

# Radiological evaluation of various types of primary bronchogenic carcinoma: a study of 65 cases

Nipa Hathila<sup>1</sup>, Divyesh Goswami<sup>2</sup>

<sup>1</sup>Department of Radiology, Pacific Medical College and Hospital, Udaipur, Rajasthan, India.

<sup>2</sup>Department of Pathology, Pacific Medical College and Hospital, Udaipur, Rajasthan, India.

Correspondence to: Nipa Hathila, Email: nipahathila@yahoo.com

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## Abstract

**Background:** Orderly approach to diagnosis and staging based on the knowledge of lung cancer requires selection of treatment for either potential cure or optional palliation of individual patient. A radiological imaging is extremely valuable and indispensable when it comes to diagnosis and staging of primary bronchogenic carcinoma.

**Objective:** To study the imaging features on various radiological and imaging techniques in various types of primary bronchogenic carcinoma and to differentiate bronchogenic carcinoma from other lung masses.

**Materials and Methods:** This was a prospective observational study. Ethical committee permission was taken before enrollment of the patients in the study. Data of participants regarding demographics, history of smoking habit, clinical presentation, histopathological type, radiographic findings on chest radiograph, ultrasonography, computed tomography (CT) scan, and, if required, magnetic resonance imaging were recorded in detail. The method of diagnosis and clinical stage of the disease were obtained. Statistical analysis was performed using descriptive statistics of the collected data.

**Result:** The maximum prevalence of bronchogenic carcinoma was seen between 60–69 years of age (50.76%) with male predominance (90.76%). About 92.31% patients showed positive smoking history. Thirty-three patients (50.76%) showed primary tumor size in lung, which was > 4 cm size. All masses (100%) showed heterogeneous contrast enhancement. Other common findings by CT scan were loss of patency of bronchus (41.53%), hilar enlargement (38.46%), enlarged mediastinal lymph nodes (35.38%), mediastinal invasion (24.61%), rib, chest wall, and plural invasion (20%), pleural effusion (15.38%), calcification (13.84%), necrosis (10.76%), cavitation (12.3%), and superior vena cava compression (10.76%).

**Conclusion:** The evaluation of a patient with known or suspected bronchogenic carcinoma requires the detection and characterization of the lesions involving the lungs, hila, mediastinum, pleura, chest wall, and upper abdomen. Various radiological imaging techniques play a dominant role in diagnosis and proper staging of the primary bronchogenic carcinoma.

**KEY WORDS:** Bronchogenic carcinoma, radiological evaluation, CT scan

## Introduction

Primary lung cancer is a leading cause of carcinoma-related deaths for both men and women in the developed and

developing countries such as India. Lung cancer was initially thought to be infrequent in India.<sup>[1]</sup> The incidence and mortality of primary lung cancer began its inexorable rise in the late ninetieth decade. According to the study done by Wig et al.,<sup>[2]</sup> lung carcinoma was a common finding in the midst of all forms of chest diseases. ICMR made a cancer registry, and, as per that register, on July 1, 2002, a total of 41,000 cases of lung cancer would have been found in India for that year.<sup>[3]</sup> It has been estimated that approximately 87% of lung cancers in male and 85% in female subjects can be attributed to cigarette smoking. The risk increased with both the duration and quantity of all smoking products.<sup>[4]</sup> The other causative factors are some industrial materials, particularly asbestos and rising air pollution.

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Patients with lung cancer may be asymptomatic in up to 50% of cases. Orderly approach to diagnosis, staging, and prognosis based on the knowledge of lung cancer requires selection of treatment for either potential cure or optional palliation of individual patient. For diagnosis and accurate staging of the lung cancer, various tests are required such as sputum cytology, bronchoscopy, needle aspiration/core cytology, lung biopsy, thoracoscopy, mediastinoscopy, and radiological investigations such as X-ray, ultrasonography, computed tomography (CT) scan, magnetic resonance imaging (MRI), and positron emission tomography scan.<sup>[5]</sup> With the major risk group for lung cancer identified, screening would seem to be an easy task. Unfortunately, screening trial programs using chest radiographs and sputum cytology have failed to demonstrate improved survival in the screened group. Hence, screening of the patient at risk for lung cancer must await further refinements in detection techniques available presently to justify their application.

