cases (24%) and decreased in 2 (4%). PET staging was accurate in eight cases with otherwise undetected distant metastases (M1) but was incorrect in six cases, including five where it over diagnosed nodal metastases (N). However, the figures

are high in this study. Upstaging had been essentially done by distant metastases finding in their study; nodal metastases have been over diagnosed. This was explained by the fact, in their centre, most of the patients present at a later disease stage harbouring nodal involvement.

A randomised trial [12] comparing PET/CT and cranial imaging with conventional imaging in the preoperative evaluation of patients with early stage NSCLC, disease was correctly upstaged in 23 of 167 PET-CT recipients and 11 of 162 conventional staging recipients (13.8% vs. 6.8%), thereby sparing these patients from surgery. Disease was incorrectly upstaged in 8 PET-CT recipients and 1 conventional staging recipient (4.8% vs. 0.6), and it was incorrectly understaged in 25 and 48 patients, respectively (14.9% vs. 29.6%). The authors have concluded that, preoperative staging with PET-CT and cranial imaging identifies more patients with mediastinal and extrathoracic disease than conventional staging, thereby sparing more patients from stage-inappropriate surgery, but the strategy also incorrectly upstaged disease in more patients. In this study, PET/CT had also understaged the disease. Though, the false-negatives were lesser than conventional imaging. As seen with the increase in patient number, the amount of upstaging done by PET/CT reduces drastically.

De Wever et al. [13] showed that integrated PET-CT predicted correctly the T status, N status, M status and TNM status in, respectively, 86%, 80%, 98%, 70% versus 68%, 66%, 88%, 46% with CT alone. Integrated PET-CT improves the staging of lung cancer through a better anatomic localization and characterization of lesions and is superior to CT alone and PET alone. The authors recommend visual correlation of PET and CT as a valuable alternative, if this integrated PET/CT is not available.

Our study has showed higher figures for upstaging done by PET/CT. The small sample size and the higher disease load in the patients admitted in our centre could have affected this gross discrepancy. Further studies with randomization and large sample size could give a clue to the real utility of PET/CT in these patients. However, PET/CT is found to be more useful in the evaluation of contra-lateral mediastinal lymph nodal status and metastasis involvement which are the major determinants of resectability in patients with NSCLC.

In conclusion, integrated PET/CT showed excellent utility in the initial staging of patients with NSCLC. PET/CT should be considered mandatory in all patients considered to have resectable NSCLC.

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