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Research Article

A Prospective Study on Stage Distribution of Lung Cancer at Clinical Suspicion, Histological Diagnosis and Pet-Ct Confirmation

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ABSTRACT
Background: Lung cancer is the most common cause of death from cancer worldwide and is still a major public health problem. Accurate staging is required for selection of the appropriate treatment modality and for prediction of prognosis. Traditional imaging modalities may underestimate or overestimate the extent of disease. The diagnosis is confirmed histopathologically but this does not define the full anatomic extent of disease. Positron Emission Tomography-Computed Tomography (PET-CT) combines metabolic and anatomic imaging and can improve the accuracy of staging by detection of occult nodal and distant metastases.
Objectives: To compare lung cancer stage distribution at clinical suspicion, histological diagnosis and PET-CT confirmation to evaluate the impact of PET-CT on stage migration.
Methods: An observational prospective study was carried out in Department of Respiratory Medicine, Coimbatore Medical College Hospital. We included fifty consecutive patients with a clinical suspicion of lung cancer who underwent histopathological confirmation and PET-CT staging after providing informed consent. Demographic details, smoking history, clinical findings, radiological investigations, histopathological diagnosis and PET-CT findings were noted. Patients with non-small cell lung carcinoma (NSCLC) were staged according to the 8th edition of the TNM classification. Patients with small cell lung carcinoma (SCLC) were classified as limited-stage or extensive-stage disease. Statistical analysis was performed using software SPSS. Continuous variables were expressed as mean ± standard deviation and categorical variables as frequency and percentage. Appropriate tests were performed using chi-square test, Fisher's exact test, and McNemar test. A p-value of <0.05 was considered statistically significant.
Results: Fifty patients were included in the study with a mean age of 62 ± 10 years. Forty-two patients (84%) were males and thirty-four patients (68%) had a history of smoking. Histopathological examination showed adenocarcinoma in 34 patients (68%), squamous cell carcinoma in 2 patients (4%) and small cell lung carcinoma in 14 patients (28%). In 36 patients with NSCLC PET-CT upstaged 26 patients (72.2%), down staged 8 patients (22.2%) and there was no stage change in 2 patients (5.6%). A highly significant difference was found between the clinical TNM stage and the PET-CT TNM stage (McNemar test, $p<0.001$).14 patients had SCLC, of whom eight had limited stage disease and six extensive stage disease at clinical assessment. PET-CT changed the classification of six of the eight limited-stage patients to extensive-stage disease, while the other two limited-stage patients and all six extensive-stage patients were unchanged. PET-CT resulted in upstaging in 32 patients (64%), downstaging in 8 patients (16%) and no stage change in 10 patients (20%).
Conclusion: PET-CT is a very useful tool to increase the accuracy of staging in lung cancer, by detecting occult nodal and distant metastases. Stage migration was significant after PET-CT, particularly in patients with NSCLC. PET-CT also identified occult extensive-stage disease in patients with SCLC, thereby impacting treatment planning. The routine inclusion of PET-CT in the staging work-up of lung cancer may improve therapeutic decision-making and optimize patient outcome.

Keywords: Lung Cancer, Pet-Ct, Nsclc, Small Cell Lung Carcinoma, Stage Migration, Tnm Staging.

INTRODUCTION

Lung cancer is the leading cause of cancer-related death worldwide and continues to be a

major challenge despite major advances in diagnosis and treatment. According to GLOBOCAN, lung cancer accounts for a large proportion of newly diagnosed cancers and is the most common cause of cancer deaths worldwide. Over the last two decades, the incidence of lung cancer has gradually increased in India due to tobacco consumption, environmental pollution and occupational exposure to carcinogens.[1,2] The disease is most likely to present in the sixth and seventh decades of life and has a male predominance, but the incidence in females is on the rise.[2,3]

Lung cancer is classified into non-small cell lung carcinoma (NSCLC) and small cell lung carcinoma (SCLC). NSCLC includes adenocarcinoma, squamous cell carcinoma and large cell carcinoma. SCLC has rapid growth, early dissemination and an aggressive clinical course.[3,4] The TNM staging system is used for NSCLC, whereas SCLC is classified as limited-stage or extensive-stage disease. Initial clinical staging depends on conventional imaging may not accurately identify mediastinal nodal disease or distant metastases, leading to inappropriate treatment decisions.[5,6] PET-CT identifies metabolically active primary tumours, nodal metastases and distant metastatic lesions with greater sensitivity. Several studies showed that PET-CT significantly improves staging accuracy and alters treatment strategy by identifying previously unrecognized metastatic disease.[7–10] The present study assess the stage distribution of lung cancer at clinical suspicion, histological diagnosis and PET-CT confirmation, and the impact of PET-CT on stage migration in patients with lung cancer.

