



Role of Multi-Detector Computed Tomography Imaging In Patients with Clinically Suspected Lung Cancer in Kumaun Region of Uttarakhand (India)

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ABSTRACT

BACKGROUND:- Bronchogenic carcinoma is most common cause of cancer-related mortality in the developed world and its incidence is rising in developing countries. Radiological imaging plays a critical role in the initial detection and diagnosis of lung cancer. Chest radiography and computed tomography are the primary imaging modalities. Multi Detector computed tomography (MDCT) is the modality of choice for evaluating the lung carcinomas.

OBJECTIVES:- The objectives of our study are to assess the role of multi detector computed tomography in diagnosis, characterization and staging of lung cancer and their cytopathological correlation.

MATERIAL AND METHODS: This cross sectional study comprised of all patients who presented to the department of radiodiagnosis GMC and associated Dr. STM hospital Haldwani (Nainital), the only postgraduate institute and a tertiary care center of the Kumaun region of Uttarakhand, for CT scan of thorax, having clinical and/ or radiographic suspicion of lung cancer. Ultimately, only those patients with a cytopathologically confirmed diagnosis of lung cancer were included in the final analysis. The study was conducted from September 2013 to August 2015.

OBSERVATIONS AND RESULTS: In the present study a total of 94 patients were studied. The most common histological presentation was squamous cell carcinoma in 43 patients (45.74%) followed by adenocarcinoma in 19 patients (20.21%), undifferentiated group found in 15 patients (15.96%), small cell carcinoma in 10 patients (10.63%), and large cell carcinoma in 4 patients (4.25%). Squamous cell carcinoma was commonest among the every age group. We also found that the most common tumor among the males was squamous cell carcinoma whereas among the females adenocarcinoma was the commonest. The prevalence of all types of bronchogenic carcinomas were more common in smokers. The most common tumor among the smokers was squamous cell carcinoma whereas the most common tumor among nonsmokers was adenocarcinoma.

KEY WORDS: Bronchogenic carcinoma, MDCT and FNAC.

INTRODUCTION

In the beginning of the twentieth century, lung cancer was considered to be rare,^{1, 2} but now it has reached epidemic proportions. Bronchogenic carcinoma remains the leading cause of cancer-related mortality in the developed world and its incidence is rising in developing countries³. In India, incidence has been rising in the past 50 yrs. Smoking is most important risk factor and is responsible for more than 85-90% of lung cancer cases.⁶ Radiological imaging plays a critical role in the initial detection and diagnosis of lung cancer. Multi Detector computed tomography (MDCT) is the modality of choice for evaluating the lung carcinomas.¹³ MDCT provides precise characterization of the size, contour, extent and tissue composition of the suspicious lesion.¹³ It identifies small nodules not visible by radiography.²¹ It also has role in characterizing them as benign or malignant. MDCT accurately stages the tumors because of the superior multiplanar reformatted images. Staging of lung cancer plays a very important role in deciding the treatment and helps in assessing the prognosis. An accurate CT guided biopsy can also be performed on the table, thus providing histological diagnosis as well. Computed tomography (CT)-guided fine needle aspiration cytology (FNAC) of suspicious lung masses is a widely accepted and simple diagnostic method of relatively low cost. FNAC confirms the diagnosis and reveals the tumor type.

AIMS AND OBJECTIVES

1. To assess the role of multi detector computed tomography in diagnosis and characterization of lung cancer.
2. To document the various CT appearances of lung cancer with cytopathological correlation.

3. To assess the role of MDCT in staging of lung cancer.

MATERIAL AND METHODS

This cross sectional study comprised of all patients who presented to the department of radiodiagnosis GMC and associated Dr. STM hospital Haldwani (Nainital), the only postgraduate institute and a tertiary care center of the Kumaun region of Uttarakhand, for CT scan of thorax, having clinical and/ or radiographic suspicion of lung cancer. Ultimately, only those patients with a cytopathologically confirmed diagnosis of lung cancer were included in the final analysis. The study was conducted from September 2013 to August 2015. The study protocol has been approved by the Ethics Committee of the Government Medical College Haldwani.

