

Multidetector Row Computed Tomography(MDCT) Evaluation of Bronchogenic Carcinoma and Histopathological Correlation

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Abstract: Bronchogenic carcinoma is one among the leading causes of death in males in India and globally. Multidetector row Computed Tomography is a non-invasive technique for evaluation of bronchogenic carcinoma. Aims and objectives: To document imaging characteristics of various histopathological cell types of bronchogenic carcinoma by MDCT and to correlate with histopathology. A prospective study was done on 60 patients with clinical or radiological suspicion of bronchogenic carcinoma undergoing MDCT. The final diagnosis was established by histopathology. Study duration was for 2 years from January 2013 to December 2014. Results: MDCT is a promising tool in evaluation of bronchogenic carcinoma. Squamous cell carcinoma is the most common histological celltype, closely followed by adenocarcinoma. Hilar mass was the predominant presentation followed by lung mass.

Keywords: Multidetector Row Computed Tomography (MDCT), Bronchogenic Carcinoma, Central, Peripheral, Histopathology

1. Introduction

Bronchogenic carcinoma is the main leading cause of death in males in India and worldwide accounting for significant mortality.¹ MDCT is a promising, 3D imaging tool that allows substantial anatomical volumes covered with isotropic submillimeter spatial resolution. Since the advent of MDCT, a decline in the use of other diagnostic chest procedures like chest fluoroscopy, tomography, mediastinoscopy, arteriography and thoracotomy has occurred². Limited studies have been done regarding the imaging characteristics of various histological cell types of bronchogenic carcinoma in India especially in the south.³ The present study was undertaken to document various MDCT features of bronchogenic carcinoma and to correlate with histopathology

2. Methodology

Study was done on 60 patients referred for Computed Tomography to Department of Radio-diagnosis, Vydehi

Institute of Medical Sciences and Research Centre, Bangalore with clinical or radiological suspicion of bronchogenic carcinoma. All cases were proven by histopathology. The study duration was 24 months from January 2013 to December 2014. Patients with lung metastasis and benign pathology were excluded.

CT was performed with WIPRO GE 16 Slice CT Scanner with 10mm collimation from apices of lung to the domes of diaphragm including the adrenals and whole of liver. 60-70 ml of non-ionic contrast was injected intravenously.

The following primary CT features like mass, location, attenuation, enhancement, calcifications, cavitations, satellite lesions were looked for. Secondary features like lymph nodes, mediastinal or chest wall invasion, pleural effusion, collapse, consolidation and metastases were evaluated.

Statistical method: Results on continuous measurements were performed on mean SD (Min – Max) and results on categorical measurements were presented in number (%). Significance is assessed at 5% level of significance. Chi square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between

two or more groups. The statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc (.0.1, Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

3. Results

Highest number of patients were found in the age group of 51-60 years (22 patients) which constituted 36.7 % of patients followed by the age group of 61-70 (20 patients) which constituted 33.33 %. Mean age was 57.10 +/- 10.47 years (Table1). Out of 60 patients 53 patients were males (88.3 %) and 7 were females (11.7 %) (Figure 1).

Out of 60 patients, 39 were smokers (65.0 %), 10 were non-smokers (16.7 %) and 11 were ex-smokers (18.3%).

Majority of patients (37, 61.7%) presented with peripheral mass lesions. In 23 (38.3%) patients presented in central locations (Table 2)

Out of 60 cases, squamous cell carcinoma accounted for maximum number of cases accounting for 28 cases (46.7 %) followed by adenocarcinoma 20 cases (33.3%) and least was large cell carcinoma found in 2 cases (3.33%) (Table 3)

Squamous cell carcinoma was the commonest tumour and

was seen both in central and peripheral locations. Adenocarcinoma was mostly seen in peripheral locations. Small cell carcinoma was exclusively seen as central tumour. Large cell and undifferentiated were seen in both central and peripheral locations (Figure 2).

