Original research article

Role of Multidetector Computed Tomography (MDCT) in evaluation of bronchogenic carcinoma with histopathological correlation

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 Abstract

Introduction: Bronchogenic carcinoma was considered to be rare in the beginning of the century but has now reached epidemic proportions. This dramatic increase correlates with the widespread prevalence of cigarette smoking. Lung cancer is the leading cause of cancer mortality for both men and women, responsible for more deaths than prostate, breast, and colorectal cancers combined. Bronchogenic carcinoma is typically detected first on chest radiography but computed tomography (CT) scan is the most important imaging technique, providing both TNM staging information and assessment of recurrence because of its better spatial resolution. CT provides precise characterization of the size, contour, extent and tissue composition of the suspicious lesion.

Materials & Methods: This is a prospective study was conducted in the Department of Department of Radio diagnosis, Kalinga Institute of Medical Sciences from July 2016 to June 2017. Patients with clinical or radiological suspicion of bronchogenic carcinoma referred for CT scan of thorax was taken. Data was collected from cases of suspected bronchogenic carcinoma referred for CT scan of thorax by purposive sampling using a proforma. All scans are done using GE bright speed 16 slice MDCT with 120 KVp and 300 mAs with 5mm section thickness, retro reconstruction of 0.625mm section thickness and reformation.

Results: In our study, out of 50 patients we studied, 38 were male and 12 were female, with male: female ratio of 3:1. Age range of patients included 40-80 (mean age of 55 years). Highest incidence of lung carcinoma was found in the age group of 60-70 years (almost 50%). Out of 50 patients, CT guided transthoracic biopsy was done in 40 patients and USG guided biopsy in 7 patients and transbronchial biopsy in 3 patients. Among these 50 patients, 21 cases were diagnosed as adenocarcinoma (42%). 11 patients (22%) with small cell type. 10 patients (20%) with BAC. 8 patients (16%) being diagnosed squmaous cell type. In regard to the radiological pattern of lung carcinoma, most of the adenocarcinoma presented with pulmonary lesion less than 4 cm and 6 patients presented with pneumonitis and 2 with apical mass. Out of these, three patients had mediastinal involvement and 2 patients had malignant pleural effusion.

Conclusion: CT scan is the modality of choice for the detection of bronchogenic carcinoma, staging of bronchogenic carcinoma and in the evaluation of metastases. It is very helpful in performing transthoracic biopsies and to the arrival of histopathological diagnosis. Early diagnosis can help better survival.

Keywords: Multidetector computed tomography, bronchogenic carcinoma, histopathology

Introduction

Most common cause of cancer-related death in men and second most common in women, worldwide. Strongest prognostic factor for survival in lung cancer cases is resectability of the tumor. Thus, accurate staging of the bronchogenic carcinoma is essential as the choice of treatment options and patient prognosis are directly related to the stage at presentation [1].

Bronchogenic carcinoma was considered to be rare in the beginning of the century but has now reached epidemic proportions. This dramatic increase correlates with the widespread prevalence of cigarette smoking [2]. Lung cancer is the leading cause of cancer mortality for both men and women, responsible for more deaths than prostate, breast, and colorectal cancers combined [3]. Physical symptoms such as fever, cough, expectoration, haemoptysis, weight loss and anorexia are common to lung cancer. However, age of the patient, smoking history, mediastinal symptoms such as hoarseness of voice, SVC obstruction and dysphagia favours the diagnosis of lung cancer [4].

On examination, there may be signs of collapse or mass, clubbing and metastatic and non-metastatic complications of lung cancer [5]. WHO classified bronchogenic carcinoma into four major cell types

which makes up 88% of all primary lung neoplasm. These are squamous or epidermoid carcinoma, small cell carcinoma, adenocarcinoma and large cell carcinoma [6]. Imaging plays a critical role in the initial staging and follow-up of the disease.

Bronchogenic carcinoma is typically detected first on chest radiography but computed tomography (CT) scan is the most important imaging technique, providing both TNM staging information and assessment of recurrence [7]. Because of its better spatial resolution. CT provides precise characterization of the size, contour, extent and tissue composition of the suspicious lesion [8]. Staging lung cancer is, of course, a multidisciplinary process, which also utilizes other procedures such as bronchoscopy and biopsy. The diagnostic yield of bronchial biopsy specimens varies from 70 to 90 percent depending on the site and type of tumour [9].

CT is the standard imaging modality used for the evaluation of bronchogenic carcinoma. It has key role in the detection, staging and post-treatment follow up of patients.

Materials & Methods: This is a prospective study was conducted in the Department of Radio diagnosis, Kalinga Institute of Medical Sciences from July 2016 to June 2017. Patients with clinical or radiological suspicion of bronchogenic carcinoma referred for CT scan of thorax was taken.

