CT Imaging of Primary Lung Tumours with CT Guided Fine Needle Aspiration Cytology Correlation among Guwahati, Assam Population

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ABSTRACT

BACKGROUND

The primary lung masses (tumours) are those that originate from the lung tissue. Although most primary pulmonary tumours are carcinomas, a large histological spectrum of benign and malignant tumours of the lung exists. Although chest x-ray is still considered to be the primary imaging modality of lungs, computed tomography (CT) not only shows the segments that are involved but also the extent of involvement. We wanted to study the sensitivity and specificity of CT in the diagnosis of primary neoplastic lesions of lung, study the CT patterns of different histological variants of bronchogenic carcinoma, and correlate CT findings with CT guided fine needle aspiration and cytology (FNAC) findings.

METHODS

The present descriptive cross-sectional study was conducted among 34 patients suspected clinically of having lung neoplasms, in Gauhati Medical College and Hospital, Guwahati, Assam from December 2010 to November 2011.

RESULTS

Considering FNAC / histopathological examination (HPE) as the gold standard, the positive predictive value and false negative value of CT scan for diagnosis of neoplastic lesions of lung were 97 % and 3 % respectively, in our study. Among our study population, mean age with lung tumours was 61 years, highest number of cases was seen in the age group of 51 - 60 years (35 %); Males and females affected were 27 (79.41 %), and 7 in number (20.59 %), respectively.

CONCLUSIONS

CT is more sensitive in the detection of neoplastic lesions of the lung and associated hilar / mediastinal adenopathy than chest roentgenography. CT has a high efficacy in detecting neoplastic lesions of lung, delineating its lobar and segmental anatomy, thereby helping surgical resection of lung. In this study, CT guided FNAC and cytological findings correlated well with CT diagnosis of primary neoplastic lesions of lung.

KEYWORDS

Primary Lung Tumour, Contrast Enhanced Computed Tomography (CECT), Fine Needle Aspiration and Cytology (FNAC)

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BACKGROUND

The primary lung masses (tumours) are those that originate from the lung tissue. Although most primary pulmonary tumours are carcinomas, a large histological spectrum of benign and malignant tumours of the lung exists. Many environment and occupational exposures have been implicated as causative agents of lung cancer. Cigarette smoking is the irrefutable major cause of lung cancer. Among the occupational agents, asbestos, arsenic, nickel, uranium, vinyl chlorides are some of the agents which can lead to the development of lung cancer.

Most studies report that only 25 - 40 % of patients have resectable disease at the time of presentation. Of 100 patients with lung cancer, less than 10 will survive for 5 years. The role of diagnostic imaging is to identify the precise anatomic location and extent of the pathologic process with a minimal number of imaging procedures. Conventional postero-anterior (PA) and lateral chest radiography rapidly grew to become the standard examination for the evaluation of pulmonary disease, including bronchogenic carcinoma. Radiography is a cost effective, sensitive, low-risk examination for lung cancer screening. Its role in staging of bronchogenic carcinoma has diminished significantly.

The invention of newer imaging modalities has contributed toward imaging of lungs to a great extent. Although chest x-ray is still considered to be the primary imaging modality of lungs; the cross-sectional images provided by CT and magnetic resonance imaging (MRI) has contributed in localisation of lesion in detail. MRI on the other hand despite of providing a great soft tissue detail is very expensive and not readily available; cannot be used in non-cooperative patients and patients with metallic chips and prosthesis. Metallic biopsy needle cannot be used for FNAC in MRI.

The use of CT has revolutionised lung imaging. CT not only shows the segments that are involved but also the extent of involvement. The use of non-contrast, contrast and high-resolution computed tomography (HRCT) enables to detect the lesion more adequately and to detect other associated effects if any. Aspiration guided by CT, ultrasonography (USG) and fluoroscopy makes it possible to attain cytological specimen from a more defined site in the lung. The cells obtained are better preserved than exfoliated cells in the sputum.

Leyden in 1883[1] performed first needle biopsy of the lung aspirating organism causing pneumonia. Menetrier in 1886,[2] successfully diagnosed a pulmonary carcinoma by needle aspiration. Several series of cases have since been reported using either an aspiration or cutting needle technique (Craver & Binkly, 1939;[3] Lauby et al. 1935 Dahlgrin & Lind, 1969)[4] and these have been reviewed by Pierce in 1973. There after gradually it has emerged as a popular method of diagnosis serving both a screening and predictive function.

Objectives

1. To determine the sensitivity and specificity of CT in the diagnosis of primary neoplastic lesions of lung.
2. To describe the CT patterns of different histological variants of bronchogenic carcinoma.
3. To correlate CT findings of these tumours with FNAC findings.

