



## Role of Computed Tomography in Diagnosis of Bronchogenic Carcinoma with Histopathological Correlation

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### ABSTRACT

**Background:** *In India, lung cancer is the commonest and most lethal cancer among males accounting for 10.9% of all cancer cases and 13% of cancer related mortality. Computed tomography is the modality of choice for evaluating bronchogenic carcinoma. CT has a role in identifying the lung nodules and characterizing them as benign or malignant. CT guided FNAC of lung lesions has rapidly emerged as less invasive, cheap, rapid & fairly accurate diagnostic aid in lung lesions. The present study is aimed at evaluating the imaging characteristics of pulmonary mass lesions by CT along with CT guided FNAC/ bronchoscopy guided biopsy of the lesions for histopathological correlation thereby aiding patients in correct diagnosis and thereby aiding patients with appropriate treatment also.*

**Materials and methods:** *Data was collected from 53 patients with clinically or radiologically suspected pulmonary mass lesion referred for CT scan of thorax to Department of Radiodiagnosis. Contrast study is done, lung lesions were characterized and CT guided FNAC done in our Department using 22G Spinal needle under local anaesthesia. Collected data were analysed based on the variables of the lung lesion seen in CT images followed by CT diagnosis and correlation made with histopathology report.*

**Conclusion:** *CT guided FNAC is a simple, less invasive and effective method to obtain Histopathology thereby prompting appropriate management. CT is a highly sensitive test (95.83%) and also has a high positive predictive value (97.87%) to diagnose Bronchogenic carcinoma in a sample suitably selected and referred for malignancy. Diagnostic work up by CT with guided FNAC may help the patient in correct diagnosis and thereby prompting appropriate management.*

**Keywords:** *Bronchogenic carcinoma, CT guided FNAC, Bronchoscopy guided biopsy*

### INTRODUCTION

Bronchogenic carcinoma remains the most common cause of cancer death worldwide. The incidence of the disease has accelerated over the past century, closely in step with tobacco

smoking. The most commonly diagnosed cancers worldwide are lung (1.61 million, 12.7% of the total), breast (1.38 million, 10.9%) and colorectal cancers (1.23 million, 9.7%). The most common cause of cancer death is lung cancer (1.38 million, 18.2% of the total). Based on the biology, therapy

and prognosis, lung cancer is broadly divided into two classes — non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC). Squamous cell carcinoma, adenocarcinoma and large cell carcinoma are classified as NSCLC and account for 75% to 80% of all lung cancer cases. For early stage NSCLC, surgery is almost curative.. The challenge is, thus, to identify the disease at its earliest stage when it is still amenable to treatment.<sup>1</sup>

### Classification

A practical classification based on the treatment options for bronchogenic carcinoma divides the histologic types into non-small cell and small cell carcinomas of which the latter responds to chemotherapy and radiotherapy.

#### Non-small cell Lung cancer (NSCLC):

**Adenocarcinoma<sup>2</sup>:** Adenocarcinoma is the most common cell type accounting for 30-35 % of all lung cancers and is the most common cell type in nonsmokers. Early metastasis is more common than with squamous cell carcinoma, particularly to the central nervous system and adrenal glands. Seventy-five percent originate in the lung periphery, presenting as a solitary pulmonary nodule or mass. In a few cases, adenocarcinoma originates within large airways. It is most common in the upper lobes. It is often associated with fibrosis; it may arise in relation to preexisting lung fibrosis (i.e. a scar carcinoma) or may result in a desmoplastic reaction in surrounding lung. Adenocarcinomas often appear ill defined on chest radiographs because of their irregular margin. On high-resolution CT, lesions appear round or lobulated. They frequently have an irregular and spiculated margin because of associated lung fibrosis. When occurring in a subpleural location, this may result in thin linear extensions to the pleural surface (i.e., a pleural tail). Air bronchograms may be visible within the nodule using CT. Most of the lesions are asymptomatic due to their peripheral location. It may be associated with concomitant lung disease, such as focal and diffuse fibrosis.

The new classification now divides adenocarc-

inoma into the following categories:

**Pre-malignant lesions:** This includes atypical adenomatous hyperplasia and adenocarcinoma in situ. These lesions are 3 cm or less in diameter and histology manifests pure lepidic growth with no solid components. These will appear as pure GGO on CT.