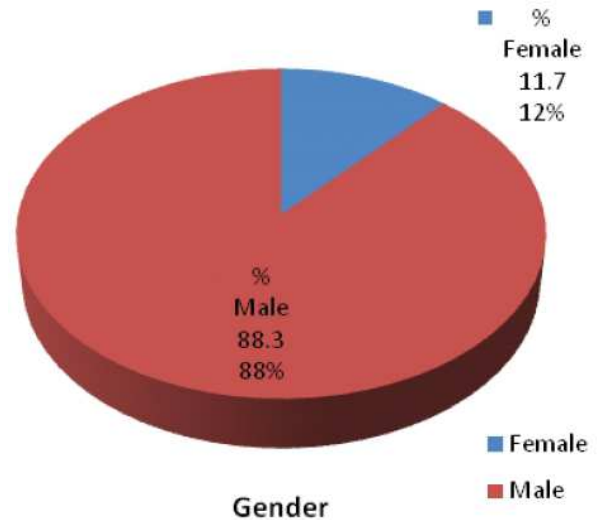
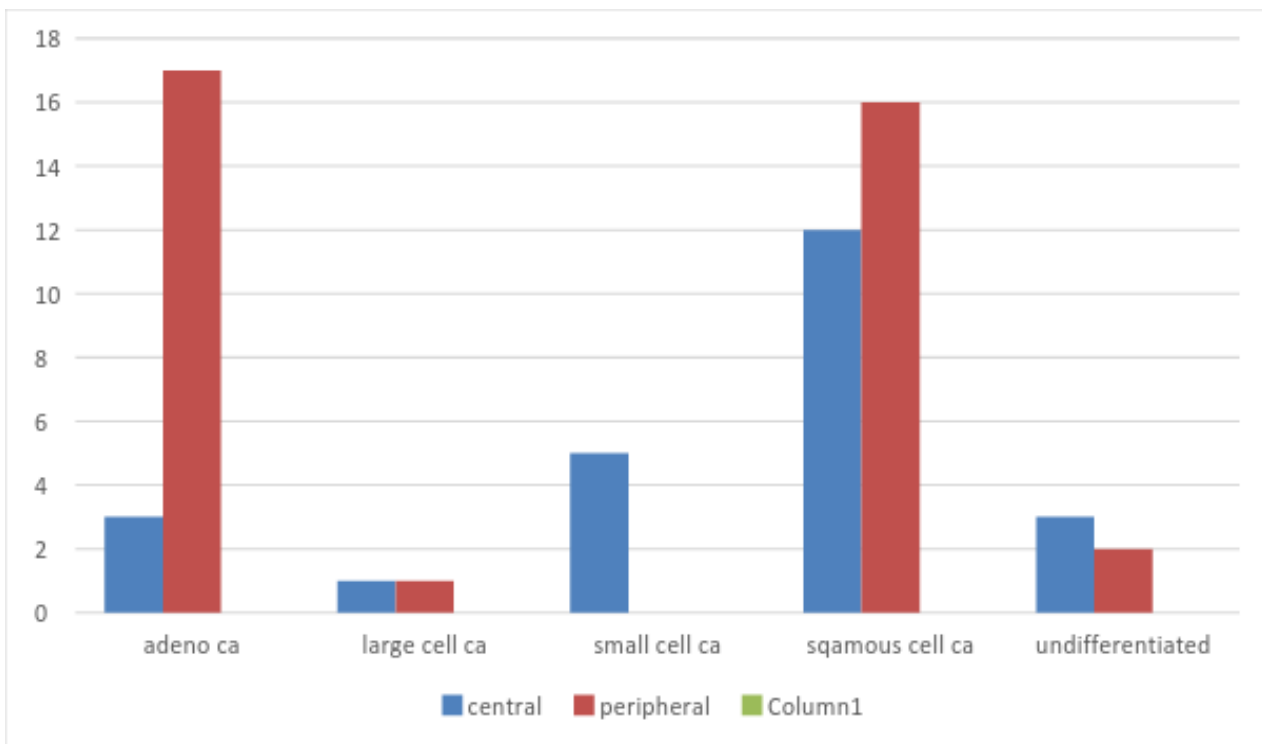


Figure 1. Gender distribution of Patients studied.