A radiological imaging is extremely valuable and indispensable when it comes to diagnosis and staging of primary bronchogenic carcinoma. Accurate newer staging methods for lung cancer is a combined responsibility of the radiologist, pulmonologist, thoracic surgeon, and pathologist based on clinical (physical) findings in conjunction with radiologist and laboratory assessment and supplemented by pathologic sampling (bronchoscopy, mediastinoscopy, needle biopsy, video-assisted thoracic surgery, etc.).<sup>[6]</sup> The radiologic workup of the bronchogenic carcinoma should always pursue to facilitate the resection of potentially curable lung cancers and to minimize the resection of benign nodules. Neoplasm can frequently be greatly alleged or excepted on the basis of radiologic features of the bronchogenic carcinoma.

So, the objective of the study was to study the imaging features on various radiological and imaging techniques in various types of primary bronchogenic carcinoma and to differentiate bronchogenic carcinoma from other lung masses.

## Materials and Methods

This prospective observational study was carried out at Radiology Department, PDU Medical College, Rajkot. Permission from institutional ethics committee was taken before starting the study.

Patients referred by clinicians with characteristics such as abnormality of the chest radiograph with no symptoms, pneumonia with segmental localization, recurrence in the same segment, pneumonia not completely resolving with antibiotics, pneumonia associated with volume loss and absence of air bronchograms, patients with positive sputum cytology, opaque hemithorax, and X-ray finding of bronchus "cut off" with distal collapse/consolidation were included in the study. The diagnosis of bronchogenic carcinoma was based on positive histopathological or cytological examination. Patients without histopathological confirmation were excluded from this study.

Patients were explained in detailed about the study and included in the study only after getting the informed written consent. The data of the patients were collected according to preformed case record form. Data of participants regarding demographics (age of the patients and sex), history of smoking habit, clinical presentation, histopathological type, and radiographic findings were recorded in detail. The method of diagnosis and clinical stage of the disease were obtained. Radiological assessment was done in all cases. All patients were evaluated with Multi Radiography System such as Philips sono Diagnost 360, CT scan using Philips Tomoscan-EG CT machine (third generation). Contiguous CT sections of chest and upper abdomen of 5 and 10 mm were taken from lung apices to the level of adrenals. Both pre- and postcontrast scans were done. All case data were tabulated. Statistical analysis was performed using descriptive statistics of the collected data.

## Result

Within one-and-a-half year of study duration, a total of 65 patients were included in the study. The demographic data of this study shows that the maximum prevalence of bronchogenic carcinoma was seen in between 60 and 69 years of age (50.76%) with distribution from 30 years to 80 years [Table 1]. In this study, of 65 patients, 59 (90.76%) were male and six (9.24%) were female subjects. Of the total 65 patients, 60 (92.31%) patients showed positive smoking history. History of smoking habit showed that all 59 male subjects and 1 female subject were smokers. Their smoking index is shown in Figure 1.

At the time of presentation, patients presented with varied complaints. The most common complaint was cough with expectoration (93.84%). The other common complaints were weight loss (81.53%), anorexia (67.69%), chest pain (56.92%), and many others [Table 2]. Symptoms from metastasis such as bone pain (16.92%) and paraplegia (1.53%) were also seen in several patients. The commonest presenting sign in this study was clubbing, and it was seen in 80% of cases. Pallor was seen in 35.38% of cases. Signs of mediastinal compression