**Malignant lesions,** divided into the following:

**Minimally invasive adenocarcinoma, with predominantly** (in distinction to pure) lepidic growth, 3 cm or less, and with invasive components of no more than 5 mm. These are generally sub-solid nodules on CT.

**Invasive adenocarcinomas,** subclassified as predominantly lepidic, acinar, papillary, micropapillary and solid types.

**Invasive mucinous adenocarcinoma,** an entity formerly described as mucinous bronchioalveolar carcinoma and considered as a separate group from the non-mucinous types above.

Prognosis of patients with adenocarcinoma in situ or minimally invasive adenocarcinoma (characterised on CT as pure ground-glass lesions) is excellent; these patients should have almost 100% disease-free survival. Invasive adenocarcinoma has a variable outlook, and to some extent this depends on the histological subtype.

#### **Squamous cell carcinoma (SCC)<sup>3,4,5,6,7,8</sup>:**

Squamous cell carcinoma contributes to approximately 30% of all lung cancers. It is associated with the best prognosis. Although it generally shows rapid local growth but distant metastases occur at a later phase. It has a strong association with smoking. At the time of detection, most tumors are between 3 and 5 cms and centrally located, resulting in post obstructive atelectasis or pneumonia. Squamous cell carcinoma is associated with the presence of amorphous, punctate calcification within the lesion and the presence of cavitation. Cavity walls are usually thick, nodular and irregular, ranging in size from 0.5 to 3 cm. Rarely, extensive necrosis may result in a thin-walled cavity. Patients also present with signs and symptoms due to invasion of adjacent central structures, such as involvement of the recurrent laryngeal nerve..

Pancoast syndrome comprises of involvement of the brachial plexus and cervical sympathetic nerves associated with severe pain in the shoulder region radiating toward the axilla and scapula; atrophy of hand and arm muscles; Horner's syndrome is a constellation of signs produced because of interruption of the sympathetic innervation; and compression of blood vessels with edema. Pancoast tumor can occur with any histology but are more commonly seen with both squamous cell carcinoma and adenocarcinoma.

The term "superior sulcus" tumor refers to its location in the superior pulmonary sulcus at the lung apex, from which it can cause local invasion of the chest wall and brachial plexus.

**Large cell carcinoma**<sup>9</sup>: The term large cell carcinoma is used to describe tumors that do not show squamous or adenomatous differentiation or have typical features of small cell carcinoma. Large cell carcinoma accounts for 10% of lung cancers. It tends to present as a large peripheral mass; more than 60% are larger than 4 cm at presentation. It is similar to adenocarcinoma in its radiologic characteristics (except for its large size), histologic ultrastructure, and survival statistics. As with adenocarcinoma, it tends to metastasize early and has a poor prognosis. It is strongly associated with smoking.

**Small cell lung cancer (SCLC)**<sup>3,4,9</sup>: Small cell lung cancer, formerly known as "oat cell carcinoma" for the small, round shape of the cancer cells, is an aggressive tumor which usually presents with generalized symptoms and distant metastases. Although these tumors respond initially to chemotherapy, later on most patients develop drug resistance. Small Cell Lung Cancer is responsible for approximately 20% all lung cancer cases. Small cell carcinoma tends to occur in the main or lobar bronchi and is associated with extensive peribronchial invasion and a large hilar or parahilar mass. Endobronchial tumor masses are less common than with squamous cell carcinoma, but the large tumor mass frequently compresses bronchi. Atelectasis may be associated. This tumor is commonly associated

with marked mediastinal lymph node enlargement. It is a common cause of superior vena cava (SVC) syndrome. Presentation as a lung nodule is very uncommon, accounting for less than 5% of cases. Over 90% of cases are stage IV at diagnosis.

**Multiple primary carcinomas**<sup>3,4</sup>: Synchronous lesions are defined as the presence of two tumors at the same time or closely following initial diagnosis. The incidence of synchronous multiple primary tumors represents less than 3.5% of all lung cancers. This number may even be higher depending on the cell type and how carefully further primary tumors are looked for and the rigidity of the criteria used to define the tumors as primary lesions. Difference in cell type is an accepted criterion. For tumors of the same histologic type they must be separated by noncancerous lung tissue.