1: Setting: Department of Radiodiagnosis, Department of General Medicine, Department of Pathology Government Medical College and associated Dr. STM Hospital Haldwani.

2: Study design: Prospective cross sectional consecutive case series.

3: Source of data: All patients with clinical and/radiological suspicion of lung carcinoma referred for CT scan of thorax to the department of Radiodiagnosis Dr. STM hospital Haldwani.

4: Criteria for Patient's inclusion: All Patients with clinical and or radiological suspicion of carcinoma lung will be studied with MDCT of thorax. Out of these patients, 94 patients with a confirmed cytopathological diagnosis will be finally included in the study.

5: Criteria for patient's exclusion: Patients in whom cytopathological confirmation is not available.

6: Imaging technique: Prior to the scan patient will be fasting for 4-6 hours and fully explained

consent will be taken. CT scan of the thorax will be performed with 130 KVp and 300 mAs protocol, 5mm thick sections non contrast scan of thorax will be obtained from the lung apices through the adrenal glands. Intravenous bolus administration of 70-80ml of low osmolar non ionic contrast will be used except in patient with known allergy to contrast or severely impaired renal function, followed by post contrast scan of 5mm thickness will be obtained. 1.5mm thin section will be reconstructed whenever necessary for better characterization of the lesion. CT scan images were viewed in lung window, mediastinal window and bone window.

7: Image analysis: The lung lesion will be analyzed and staged based as following- tumor site - right/left, central /peripheral , lobar/segmental location , size , tumor contour - spiculated, lobulated, smooth, enhancement pattern, presence of any cavitation, calcification, air bronchograms within the lesion , satellite lesions.

Central tumors were assessed as : presence of collapse, obstructive pneumonitis, bronchial abnormality- endobronchial lesion, extrinsic compression, luminal narrowing, peribronchial thickening.

Chest wall invasion was interpreted based on the following criteria: greater than 3cms of degree of contact with the pleura, pleural thickening, obliteration of extrapleural fat plane, bone destruction, soft tissue mass. Direct mediastinal invasion was interpreted based on the following criteria: greater than 3 cm contact with mediastinum, greater than 90° of circumference contact with the aorta, a visible mediastinal fat plane between the mass and vital mediastinal structures. Presence of satellite nodules, involvement of mediastinal nodes and nodal status, distant metastases- liver, adrenals, CNS and bone

were assessed. CT staging done based on TNM staging -New International staging system (revised in1997). CT findings will be correlated with cytopathological findings of the specimen obtained from CT guided fine needle aspiration cytology.

Statistical analysis: Sensitivity and accuracy of radiological diagnosis were calculated considering cytological criteria as standard analysis.

OBSERVATIONS AND RESULTS

In our study a total of 94 patients with a confirmed cytopathological diagnosis bronchogenic carcinoma will be finally included.

Age and sex incidence: In our study the median age of the study population was 62 years. The youngest patient was 35 year old and oldest was 86 years old. Majority of the patients were between 51-70 years of age (31 patients of 51-60years and 38 patients of 61-70 years). Male patients were 76(80.85%) and female patients were 18(19.15%).Male to female ratio was 4.2:1.

Predisposing factors

Out of 94 cases 78((82.98%) were chronic smokers, 16(17.02%) were non smokers. The radio of smokers to non smokers was 4.87:1. Among smokers out of 78 patients, 70(94.81%) were males and 8(5.19%) were femals. The ratio of male smokers to female smokers was 8.75:1. Majority of males were smokers.

Clinical features

Out of 94 patients 68(72.34%) patients complained of cough with expectoration, 48 (51.06%) complained of breathlessness, 58(61.7%) complained of loss weight and /appetite, 47(50%) complained of fever, 26 (27.66%) complained of chest pain, 19(20.21%) complained of haemoptysis, 6 (6.38%) complained of hoarseness of voice, 1(1.06%) complained of bone pain and

1(1.06%) presented with left hemiparesis.