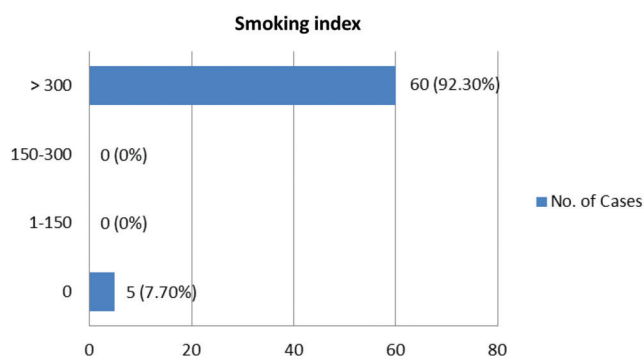


Figure 1: Smoking index.

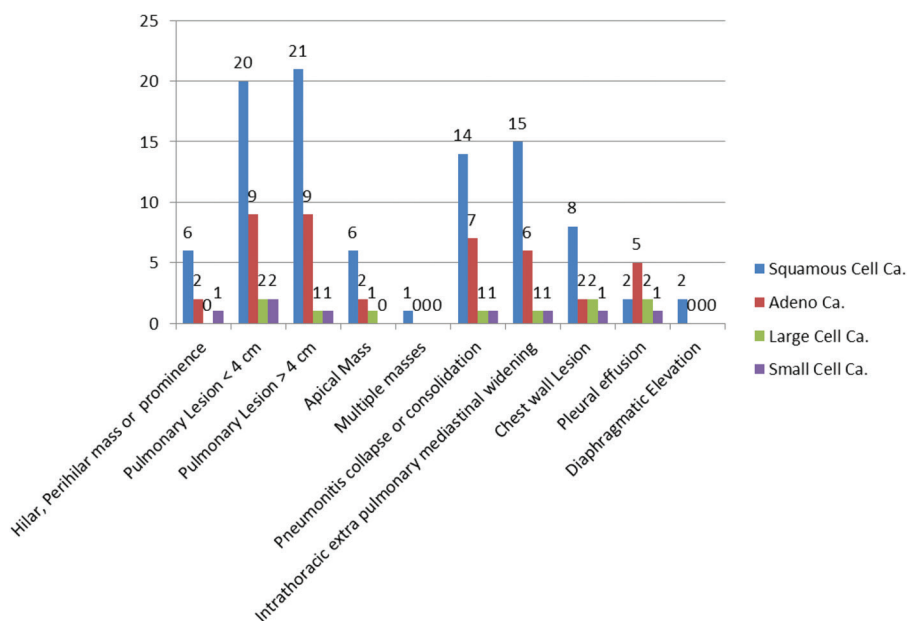


Figure 2: Abnormal radiographical pattern of carcinoma of lung according to histological cell types.

Table 1: Age incidence of bronchogenic carcinoma

Age group (years)	No. of cases	% of cases
30–39	1	1.53
40–49	7	10.76
50–59	17	26.15
60–69	33	50.76
70–79	6	9.23
>80	1	1.53

Table 2: Presenting symptoms of the patients

Symptoms on presentation	No. of cases	% of cases
Cough with expectoration	61	93.84
Chest pain	37	56.92
Dyspnea on exertion	23	35.38
Anorexia	44	67.69
Weight loss	53	81.53
Low-grade fever	34	52.30
Hemoptysis	7	10.76
Hoarseness of voice	8	12.30
Dysphagia	7	10.76
Paraplegia	1	1.53
Bone pain	11	16.92
Hemiplegia	–	–
Convulsions	–	–

Table 3: Clinical signs at the time of presentation

Clinical findings	No. of cases	% of cases
Clubbing	52	80.00
Pallor	23	35.38
Mediastinal compression	15	23.07
Rib erosion	7	10.76

Table 4: Histopathological classification of primary lung cancer and frequency of occurrence

Type	No. of cases	% of cases
Squamous cell carcinoma	40	61.53
Adenocarcinoma	18	27.69
Small-cell carcinoma	4	06.15
Bronchoalveolar carcinoma	1	01.53
Large-cell carcinoma	2	03.07

were noted in 23.07% of cases, and signs of local spread in the form of rib erosion were noted in 10.76% of cases [Table 3].