P<0.001**, Significant, Fisher Exact test

Figure 2. Showing association of histological cell types with central/peripheral locations.

Out of 60 patients 28 cases (46.7%) were squamous cell carcinoma, presenting centrally in 12 case (42%) and peripherally in 16 cases (57%). Out of 60 patients, 20 cases (33.3%) were adenocarcinoma, presenting centrally in 3 cases (15%) and peripherally in 17 cases (85%).

5 cases (8.33%) were small cell carcinoma presenting

only in central locations. 2 cases (3.33%) were large cell carcinoma presenting both centrally (50%) and peripherally (50%). 3 cases (5 %) were undifferentiated presenting in both central (60%) and peripheral locations (40%).

Hilar mass was the most common presentation (40%) seen mostly by squamous cell carcinoma, followed by small cell

carcinoma (which is central tumour), adenocarcinoma and undifferentiated carcinoma in that order. Lung mass was the next common feature found in adenocarcinomas. Squamous cell carcinomas also presented as Pancoast or chest wall masses. Cavitory lesions were seen both in adenocarcinoma and squamous cell carcinoma. SPN was a feature of adenocarcinoma. (Table 4)

Table 1. Age distribution of patients studied.

Age in years	No.of patients	%
21-30	2	3.3
31-40	1	1.7
41-50	12	20.0
51-60	22	36.7
61-70	20	33.3
71-80	3	5.0
Total	60	100.0

Table 4. Distribution of histological cell types according to the radiological findings.

	Hilar mass	Lung mass	Spiculated Lobulated	Spn	Cavitary	Peripheral Chest wall
SQ	12	2			2	12
Adeno	3	8	4	1	4	
Large	1	1				
Small	5					
Undiff	3	2				
Total	24	11	4	1	6	12

4. Discussion

In the present study the mean age of the patients was 57 which was close to Prasad⁴ et al lucknow India and A dey⁵ Kolkatta. Majority of lung cancer fell between the age group 40 to 70 years.

Gender distribution was M: F = 7.5:1, this is in close relation with Santos – martinez⁶ and Jagdish⁷ gender distribution of patients studied. Cough was the most common symptom followed by chest pain, weight loss and pleural effusion. One case presented with CNS features and retrospectively diagnosed due to bronchogenic carcinoma.

Squamous was seen most commonly in smokers. Adenocarcinoma was most common in non-smokers and females.

Squamous formed the major histologic cell type accounting for 46% followed by adenocarcinoma accounting for 33%, small cell carcinoma was found in 11.6 % and large cell carcinoma in 8.3%. These findings were similar to various studies done by Jindal⁸ and Gupta.⁹ The ratio of squamous cell carcinoma to adenocarcinoma was 1.39:1. The rise in adenocarcinoma is significant in USA but not in India, where squamous cell carcinoma still dominates but the ratio is declining from 1.7:1 to 1.39.^{9,10} In the last 30 years, there has been a relative increase in the number of adenocarcinoma, bringing that ratio to 14:1.^{10,11} This may be due to the fact that more and more adenocarcinomas are diagnosed by immunohistochemistry.

Squamous cell carcinoma was seen both in central and peripheral locations. It presented as hilar mass in central locations and Pancoast and chest wall invasive lesions in peripheral locations. Adenocarcinoma was most commonly

Table 2. Central/Peripheral locations of patients studied.

Central/ peripheral	Number of patients	%
Central	23	38.3%
Peripheral	37	61.7%
Total	60	100.0

Statistically significant (P< 0.001**)

Table 3. Histology of patients studied.