Metachronous lesions are defined as the second cancers appearing after a time interval, usually 12 months or more. The peak incidence is between the third and eighth postoperative years. These lesions constitute at least two thirds of multiple pulmonary neoplasms. Ten percent to thirty two percent of patients surviving resection for lung cancer may develop a second primary tumor. The reported incidence has increased probably because second primary lung cancer can be distinguished from recurrence and satellite disease due to better investigations. These lesions are regarded as multiple primary lesions only if they show unique histologic features. Adenocarcinoma has replaced squamous cell carcinoma as the most common histologic type in multiple carcinoma.

**Imaging features of bronhogenic carcinoma**<sup>10</sup>: **Peripheral tumours:** Approximately 40% of bronchial carcinomas arise beyond the segmental bronchi, and in 30% a peripheral mass is the sole radiographic finding.

**Tumour Shape and Margins:** Tumours at the lung apex (Pancoast's tumours, superior sulcus tumours) may resemble apical pleural thickening; however, the majority of peripheral lung cancers are approximately spherical or oval in shape.

Lobulation, a sign that indicates uneven growth rates in different parts of the tumour, is common. Occasionally, a dumb-bell shape is encountered or two nodules are seen next to one another. The term 'corona radiata' is used to describe numerous fine strands radiating into the lung from a central mass, sometimes with transradiant lung parenchyma between these strands. While not specific, this sign is a highly suggestive of bronchial carcinoma. Absolutely spherical, sharply defined, smooth-edged nodules due to carcinoma of the lung are rare. A peripheral line shadow or 'tail' may be seen between a peripherally located mass lesion and the pleura, a phenomenon that occurs in both benign and malignant lesions. When associated with carcinoma of the lung, the 'tail' probably represents either plate-like atelectasis secondary to bronchial obstruction beyond the mass or septal oedema due to lymphatic obstruction. Although the edges of a tumour are frequently well defined, some peripheral cancers, notably some types of adenocarcinoma, have ill-defined edges similar to pneumonia.

**Cavitation:** Cavitation may be identified in tumours of any size and is best demonstrated by CT. Squamous cell carcinoma is the most likely cell type to show cavitation. The walls of the cavity are of irregular thickness and may contain tumour nodules, but sometimes the wall has smooth inner and outer margins. The cavity wall is usually 8- mm thick or greater. Fluid levels are common.

**Calcification:** Calcification within bronchogenic carcinomas is rarely seen on chest radiography but is identified on CT in 6–10% of cases. Some foci of calcification represent preexisting calcified granulomatous disease engulfed by tumour. However, amorphous or cloud-like calcification consistent with dystrophic tumour calcification is still seen in a small proportion of cases (<10%). Most calcified tumours are large with a diameter of 5 cm or more, but calcification can also be seen in small peripheral tumours.

**Other Findings:** Air bronchograms and bubble-like lucencies or pseudocavitation may be seen

within lung cancers, in particular with adenocarcinoma. Occasionally, dilated mucus filled bronchi (bronchocele, mucocele, mucoid impaction) are seen distal to a carcinoma obstructing a segmental or subsegmental bronchus. Ground-glass attenuation may be seen as a component of nodules and is associated with a greater risk of malignancy than that of purely solid nodules. It is more commonly associated with adenocarcinoma, which may present as a purely ground-glass opacity.

**Central tumours:** The cardinal imaging signs of a central tumour are collapse/consolidation of the lung beyond the tumour and the presence of hilar enlargement, signs that may be seen in isolation or in conjunction with one another.

**Collapse/Consolidation in Association with Central Tumours:** Obstruction of a major bronchus often leads to a combination of atelectasis and retention of secretions with consequent pulmonary opacity, but collateral air drift may partially or completely prevent these post obstructive changes. Secondary infection may occur beyond the obstruction. The following features suggest that pneumonia is secondary to an obstructing neoplasm:

1. The shape of the collapsed or consolidated lobe may be altered because of the bulk of the underlying tumour. In cases with lobar collapse due to a central tumour mass, the fissure in the region of the mass is unable to move in the usual manner and, therefore, the fissure may show a bulge (the Golden S sign if involving the right upper lobe). The description now seems to have become extended to include the CT equivalent appearance of a hilar mass and collapsed distal lobe and also to describe the phenomenon in other lobes.
2. The presence of pneumonia in an at-risk patient, confined to one lobe (or more lobes if there is a common bronchus) that persists unchanged for longer than 2–3 weeks, or a pneumonia that recurs in the same lobe, particularly if the lobe shows loss of volume and no air bronchograms.

