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Original Research Article

A Retrospective Study To Analyse The Typical CT Imaging Features of Lung Adenocarcinoma

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Abstract

Purpose: The main objective of the study was to evaluate the typical CT imaging features of histopathologically proven lung adenocarcinoma.

Methodology: In this retrospective study, 132 patients with histopathologically proven adenocarcinoma were evaluated. The data were gathered retrospectively from the Department of Radiodiagnosis at the Amrita Institute of Medical Sciences in Kochi, Kerala, India. Patient data were collected over a period of 7 years from June 2010 to June 2017. Patient demographic details such as age and gender, tumour characteristics in chest CT scan like location, size, shape, margins, pleural tag, cavitation, reticulation, air bronchogram, nodal metastases, distal metastases, and recurrence-free survival period were collected.

Result: Out of 132 study participants, the majority (66.7%) of them were males, and their mean ± SD age was 64.8±10.4 years. The majority (56.8%) of the patients presented with primary symptoms related to isolated cough, followed by breathlessness (14.4%), hemoptysis (1.5%), chest pain (12.1%), cough with breathlessness (8.3%) and cough with hemoptysis (6.1%). CT findings showed that 77.2% of adenocarcinoma lesions had predominant peripheral distribution and the size of the lesion ranged from 3-5 cm (34.1%). The majority (93.2%) of the lesions had a solid consistency, 56.1% of lesions had spiculated margins, and 92.4% of lesions showed pleural tags.

Conclusion: Lung adenocarcinoma has typical imaging features in CT scans. The salient findings will enable the radiologist to accurately interpret the lung nodule/masses as benign or malignant. Early detection of such lesions would aid in better management of these cases, and early management will indirectly mean better survival.

Keywords: Adenocarcinoma, AIMS, Computerized tomography, PET

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Introduction

Lung cancer has been progressed from uncommon cancer to the most common cancer in the world during the last century. It has been developed as the most common cause of cancer deaths globally. It is the second most common cancer after prostate cancer for men and breast cancer for women[1].

Tobacco smoking is the most important risk factor for lung cancer followed by air pollution [2,3]. Air pollution is considered to be one of the important etiologic factors for lung cancer. Lung cancer rates vary around the globe, reflecting geographical differences in tobacco use and air quality. Non-small cell cancer refers to the most common type of lung cancer. It includes squamous cell carcinoma and adenocarcinoma. In the recent past, adenocarcinoma incidence has increased globally replacing squamous cell carcinoma. [4,5,6]. Because of its indolent nature, the diagnosis of lung adenocarcinoma is often delayed.

Advanced lung cancer has an extremely poor prognosis, with 5-year survival. Lung cancer incidence shows a strong gender difference as well. In developed countries, the rate of lung carcinoma is considerably higher in men, predominantly related to smoking habits. In men, lung cancer is the most common cancer compared to women.[5]. The overall incidence is decreasing in men in developed countries due to tobacco control policies. Unlike in developed countries, lung cancer incidence continues to rise in India. It is a major public health issue in India as it is the leading cause of cancer deaths in the country. Lung cancer incidence is very high in Kerala. Lung cancer is diagnosed very late in Kerala due to the high prevalence of tuberculosis in this south Indian state.

In adenocarcinoma, the tumour is located peripherally in the lung and is usually asymptomatic. In adenocarcinoma, even with a smaller size of the lesion as good as a solitary pulmonary nodule, it tends to metastasize early. As adenocarcinoma is not responsive to radiation, surgery by lobectomy or pneumonectomy is needed to treat it. Lobectomy in the early stages renders a better survival rate. Knowledge of morphologic features helps to get an accurate and early diagnosis of adenocarcinoma [6-7]. As a noninvasive examination CT scan has become the most widely used modality for the early screening of lung cancer. CT scan could be used to make an early diagnosis of adenocarcinoma and thereby determine the timing of surgery and predict prognosis.