METHODS

The present descriptive cross-sectional study was conducted among 34 patients suspected clinically of having lung neoplasms, from both inpatient and outpatient departments in Gauhati Medical College and Hospital, Guwahati. The study was conducted over a period of 12 months, from December 2010 to November 2011. Computed tomographic examinations and FNAC were performed in the department of radio-diagnosis. Although contrast CT imaging was done in 42 patients, only 34 patients with pulmonary tumours were included in the final study and rest 8 patients were excluded from the final study because of lack of or incomplete FNAC correlation.

Inclusion Criteria

All patients referred for chest radiography and computed tomography, with clinically suspected carcinoma lung were included in this study. Cases of lung neoplasms incidentally detected on chest X-ray and CT scans were also included in the study.

Exclusion Criteria

The patients who were diagnosed with lung tumours but did not turn up for FNAC, whose FNAC report was indeterminate for neoplasm and, patients with inadequate FNA sampling were excluded from the study. The patients with metastatic lung lesions with different primary sites were also exclude from the study.

Data Collection Procedure

Each patient underwent a thorough clinical evaluation including a detailed history and physical examination. The duration of complaints was noted in each patient. All the patients underwent routine blood investigations, cytological examination of sputum, bronchial brushings and bronchial washings. However, this did not form a part of study. All the patients were made to undergo chest radiography and CT scan as the radiological examination after taking an informed consent for the same. The clinical chest radiographic and CT findings were assessed and compared with pathologic features. The CT guided FNAC of the mass lesions were taken and cytological correlation was done.

Equipment

The chest radiographs were taken in posteroanterior and lateral view using Siemens 300 / 500 MA machines. CT scan of the thorax was performed using Siemens Somatom dual slice CT machine. Operation was system guided and performed via the keyboard. The images are stored in the system for a limited period of time and can be transferred onto a conventional film through a multiformat digital camera. Images can be obtained in thickness of 1 mm – 10 mm. The images can be reconstructed three dimensionally from a series of adjacent axial slice images. The FNAC needle used was 20 G Chiba needle and 20/22 G LP needle. IV contrast used was 71.4 % w/v non-ionic iodinated IV contrast (Iomeprol).

Scan Technique

Non-Enhanced Computed Tomography (NECT)

With the patient lying in supine in gantry, the thorax was scanned from the apex to the domes of the diaphragm. When staging was required the scan was extended up to the adrenals bilateral. Scanning was done with contiguous 10 mm slice without gap between each slice covering the inter-thorax. In the region of hila contiguous, 5 mm slice without gap was used to evaluate hilar mass or lymphadenopathy.

Contrast-Enhanced Computed Tomography (CECT)

After preliminary NECT, 100 ml of non-ionic contrast was given as bolus at a rate of 2 - 3 ml/sec. The entire thorax was again scanned from the same levels taking similar slice thickness as NECT scans.

High-Resolution Computed Tomography (HRCT)

Using thinly collimated slice of 1 - 1.5 - 2.0 mm and increasing the kVp (130) and mA (260) selected segment of lung was scanned. The width used; 1000-2000 HU and level/centre: 500 to (-) 750 HU. For evaluation of pleural thickening and irregularity a broader window sitting was used.

CT Guided FNAC

After localisation of mass lesion by NECT and CECT, patients were subjected to CT guided FNAC. At first the whole procedure was explained to the patient and attendants and written consent for invasive procedure was taken. Sterilization of the body surface on the puncture site by absolute alcohol and povidone iodine solution was made. The pathway of the needle was anaesthetized by local anaesthetic infiltration and skin up to the pleura was anaesthetized.

Trajectory of the needle was planned as per the location of the mass as depicted by CT scan images. The shortest possible pathway was chosen. After the patient was made to lie in required position, i.e. supine, prone or lateral decubitus, the FNAC needle was inserted into the lung in suspended respiration. The needle position inside the lesion was confirmed by taking intermittent thin slice and making positional adjustment of the needle accordingly. The stylet was withdrawn and a 20-cc disposable syringe was filled to FNAC needle. Several in and out rotational movements were made maintaining 10 cc suction of the syringe. The FNAC needle was than withdrawn maintaining the suction. At least two passes of similar kind were made.

The aspirated material was then put into different glass slides and thick & thin smears were made. The slides were then sent for cytological evaluation after proper drying. The scanned images were viewed on both soft tissue and wider window sitting to visualize calcification. Diagnosis was made as per the standard CT diagnostic criteria of neoplastic lesions of lung. The scan was viewed by two senior radiologists to minimize interpretative errors.

Statistical Analysis

Our study constitutes descriptive statistical analysis of clinical and radiological features of primary lung tumours in Guwahati, Assam population. Continuous measurements results were presented on mean + / - standard deviation (min – max) and categorical measurements results were presented in number (%). Significance of association between CT scan diagnosis and the final cytopathological diagnosis was done with the help of chi square test / Fischer exact test. The correlation of CT scan findings with final diagnosis was done by sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV). Statistical methods are framed with biostatistician consultation.