Location

Out of 94 patients right side involvement was seen in 49(52.13%) cases, left side involvement in 42(44.68%) of cases and 3(3.19%) showed bilateral involvement.

Computed tomographic (CT) diagnosis

Out of 94 cases CT could diagnose primary bronchogenic carcinoma in 92 (97.8%) of the cases. CT was highly sensitive in diagnosing CA Lung compared to Chest radiograph, P value was highly significant ($P < 0.05$). Majority of the lesions were greater than 3cms showing predominantly heterogeneous contrast enhancement and had speculated margins in 82 (87%) cases. Necrosis was noted in 35 (37.2%), Calcification was noted in 16 (17%) cases. 34(36.1%) patients presented with associated collapse/consolidation, 39(41.48%) patients presented with pleural effusion.

Local tumor invasion

Mediastinal nodal involvement was observed in 68(72.34%), pleural and/chest wall invasion was noted in 16(17%) cases, adjacent rib/vertebrae involvement was noted in 10(10.64%), mediastinal invasion in 9(9.57%) of cases and superior vena

cava invasion was observed in 3(3.19%) of cases

Distant Metastasis

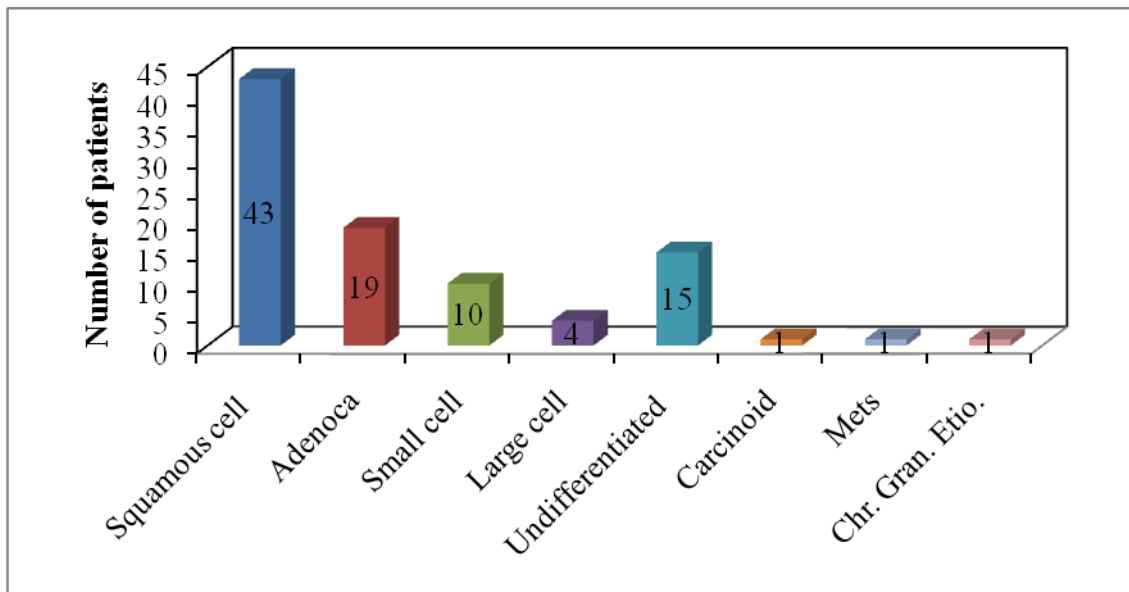
Distant metastases was observed in 29(30.85%) of cases. Most common organ to be involved being liver 14(14.89%) of cases followed by adrenals 9(9.57%) and bone 8(8.51%) of cases.

Histopathological diagnosis

The most common histological presentation was squamous cell carcinoma in 43 patients (45.74%) followed by adenocarcinoma in 19 patients (20.21%), undifferentiated group found in 15 patients (15.96%), small cell carcinoma in 10 patients(10.63%), and large cell carcinoma in 4 patients (4.25%) [table-1]. Squamous cell carcinoma was commonest among the every age group (table 9). We also found that the most common tumor among the males was squamous cell carcinoma whereas among the females adenocarcinoma was the commonest. The prevalence of all types of bronchogenic carcinomas were more common in smokers. The most common tumor among the smokers was squamous cell carcinoma whereas the most common tumor among nonsmokers was adenocarcinoma.

