

# Changing Pattern Of Bronchogenic Carcinoma : A Statistical Variation Or A Reality ?

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## OBJECTIVES:

To document the various CT appearances of bronchogenic carcinoma with histopathologic correlation ,to identify changing trend in the radiographic pattern of bronchogenic carcinoma, if any and to evaluate the role of CT in staging of bronchogenic carcinoma was also evaluated.

## MATERIALS AND METHODS

A prospective study of 81 patients over a period of 2 yrs with clinical and or radiological suspicion of bronchogenic carcinoma and confirmed histopathological diagnosis was undertaken with CT of the thorax using 10 mm collimation sections from the level of lung apices to the diaphragm and routinely included the adrenals.

## RESULTS :

Squamous cell carcinoma is the most common histologic subtype followed by adenocarcinoma and small cell carcinoma. There was a definite male preponderance with smoking being the most common risk factor. Adenocarcinoma is presenting predominantly as central tumor( 70.5% ) Squamous cell carcinoma is presenting predominantly as peripheral tumor (52.7% ) .

## CONCLUSION

Computed tomography is the modality of choice for evaluating bronchogenic carcinoma because of its better spatial resolution. CT provides precise characterization of the size, contour, extent and tissue composition of the suspicious lesion. If the lesion represents a bronchogenic carcinoma, CT serves as a part of the staging process to assess the extent of the disease. The radiologic presentation of adenocarcinoma and squamous cell carcinoma is showing a changing pattern. In our study, adenocarcinoma is presenting predominantly as a central tumor and Squamous cell carcinoma is presenting predominantly as a peripheral tumor. This relative increase in the percentage of centrally located adenocarcinoma is a statistical variation or a reality needs to be evaluated further.

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## INTRODUCTION

Bronchogenic carcinoma is the most frequently diagnosed "major" cancer in the world and it accounts for more deaths than any other malignancy. The enormity of the world wide disease burden is a fairly recent phenomenon with incidence rates rising sharply. In 1990,estimated 1.04 million new cases of lung cancer were diagnosed representing 12.8 % of total cancer incidence worldwide. In India, incidence has been rising in the past 50 yrs. A recent study showed that lung cancer accounted for 7.4 % of total cancer incidence in India. The prevention and early diagnosis of lung cancer thus assumes a major public health issue.

Imaging plays a very vital role in the management of patients with lung cancer. The role of imaging ranges from screening for lung cancer in high risk individuals to staging bronchogenic carcinoma in advanced stages of the disease. As a single comprehensive study, CT remains the most effective noninvasive technique for evaluating suspected or known lung cancer and mediastinum which may contain associated mediastinal disease and lymphadenopathy.

Many studies have been published on the clinical profile of bronchogenic carcinoma in India. However there is paucity of studies on the CT evaluation of lung cancer. The present study is aimed at evaluating the imaging

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characteristics of bronchogenic carcinoma by computed tomography .

## MATERIALS AND METHODS

### Selection criteria:

Patients with clinical and or radiological suspicion of bronchogenic carcinoma were studied with CT. Out of these, 81 patients with a confirmed histopathological diagnosis of carcinoma were finally included in the study. The study population composed of 75 males and 6 females who ranged in age from 35 to 85 years (mean, 60.5 years).

### Imaging technique:

CT was performed with a Wipro GE prospeed SX helical CT scanner. CT scans of chest were obtained with contiguous 10 mm collimation sections from the level of lung apices to the diaphragm and routinely included the adrenals. If a mass or nodule was identified, additional 5mm collimation sections were obtained through the lesion.

IV contrast was routinely used (except in patients who previously had contrast reactions or in renal failure). 60-70ml of non ionic water soluble contrast media (i.e Ultravist / Omnipaque) of strength 300mg/ml were used in all the patients. Post contrast 5mm sections at hila were obtained. CT scan images were viewed in lung window, mediastinal window and bone window.

### Image analysis:

CT findings were interpreted based as following : mass lesion based on tumor site - right/left, central /peripheral , lobar/segmental location ;size - < 1 cm, 1-2 cms, 2-3 cms or > 3 cms; 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 3 cms 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 90of circumference contact with the aorta, a visible mediastinal fat plane between the mass and an 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). The histopathology reports of FNACs, bronchoscopic biopsies and thoracotomies were reviewed. These were later compared with our CT findings.