RESULTS

The lowest age of an individual case was 18 years and the oldest was 77 years, with the mean age being 61 years. Highest number of cases were seen in the age group 51 - 60 years, 12 cases in this group (35 %), followed by 61 - 70 years age group, 9 cases (27 %). 21 - 30 years age group had no incidence of cases. Males comprised of 27 cases (79.41 %), female comprised of 7 cases (20.59 %). All patients had respiratory problems.

Cough was the most common presentation (88 %) followed by chest pain 53 %. Weight loss was a common symptom in our study complained by 40 % of cases. Other less common symptoms were dyspnoea, fever and hoarseness of voice. Out of the 34 patients, 70 % of patients (24 cases) were smokers and only 30 % (10 cases) were non-smokers. The most commonly occurring physical findings in our study were pallor (79 %), followed by finger clubbing (47 %), lymphadenopathy (20 %), engorged neck veins (9 %) and hepatomegaly (9 %). One patient in our series had hypertrophic pulmonary osteoarthropathy.

The majority of the patients (62 %) at presentation had symptoms lasting for less than 2 months followed by 2 - 4 months (24 %). Consolidation was the most common respiratory system finding seen in 37 % of patients. No abnormality was found in 33 % of patients. Chronic obstructive pulmonary disease (COPD) findings were found in 17 % while collapse was found in 13 % of patients.

Out of 34 cases, chest radiograph was conclusive (suggestive of neoplastic aetiology) in only 11 (32 %) cases.

In rest of the 23 cases, chest radiograph showed only associated findings.

	Age Group (in Years.)	No. of Cases	Percentage (%)
Age distribution	11 -20	1	3.0
	21 - 30	0	0.0
	31 - 40	2	6.0
	41 - 50	5	15.0
	51 - 60	12	35.0
	61 - 70	9	27.0
	71 - 80	5	15.0
Common presenting symptoms	**Symptoms**	**No. of Cases**	**Percentage (%)**
	Cough	30	88.0
	Expectoration	11	32.0
	Haemoptysis	13	38.0
	Chest pain	18	53.0
	Dyspnoea	7	21.0
	Fever	4	12.0
	Hoarseness of voice	3	8.8
	Weight loss	12	35.0
General physical signs	**General Physical Sign**	**No. of Cases**	**Percentage (%)**
	Pallor	27	79.0
	Clubbing	16	47.0
	Lymphadenopathy	7	20.0
	Hypertrophic pulmonary osteoarthropathy	1	2.9
	Engorged neck veins	3	9.0
	Hepatomegaly	3	9.0

Table 1. Age Distribution, Presenting Symptoms and Signs in Patients with Primary Lung Tumours, in the Current Study

CT Findings

Right side involvement was found in maximum number of patients 24 (70 %) while left side accounts for 8 cases (24 %). Bilateral involvement is noted in 2 (6 %) cases. Right upper lobe accounted for 14 (41 %) cases followed by mass effecting the right lower lobe 8 cases (23 %). Left upper and lower lobe was affected in 6 (18 %) and 2 (6 %) cases respectively.

Most of the bronchogenic carcinoma are presented as solitary pulmonary lesions (91 % of total cases) which may or may not be associated with hilar lymphadenopathy. 9 % of the total cases are presented by multiple lesions, because of associated satellite and metastatic nodules. In the 34 cases studied, margins were either smooth, smooth lobulated, infiltrating, infiltrating lobulated, lobulated. Mass with smooth margins accounts for most of the cases 15 (44 %), followed by mass with smooth lobulated and infiltrating margins 9 (26 %) and 6 (21 %) cases respectively. Cavitation was seen only in 4 patients with large peripheral mass account for 11 % of patients. The cavities were thick wall and eccentric. All the four masses were of squamous cell type. Hilar lymphadenopathy was found in 12 patients (35 %), i.e. 4 patients of squamous cell carcinoma, 3 patients of adenocarcinoma (1 among them is bronchioloalveolar carcinoma case), 3 patients of large cell carcinoma and 2 patients with small cell carcinoma. Multiple were found to have unilateral or bilateral hilar lymphadenopathy. Out of 34 cases, local tumour invasion is noted in 19 cases (55 %). 8 cases showed hilar / mediastinal invasion, 8 cases showed pleural involvement. Destruction of adjacent rib / vertebrae was noted in 2 cases and superior vena cava involvement is noted in 1 case.

Out of 34 cases, 9 showed distant metastases, the most common organs being liver, skeleton (ribs / vertebrae) and opposite lung (2 cases each). Considering FNAC/HPE as a gold standard, the positive predictive value and false negative value of CT scan for diagnosis of neoplastic lesions of lung were 97 % and 3 % respectively.

Out of 19 diagnosed cases of squamous cell carcinoma on CT scan, only one patient was misdiagnosed, which turned out to be adenocarcinoma on FNAC correlation. In rest all the cases CT correctly diagnosed the histological variants of bronchogenic carcinoma correctly.