Table-1 : Histological diagnosis

Types	No. of patients	Percentage
Squamous cell CA (SCC)	43	45.74
Adenocarcinoma	19	20.21
Small cell CA (SCLC)	10	10.63
Large cell CA (LCLC)	4	4.25
Undifferentiated	15	15.96
Carcinoid tumor	1	1.06
Metastasis	1	1.06
Chronic Granulomatous Etiology	1	1.06



Staging

Majority was diagnosed at the later stages of illness. Among the non small cell carcinoma out of 84 cases, 27(32.14%) were diagnosed in stage IV, 34(40.47%) in stage IIIB, 7(8.33%) in stage

IIIA, 9(10.71%) in stage IIB, 2(2.38%) in stage IIA, 3(3.57%) in stage IB and 1(1.19%) in stage IA [table-2]. Among the small cell carcinoma out of 10 cases, 7(70%) were diagnosed in extensive stage and 3(30%) in limited stage [table-3].

Table-2 : TNM staging for non small cell carcinoma

Stage	No. of patients(total n=84)	Percentage
IA	1	1.19
IB	3	3.57
IIA	2	2.38
IIB	9	10.71
IIIA	7	8.33
IIIB	34	40.47
IV	27	32.14

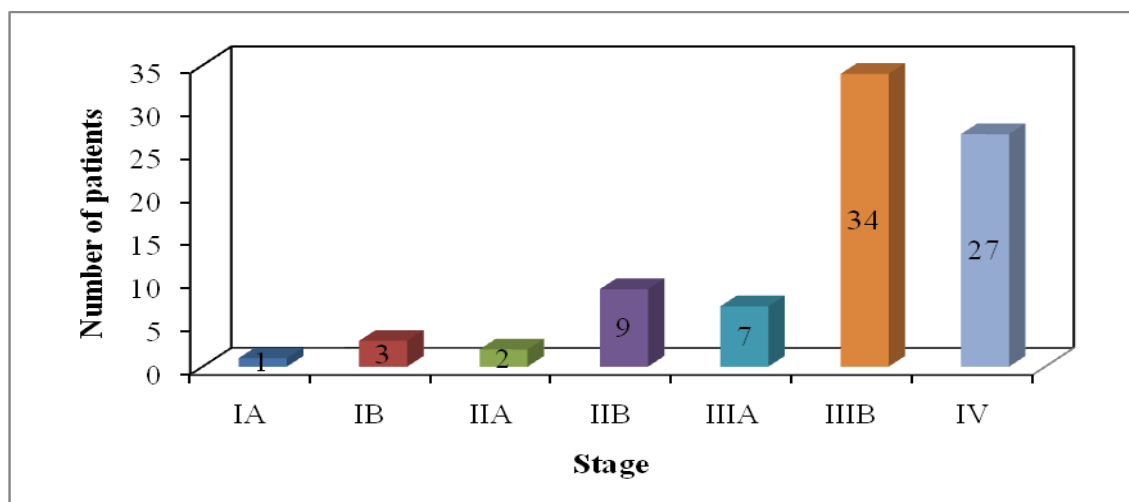
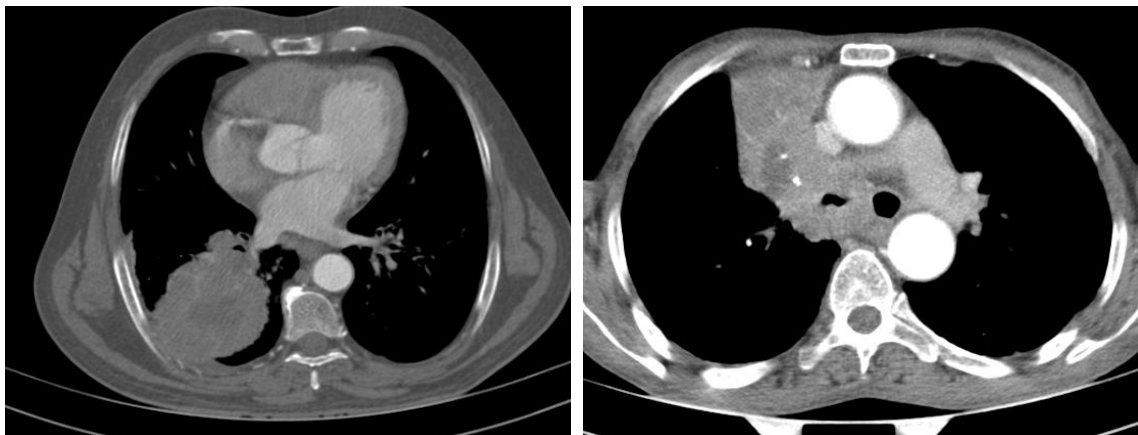
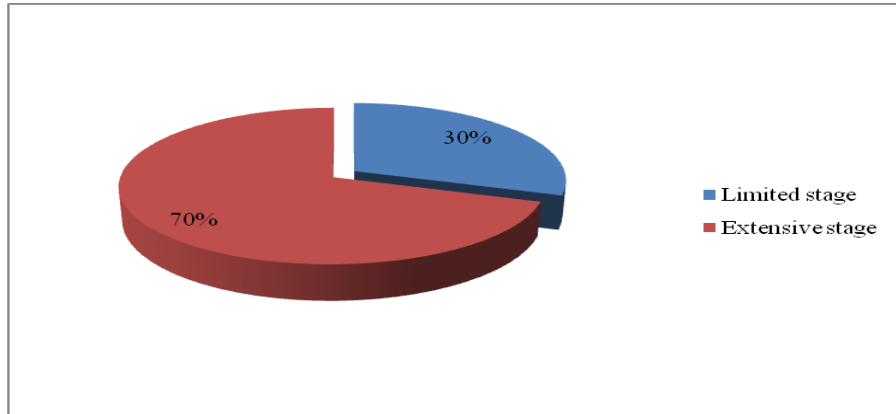
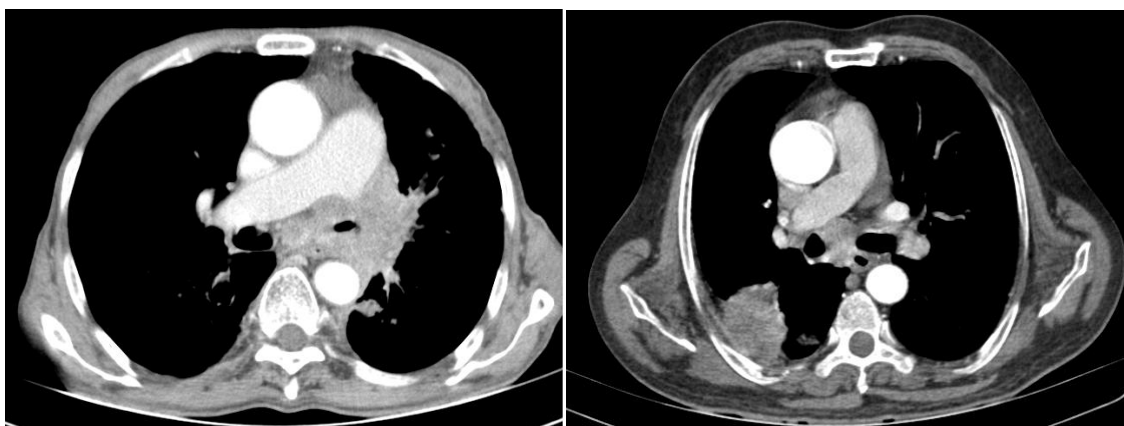


