Research Article

Role of multidetector computed tomography in evaluation of suspected bronchogenic carcinoma

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ABSTRACT

Background: Bronchogenic carcinoma is the leading cause of cancer deaths in developed countries and is rising at alarming rates in developing countries. Deaths due to lung cancer are more than those due to colorectal, breast and prostate cancers put together. CT remains the routine imaging procedure for determining resectability and assessing intra- and extra thoracic spread of lung cancer.
Methods: 30 patients with strong clinical / radiological suspicious of bronchogenic carcinoma were included in this study. MDCT was carried out and its provisional diagnosis of bronchogenic carcinoma was correlated with pathological diagnosis obtained on bronchoscopic biopsy / CT guided FNAC.
Results: Patient's age ranged between 45 to 80 years with the mean age of 59 years. There was significant male preponderance (26 males) with smoking being the most common risk factor (83.3%). Cough (83.3%) and dyspnea (80%) were the commonest symptoms. The most common radiological manifestation was central hilar mass seen in 20 (66.6%) patients and peripheral mass seen in 10 (33.3%) patients. Provisional CT diagnosis was found in complete correlation with pathological diagnosis made on bronchoscopy biopsy/ CT guided FNAC in 28 (93.3%) patients and others 2 patients diagnosed as pulmonary tuberculosis, non caseating granulomatous inflammation on histopathological diagnosis. Squamous cell carcinoma was the commonest histopathological type seen in 16 (53.3%) patients followed by adenocarcinoma seen in 8 (26.6%) patients.
Conclusions: Multidetector computed tomography plays an important role in evaluating and staging of bronchogenic carcinoma.CT had the high predictive value in evaluating bronchogenic carcinoma and found to be 93.3%.

Keywords: Multidetector computed tomography, Bronchogenic carcinoma, Bronchoscopic biopsy, CT guided FNAC

INTRODUCTION

Bronchogenic carcinoma was considered to be rare in the beginning of the century but has now reached epidemic proportions. This dramatic increase correlates with the widespread prevalence of cigarette smoking.[1] Lung cancer is the leading cause of cancer mortality for both men and women, responsible for more deaths than prostate, breast, and colorectal cancers combined.[2] Physical symptoms such as fever, cough, expectoration, haemoptysis, weight loss and anorexia are common to lung cancer. However, age of the patient, smoking history, mediastinal symptoms such as hoarseness of voice, SVC obstruction and dysphagia favours the diagnosis of lung cancer. On examination, there may be signs of collapse or mass, clubbing and metastatic and non-metastatic complications of lung cancer.[1]

WHO classified bronchogenic carcinoma into four major cell types which makes up 88% of all primary lung neoplasm. These are squamous or epidermoid carcinoma,

small cell carcinoma, adenocarcinoma and large cell carcinoma.[3]

Imaging plays a critical role in the initial staging and follow-up of the disease. Bronchogenic carcinoma is typically detected first on chest radiography but computed tomography (CT) scan is the most important imaging technique, providing both TNM staging information and assessment of recurrence.[4,5] because of its better spatial resolution. CT provides precise characterization of the size, contour, extent and tissue composition of the suspicious lesion.[6]

Staging lung cancer is, of course, a multidisciplinary process, which also utilizes other procedures such as bronchoscopy and biopsy. The diagnostic yield of bronchial biopsy specimens varies from 70 to 90 percent depending on the site and type of tumour.[7,8]

METHODS

The present prospective study was carried out on 30 patients with strong clinical / radiological suspicion of bronchogenic carcinoma. MDCT was carried out on all patients. Plain and contrast enhanced scans of the chest were done on 64 multidetector CT Ingenuity (Philips Medical Systems) with 0.765 pitch, Collimation 64x0.625, 5mm increment at 120 KVp and 200 mAs and 5 mm section thickness from the level of lung apices to the diaphragm and routinely included the adrenals.. The images were viewed with 2 window settings primarily lung window and mediastinal window, so as not to miss associated mediastinal, chest wall & other bony lesions.