This study aims to retrospectively analyse the CT imaging features of histopathologically proven lung adenocarcinoma. This may help in apt diagnosis and early-stage detection, which in turn would shorten the waiting time for its treatment. Early treatment may lead to a better prognosis and improve the survival of these patients.

METHODOLOGY

The main objective of the study was to derive the typical CT imaging features of histopathologically proven lung adenocarcinomas. Patients Data were retrospectively collected from the department of radiodiagnosis of a tertiary care centre in central Kerala, India for a period of 7 years from June 2010 to June 2017. The study included 132 patients with histopathologically proven lung adenocarcinoma. The collected data was stored in a Microsoft Excel file. The document containing the study data was encrypted with a password and the device was kept safe and secure for data security. The personal identifiers of the patients

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(Patients' names and addresses) were kept confidential and secure. Each patient was given a Unique ID number to make each entry anonymous.

Inclusion Criteria: Patients with histologically proven adenocarcinoma who underwent CT scan during the period 2010 to 2017 in Dept. of Radiology AIMS, Kochi.

Exclusion Criteria: Patients who already underwent treatment.

Chest CT analysis had been performed on a siemens 64 slice multi-detector CT scanner. The collected data included demographic characteristics of the patient such as age, gender and clinical symptoms at the time of presentation also were noted.

CT Findings: (1) Size of primary lesion (2) Location (3) Number (4) Margins (5) Density (6) Pleural involvement (pleural tag/pleural effusion) (7) Presence of cavity (8)Presence of calcifications (9) Bronchial cut off/air bronchogram (10) Lymph nodal involvement were noted.

Statistical analysis

The personal identifiers of the patients (Patients' names and addresses) were kept confidential and secure. Each patient was given a Unique ID number to make each entry anonymously. Descriptive analysis was done. In this study, descriptive statistics were analyzed using SPSS version 26.0.

RESULT

A total of 132 histopathologically proven lung adenocarcinoma patients underwent for chest CT scan at the department of radiology AIMS, Kochi. The demographic characteristics are shown in table-1. Mean± SD age of the patients was 64.8±10.4 years. The youngest subject was 31 years whereas the oldest subject was 86 years old (Table1). There were 88 (66.7%) males and 44 (33.3%) females.

Table 1 Demographic characteristics (N=132)

S.N	Characteristics	Variable	Total(N=132)
1	**Age**	Mean age: Age range	64 +/- 10.4 years 31 to 86 years
2	Gender	Male Female	88(66.7%) 44(33.3%)
Total			**132(100%)**

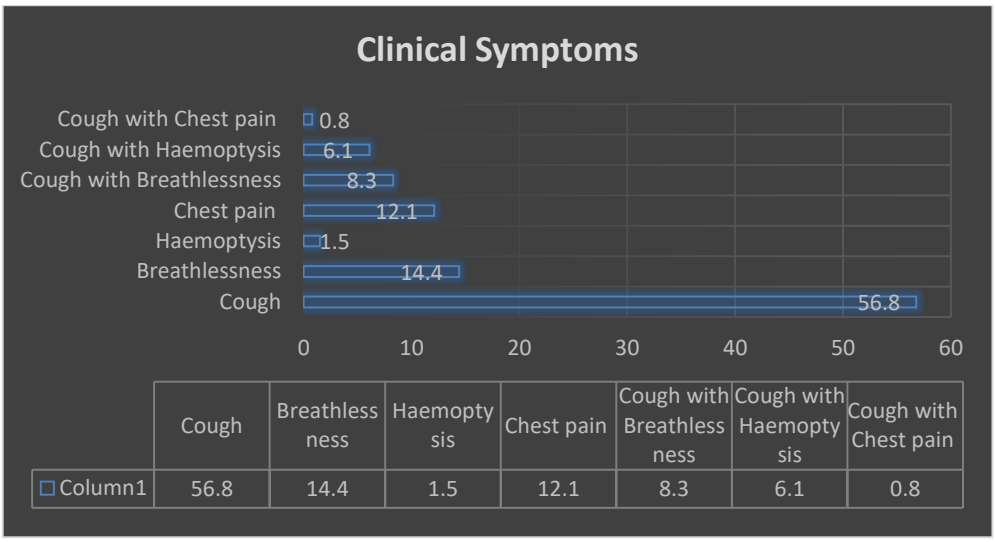

Figure. 1 Clinical symptoms of the study subjects

Clinical features of the total patients shown in the above figure, Majority (56.8%) of the