Table-3: Staging for small cell carcinoma

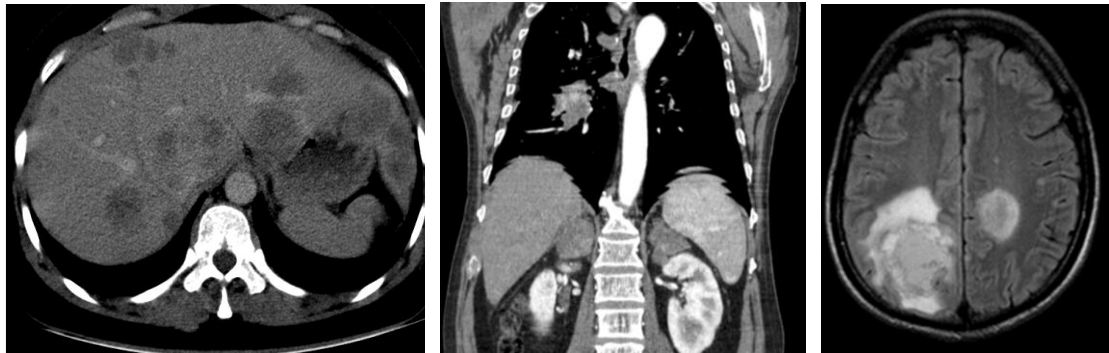
Stage	No. of patients(total n=10)	Percentage
Limited stage	3	30
Extensive	7	70



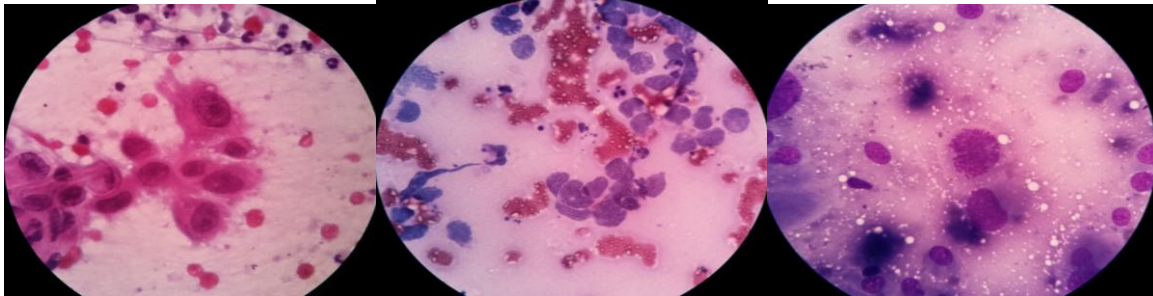
(A)-CECT shows heterogeneously enhancing mass lesion in right lower lobe. (B)-CECT showing mass lesion causing narrowing and encasement of right main bronchus and right main pulmonary artery with upper lobe collapse.



(A)-CECT showing heterogeneously enhancing left hilar mass with encasement of the left main bronchus and left pulmonary artery by a soft tissue mass.(B)- CECT showing mass in right lower lobe and mediastinal lymphadenopathy.



Multiple metastatic lesions to the liver, adrenal and brain in known case of bronchogenic carcinoma.



Fine needle aspiration cytology showing features of (A)- keratinizing squamous cell carcinoma (B)-small cell carcinoma (C)-adenocarcinoma.

DISCUSSION

Bronchogenic carcinoma remains the leading cause of cancer-related mortality in the developed world and its incidence is rising in developing countries⁽³⁾. Computed tomography is superior in defining tumor extent and relationship to surrounding structures, the presence or absence of metastasis, thereby providing information of therapeutic and diagnostic significance. Hence, this study was performed with the objective of assessing the role of computed tomography in the diagnosis of carcinoma lung and studying the sensitivity of CT in determining tumor extent, hilar and mediastinal involvement, staging of the disease and influencing the therapeutic approach. The aim of this analysis was to study the current clinico-radio-pathological profile of lung cancer patients at our centre.

A total of 94 cases having clinical and/radiological suspicion of lung cancer were underwent multi detector computed tomography examination and

fine needle aspiration cytopathology. 91(96.8%) cases were diagnosed as primary bronchogenic carcinoma, one case as carcinoid tumor, one case as metastatic lesion and one case as chronic granulomatous etiology. The sensitivity of computed tomography in comparison to cytology was found to be 97.8%.