Central or peripheral lung mass detected on CT sections were characterised based on the site, size, enhancement pattern, presence of calcification, cavitation, hilar and mediastinal lymph nodes, pleural and chest wall involvement. Both the lung fields were also studied in details for evidence of associated lung lesions. Lymph nodes were assessed for size, shape, number and were classified according to lymph node station. Additional lesions were looked for an ipsilateral/contralateral lung. Visualised parts of liver and adrenals were assessed for any evidence of metastasis. Based on the details, CT findings of extent of the main lung mass, lymph nodes involvement and distant metastasis TNM staging was done. Lung mass characterized based on MDCT appearance and the findings were correlated with pathological diagnosis made from Bronchoscopy biopsy/ CT guided FNAC of the mass lesion.

RESULTS

Most patients were in the age group of 51 to 60 years (43.3%). The youngest patient was aged 45 years and the oldest was aged 80 years. The overall mean age of the study subject was 59 years. Male preponderance was seen with male: female ratio of 6: 1 accounting 26 males and 4 female patients.

25 patients (83.3%) in our study were chronic smokers. All 4 (13.3%) female patients and 1 (3.3%) male patient taken in our study were non smokers. Cough was the most common pulmonary symptom seen in 25 (83.3%) patients followed by dyspnoea in 24 (80%) patients, chest pain in 16 (53.3%) patients and haemoptysis in 9 (30%) patients, hoarseness of voice in 6 patients (20%) and fever in 5 patients (16.6%). The most common associated extrapulmonary symptom was weight loss seen in 20 (66.6%) patients (Figure 1).
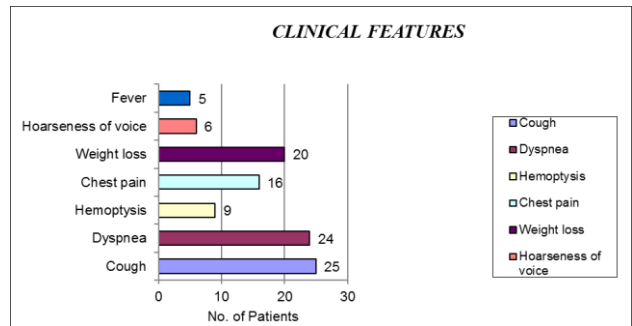
Figure 1: Bar diagram depicting clinical features of patients.

Diagnosis of bronchogenic carcinoma was suspected on chest radiograph and all 30 (100%) patients revealed suspicious mass lesion. The most common radiological manifestation on MDCT was central hilar mass lesion seen in 20 (66.6%) patients with or without collapse-consolidation in 18 (60%) patients. Peripheral mass lesion was seen in 10 (33.3%) patients. All cases showed enhancement on post contrast images.

Spiculated margins of the mass lesion was seen in 10 (33.3%) patients whereas lobulated margin in 8(26.6%) patients. Pleural effusion was seen in 18 (60%) patients whereas fluid bronchogram was seen in 8 (26.6%) patients. Cavitation was seen in 4 (13.3%) patients. Associated collapse/ consolidation were seen in 18 (60%) patients mainly with the central mass.
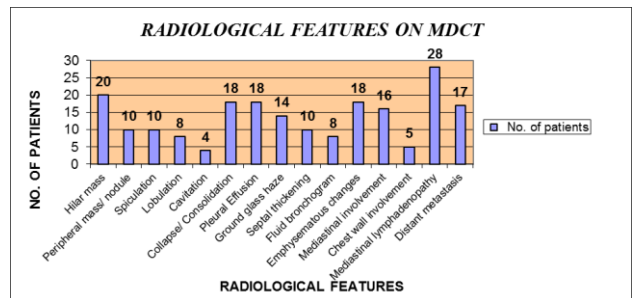
Figure 2: Bar diagram showing different radiological features of bronchogenic carcinoma on CT scan.