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patients were presented with primary symptoms related to isolated cough, followed by breathlessness (14.4%), chest pain (12.1%) cough with breathlessness 8.3% cough with hemoptysis (6.1%) cough with chest pain and followed by hemoptysis (1.5%).

Table 2: Chest CT Image features of Adenocarcinoma of lung N=132

S.N	Characteristics	Variable	Total(N=132)	%
1	Size of the primary lesion	Size Less Than 3 Cm Size3- 5 Cm Size Between 5 To 7 Cm Size More Than 7 Cm	36 45 20 31	27.3 34.1 15.2 23.5
2	Number of the lesions	Predominantly solitary lesions Two lesions Three lesions More than three lesions	95 6 4 27	72.2 4.5 3 19.3
3	Side of the lesion	Right Left Both	90 40 2	68.2 30.3 1.5
4	Location of the lesion: Central vs Peripheral	Right Central Right Peripheral Left Central Left Peripheral Bilateral	23 65 5 37 2	17.4 49.2 3.8 28.0 1.5
5	Margins	Smooth Lobulated Spiculated Combined Fluffy	20 31 74 0 7	15.2 23.5 56.1 0 5.3
6	Density	Solid ground glass Part solid	124 5 3	93.9 3.8 2.3
7	Pleural tags	Present Absent	122 10	92.4 7.6
8	Pleural effusion	Present Absent	20 112	15.2 84.8
9	Presence of cavity	Present Absent	4 128	3 97
10	Presence of calcifications	Present Absent	2 130	1.5 98.5
11	Bronchial cut off/air Broncho gram	Bronchial cut off Air Broncho gram No Bronchial involvement	25 19 88	18.9 14.4 66.7
12	Lymph nodal involvement	Present Absent	79 53	59.8 40.2
13	Metastasis	Ye No	81 51	61.4 38.6
	Total		**132**	**(100%)**

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Size and number of the lesions

Out of a total of 132 study subjects, the chest CT scan showed that the majority (34.1%) of the patients had a mass presentation with a size ranging from 3 to 5 cm, followed by a smaller nodular size of less than 3 cm (27.3%), followed by a mass size of more than 7 cm (23.5%), and larger masses with a size between 5 to 7 cm (15.2%), respectively.

More than half (72.2%) of the adenocarcinoma lesions were predominantly solitary lesions, and 19.3% of the lesions were more than three in number, followed by two (4.5%) and three lesions (3%).

Side and location of the lesion

The majority of the adenocarcinoma lesions were located in the right lung (68.2%), Left lung (30%) and both lungs (1.5%). The majority (77.2%) of the adenocarcinoma lesions had predominant peripheral distribution (Right Peripheral 49.2% and Left Peripheral 28%), followed by central distribution 21.2% (Right Central 17.4% and Left Central 3.8%) and Bilateral (1.5%) respectively