Site	No. of Patients
Hilar / Mediastinum	8
Pleural involvement	8
Adjacent ribs / vertebra	2
Superior vena cava involvement	1

Table 2. Site and Incidence of Local Tumour Invasion

Site	No. of Patients
Liver	2
Opposite lung	2
Skeletal	2
Adrenal	1
Brain	1
Kidney	1

Table 3. Site and Incidence of Distant Metastasis

Disease	CT Scan	CT Guided FNAC & HPE Diagnosis
Squamous cell carcinoma	19	18
Adenocarcinoma	6	7
Large cell carcinoma	3	3
Small cell carcinoma	3	3
Bronchioloalveolar carcinoma	3	3

Table 4. Comparison of CT Scan and CT Guided FNAC Diagnosis of Neoplastic Lesions of Lung

Clinical Features and CT Findings of Different Histological Types of Bronchogenic Carcinoma

Squamous Cell Carcinoma

Out of 34 patients studied, 18 patients (53 %) were suffering from squamous cell carcinoma. Maximum number of patients were found in 51 - 60 years age group, 8 (44 %) cases followed by age group of 61 - 70 years, 5 (38 %); 71 - 80 years and 31 - 40 years accounted for 2 (11 %) cases each. 1 (6 %) case was found in the age group of 41 - 50 years. Among the 18 cases, 13 cases were males and 5 cases were females. All 13 males were smokers and all 5 females were non-smokers.

CT Features

All the squamous cell carcinoma lesions were solitary. Most of the squamous cell carcinomas were located in the hilar or perihilar region (40 %). Mostly affected the right upper lobe, 9 (50 %) cases followed by left upper lobe, 6 (28 %) cases. Right lower lobe accounted for 3 (17 %). The margins of most of the squamous cell carcinoma were smooth, 8 (44 %) cases or smoothly lobulated, 8 (44 %) cases. Infiltrating margins were found in 2 (12 %) cases. Cavitation was found in 4 peripherally located mass. All lesions with cavitation were more than 4 cm in diameter. Cavities were thick walled and eccentric.

Hilar lymphadenopathy was found in 4 cases. NECT showed (out of 18 cases) homogenous mass of soft tissue density in 14 cases, central necrosis in 4 cases. Masses were generally centrally located. Size varied from 2 - 6 cm. CECT revealed homogenous enhancement of the lesion.

Enhancement of the wall was found in 4 cases with cavitation. Enhancements of the lymph node were also seen.

Adenocarcinoma

Out of the total 34 patients studied, 10 cases (29 %) were of adenocarcinoma. The age range was 45 - 70 years with a mean age of 56.25 years. Out of these 10 cases, 8 were males and 2 were females. The commonest age group was 45 - 55 years. 7 out of 8 males were smokers.

CT Features

All cases of adenocarcinoma presented as a peripherally located solitary mass. The most common side to be affected was right side (9 cases), right lower lobe account for 5 (50 %) cases followed by right upper lobe 4 cases (40 %) and left lower lobe 1 (10 %). Most of the adenocarcinoma were round patchy configuration found in 1 case of bronchioalveolar carcinoma. Margins of most of the lesions (5 i.e. 50 %) was smooth. Infiltrating (3) cases and infiltrating lobulated (2) cases accounted for 30 % and 20 % of cases each. Cavitation was not found in any of the cases. Hilar lymphadenopathy was found in 2 (20 %) cases.

NECT showed small peripherally located mass of soft tissue density. Adenocarcinomas were less than 4 cm in diameter. 1 case of bronchioalveolar carcinoma presented as alveolar opacities with air bronchogram and alveologram. 1 case of bronchioloalveolar carcinoma presented as round homogenous mass with a density less than soft tissue in the range of 16 - 20 HU. CECT revealed homogenous enhancement of the soft tissue. Enhancement of the lymph node was also seen.

Large Cell Carcinoma

Out of the 34 cases studied, 3 (10 %) cases were found to be of large cell type. The age of the patient ranged from 61-75 years of age with mean age of 69.3 years. All the 3 patients were males. 1 patient was chronic smoker.

CT Features

All the 3 cases were found to be affected on right side. The right middle lobe was affected in 2 out of 3 (67 %) patients. One case (33 %) had an affected right upper lobe. All the 3 patients had a peripheral location of tumour in the lung. Margins of all the 3 masses were infiltrating type. Cavitation was not found in any of the cases. Gross hilar lymphadenopathy was found in all the 3 cases. NECT showed large cell carcinoma presenting in all three cases as peripherally placed mass of irregular configuration with infiltrating boundaries. These masses seem to invade directly into the adjacent chest wall. Contrast administration reveals homogenous enhancement *of* the mass. Mediastinal lymphadenopathy was better delineated by contrast administration.