Simple pneumonia often clears or spreads to other segments within a few weeks. In practice, complete resolution of pneumonia virtually excludes an obstructing neoplasm as a cause of infection. Although consolidation may improve partially on appropriate antibiotic therapy, it almost never resolves completely if secondary to an underlying carcinoma. Occasionally, the opacified lobe may appear larger than normal because of the build-up of infected secretions beyond the obstructing carcinoma, an appearance that has been labelled the 'drowned lobe'.

3. A visible mass with irregular stenosis of a mainstem or lobar bronchus. Careful analysis of CT images may demonstrate the presence of an obstructing tumour when there is obstructive atelectasis.
4. Simple pneumonia rarely causes radiographically visible hilar adenopathy, though enlarged central nodes may be seen on CT or MRI. Lung abscess can occasionally be confused with bronchial carcinoma because it may result in hilar or mediastinal adenopathy.
5. Mucus-filled dilated bronchi may be visible within collapsed lobes on a CT examination as branching, tubular low-density structures, and when seen should prompt a search for a centrally obstructing tumour.

**Hilar Enlargement:** Hilar enlargement is a common presenting feature in patients with bronchial carcinoma. It may reflect a proximal tumour, lymphadenopathy, consolidated lung, or a combination of these phenomena. A mass superimposed on the hilum may lead to increased density of the hilum, owing to summation of the opacity of the mass and that of the normal hilar shadows. This sign may be the only indication of lung cancer on a frontal chest radiograph; when suspected, it is essential to inspect the lateral radiograph with care.

**Mediastinal Invasion:** Plain radiograph evidence

of mediastinal invasion relies on demonstrating phrenic nerve paralysis. Caution is needed, however, before deciding that a high hemidiaphragm is caused by phrenic nerve invasion, because lobar collapse can also lead to elevation of a hemidiaphragm, a subpulmonary effusion may mimic it, and diaphragmatic eventration is common. The major CT signs of mediastinal invasion include the demonstration of visible tumour deep within the mediastinal fat, particularly if tumour surrounds the mediastinal vessels, oesophagus, or proximal mainstem bronchi. Associated pneumonia or atelectasis may make it very difficult to determine whether or not mediastinal contact is present. Even clear-cut contact with the mediastinum is not enough for the diagnosis of invasion, and the apparent interdigitation of tumour with mediastinal fat can be a misleading sign on both CT. Glazer et al. showed that the presence of (A) less than 3 cm of contact with the mediastinum, (B) less than 90° of circumferential contact with the aorta, or (C) a visible mediastinal fat plane between the mass and any vital mediastinal structures indicated a very high likelihood of technical resectability, even if the tumour had crossed into the mediastinum, and that most tumours in their series conforming to this description had no mediastinal invasion at surgery. When the question is turned round to enquire as to the criteria for unresectability, however, the answer is less certain. Tumours that obliterate fat planes or show greater contact than that described above are not necessarily unresectable, though the greater the degree of invasion and the extent of contact, the more

**Chest Wall Invasion:** The presence of chest wall invasion alone does not preclude surgical resection, though it does adversely affect prognosis. The necessarily more extensive surgery is associated with increased morbidity and mortality and it therefore helps the surgeon to know the extent of any chest wall invasion preoperatively. The diagnosis of chest wall involvement adjacent to a tumour is unreliable on CT, unless there is clear-cut bone destruction or a large soft-tissue mass. Local chest wall pain

remains the single most specific indicator of whether or not the tumour has spread to the parietal pleura or chest wall. Contact with the pleura on CT examination, even if the pleura is thickened, does not necessarily indicate invasion, though the greater the degree of contact and the greater the pleural thickening, the more likely it is that the parietal pleura has been invaded, particularly if the extrapleural fat plane is obliterated. A definite extrapleural mass that is not explicable by previous chest trauma is likely to be the result of invasion by tumour, but even this sign may be misleading since soft-tissue swelling may be due to inflammation and fibrosis rather than neoplasm. Conversely, a clear extrapleural fat plane adjacent to the mass may be helpful, but again not definitive, in excluding chest wall invasion.