Mediastinal invasion was seen in 16 (53.3%) patients and chest wall invasion in 5 (16.6%) patients indicative of late presentation of the disease (Figure 2).

Lympadenopathy was seen in 28 (93.3%) out of 30 patients. Most common lymph nodal stations involved in bronchogenic carcinoma were pretracheal, prevascular seen in 28 (93%) patients. Hilar nodes were seen in 15 (50%) patients and another 15 (50%) patients presented with subacrinal lymph nodes. Supraclavicular lymph nodes were seen in 5 patients and others (paraoseophageal, paravertebral and peripancreatic) lymph nodes were seen in 6 patients (Figure 3). Distant metastases were seen in 17 (56.6%) patients. Bones were the common site of metastasis and was seen in 8 patients (26%) followed by liver in 6 patients (20%), adrenal in 6 (20%) patients, kidney in 1 (3.3%) patient and another 1 (3.3%) patient presented with brain metastasis (Figure 4).
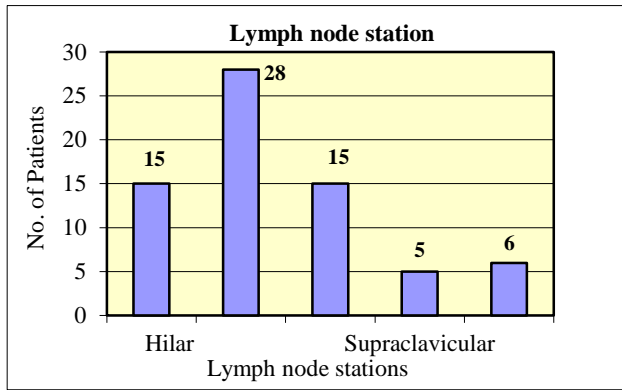

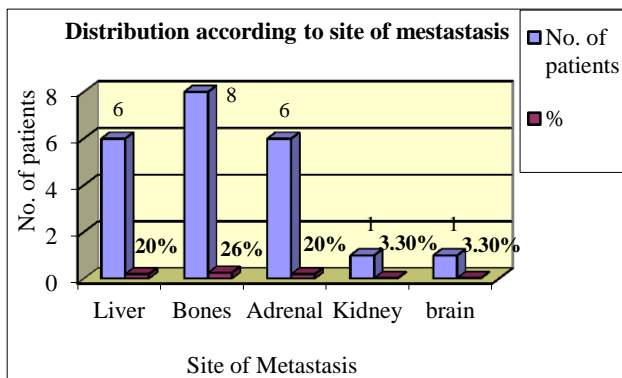**Figure 3: Distribution of patients according to lymph nodal station involved.**

Figure 4: Bar diagram showing site of distant metastasis.

MDCT played an effective role in the precise diagnosis and accurate staging of bronchogenic carcinoma. Most of the patients presented in advanced stage of disease. Maximum patients viz 6 patients (20%) presented with T4N2Mx staging followed by T4N3M1b in 4 patients (13.3%), T3N2M1b in 3 (10%) patients, T4N2M1b staging in three (10%) patients, CT staging of T2bN2M1a, T3N1Mx, T2N2Mx and T4N1Mx was made

in two (6.6%) patients each respectively. CT staging of T2bN2M1b, T4N1M1b, T3N2Mx, T2bN2Mx, T3N0Mx and T3N0M1b was made in one patient (3.3%) each respectively. On MDCT all 30 patients were diagnosed as bronchogenic carcinoma. 20 patients were diagnosed as central mass and 10 patients as peripheral mass (Figure 5).
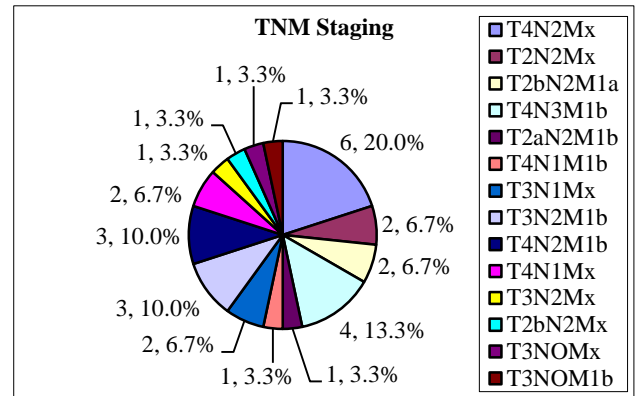

Figure 5: Distribution of patients according to TNM staging.