By histopathological analysis, the cell type of bronchogenic carcinoma was identified as shown in Table 4. In this study, squamous cell carcinoma was the most frequent cell type of bronchogenic carcinoma (61.53%), followed by adenocarcinoma (27.69%), small-cell carcinoma (6.15%), large-cell carcinoma (3.07%), and bronchoalveolar carcinoma in (1.53%).

Figure 2 shows abnormal radiological pattern found in different histological types of bronchogenic carcinoma. Radiologically, 33 patients showed tumor size in lung, which was > 4 cm in size, and 32 patients presented with <4 cm in size.

**Table 5:** CT scan findings in primary bronchogenic carcinoma

Findings	No. of cases	% of cases
Pattern of enhancement	65	100.00
Loss of patency of bronchus	27	41.53
Calcification	9	13.84
Necrosis	7	10.76
Cavitation	8	12.30
Hilar enlargement	25	38.46
Distal collapse	9	13.84
Pleural effusion	10	15.38
Spread of the lesion		
Mediastinal lymphadenopathy	23	35.38
Mediastinal invasion	16	24.61
SVC compression	7	10.76
Rib chest wall pleura invasion	13	20.00
Vertebral invasion	2	03.07

Other common findings were pneumonitis, collapse and consolidation, mediastinal widening, lesion extension into chest wall, pleural effusion, hilar, perihilar, and apical masses. The most common finding of squamous cell carcinoma was pulmonary lesion >4 cm in size (21/40). Other common findings were pulmonary lesion <4 cm (19), intrathoracic extra pulmonary mediastinal widening (15/40), pneumonitis, collapse or consolidation (14/40), etc. One case of squamous cell carcinoma presented as multiple masses. Pleural effusion was commonly seen with adenocarcinoma (5/10).

Table 5 shows CT scan findings in primary bronchogenic carcinoma. It is evident that all masses (100%) show heterogeneous contrast enhancement. Other common findings were loss of patency of bronchus (41.53%), hilar enlargement (38.46%), enlarged mediastinal lymph nodes (35.38%), mediastinal invasion (24.61%), rib, chest wall, and plural invasion (20%), pleural effusion (15.38%), calcification (13.84%), necrosis (10.76%), cavitation (12.3%), and superior vena cava compression (10.76%).

## Discussion

Bronchogenic carcinoma is a primary tumor of lung. Lung cancer is one of the leading fatal malignancies worldwide both in male and female subjects. They are subdivided into four main cell types: squamous cell carcinoma, small-cell carcinoma, adenocarcinoma, and large-cell carcinoma.

The common age for the bronchogenic carcinoma in this study is 60–69 years of age. According to another similar study done by Chaudhary,<sup>[7]</sup> incidence is common in 50–59 years of age. Moreover, another study from outside India done by Wynder and Graham<sup>[8]</sup> and review done by Behera and Balamugesh<sup>[4]</sup> found the maximum incidence between 50 and 59 years of age. The reason for it might be late presentation of the patients and delayed diagnosis. In this

study, incidence of bronchogenic carcinoma was very common in male (90.76%) than female (9.24%) subjects. Similar findings were found in the studies done by Chaudhary et al.<sup>[7]</sup> and Basu and Ghosh.<sup>[9]</sup> In the previous study, it is being very well-stated that smoking is one of the major etiological factors for lung cancer. In this study, the association is clearly found with 60 of 65 who showed chronic habit of smoking. Moreover, the smoking index was found to be > 300 in 92.3% of patients, which is at a higher side in comparison with the study done by Chaudhary et al., in which the smoking index > 300 was seen in 80% of patients. Behera and Balamugesh found association of smoking was variable from 2 to 20:1 ration of smoker to nonsmoker. In this study, the smoker to non-smoker ratio was 13:1.