Small Cell Carcinoma

Out of 34 cases studied, 3 cases were of small cell carcinoma. The age of the patient ranged from 57 - 65 years with mean age of 61 years. All the 3 patients were males and smokers.

CT Features

Left lower lobe was affected in one case (33 %). Rest two cases (67 %) showed bilateral multilobar involvement because of satellite and metastatic nodules. All the three cases were located centrally as a hilar or perihilar mass. All the three patients had round mass located in hilar and perihilar region. Margins of all the 3 masses were smooth and smoothly lobulated. No cavitation was found in any of the 3 cases. Hilar lymphadenopathy was found in 2 (67 %) cases. NECT revealed homogenous round mass of soft tissue density, placed near the hilum usually round and smoothly marginated. CECT showed homogenous enhancement of the soft tissue mass. Lymph nodes were delineated better after contrast administration.

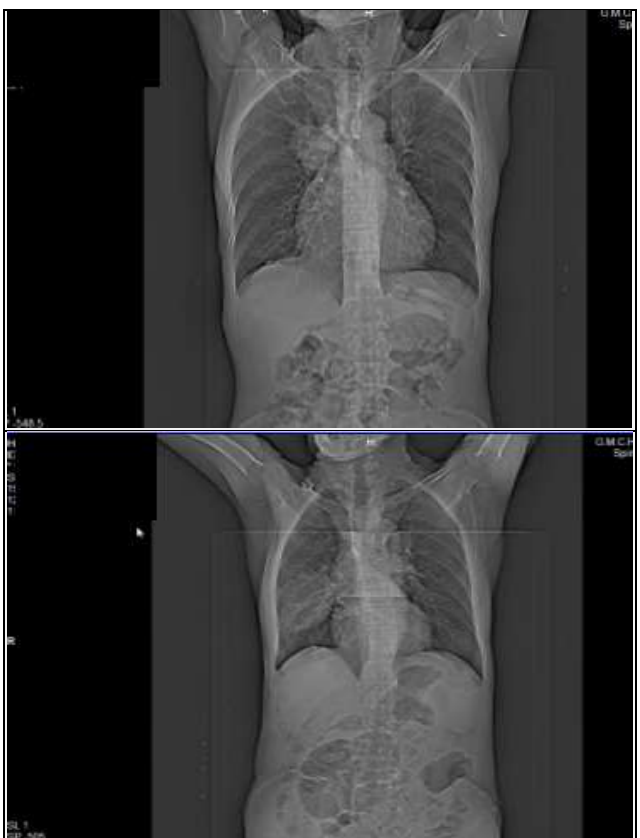

Figure 1. Tomograms Showing Lung Carcinoma as Well-Defined Mass Lesions in the Right Lung, in Two Different Patients

Figure 2. 55-Year-Old Male Smoker with Peripherally Located Heterogeneously Enhancing Soft Tissue Lesion in the Upper Lobe of Right Lung with Relatively Smooth Margins and Internal Necrotic Areas, on CECT Image. Cytology was Positive for Squamous Cell Carcinoma

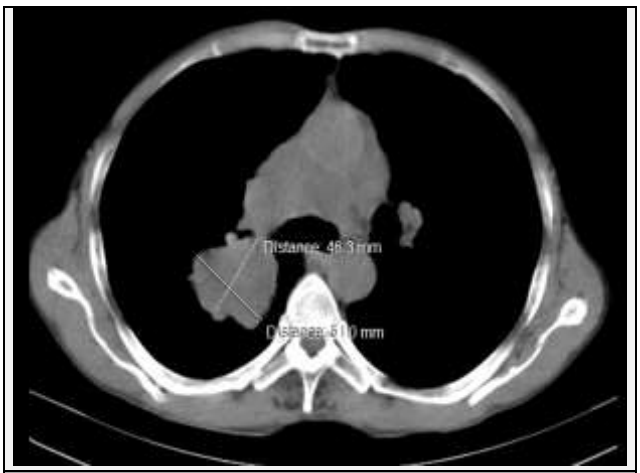

Figure 3. A 54yr. Old Male with Relatively Homogeneous Soft Tissue Lesion in the Perihilar Region of Right Lung with Smoothly Lobulated Margins, on NECT Image. Cytology was Positive for Squamous Cell Carcinoma