Aim & Objecives

Aim

To study stage distribution of lung cancer at clinical suspicion, histological diagnosis and PET-CT confirmation.

Objectives

Primary Objective

To compare stage distribution at clinical suspicion, histological diagnosis and PET-CT confirmation.

Secondary Objectives

1. To determine frequency of stage migration following PET-CT.
2. To identify patterns of upstaging and downstaging.
3. To correlate demographic and clinical variables with stage migration.

MATERIALS AND METHODS

Study Design

This Prospective observational study was conducted in the Department of Respiratory Medicine, Coimbatore Medical College Hospital, Coimbatore for a period of 12 months on 50 Patients admitted with clinical and radiological suspicion of lung cancer.

Inclusion Criteria

- Age ≥18 years.
- Clinically and radiologically suspected lung cancer.
- Histopathological confirmation of primary lung malignancy.
- PET-CT performed before treatment.

Exclusion Criteria

- Previously treated lung cancer.
- Recurrent lung malignancy.
- Patients without histopathological confirmation.
- Patients who did not undergo PET-CT.
- Patients unwilling to participate.

METHODOLOGY

Written informed consent was obtained from all participants.

Detailed demographic data, smoking history, alcohol history, respiratory symptoms and physical examination findings were recorded.

All patients underwent:

- Chest X-ray
- CT/CECT chest
- Initial clinical staging
- Histopathological confirmation
- PET-CT staging
- Patients with NSCLC were staged according to the 8th edition TNM classification, whereas patients with SCLC were classified into limited-stage and extensive-stage disease.[5,11]

Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics software (Version 26.0). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were expressed as frequency and percentage. The association between categorical variables such as gender, smoking status, histological subtype and stage migration was analysed using the Chi-square test or Fisher's exact test, wherever appropriate.

Among patients with non-small cell lung carcinoma (NSCLC), comparison between clinical TNM staging and PET-CT TNM staging was performed using the McNemar test to evaluate stage migration after PET-CT. A p-value <0.05 was considered statistically

significant. Patients with small cell lung carcinoma (SCLC) were analysed separately because SCLC is conventionally classified as limited-stage and extensive-stage disease rather than by TNM stage groups. Therefore, SCLC data were presented using descriptive statistics (frequency and percentage).

RESULTS

Age Distribution

Mean age = 62 ± 10 years

Table 1: Gender Distribution

Gender	Number	Percentage
Male	42	84%
Female	8	16%

Table 2: Smoking Status

Smoking Status	Number	Percentage
Smoker	34	68%
Non-Smoker	16	32%

Table 3: Histological Distribution

Histology	Number	Percentage
Adenocarcinoma	34	68%
Small Cell Carcinoma	14	28%
Squamous Cell Carcinoma	2	4%

Table 4: Overall Stage Migration

Stage Migration	Number	Percentage (%)
Upstaged	32	64
Downstaged	8	16
No Stage Change	10	20
Total	50	100

Overall, PET-CT altered disease stage in 40 of 50 patients (80%), with upstaging being the most common pattern of stage migration.

Association between Demographic Variables and Stage Migration

Table 5: Association between Age Group and Stage Migration

Age Group (Years)	Stage Migration n (%)	No Stage Change n (%)	Total
<60	16	5	21
≥60	24	5	29

Statistical Test: Chi-square Test

There was no statistically significant association between age group and stage migration ($p = 0.73$).

Table 6: Association between Gender and Stage Migration

Gender	Stage Migration n (%)	No Stage Change n (%)	Total
Male	35	7	42
Female	5	3	8

Statistical Test: Chi-square Test

Gender was not significantly associated with stage migration following PET-CT ($p = 0.36$).

Table 7: Association between Smoking Status and Stage Migration

Smoking Status	Stage Migration n (%)	No Stage Change n (%)	Total
Smoker	30	4	34
Non-smoker	10	6	16

Statistical Test: Chi-square Test

Smoking status showed a statistically significant association with stage migration. Smokers had a higher frequency of stage migration following PET-CT than non-smokers (p = 0.031).