Histology	Number of patients	%
Adenocarcinoma	20	33.3%
Large cell carcinoma	2	3.33%
Small cell carcinoma	5	8.3%
Squamous cell carcinoma	28	46.7%
Undifferentiated	5	8.33%
Total	60	100.0

located in the periphery, with lung mass as a presenting radiological feature. Large cell and undifferentiated were seen in both central and peripheral locations. Small cell carcinoma was seen exclusively in central location.

Hilar mass was the most common presentation, though studies by Loris¹² et al showed that lung mass was the commonest presentation.

Squamous cell carcinoma

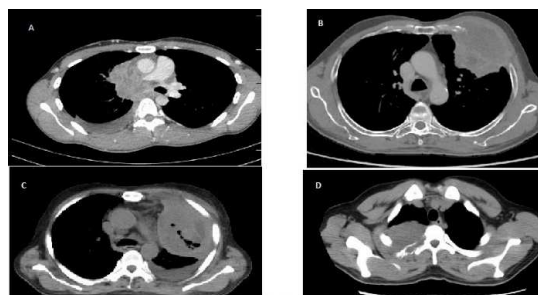


Image 1a. Squamous cell carcinoma presenting as hilar mass, chest wall mass, cavitary lesion and Pancoast tumor.

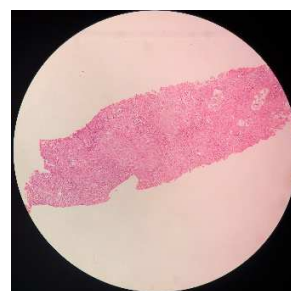


Image 1b. Squamous cell carcinoma 10x H&E.

Among 28 cases of squamous cell carcinomas, equal numbers were found as hilar and peripheral masses. Tumours usually ranged in size from 1-10cms. The large size of tumour at the time of presentation is due to slow growth.¹¹ Centrally, the masses were typically found in the central bronchi, resulting in post obstructive pneumonia and atelectasis in up to 80 %.¹² Mucoid impaction, bronchiectasis, and hyperinflation are additional findings of a central obstructing neoplasm. Extension into the chest wall or mediastinum with bone destruction, superior vena cava syndrome, phrenic or recurrent laryngeal nerve paralysis has been reported.¹³

Peripheral masses were seen as Pancoast/superior sulcus tumours or peripheral chest wall masses either causing rib destruction or chest wall invasion. Squamous cell carcinoma

is the most common cell type to present as Pancoast or Superior sulcus tumour¹³ and this was seen in 5 cases (17%) and as peripheral masses eroding the rib or chest wall invasion in 7 cases (25%). They are usually slow growing with late metastasis predominantly to the liver, adrenal glands, kidneys and bones.¹³

Squamous cell carcinoma cavitates in 10 to 20 % of cases particularly, the large peripheral lesions.¹³

2 (7.14%) cases were seen as thick walled cavitory lesions. Cavity walls were thick and irregular ranging 0.5 to 1.5cm. Rarely, extensive necrosis within the mass can be seen as thin-walled cavity.¹⁴

Adenocarcinoma

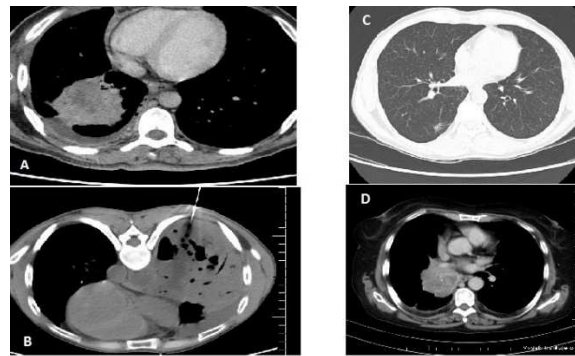


Image 2a. Adenocarcinoma presenting as lung mass, spiculated mass, cavitory lesion and hilar mass.