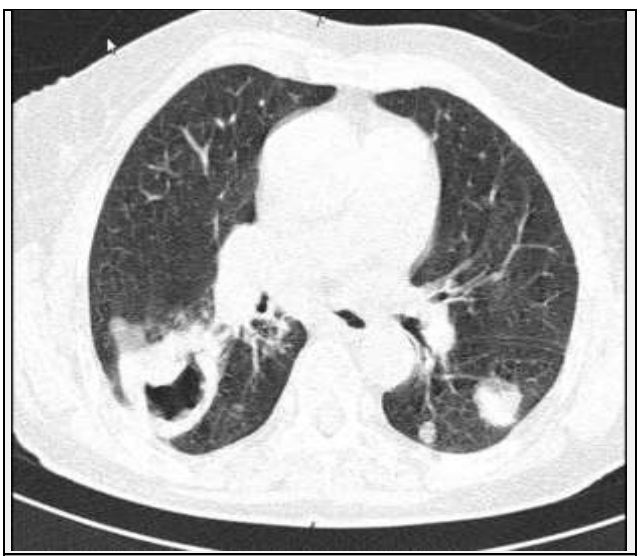

Figure 4a. A 57-Year-Old Male with Peripherally Located Cavitary Lesion in the Right Lung with Thick Peripheral Wall, on HRCT (a) and CECT (b). Cytology was Positive for Squamous Cell Carcinoma

Figure 4b. 57-Year-Old Male with Peripherally Located Cavitary Lesion in the Right Lung with Thick Peripheral Wall, on HRCT (a) and CECT (b). Cytology was Positive for Squamous Cell Carcinoma

Figure 5. A 46-Year-Old Male Smoker with Small Well Defined Peripherally Located Soft Tissue Lesion with Central Low Density and Pseudo Cavity, Showing Mild Homogenous Enhancement and Smooth Margins on CECT Images. Cytology was Positive for Adenocarcinoma

Figure 6. A 63-Year-Old Male with Small Fairly Well-Defined Soft Tissue Lesion in the Left Lung with Mild Homogeneous Postcontrast Enhancement on CECT Images. Cytology was Positive for Adenocarcinoma

Figure 7. A 72-Year-Old Male Chronic Smoker with a Large Peripherally Located Soft Tissue Lesion in the Right Lung with Local Invasion of Chest Wall and Destruction of Ribs. Cytology was Positive for Large Cell Carcinoma

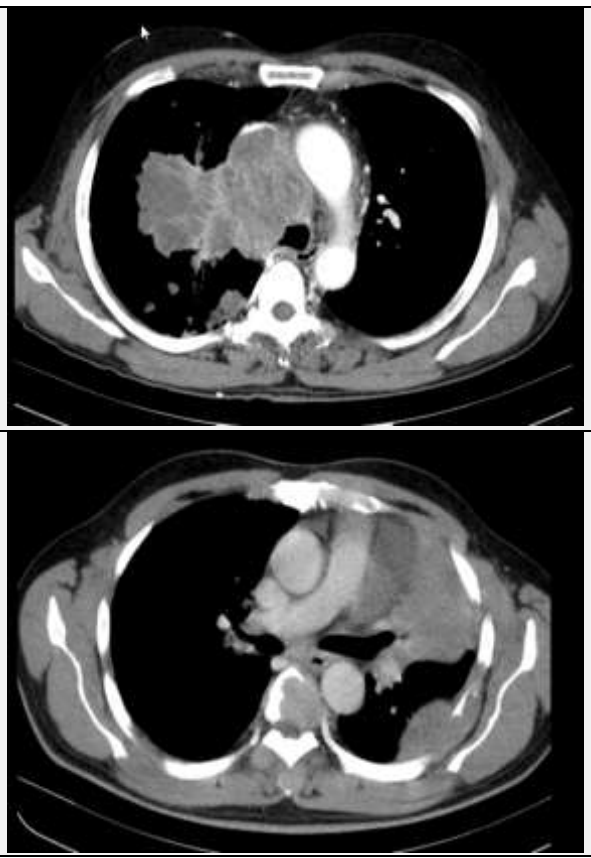

Figure 8. a, b & c. A 65-Year-Old Chronic Smoker with a Large Heterogeneously Enhancing Soft Tissue Lesion in the Right Perihilar Region with Bronchial Narrowing(a), Lymph Node Enlargement and Mediastinal Invasion(b) and Skeletal Metastases (c). Cytology was Positive for Small Cell Carcinoma

Figure 9 a, b & c. A 70-Year-Old Male Chronic Smoker with Primary Mass Lesion in Upper Lobe of Right Lung with Multiple Satellite Nodules in the Same Lung and Metastatic Nodules in the Opposite Lung. Cytology was Positive for Small Cell Carcinoma

Figure 10. CT Guided FNAC of a Peripherally Located Mass Lesion Performed in Radiology Department of GMC & H, Guwahati

DISCUSSION

In our study we have found cases mostly within the age group of 31 - 80 years. We had only one case (2.9 %) below the age of 30 years. Maximum number of cases were encountered in the age group of 51 - 60 years age group (35 %) followed by 27 % of cases in the age group of 61 - 70 years. A total of 76.47 % of cases were above the age of 50 years. Frasir & Pare (1978)[5] commented that bronchogenic carcinoma is predominantly a disease occurring in the middle age and after. In 1942 Ochsner & DeBakey studying 4307 cases have shown that 25.4 % cases occurred between the age of 40 and 49 years, 34.1 % cases occurred between the age of 50 and 59 years and 20 % between 60 and 69 years. Sinha et al. (1961)[6] reported maximum incidence in 51 - 60 years age group.