Table 8: Association between Histological Type and Stage Migration

Histology	Stage Migration n (%)	No Stage Change n (%)	Total
Adenocarcinoma	32	2	34
Squamous Cell Carcinoma	2	0	2
Small Cell Lung Carcinoma	10	4	14

Statistical Test: Fisher's Exact Test

Histological subtype was not significantly associated with stage migration (p = 0.44).

Table 9: Comparison of Clinical Staging and PET-CT Staging in NSCLC

Variable	Upstaged	Down staged	No Stage Change	P-value
NSCLC (n=36)	26	8	2	<0.001

Statistical Test: McNemar Test

PET-CT significantly changed TNM staging in patients with NSCLC.

Table 10: PET-CT Reclassification in SCLC

Clinical Stage	PET-CT Result	Number (%)
Limited Stage	Changed to Extensive Stage	6 (42.9)
Limited Stage	No Change	2 (14.3)
Extensive Stage	No Change	6 (42.9)

PET-CT identified occult extensive-stage disease in 6 patients with initially limited-stage SCLC. As SCLC is staged as limited or extensive disease rather than by TNM stage groups, descriptive analysis was performed**.**

Stage Migration Analysis

Histological Type	Total (n)	Upstaged n (%)	Down staged n (%)	No Stage Change n (%)	Statistical Test	P-value
NSCLC	36	26 (72.2)	8 (22.2)	2 (5.6)	McNemar Test	<0.001
SCLC	14	6 (42.9)	0 (0.0)	8 (57.1)	Descriptive Analysis	—
Overall	50	32 (64.0)	8 (16.0)	10 (20.0)	—	—

Summary of Statistical Analysis

Variable Compared	Statistical Test Used	P-value	Interpretation
Clinical TNM Stage vs PET-CT Stage (NSCLC, n=36)	McNemar Test	<0.001	Highly Significant
Smoking Status vs Stage Migration	Chi-square Test	0.031	Significant
Gender vs Stage Migration	Chi-square Test	0.36	Not Significant
Histological Type vs Stage Migration	Fisher's Exact Test	0.44	Not Significant

DISCUSSION

The present study was undertaken to evaluate the effect of PET-CT on staging of lung cancer by comparing clinical staging with PET-CT findings in 50 patients with histopathologically proven lung cancer. Adequate staging is critical for the selection of the appropriate treatment modality and for prognosis.

The mean age of the study population was 62±10 years with a male preponderance (84%) and a high prevalence of smoking (68%). These findings are consistent with earlier Indian studies reporting the higher prevalence of lung cancer among older male smokers. (Table 1). The most common histologic subtype was adenocarcinoma (68%) followed by small cell lung carcinoma (28%) and squamous cell carcinoma (4%). This is consistent with recent epidemiologic trends showing an increased predominance of adenocarcinoma. (Table 3). In 36 patients with NSCLC, PET-CT significantly changed the TNM stage in 72.2% (upstaged), 22.2% (down staged) and 5.6% (no change). The difference between clinical and PET-CT staging was highly significant (McNemar test, p < 0.001). This shows the superiority of PET-CT in the diagnosis of occult nodal and distant metastases. (Table 9). These findings are consistent with previous PET-CT staging studies.[7–10] The patients with SCLC were

analyzed separately by limited-stage and extensive-stage classification. PET-CT changed the stage from limited-stage to extensive-stage disease in 6 of 14 patients (42.9%) while in 57.1% no change was seen. These results highlight the role of PET-CT in detection of occult metastatic disease and appropriate planning of treatment in SCLC.[12] (Table 10).
Overall, PET-CT caused upstaging in 64%, downstaging in 16% and no stage change in 20% of patients, with an overall stage migration rate of 80%. Stage migration was significantly associated with smoking status ($p = 0.031$) but not with gender or histological subtype. (Table 4).

CONCLUSION

The present study findings support the routine use of PET-CT in the staging of lung cancer as it improves the staging accuracy, appropriate treatment selection, and helps in avoiding unnecessary surgical intervention.

Limitations

1. Single-centre study.
2. Small sample size.
3. Short study duration.
4. Surgical validation of PET-CT findings was not available in all patients.

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