## RESULTS

The study population composed of 75 males and 6 females who ranged in age from 35 to 85 years (mean, 60.5 years). All the males in our study were smokers (93%). All the non smokers were females. Most common pulmonary symptom was cough with expectoration ( 55.5%), followed by dyspnea (43.2%), Hemoptysis (35.8%), & chest pain(33%). Among the associated risk factors, smoking was observed in 75 patients (92.5%), pulmonary Kochs in 10 (12.3%), Bronchiectasis in 1 (1.23%) and COPD in 7 (8.6%).

The most common extrapulmonary symptoms were weight loss in 60%, hoarseness of voice in 7 (8.6%), lower limb weakness in 2( 2.46%), bone pain in 5 ( 6.1%), Pancoasts syndrome in 3(3.7%).Clubbing was seen in 22.2%, out of which 8 were squamous cell carcinoma, 4 were adenocarcinoma, 4 were small cell carcinoma and 1 large cell carcinoma. Paraneoplastic syndrome was seen in 3.7%( 3 cases) and two cases of hypercalcemia and one case of SIADH were seen. Right lung was involved in 44%, left in 36%, both lungs in 20% of cases. Upper lobe was most commonly involved. Central tumors were 45 (55.5%) and peripheral in 36(44.4%). Adenocarcinoma is presenting predominantly as central tumor, 70.5% of adenocarcinomas are centrally located. Squamous cell carcinoma is presenting predominantly as peripheral tumor, 52.7% of squamous cell carcinomas are peripherally located.[Table 1]

**Table 1 : Histological distribution based on central and peripheral location**

CELL TYPE	Central (45)		Peripheral (36)	
SQUAMOUS	17	37.2%	19	52.7%
ADENOCA	12	26.6%	5	13.8%
SMALL CELL	11	24.4%	3	8.3%
LARGE CELL	5	11%	3	8.3%
OTHERS	-	-	6	16.6%

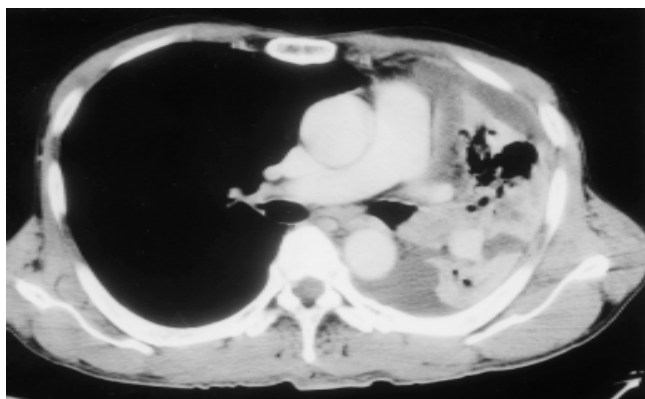


FIG 1. Central squamous cell carcinoma as an intraluminal growth occluding the left main bronchus causing extensive lung collapse.

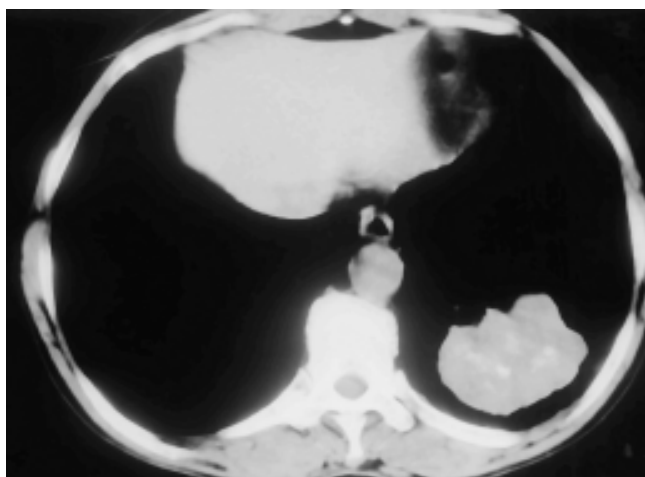


FIG.2. Peripheral squamous cell carcinoma with speckled calcification.