In our study out of total 34 cases, 27 cases were males and 7 were females with a male to female ratio of 3.8 : 1. Sinha et al. (1961)[6] commented that bronchogenic carcinoma was 4.5 times more common in males than in females. Wig et al. (1961) obtained somewhat lower ratio of 3.5 : 1 in their series. Arora et al. (1990)[7] had shown a male to female ratio of 4.5 : 1. With the increasing incidence of cigarette smoking amongst females the gap between male and female is becoming narrower. In the West, the ratio has already come down to 2.3 : 1 and in India it is likely to come down in future. But so far, our results in this regard are comparable with most of Indian workers.

In our study out of 34 cases, 24 (70 %) cases were smokers while only 10 (30 %) cases being non-smokers. Reports from American Cancer Society (Breslow et al. 1954) revealed that cancer of lung is 27 times higher amongst those who smoke two packets of cigarette a day than amongst those who never smoke. A person who smokes heavily i.e. more than 2 packets per day for many years has about one chance in ten of eventually developing lung cancer, if less than one packet a day, than one chance in thirty-six of developing lung cancer and for a non-smoker, this chance is one in 270. In England, Wales & United States 92 to 94 % lung cancer deaths are attributable to tobacco smoking in males (International Agency for Research of Cancer, 1986). It shows that our results in this aspect are almost similar to already established facts.

The duration of illness at presentation varied from 15 days to 9 months. Maximum number of cases had symptoms for 1 to 2 months; this was followed by 26.6 % cases symptomatic for less than 1 month, 13.3 % for more than 4 months and rest of the cases from 2 to 4 months. In Forbes series (1954)[8] the average duration between the time of onset and hospital entry and diagnosis was 2.2 and 3.2 weeks respectively. In the study by Wig et al. (1961) the cases presented more than 2.5 months after the onset of symptoms.

In the present study majority of cases did not have much abnormality on respiratory system examination. Most frequently occurring abnormality was consolidation (11) cases. It was followed by evidence of chronic airway obstruction in 16.6 % cases and collapse in 13.3 % cases. In the series of Guleria JS et al. (1971)[9] which consisted of mostly advanced cases, lung signs were absent in 10 % cases. Signs of consolidation were present in 24.16 % cases, pulmonary collapse in 30.83 ft and pleural effusion in 26.66 % cases.

During the early part of the illness, bronchogenic carcinoma produces very few symptoms. As the symptoms are very mild at the onset, carcinoma may not be suspected for many months and even may present with non-specific extra pulmonary manifestations. In the series by Wig et al. the cases presented 2.5 months after the onset of symptoms. This delay rendered all of them inoperable. Sinner (1976)[10] commented that significant time had been lost during the diagnostic and therapeutic procedures influencing the prognosis of cancer. A lapse of few months between the occurrence of first symptoms and medical consultation - the so called 'patients delay' might result in operable tumour becoming inoperable. The period between positive chest x-ray and positive histopathology - "doctor's delay" is still more important as in Sinner's series only half of patients underwent transthoracic needle biopsy. In the present series doctor's delay was curtailed to a significant extent because as soon as the diagnosis of bronchogenic carcinoma was entertained guided needle biopsy was undertaken.

About 10 % of bronchogenic carcinoma is asymptomatic, when first seen, the diagnosis being considered initially from an abnormal chest roentgenogram or very occasionally from cytological examination (Spring et al. 1965; Cohen et al. 1966; Gupta et al. 1965).

In contrast to other worker's findings, all the cases were symptomatic in our series. This was because one of the criteria of selecting cases was non resolving pulmonary opacities found in chest x-ray. Another factor contributing to this finding is lack of routine health check-up and screening chest x-ray programs in our set up. Most of our patients belonged to lower socio-economic status and had very little concern about health.

In the study of Byrd et al. (1968)[11] squamous cell carcinoma presented as hilar or peripheral mass (35 %). Peripheral mass was seen in 24 % of 263 patients studied. Cavitation was found in 6.8 % of peripheral mass majority of them were larger than 4.0 cm. The wall of these cavities

was eccentric and thick walled. Theros E. G (1977)[12] found that 2 - 10 % of carcinomas cavitate especially if they are located peripherally. These cavities are thick walled and eccentric cavitation is more common in squamous cell carcinoma. In our present study, 40 % of the squamous cell carcinoma presented as central mass. Cavitation was found in 11 % of cases. All the cavities were thick walled and eccentric, the size of the masses with cavitation were more than 4 cm and were peripherally located.