Bronchoscopy biopsy was carried out in 20 (66.6%) patients with central mass lesion on MDCT. 18 patients out of 20 proved to be bronchogenic carcinoma on histopathological correlation and in remaining 2 patients definite diagnosis of pulmonary tuberculosis and non caseating granulomatous inflammation were made in one patient each respectively.

CT guided FNAC was carried in 10 (33.3%) patients with peripheral mass lesion. Diagnosis of bronchogenic carcinoma made on MDCT was proved on the basis of cytological correlation in all 10 patients.

Squamous cell carcinoma was the most common histological type seen in 16 (53.3%) patients followed by adenocarcinoma in 8 (26.7%) of patients, small cell carcinoma in 3 (10%) patients and large cell carcinoma noted in 1 (3.3%) patient (Figure 6).
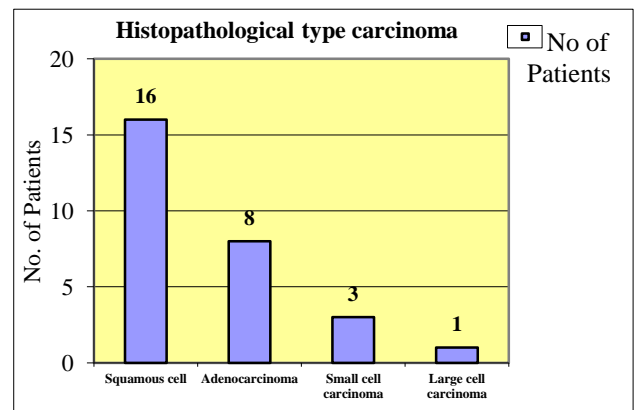

Figure 6: Bar diagram showing histological type of carcinoma in patients.

15 patients (50%) with the diagnosis of squamous cell carcicoma presented as central mass lesion and 1 patient presented as peripheral mass. Adenocarcinoma presented as peripheral mass in 7 patients out of 8 patients (23.3%) and in one patient (3.3%) adenocarcinoma presented as central mass. Small cell carcinoma presented as central mass in 3 patients (10%) and large cell carcinoma presented as peripheral mass seen in 1 patient (3.3%).

Strong association was noted between the occurrence of squamous cell carcinoma and smoking. Adenocarcinoma was seen more commonly in women and non smokers.

Provisional diagnosis of bronchogenic carcinoma on MDCT was found in complete correlation with the final histopathological/ cytological diagnosis in 28 patients (93.3%).

Case 1:

Figure 7(a): Axial CT showing lobulated soft tissue attenuation mass left upper lobe causing encasement of left subclavian artery.
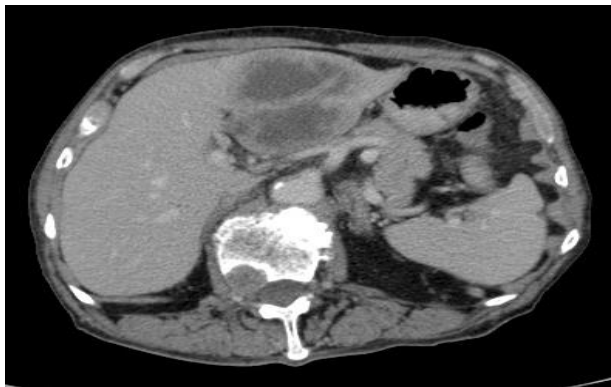
Figure 7(b): Large hypodense areas seen in left lobe of liver showing non homogenous enhancement enhancement with nonenhancing necrotic are as- s/o Metastasis with necrosis. D4 vertebrae show destruction with formation of extradural soft tissue component.