Majority of the lesions were greater than 3 cms showing predominantly heterogenous enhancement. Nodules had speckled margins in 48 cases (85%), lobulations in 24 cases (70%) and smooth margins in 5 cases (8%). Calcification was noted in 13 cases (16%). Amorphous pattern of calcification was observed in 2, punctate in 9 and atypical central nodular pattern in 1. Out of the 17 centrally obstructing tumors with collapse, 5 cases showed dilated fluid filled bronchi suggestive of positive "Mucous bronchogram" sign. There was one case of solitary pulmonary nodule measuring 2.7 cms (squamous cell carcinoma) & one case of lymphangitis carcinomatosa (adenocarcinoma).

**Table 2: Comparison of cell types in different studies**

CELLTYPE	Present study	Chhajed	Jain	Guleria	Quinn	Gupta
Squamous	44.4%	23.3%	39.1%	46.1%	28%	42%
Adenoca	18.5%	28.8%	15.9%	17.3%	36%	20%
Smallcell	17.2%	16.3%	23.1%	15.4%	25%	14%
Large cell	9.8%	12.3%	10.1%	21.1%	6%	18%
Bronchiolo-alveolar	2.4%	-	-	-	2%	-
Adenosq.	1.2%	-	-	-	2%	-
Others	4.8%	-	-	-	-	6%

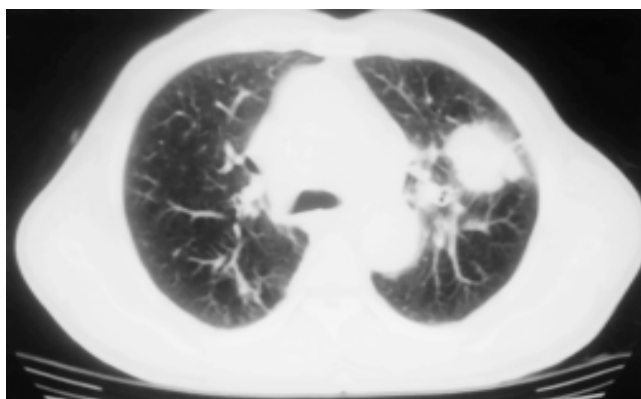


FIG.3. Typical peripheral adenocarcinoma with lobulated, spiculated margin and a pleural tag.

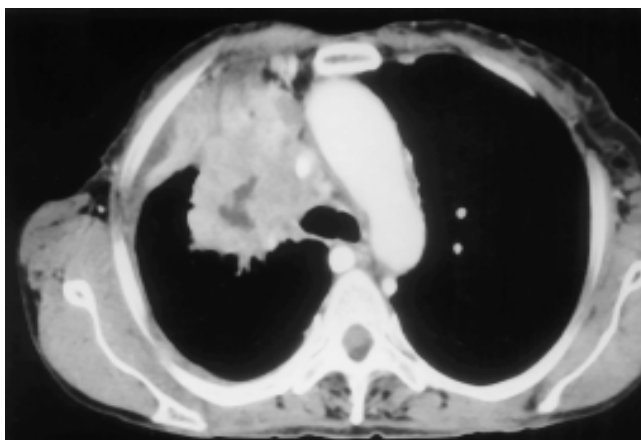


FIG 4. Central adenocarcinoma with invasion of superior vena cava.

Mediastinal nodal involvement was observed in 74%, mediastinal invasion in 26% of cases and vascular invasion was observed in 51.8% of cases. Extrathoracic metastases was observed in 48.1% of cases. Most common organ to be involved being bone (19.7%) followed by liver (18.5%) and adrenals (6.1%). Most of the patients in this study at presentation were already in advanced stage of the disease both in nonsmall cell carcinoma (stage IIIb 38.27%, stage IV 44.4%) and small cell carcinoma group (extensive stage 78.5%). [Table 2]

## DISCUSSION

Most of the Indian studies have kept squamous cell carcinoma at the top accounting for 34-73% of total cases. Even a recent study by Gupta[1] reported squamous cell carcinoma as the commonest type. However, two recent studies, by Chhajed [2] and Gupta and Aggarwal [1] differ in that they have reported the commonest types to be adenocarcinoma and small cell carcinoma respectively.[Table 3]. The most common tumor cell type noted in this study was squamous cell carcinoma accounting for 44.4% % of the cases, followed by adenocarcinoma accounting for 18.5%. Hence the pathological profile noted in our study is in keeping with most (except two recent) of the Indian studies which report squamous cell carcinoma as the commonest type.