**Lymph Node Assessment:** Lymph node assessment on CT and MRI is limited to size, shape and location, with size being the major criterion used to predict metastatic involvement. Normal mediastinal lymph node size on CT or MRI varies according to the location of the nodes within the mediastinum, but a simple and reasonably accurate rule is that nodes with a short-axis diameter of less than 10 mm fall within the 95th percentile and nodes above this size should, therefore, be considered enlarged.

**Pleural Involvement:** Pleural involvement may occur as a result of direct spread, lymphatic involvement, or tumour emboli. On occasion, adenocarcinoma takes the form of a sheet of lobular pleural thickening indistinguishable from malignant mesothelioma. A pleural effusion in association with a primary lung cancer designates the tumour as being M1a. The exception is the few patients who have clinical evidence of another cause for the effusion (e.g. heart failure) and in whom cytology examinations of multiple pleural fluid samples are negative for tumour cells, in which case the effusion can be disregarded as a staging criterion.

**Extra Thoracic involvement:** Lung cancer is commonly associated with widespread haematogenous dissemination at the time of

presentation. Sites of spread include the adrenal glands, bones, brain, liver and more distant lymph nodes. Detection of metastatic disease precludes surgical resection of the primary tumour. In most centres chest CT is extended to include the liver and adrenals (with appropriate timing for portal venous enhancement). Further imaging is usually only undertaken if there are clinical features suggesting metastatic disease.

### **Tissue sampling and arriving at final diagnosis<sup>11</sup>**

Tissue sampling of nodules which are both accessible and of a size, shape and morphology to suggest the possibility of malignancy, may be undertaken transbronchially, surgically or percutaneously with radiological guidance. Central lesions may be amenable to bronchoscopic biopsy but even perihilar nodules, in the absence of an endoluminal component, remain very challenging for bronchoscopic diagnosis. Bronchoscopic biopsy of peripheral lung cancer using conventional techniques is also highly problematic.

Percutaneous fine needle or cutting needle biopsy has been demonstrated as an accurate technique for the identification of malignancy, but not all nodules are suitable for this approach. When a final diagnosis of lung cancer is eventually established, a previous aspiration biopsy has a 90% likelihood of providing confirmation of a malignant diagnosis. There is a very low false-positive rate but there is a recognised and troubling false-negative rate. Transthoracic needle biopsy remains an essential tool in the management part of indeterminate nodules. Multidisciplinary team discussion of the relative merits of a follow-up strategy, further imaging, percutaneous or bronchoscopic diagnostic procedures or surgical resection for an individual lung nodule remains the ideal management step in this common problem.

FNAC has proven its role in diagnosis of infections & other diffuse benign processes although the main indication remains the diagnosis of localised intra-thoracic lesions suspected of being malignant.

## MATERIALS AND METHODS

The Study was designed as Diagnostic test evaluation and conducted at CT Scan centre, Department of Radiodiagnosis Alappuzha

**Inclusion criteria:** 1. Patients with clinically or radiologically suspected pulmonary mass lesion who came for CT thorax to Department of radiodiagnosis for evaluation and upon CT imaging were found to have pulmonary mass lesion which is defined as - "A focal pulmonary lesion which is greater than 3 cm in diameter in CT Thorax". 2. Patients in whom histopathological correlation is available.

**Exclusion criteria:** 1. Patients with pulmonary mass lesion in whom Histopathology is already proved. 2. Patients with history of contrast allergy. 3. Patients with deranged renal function test

**Sample size:** The number of patients satisfying the inclusion criteria within the duration of the study were fifty three.

All scans were done using Siemens Somatom Spirit dual slice spiral CT scan with 130 KVp and 40-60mAs with 5mm section thickness, retro reconstruction of 1mm section thickness and reformation. Contrast study is done using 50 ml of 300mgI/ml non-ionic iodinated contrast, injected manually after 0.1 ml intradermal test dose and 1 ml intravenous test dose which is the routine followed in our CT department for all contrast studies. Sections were taken from the level of lung apices to the diaphragm routinely including the liver and adrenals.