Hence, true positive cases were 28; false positive cases were 2 in number. In no patient diagnosis was true

negative and false negative. CT sensitivity having bronchogenic carcinoma was high and came out to be 100% due to small sample size. CT had the high predictive value in evaluating bronchogenic carcinoma and found to be 93.3% and CT accuracy was 93.3%.
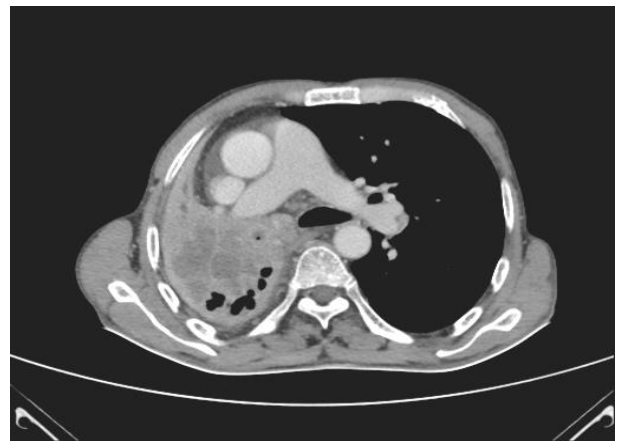

Figure 7(c): Destruction of left superior ramus and left iliac bone and soft tissue formation is noted.

Figure 7(d): NCCT Brain shows the hyperdense lesion with nonenhancing necrotic areas within them-? Brain metastasis.
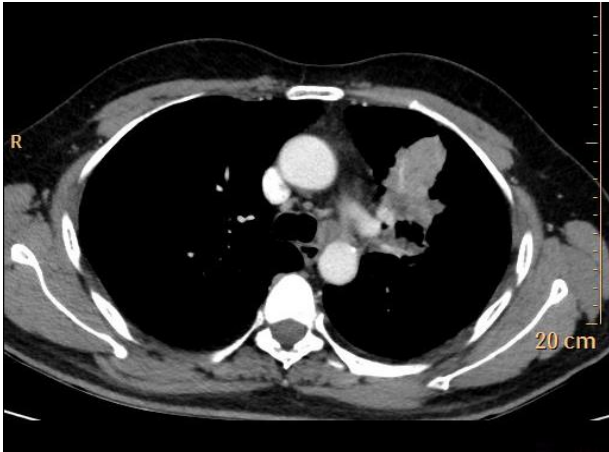
Case 2:

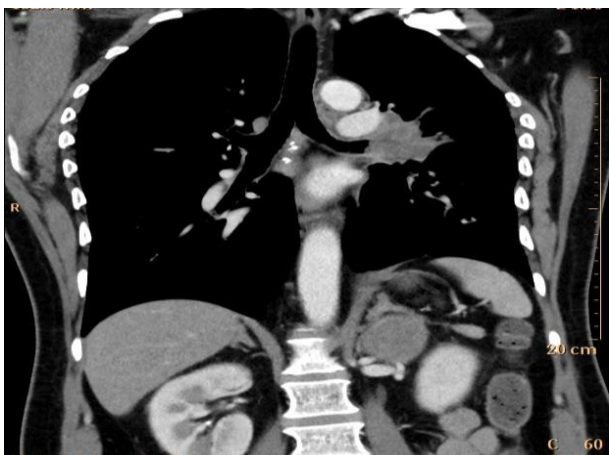**Figure 8(a): Axial CT shows infiltrative mass right hilar causing occlusion of right main stem bronchus.**