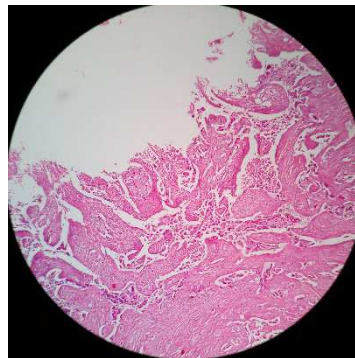


Image 2b. Adenocarcinoma 40x H&E.

Adenocarcinoma accounted for 33% of all malignant tumours with only 15% were seen as central hilar masses. Only one case showed frank intraluminal extension. Recent studies by Shetty et al³ have shown that adenocarcinoma predominantly presented as central masses. However we saw adenocarcinomas predominantly located in the periphery as consolidative process, lung masses around the segmental bronchi, spiculated or lobulated peripheral masses, SPN, cavitory lesions and. Lung masses around the segmental bronchi accounted for 47% and was the most common presentation. Air Bronchogram sign was seen in 40% of cases. Small spiculated masses were seen in 15% of cases and lobulated masses were seen in 5 %. One case (5%) presented as SPN. 2 cases (10%) were seen as cavitory lesions and 2 cases (10%) cases presented as Bronchoalveolar

carcinoma.(BAC)

The borders of the tumour were rounded, lobulated or poorly defined. Lobulation reflects the histologic heterogeneity of lung cancer due to the differential growth rates in different areas within the tumour. Ill-defined borders may relate to invasion of the adjacent lung, fibrosis, or interstitial oedema.²¹ The typical radiologic manifestation of adenocarcinoma is a solitary pulmonary nodule or mass that may have well-marginated, lobulated, irregular or poorly defined borders.²²

The most common radiologic manifestation of the bronchioloalveolar subtype of adenocarcinoma is that of a well-circumscribed peripheral solitary pulmonary nodule or mass.²³ Cavitation, an infrequent finding in adenocarcinomas, may be seen in bronchioloalveolar carcinoma. The lepidic

pattern of tumor growth may result in lesions of heterogeneous radiologic opacity, with air bronchograms and poorly marginated borders mimicking pneumonia.²⁴ Less commonly, patterns of multiple nodules or extensive consolidation involving one or more lobes may be seen.^{25, 26} Patients with extensive consolidation of multifocal disease

have a poor prognosis. High-resolution CT may demonstrate air attenuation and pseudocavitation within the nodules corresponding to small bronchi and cystic spaces.²⁶

Small cell carcinoma

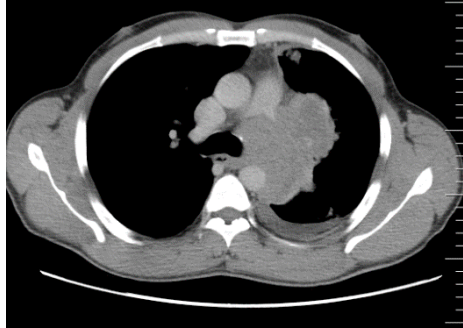


Image 3a. Small cell carcinoma presenting as hilar mass.

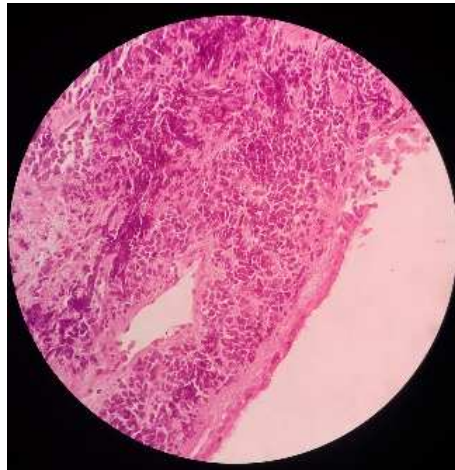


Image 3b. Small cell carcinoma. 40xH&E.