Most of the patients in our study belonged to the age group between 51-70 years, with median age was 62 years which is corresponding to other Indian studies^{(6), (13), (27), (34), (35)}. Majority of patients were males with M: F ratio was 4.2:1. Similar sex ratio was reported by R Prasad et al⁽²⁷⁾ (2004), Sumdaram V et al⁽³⁴⁾ (2014) and Prabhat Singh Malik et al.⁽³⁵⁾ (2013). Reddy et al. (1972) also found a male to female ratio of 4:1 in his study.

Smoking was found to be the most important risk factor for lung cancer in our study, 82.98% of patients were smokers.

Cough with expectoration was the most common

complain found in 68(72.34%) of cases followed by loss of weight and /appetite 58(61.7%), breathlessness 48(51.06%), fever 47(50%), chest pain 26(27.66%), haemoptysis 19(20.21%) and hoarseness of voice (6.38%). A similar observation was reported by Jagdish Rawat et al ⁽⁶⁾ (2009), Manoj Kumar Agrawal et al. ⁽²⁸⁾.

The most common histological presentation was squamous cell carcinoma in 43 patients (45.74%) followed by adenocarcinoma in 19 patients (20.21%), undifferentiated group found in 15 patients (15.96%), small cell carcinoma in 10 patients (10.63%), and large cell carcinoma in 4 patients (4.25%). This is similar to the reports from other part of India ^{(6), (25), (27), (108)}.

In the present study, majority of patients were diagnosed at latter stage of disease. The majority (72.61%) of non-small-cell carcinoma patients had advanced stage disease (IIIB and IV) and 70% of small-cell carcinoma patients had extensive stage disease at the time of diagnosis. Similar observation reported by Jindal and Behera et al. ⁽²⁵⁾ (1990), R Prasad et al. ⁽²⁷⁾ (2004), Prabhat Singh Malik et al ⁽³⁵⁾ (2013), and Viswnath Sundaram et al (2014).

In our study computed tomography (CT) was found successful in truly diagnosing the primary bronchogenic carcinoma in 89(94.68%) cases whereas CT guided FNAC was found successful in making the diagnosis in 91(96.80%). CT was found to highly sensitive and accurate in characerrizing the tumors and able to define its extent. Computed Tomography accurately evaluated the hilar and mediastinal lymphadenopathy in 72% of cases. This reveals that computed tomography of chest is the most preferred modality for the evaluation of hilar and mediastinal involvement of lung cancer (Lee Sider et.al 1990). CT was also found to be highly

sensitive in assessing extrathoracic spread of lung cancer including liver adrenal and vertebral metastasis.

In our study CT guided FNAC was found highly sensitive and specific in diagnosing the bronchogenic carcinoma. It can subclassify the type of bronchogenic carcinoma and the vast majority of lung malignancies. Hence CT guided FNAC diagnosis alone can be used with confidence to select treatment modalities and to avoid unnecessary surgeries in patients with lung malignancies.

CONCLUSIONS

Lung cancer is presently the most common malignant disease and the leading cause of cancer deaths in the world in all age groups. Smoking is the most common risk factor, more in males. The most common lung cancer is squamous cell carcinoma. Most of the patients present at a late stage of the disease and outcome remains poor. The result our study correlates well with those found in other studies in India. Computed tomography is the most sensitive and non-invasive imaging modality that provides valuable information of the tumor characteristics and its extent. CT remains the routine imaging procedure for determining respectability and assessing intra- and extrathoracic spread of lung cancer. CT guided FNAC is a simple, safe, and reliable procedure with high diagnostic accuracy for the diagnosis and sub typing of lung cancer. This study and others suggest that regardless of age or sex, patients who have persistent signs of pulmonary disease and a history of heavy smoking must be considered at risk for lung cancer. Diagnostic tests should be performed early to exclude the possibility of lung cancer.

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