Lung lesions were characterised based on the following variables- site, size, margins, enhancement pattern, presence of calcification, cavitation, involvement of the hila, involvement of pleura, involvement of chest wall, involvement of mediastinum, involvement of bone, involvement of liver and involvement of adrenals. CT findings were compared with histopathological examination of the specimen obtained by anyone of the following methods: CT guided FNAC done in our Department using 22G Spinal needle under local anaesthesia with aseptic precautions in accessible cases after obtaining

proper informed consent. Arteriovenous malformations, pulmonary artery hypertension, bleeding disorder were ruled out before doing the procedure. Patients were observed for a period of 1 hour after FNAC to keep track of any complication. Repeat CT was performed in cases with suspected complication like pneumothorax post procedure.

Bronchoscopic Biopsy of the lesion/open surgical removal of the lesion which is usually done for the patient as a part of his/her management by respiratory medicine Department or cardiothoracic Department of depending upon the site of the lesion.

## Statistical analysis

Collected data were analysed based on the variables of the lung lesion seen in CT images as already mentioned followed by CT diagnosis and staging and correlation made with histopathology report.

As the study design is diagnostic test evaluation, collected data were analysed by calculating sensitivity, specificity, positive predictive value, negative predictive value using MedCalc software.

## RESULT

Data collected from 53 patients suspected to have bronchogenic carcinoma in whom CT Thorax and tissue sampling was done by either CT guided FNAC or by Bronchoscopic biopsy of the lesion/open surgical removal of the lesion. Out of this 53 patients, 47 were diagnosed to have Bronchogenic carcinoma by CT based on imaging findings and 48 patients were Histopathologically proven to have Bronchogenic carcinoma.

**Table.1.** Distribution of subjects based on size of the mass lesion

Size	Frequency	Percent
3-7 cms	33	62.3
>7cms	20	37.7
Total	53	100.0

**Table.2.** Comparison between margins and histopathology

Margins	Histopathology					Total
	Adeno carcinoma	Squamous cell	small cell carcinoma	large cell carcinoma	Others	
Spiculated	10	15	6	1	2	34
Lobulated	3	7	2	0	2	14
Smooth	0	0	0	0	1	1
Irregular	1	2	1	0	0	4
Total	14	24	9	1	5	53

**Table.3** Distribution of subjects based on cavitation of the mass lesion in CT

Cavitation	Frequency	Percent
Present	10	18.9
Absent	43	81.1
Total	53	100.0

**Table.4.** Distribution of subjects based on Contrast enhancement of the mass lesion in CT

Contrast enhancement	Frequency	Percent
mild (<20 HU)	12	22.6
moderate (20-40 HU)	40	75.5
marked(>40 HU)	1	1.9
no enhancement	0	0
Total	53	100.0

**Table.5** Distribution of subjects based on CT diagnosis of Bronchogenic carcinoma

CT diagnosis	Frequency	Percent
Present	47	88.7
Absent	6	11.3
Total	53	100.0

**Table.6** Distribution of subjects based on Histopathology of CT lesion

Histopathology	Frequency	Percent
Adeno carcinoma	14	26.4
Squamous cell carcinoma	24	45.3
Small cell carcinoma	9	17.0
Large cell carcinoma	1	1.9
Others	5	9.4
Total	53	100.0

Method of specimen collection was by CT guided FNAC in 44 cases, Bronchoscopic biopsy in 8 cases and open Thoracotomy with wedge resection in 1 case.

The case in which wedge resection was done, HPR came as Bronchopulmonary sequestration which was diagnosed as necrotic malignant mass

by CT.

**Diagnostic test evaluation :** CT diagnosis of the mass lesion to be Bronchogenic carcinoma was made when the lesion had the following features either alone or in combinations depending upon the case : spiculated margins, irregular thick walled cavitation, pseudocavitation, abrupt bronchus cut off with distal collapse consolidation and a differentially enhancing lesion, associated hilar/ mediastinal/ supraclavicular lymphadenopathy, chest wall/ mediastinal / pleural invasion by the mass lesion with or without pleural effusion/pleural nodules, adjacent interstitial septal thickening (Lymphangitis carcinomatosa), separate nodules in ipsilateral or contralateral lung, distal metastatic lesion in adrenals/liver/bone.