Stephen J Swensen & Larry R Brown (1995)[13] studied the enhancement pattern of pulmonary nodule with iodinated contrast media and noted that the adenocarcinoma enhances typically more in periphery than the centre and the enhancement at CT ranges from > 39 - 63 HU. Armstrong P et al. (1993)[14] states that 72 % of adenocarcinoma presents as a peripheral nodule. He also states that the margins are lobulated and ill-defined edges. Cavitation is not a feature of adenocarcinoma. He found that adenocarcinoma seems to be changing its pattern and now a day present with hilar and mediastinal lymphadenopathy. Peter Y Poon (1987)[15] found that adenocarcinomas enhance homogenously on administration of iodinated contrast media. The average size of adenocarcinoma is 19.27 mm. In the present study we have found that that adenocarcinomas (excluding BAC) account for 20 % of all bronchogenic carcinoma. These lesions presented as peripherally located solitary mass with an average mean diameter of 2 cm. The margins of adenocarcinomas are smooth and lobulated in 50 %, infiltrating in 30 % and infiltrating lobulated in 20 % of cases. Lymphadenopathy was encountered in 20 % of adenocarcinoma cases.

NECT studies reveals peripherally located soft tissue mass with no cavitation. Contrast study revealed homogenous enhancement of the soft tissue. Lymphadenopathy is also better delineated by contrast study. So, we have found that our results are in good approximation to the results of other workers.

Armstrong P et al. (1997)[14] states that bronchioalveolar carcinoma accounts for 2 - 5 % of lung cancers. Bronchioalveolar carcinoma commonly presents as solitary lobulated or speculated pulmonary masses or they may present as homogenous or patchy area of consolidation or as multiple ill-defined nodules spread widely through multiple lobes in one or both lungs. Adler B et al. (1992)[16] found that bronchioloalveolar carcinoma has three typical radiographic presentation, as solitary nodule (43 %), consolidation (30 %) and multicentric or diffuse disease (27 %). Pleural effusion was found in 32 % of cases and hilar & mediastinal lymphadenopathy in 18 %. In our present study, bronchioloalveolar carcinoma accounted for 8.8 % of all neoplastic lesions of lung. 33 % of cases presented as solitary nodule while 66 % presented area of consolidation. Pleural effusion and hilar lymphadenopathy were found to be associated with 33 % of cases. One case which presented as solitary nodule had a low density which may be due to excessive mucin secretion by the tumour.

In a study Byrd RB et al. (1968)[17] states that large cell carcinoma presents as a peripheral mass which are mostly more than 4 cm with no notching. Hilar lymphadenopathy was present in 32 % of cases. Pleural effusion was associated with 2 % of cases. Armstrong P et al. (1997)[14] states the 63 % of large cell carcinoma presented as peripheral nodule. The largest peripheral mass is seen with squamous and large cell carcinoma. He also states that cavitation is not a feature of large cell carcinoma but about 4 - 6 % of cases cavitate. Early, often massive, hilar and mediastinal lymphadenopathy and direct mediastinal invasion were well recognized phenomenon of large cell carcinoma.

In our study we have found that large cell carcinoma arises peripherally which is more than 4 cm in diameter, and it grows towards the mediastinum. The mass invades the mediastinum directly causing gross lymphadenopathy. Cavitation was not found in any of the cases. Contrast study revealed homogenous enhancement of the whole mass. Lymphadenopathy is better delineated by contrast administration.

Byrd RB et al. (1968)[17] found in his study 76 % of small cell carcinoma presented as hilar or perihilar mass. Bronchial obstruction (29 %) and mediastinal widening 12.28 % is the most common presenting feature. Peripheral mass account for 29 % of cases of which 36 % of cases associated hilar or perihilar mass was found.

Armstrong P et al. (1997)[14] states that 78 % of centrally placed mass lesions are small cell carcinoma. Early and massive lymphadenopathy and direct mediastinal invasion is a feature of small cell carcinoma. In our present study, we have found that all small cell carcinomas presented a smoothly marginated round hilar or perihilar mass. Hilar and mediastinal lymphadenopathy was found in 67 % of cases. Cavitation was not found in any case.

CONCLUSIONS

CT is more sensitive in the detection of neoplastic lesions of the lung and associated hilar / mediastinal adenopathy than chest roentgenography. CT has a high efficacy in detecting neoplastic lesions of lung, delineating its lobar and segmental anatomy, thereby helping surgical resection of lung. It also helps in providing indications for conservative or palliative treatment in case of advanced neoplastic lesions.

CT guided FNAC for tissue diagnosis of the mass lesions is also a very important advancement in the fold of diagnostic scenes. In this study, CT guided FNAC and HPE findings correlated well with CT diagnosis of different histological variants of bronchogenic carcinoma. This helped in proper diagnosis of these neoplastic lesions and in further management of patients thereafter. This study helped in showing the utility of CT scan as an evaluatory tool for neoplastic lesions of lung, thus ensuring correct management of the affected patient.

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