5 cases (8.33 % of 60 lung cancers) were small cell carcinomas. They probably arise from neuroendocrine cells and contain neurosecretory granules and may produce peptide hormones.^{15, 16} The tumours were centrally located and mediastinal extension was seen with encasement of mediastinal structures and tracheobronchial compression in

60% of cases.^{17, 18} The less commonly described peripheral small cell carcinoma is often associated with hilar adenopathy and atelectasis secondary to main stem bronchus compression.¹⁹

Large cell carcinoma

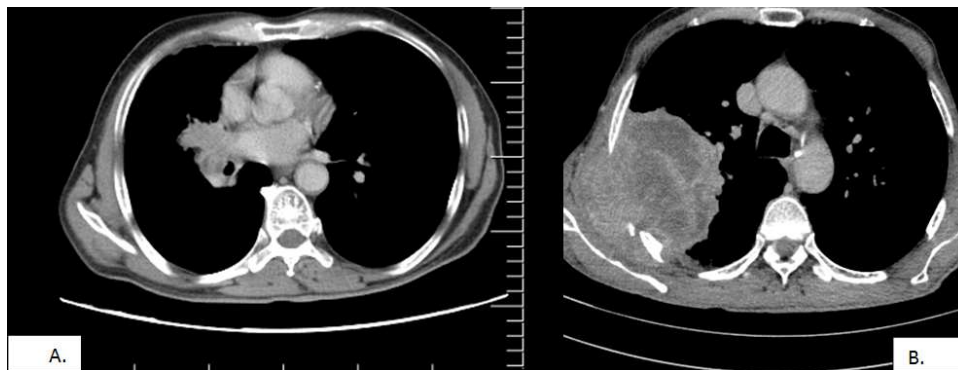


Image 4. Large cell carcinoma presenting as hilar and peripheral lung masses.

Large cell carcinoma represents less than 5% of all bronchogenic carcinomas and can present in both central and

peripheral locations. Here large cell carcinomas were seen as hilar and lung masses.

Undifferentiated carcinoma

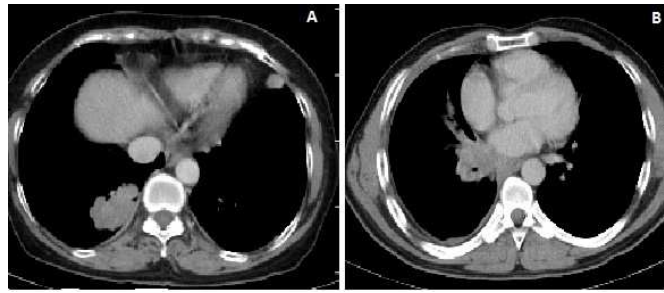


Image 5. Undifferentiated carcinoma presenting as peripheral and hilar masses.

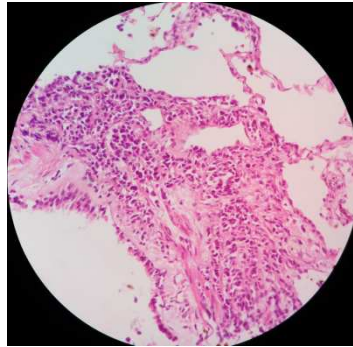


Image 6. Undifferentiated carcinoma 40x H&E.

Undifferentiated carcinomas are usually bulky tumours typically greater than 3cm in diameter. Involvement of large bronchi is seen in approximately 50% of central lesions. The typical radiologic appearance of these neoplasms is that of a large peripheral lung mass and have large areas of necrosis.

Other features:

Mediastinal lymph nodes were seen invariably in squamous cell, small cell, large cell, undifferentiated and adenocarcinomas in that order. Central masses had more association with lymph nodes(85%). Pleural effusion was predominantly seen in adenocarcinoma, followed by squamous cell carcinoma. Metastases to liver, adrenal, bone and brain were seen predominantly in adenocarcinoma.

5. Conclusion

MDCT with precise anatomic details is the imaging modality of choice in assessment of various histopathological celltypes of bronchogenic carcinoma. Squamous cell carcinoma is the commonest histologic celltype, presenting as hilar mass whereas adenocarcinoma is seen predominantly in peripheral location presenting as lung mass.

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