The most common presenting symptom in majority of patients in this study is cough with expectoration (93.84%). Similar incidence was found in the study done by Chaudhary et al. (93.33%) and review by Behera and Balamugesh (88%). However, study done by Basu and Ghosh shows that only 66.66% patients showed the presenting symptoms of cough with expectoration. It might be because of less sample size (24) in the study by Basu and Ghosh. The frequency of other presenting symptoms such as weight loss, low-grade fever, anorexia, chest pain, and dyspnea on exertion were also similar to the study by Chaudhary et al. Clubbing was a common sign and seen in nearly 80% of patients, which was less in the study by Chaudhary et al (53.30%), while pallor was seen in every patient of that study, which was very less (35.38%) in this study.

Histopathological classification shows that most common type of lung cancer in this study was squamous cell carcinoma (61.53%). Others types of lung cancer were adenocarcinoma (27.69%), small-cell carcinoma (6.15%), large-cell carcinoma (3.07%), bronchoalveolar carcinoma (0.53%). Study by Chaudhary et al shows similar findings with 36.67% incidence of squamous cell carcinoma, followed by 33.34% adenocarcinoma and 23.34% small-cell carcinoma, while study done by Auerbach and Garfinkel<sup>[10]</sup> shows incidence of adenocarcinoma (35%–40%), which was slightly higher than the squamous cell carcinoma (30%–35%).<sup>[10]</sup> However, many previous studies show that the squamous cell carcinoma is the commonest type of lung cancer.

The radiographic presentation in this study shows that 21 of 40 (52.5%) patients of squamous cell carcinoma patients presented pulmonary lesion > 4 cm, and 19 patients (67.5%) revealed pulmonary lesion < 4 cm in size. In the study by Chaudhary et al., incidence of pulmonary lesion > 4 cm was 54%, while in the study by Byrd et al.,<sup>[11]</sup> 19 of 50 patients showed pulmonary lesions, which were > 4 cm in size. Pulmonary collapse and consolidation were found in 14 (35%) patients of squamous cell carcinoma in this study. It is also a common finding in the studies by Chaudhary et al and Byrd et al. Mediastinal widening was more common in squamous cell carcinoma in this study, while, in the studies by Chaudhary et al and Byrd, small-cell carcinoma was a common finding. The incidence of other findings such as hilar, perihilar, and

apical masses, pleural effusion, chest wall invasion, and diaphragmatic elevation were nearly similar with other two studies. The CT scan finding shows that all patients (100%) showed contrast enhancement pattern in the pulmonary mass. Study by Chaudhary et al. showed similar findings. The incidence of other findings such as loss of patency of bronchus, calcification, cavitation, hilar enlargement, distal collapse, and pleural effusion were similar in both the studies except for necrosis. It was seen in 51.67% of patients, while, in this study, only 10.76% patients showed necrosis in the lesion. Enlarge mediastinal lymph nodes were seen in 35.38% patients in this study, while Chaudhary et al showed the occurrence in 50% patients. Mediastinal invasion of tumor and superior vena cava compression were somewhat at higher side in the study by Chaudhary et al when compared with this study.

### Strengths and Limitations of the Study

Accurate staging could be done by combined histological and radiological techniques. However, in this study, the sample size is low. The study could be extended with more sample size.

### Conclusion

The evaluation of a patient with known or suspected bronchogenic carcinoma requires the detection and characterization of the lesions involving the lungs, hila, mediastinum, pleura, chest wall, and upper abdomen. CT scan is most advantageous radiologic technique for evaluating these regions simultaneously. Today, for staging of bronchogenic carcinoma, CT scan is the dominant modality in use along with other histopathological cytological analysis. MRI and other newer imaging techniques have some theoretical and real advantages; presently, these are outweighed by consideration such as availability, cost, and examination of choice for evaluation of a patient with primary bronchogenic carcinoma.

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