Inclusion criteria
- Discovery of an abnormality on the chest radiograph of a patient with no symptoms. (Health check-up programme).
- Pneumonia.

a) Pneumonia not completely resolving with antibiotics.
b) Associated with volume loss and absence of air bronchograms.
- In cases of opaque hemithorax to rule out an underlying carcinoma.
- Bronchus 'cut off' with distal collapse consolidation seen on chest X-ray.
- For further characterization of solitary pulmonary nodule on chest X-ray.

Exclusion Criteria:
1) Patients in whom histopathological correlation is not available.
2) Severely debilitated patient.
3) Renal impairment.
4) Allergic to contrast media.
5) Previously diagnosed cases of bronchogenic carcinoma who were treated and now comes with recurrence.
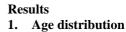
Data was collected from cases of suspected bronchogenic carcinoma referred for CT scan of thorax by purposive sampling using a proforma. All scans are done using GE bright speed 16 slice MDCT with 120 KVp and 300 mAs with 5mm section thickness, retro reconstruction of 0.625mm section thickness and reformation. Contrast study is done using 70-80 ml of 350mg/ml non-ionic iodinated contrast, injected using pressure injector at the rate of 3-4ml/s.
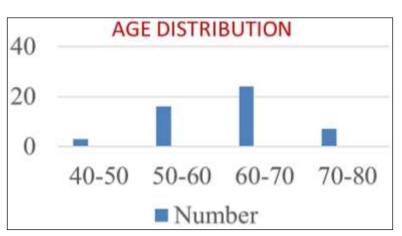
Lung lesions are characterised based on the site, size, enhancement pattern, presence of calcification, cavitation, involvement of the hila, pleura, chest wall or mediastinum MDCT findings are correlated with histopathological examination of the specimen obtained from FNAC/biopsy of the lesion. Equipment CT is performed with multi-slice CT scanner GE Bright Speed.
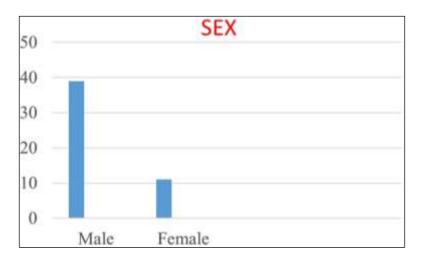
Statistical Analysis
Collected data were analysed based on the variables of the lung lesion seen in CT images as already mentioned followed by CT diagnosis and staging and correlation made with histopathology report. As the study design is diagnostic test evaluation, collected data were analysed by calculating sensitivity, specificity, positive predictive value, negative predictive.

Results

1. Age distribution

2. Sex distribution

3. Histological types

Histological diagnosis	Number of cases	Percentage of cases
Squamous Cell Carcinoma	8	16%
Adenocarcinoma	21	42%
Small Cell Carcinoma	11	22%
Bronchioloalveolar carcinoma	10	20%

4. Sites of origin of lung carcinoma

Histopathological Diagnosis	Upper Lobe		Middle Lobe		Lower Lobe	
	No. of Cases	Percentage	No. of Cases	Percentage	No. of Cases	Percentage
Squamous Cell	3	6%	1	2%	4	8%
Adenocarcinoma	13	26%	3	4%	6	12%
Small Cell	6	12%	4	8%	1	2%
Bronchioloalveolar	4	8%	2	4%	4	8%
Total	26	52%	10	18%	15	30%

5. Distribution in right or left lung

	Number
Right	32
Left	18

6. Radiological pattern of lung carcinoma with histological type

Radiological Findings	Small Cell CA	Adeno CA	Bac	Squamous Cell CA
Hilar, Perihilar Mass/Prominence	8	0	0	1
Focal Pulmonary Lesion Less Than 4 CM	3	13	2	2
Apical Mass	0	2	0	5
Pneumonitis, Collapse/Consolidation	0	6	8	0
Mediastinal Involvement	4	3	2	0
Chest Wall Invasion	0	0	0	1
Pleural Effusion	1	2	0	1

7. Extent of disease at presentation

Stage	Number of Cases	Percentage of Cases
I	8	16%
II	8	16%
III	18	36%
IV	16	32%

8. Distribution of metastasis

Site	Number of Cases	Percentage of Cases
Lungs	4	16%
Pleura	4	19%
Liver	5	19%
Adrenal	5	19%
Brain	5	16%
Bone	3	11%

9. Histopathological cell type in relation to ln involvement

Type	Peribronchial/Hilar	Subcarinal/Mediastinal	Contralateral/Supraclavicular
Small cell CA	6	1	3
Adenocarcinoma	4	2	1
Squamous cell ca	1	2	2

Discussion

In our study, out of 50 patients we studied, 38 were male and 12 were female, with male: female ratio of 3:1 correlating with other studies like Baron *et al.*, and study in Indian population conducted by Sandler MA *et al.*, [10].

Age range of patients included 40-80 (mean age of 55 years). Highest incidence of lung carcinoma was found in the age group of 60-70 years (almost 50%). This included both males and females. These findings are similar to study conducted by Faling LJ *et al.*, [11].