**Table 3: Radiographic patterns in present study**

FEATURES	NUMBER	%
SPICULATION	48	85%
LOBULATION	24	70%
SMOOTH	5	8%
CAVITATION	9	8.6%
CALCIFICATION	13	16%
AIR BRONCHOGRAMS	9	13%
PLEURAL EFFUSION	36	34.5%
CHEST INVASION	9	11.1%
DIRECT MED. INVASION	26	32%
SVC	7	8.6%
OESOPHAGUS	8	9.8%
TRACHEA	5	1.2%
CARDIA	3	3.7%
LIVER	15	18.5%
ADRENAL	5	6.1%
BONES	16	19.7%
BRAIN	3	3.7%

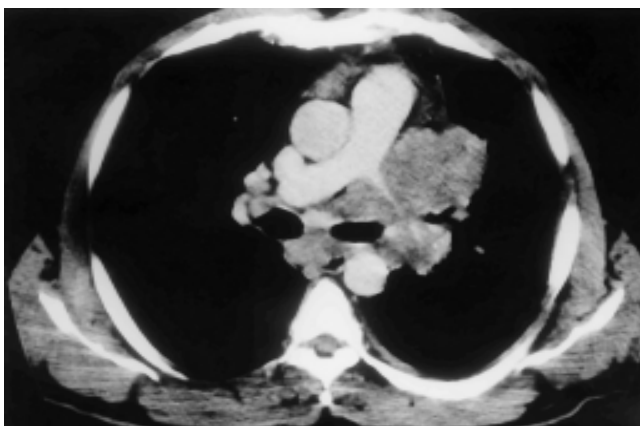


FIG 5. . Small cell carcinoma with Invasion of left pulmonary artery.

In our study adenocarcinoma was found to be the commonest cell type amongst nonsmokers and females , confirming with that reported by Chhajed

[2]. Adenocarcinoma of the lung develops from epithelial metaplasia , dysplasia and carcinoma insitu in response to chronic inflammation and injury . Since the greatest part of respiratory epithelial surface lies in the periphery of the lung, adenocarcinoma is statistically more likely to arise in the periphery of the lung than in a central location[3]. In our study, adenocarcinoma occurred more frequently as a central tumor as compared to peripheral tumor, this finding was compared with a study by Sharma [4] who had observed adenocarcinoma presenting predominantly as a peripheral tumor. Chi square test was applied & p value calculated. The occurrence of adenocarcinoma predominantly as a central tumor was proved to be statistically significant ( p value < 0.05).[Table 4]

**Table 4: Comparison of adenocarcinoma cell type based on location**

ADENOCARCINOMA	Central	Peripheral	Total
Present study	12	5	17
C P Sharma	23	37	60
Total	35	42	77

Squamous cell carcinoma presented more peripherally than centrally in our study. This was compared with study by Sharma [4], using Chi square test. The occurrence of squamous cell carcinoma predominantly as a peripheral tumor was proved to be statistically significant ( p value < 0.05).[Table 5] Similar conclusions were drawn by Quinn and associates[5] . They found that adenocarcinoma has increased in relative frequency among lung cancers ,the percent of cases with peripheral primary tumors is decreased while central tumors have increased. Squamous carcinoma has had a relative increase as peripheral mass presentation.

**Table 5 : Comparison of squamous cell type by location**

SQUAMOUS CELL	Central	Peripheral	Total
Present study	16	19	35
C P Sharma	114	44	158
Total	130	63	193

A recent Indian study by Chhajed [2] also concluded adenocarcinoma as the most common tumor cell type and also the most common tumor seen in central location. Chhajed [2] attributed it to the increasing trend of lung cancer in non smokers and women and also because of increasing inclusion of large cell carcinoma as adenocarcinoma on the basis of more detailed tests.