Figure 8(b): Coronal image shows resultant complete collapse of right lung with fluid bronchogram. Right kidney shows hypodense area -? metastasis.
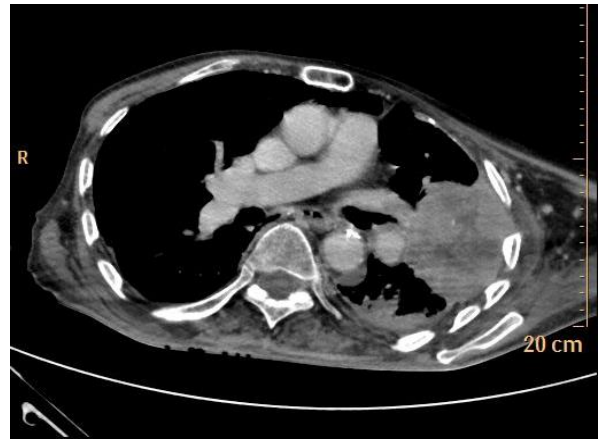
Case 3:

Figure 9(a): Axial CT shows soft tissue spiculated mass in left hilar region.

Figure 9(b): Coronal image shows mass hilar mass causing complete cut of upper lobar bronchus. Left adrenal is bulky and shows hyopdense deposit-? Metastasis.
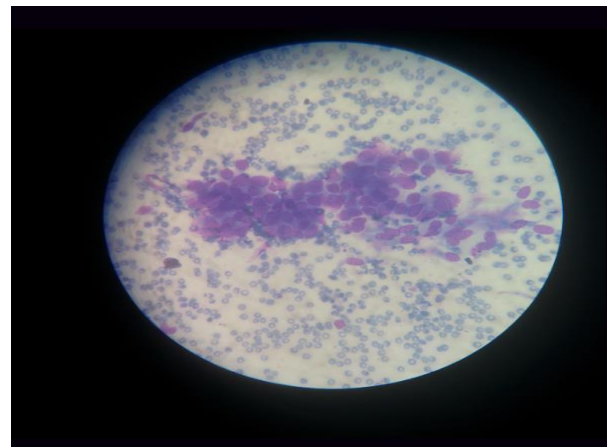
Case 4:

Figure 10(a): Infiltrative mass left upper lobe with few calcified lesions- ?engulfed calcification.

Figure 10(b): Coronal image extrathoracic extension of mass into chest wall superiorly, into posterior paraspinal muscles causing erosion and destruction of multiple ribs.

Figure 10(c): High power showing adenocarcinoma on FNAC.

DISCUSSION

Bronchogenic carcinoma is the leading cause of death worldwide. It is becoming a world health problem because of increasing indulgence in the habit of smoking and rapid strides taking place in the automobile industry, resulting in almost uncontrolled atmospheric population by the hydrocarbons released by the cigarette and automobile smoke. The incidence of lung cancer has seen a steady rise in incidence over the past few years especially in developing countries like India. In our study, an attempt had been made to ascertain the demographic characteristics, clinical presentation, MDCT characteristics and histological types of Bronchogenic Carcinoma.

The mean age of patients with lung carcinoma has remained relatively constant over the years. The mean age in our study was 59 year which was similar to that found in a study done by Arora et al and Krishnamurthy et al.[9,10]

In our study 86.6% patients were male and 13.3% were female patients with male to female ratio is 6:1. The male preponderance seen in our study correlates with most of the studies done worldwide which was similar to the study of Rawat et al.[11]

25 out of 26 male patients diagnosed with lung carcinoma in our study were smokers whereas all the 4 female patients and one male patient were non smokers. Thus overall 83.3 % of the patients were smokers. According to the ATS statement on cigarette smoking and health (1996), 80-90% of bronchogenic carcinoma directly linked to active cigarette smoking.[12]

Cough was the commonest symptom in our study, being present in 25 patients (83.3%), followed by dyspnea seen in 24 patients (80%), weight loss in 20 patients (66.6%), chest pain in 16 patients (53.3%), hemoptysis in 9 patients (30%), hoarseness of voice in 6 patients (20%) ,and fever in 5 patients (16.6%). Similar findings had been reported by Rawat et al, Arora et al, Youshif et al and Shetty et al.[7,9,11,13]