Out of 50 patients, CT guided transthoracic biopsy was done in 40 patients and USG guided biopsy in 7 patients and transbronchial biopsy in 3 patients.

Among these 50 patients, 21 cases were diagnosed as adenocarcinoma (42%). 11 patients (22%) with small cell type. 10 patients (20%) with BAC. 8 patients (16%) being diagnosed squmaous cell type.

Our study depicts large number of patients with adenocarcinoma type which is nowadays most common type. This correlates well with the recent study done by Henschke CI *et al.*, who had 47% of patients with adenocarcinoma type out of 51 patients and 41% patients with squamous cell carcinoma, 9% BAC and 3% other carcinomas [12]. However, studies done at middle-east and rest of the world by Uddin and Akhtar, Quiyyum *et al.*, Hassan *et al.*, showed large number of patients with squamous cell type [13].

One of the Indian studies conducted by Rosado-de-Christenson ML *et al.*, found 42% and 44% patients with squamous cell carcinoma, 36 & and 19% with adenocarcinoma, 25% and 17.2% with small cell carcinoma [14].

The ratio of involvement of right to left lung was 1.9. Most common lobe affected was right upper lobe (52%) with adenocarcinoma being 26% (highest), squamous cell carcinoma being 6% (lowest). This is similar to the study conducted by Baron LR *et al.*, 20% patients presented with middle lobe lesion, small cell carcinoma consisted of 8% of these cases (highest) and lowest is squamous cell carcinoma (2%). 30% of patients had lower lobe mass with large number of patients being diagnosed as adenocarcinoma (12%) and squamous cell carcinoma, BAC involving similarly upto 8% and small cell carcinoma being the least (2%) [15]. So, adenocarcinoma is the most prevalent cell type in upper lobe and lower lobe carcinomas while squamous type was most common in middle lobe and hilar masses.

In regard to the radiological pattern of lung carcinoma, most of the adenocarcinoma presented with pulmonary lesion less than 4 cm and 6 patients presented with pneumonitis and 2 with apical mass. Out

of these, three patients had mediastinal involvement and 2 patients had malignant pleural effusion. Most of the BAC in our study presented with consolidation, i.e. 8 patients and only two patients presented with pulmonary lesion.

The most common presentation of the small cell carcinoma was hilar, perihilar mass, i.e. 8 patients and 3 patients with pulmonary lesion and half of these patients had mediastinal involvement. Most of the patients of squamous cell carcinoma presented with apical mass, i.e. 5 patients. Two patients with pulmonary lesion and one hilar mass. One each of the patient had chest wall involvement and pleural effusion.

Out of 50 patients, 26 patients (50%) had presented with variable metastasis at the time of diagnosis. Among these 26 patients, 5 patients had metastasis to contralateral lung in form of satellite nodules which were later confirmed on PET CT, 5 patients had malignant pleural effusion which was diagnosed on pleural fluid analysis.

In case of distant metastasis at the time of diagnosis, 5 patients had metastasis to liver and 5 patients to adrenals (3 patients of adenocarcinoma and two patients with small cell carcinoma). 4 patients had involvement of brain.

Bone involvement in the form of lytic destruction was seen in three patients. This in contrary to the study conducted by Minna JD et al., showed bone metastases and respiratory metastases is more common. [16] In our study, it showed equal involvement of liver, adrenals and respiratory system.

Ipsilateral mediastinal lymph nodes were most commonly involved in all types of the lung carcinoma. In our study, perihilar, hilar lymph nodes were involved most commonly (6 patients) in small cell carcinoma and least in squamous cell carcinoma (1 patient) and 4 patients in adenocarcinoma. Involvement of contralateral and supraclavicular lymph nodes was most common in small cell carcinoma (3 patients) followed by squamous cell carcinoma and least in adenocarcinoma.

Most of the patients in our study at the time of diagnosis were in stage III with18 patients (36%), stage IV 16 patients (32%) and stage I and II patients with 8 patients (16%) each. This correlates very well with study done by Arora VK et al., [17].

Out of all these 50 patients, 44 patients were diagnosed as bronchogenic carcinoma by CT and was confirmed by cytological examination, coming true positive. Two patients were diagnosed as bronchogenic carcinoma by CT, but not confirmed on cytological evaluation (false positive).

Sensitivity of CT to diagnose bronchogenic carcinoma was 96%. Specificity was 86% with PPV of 92% and accuracy of 96%.

This in comparison with study conducted by Krishnamurthy A et al., which had sensitivity upto 88% and specificity upto 77%, which is in correlation with our study [18].

Conclusion

CT scan is the modality of choice for the detection of bronchogenic carcinoma, staging of bronchogenic carcinoma and in the evaluation of metastases. It is very helpful in performing transthoracic biopsies and to the arrival of histopathological diagnosis. Early diagnosis can help better survival.

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