**Table.7** Sensitivity, Specificity, Positive predictive value, Negative predictive value of CT to diagnose Bronchogenic carcinoma

	Histopathology for Bronchogenic carcinoma		Total
	Yes	No	
CT for Bronchogenic carcinoma	46 true positive	01 false positive	47
	02 false negative	04 true negative	06
Total	48	05	53

INDICES	
Sensitivity	95.83%
Specificity	80.00%
Positive predictive value	97.87%
Negative predictive value	66.67%

**DISCUSSION**

Bronchogenic carcinoma is the leading cause of cancer death in developed countries and is rising in alarming rates in developing countries. Patients with bronchogenic carcinoma have a poor prognosis with an overall 5 year survival rate of 10 – 15%. In our study attempt has been made to ascertain the CT characteristics, and histological typing of bronchogenic carcinoma.

**CT evaluation of Tumor characteristics:** In our study majority of the lesions were peripherally



located (73.5%) and the rest were found in a central location (26.5%). This is in concordance with the study done by Vigg A<sup>12</sup> where peripheral lesions are found to be more common than central lesions. Among peripherally located lesions squamous cell carcinoma was the most common in our study followed by adenocarcinoma. Usually adenocarcinoma is located peripherally.

About 64% of cases in our study had spiculated margins of the lesions in CT and 94% of spiculated lesions were found to be Histopathologically positive for Bronchogenic carcinoma. Similar finding were seen in a study done by Shetty CM<sup>13</sup>. Cavitation is seen in about 18% of cases in our study and is seen most and is seen most common with squamous cell carcinoma. Calcification is identified in 4 cases out of the total 53 and among those 4 cases 2 were of Squamous cell carcinoma and other 2 were of benign pathology. Calcification in malignant cases could probably be dystrophic calcification. About 75% of cases showed moderate enhancement of the mass lesion in CECT and most of which were positive for malignancy by histopathology and 22% of cases showed only mild enhancement of the lesion

Pleural effusion was noted in about 23% of cases. Adrenals and bone were found to be the most common site of distal metastasis followed by liver in our study. About 88.7% of study subjects were diagnosed to have Bronchogenic carcinoma by CT and about 90.1% were diagnosed to have Bronchogenic carcinoma by Histopathology.

CT is a highly sensitive test (95.83%) and also has a high positive predictive value (97.87%) to diagnose Bronchogenic carcinoma from our study. But this increase in Positive predictive value (and a low Negative predictive value) may not be genuine and may be due to less number of Gold standard negatives in the sample studied which is a limitation of the study.

Histopathology and Staging : Method of specimen collection for Histopathology was by CT guided FNAC in 44 cases, Bronchoscopic biopsy in 8

cases and open Thoracotomy with wedge resection in 1 case. Pneumothorax was the most common complication associated with CT guided FNAC which was seen in 2 cases.

In our study squamous cell carcinoma is the most common histopathology followed by adenocarcinoma. This is in concordance with the study by Rawat et al<sup>14,15</sup>, Quamrul M<sup>16</sup> and Shetty CM<sup>17</sup>

**Table 30** Comparison of Various Histopathological Types of Bronchogenic Carcinoma between Present Study and Other Studies :

	Present study	Rawat et al <sup>14</sup>	Krishnamurthy A <sup>15</sup>	Quamrul M <sup>16</sup>	Shetty CM <sup>13</sup>
Squamous cell carcinoma	45.3%	44.8%	15.6%	66%	44.4%
Adenocarcinoma	26.4 %	19.7%	42.6%	25.4%	18.5%
Small cell carcinoma	16.9%	16.75%	13.2%	3.4%	17.2%
Large cell carcinoma	1.8%	8.3%	2.3%	3.4%	9.8%
Others	9.4%	10.3%	7%	1.7%	8.4

Others include 5 cases which are Histopathologically negative for Bronchogenic carcinoma and it includes cases in which Histopathology reports came as inflammatory infiltrates without evidence of malignancy. Out of the 47 cases diagnosed as Bronchogenic carcinoma and staged by CT, 21 cases ( 44.7%) were found to be of Stage IV which has poor prognosis

## CONCLUSION

CT guided FNAC is a simple, less invasive and effective method to obtain Histopathology thereby prompting appropriate management.

CT is a highly sensitive test (95.83%) and also has a high positive predictive value (97.87%) to diagnose Bronchogenic carcinoma in a sample suitably selected and referred for malignancy. Diagnostic work up by CT with guided FNAC may help the patient in correct diagnosis and thereby prompting appropriate management.

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