In our study, 66.6% patients had central type of tumour as compared to peripheral location in 33.3% patients. This was in concordance with the study done by Shetty et al.[7]

In our study, speculated margin of mass was seen in 33.3% patients whereas lobulated margin was seen in 26.6% patients. Similar findings were reported by Shetty et al and Kuriyama.[7,14]

In our study pleural effusion was seen in 60% patients out of 30 cases. Shetty et al recorded pleural effusion in 35% cases.[7]

In our study 53.3% patients out of 30 cases presented with mediastinal involvement and 16.6% presented with chest wall invasion.

In our study distant metastasis was seen in 17 patients (56.6%) out of 30 patients. Bones were the most common site of metastasis seen in 8 (26%) patientsout of 17 patients followed by liver in 6 (20%) patients. Adrenal metastasis was also seen in 6 (20%) patients. Kidney metastasis was seen in only 1 (3.3%) patient. Brain metastasis was seen in only 1 (3.3%) patient. Lung metastasis was also seen in two patients bilaterally out of 30 patients in our study. Our study findings were similar to that of Shetty CM et al, Marvin EN et al and Sandler MA et al.[7,15,16]

In our study 28 (93%) patients presented with lymph nodal enlargement whereas 2 (6.6%) patients did not present with any lymphadenopathy. The common lymph nodal stations involved in our study were pretracheal, prevascular lymph nodes seen in 28 (93%) patients out of 30 patients. Similar findings were seen in studies by Faling et al and McLoud et al.[17,18] Our study findings percentage was higher to that of studies by Libshitz et al, Primack et al and Shetty et al as most of the patients included in this study presented late with advanced disease.[7,19,20]

Most of the patients in our study presented in advanced stage of disease. These patients were not suitable for surgical resection. This finding correlated with the study done by Rawat et al and Shetty et al.[7,11]

In our study, bronchoscopy biopsy achieved diagnosis in 90% of lung cancer patients. Also the easy availability of bronchoscope and high skilled bronchoscopists has increased the sensitivity of bronchoscopy.

Naidich DP et al compared CT to bronchoscopy in a large series to study the value of CT for visualizing bronchial mass.[21] He concluded that CT was positive in 59 (92%) out of 64 patients in which lesions were detected on bronchoscopy biopsy.

There has been some variation in the relative proportion of various histological subtypes in different studies. The higher incidence of squamous cell carcinoma in present study was in accordance with most of the Indian studies by Gupta et al, Rawat et al, Sider et al and Jain et al which also reported squamous cell carcinoma was the commonest type.[11,15,22,23]

In our study adenocarcinoma was also most common cell type seen in women and non smokers. This was in concordance with the study done by Rosando- de-Christenson et al.[24]

In our study, true positive cases were 28, false positive cases were 2. There was no case seen under the category of true negative and false negative. Hence, CT sensitivity

was calculated as 100% in our study due to small sample size and CT accuracy was approximately calculated as 93.3%. Therefore, positive predictive value was 93.3%. The positive predictive value of MDCT (93.3%) in evaluating bronchogenic carcinoma proves that, it is indeed a good tool in the evaluation of bronchogenic carcinoma. Baron et al showed prediction of CT sensitivity was 93% in his study.[25]

CONCLUSION

Bronchogenic carcinoma is more commonly seen in males. Smoking is the major risk factor associated with causation of bronchogenic carcinoma particularly males. MDCT is a useful tool in the staging of bronchogenic carcinoma. Staging is important in treatment planning and predicting outcome. Multi detector computed tomography has a high predictive value suggestive of great diagnostic accuracy in the evaluation of bronchogenic carcinoma. There is significant correlation with the MDCT diagnosis of bronchogenic carcinoma with that of histopathology/ cytology.

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