Recent literature has noted a relative increase in centrally located adenocarcinoma. There is no single satisfactory explanation for the changing histologic pattern over the past two decades . Possible explanations for this phenomenon include the following . About 50% of large

cell carcinomas arise in a large bronchus. The inclusion of large cell carcinomas with mucus production into the subtype of poorly differentiated adenocarcinoma could account for some of the increase in centrally located adenocarcinoma [3]. Increasing use of mucin stains and immunocytochemical staining for antibodies to CEA has contributed to enhanced recognition of adenocarcinomas. Also, there appears to be an increasing association of adenocarcinoma with cigarette smoking which is highly associated with centrally located adenocarcinomas [3]. Lowering of the nicotine content of cigarettes leads individuals to inhale more deeply and smoke more intently that is larger puff volumes at higher frequency in an attempt to maintain blood nicotine level. Although the net effect of such changes on pulmonary carcinoma rate is modest, it may be related to an increase in the proportion of adenocarcinomas [6,7].

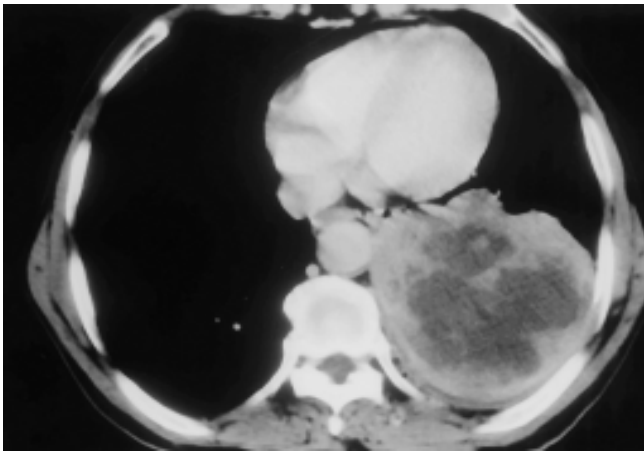


FIG 6. Large cell carcinoma presenting as a large necrotic peripheral mass.

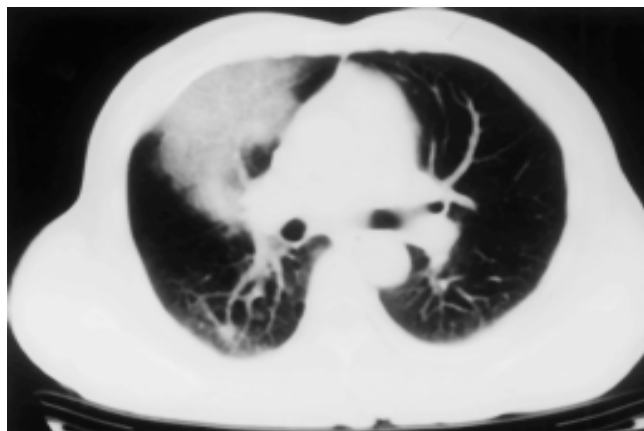


FIG 7. Bronchioloalveolar carcinoma demonstrating lepidote growth and focal ground glassing.

In our study, pleural effusion was most commonly noted in adenocarcinoma, followed by bronchoalveolar carcinoma compared to other cell types which correlates with literature. Features of bubble like lucencies, pseudocavitations were seen in bronchioloalveolar

carcinoma and adenocarcinomas. Advanced stage at presentation with extrathoracic metastases was seen in adenocarcinoma and small cell carcinoma as reported in literature.

Calcifications were seen predominantly in squamous cell carcinomas (46%) and in central tumors (53%) compared to peripheral tumors, correlated with literature. Cavitations were predominantly seen in squamous cell carcinoma correlating with that reported in literature.

In this study, the high incidence of liver metastases in adenocarcinoma is probably due to the high incidence of adenocarcinoma compared to small cell carcinoma and the high tendency of adenocarcinoma to metastasise extrathoracically. This correlates with that reported by Chhajed [2] with incidence of liver metastases being 23.3%, adenocarcinoma accounting for majority (35.5%).

In conclusion, computed tomography is the modality of choice for evaluating bronchogenic carcinoma because of its better spatial resolution. CT provides precise characterization of the size, contour, extent and tissue composition of the suspicious lesion. If the lesion represents a bronchogenic carcinoma, CT serves as a part of the staging process to assess the extent of the disease. The radiologic presentation of adenocarcinoma and squamous cell carcinoma is showing a changing pattern. In our study, adenocarcinoma is presenting predominantly as a central tumor and squamous cell carcinoma is presenting predominantly as peripheral tumor. This relative increase in the percentage of centrally located adenocarcinoma is a statistical variation or reality needs to be evaluated further.

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