Characteristics of the lesions

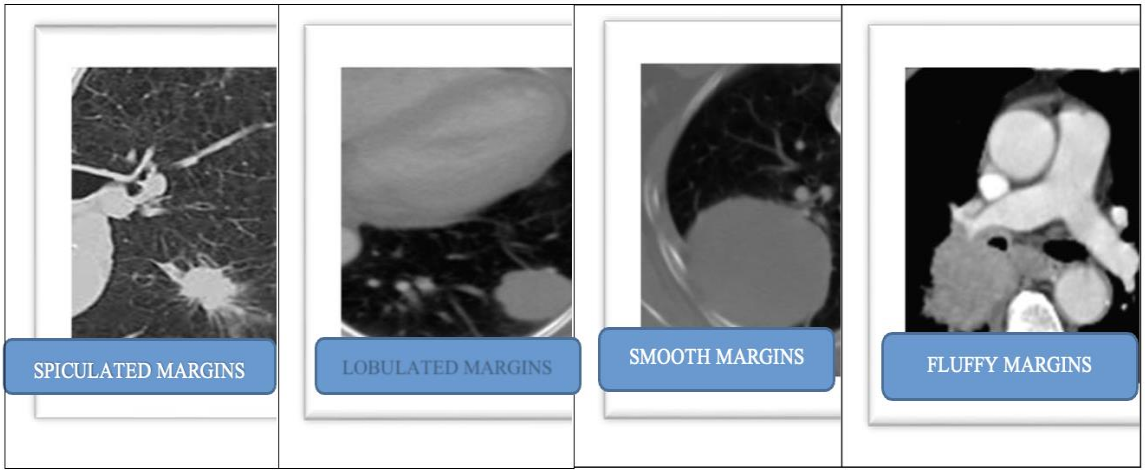

Figure 2: Margin

Margin (Figure 2): The majority 56.1% of the adenocarcinoma lesions margins were noted as speculated followed by Lobulated 23.5%, Smooth 15.2 % and fluffy 5.3 % margins.

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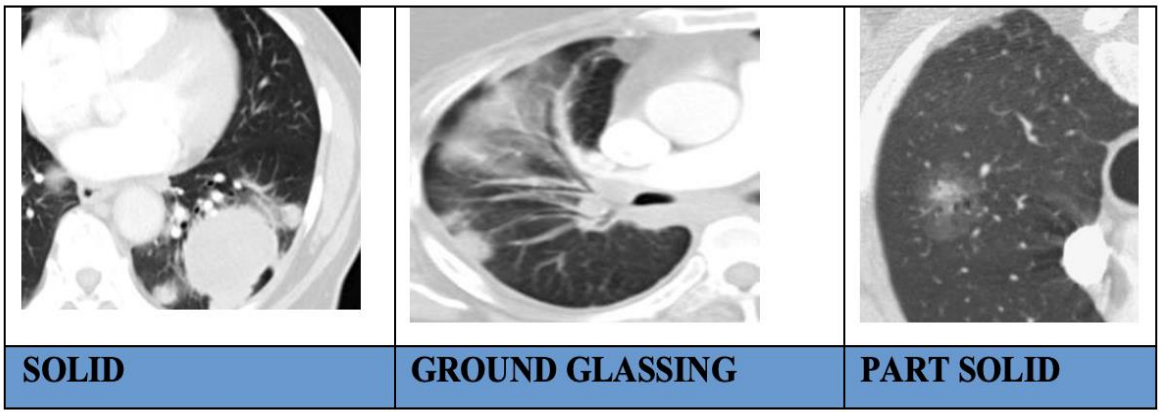

Figure 3: Density

Density (Figure 3): Most 93.9 % of the adenocarcinoma lesions were solid, 3.8 % of lesions were ground-glass nodules and 2. 3% of lesions were part solid
Pleural involvement: The majority 92.4 % of lesions showed pleural tags, 7.6 % showed no pleural tags. Pleural effusion was present in 15.2% of cases, absent in 84.6% of the cases.
Cavity: The majority of the 97.3 % lesions were non-cavitating and only 2.7% showed cavitation. Calcification: 98.5 % of lesions showed no intra lesion calcifications, 1.5 % showed calcifications Bronchial Involvement: A majority of the adenocarcinoma lesions showed air Bronchogram (18.9%) and bronchial cut off (14.4%). Hence, air bronchogram signs cannot be ignored solely as a sign of infection and left alone. Such findings should be serially followed up until resolution to avoid the risk of missing an early malignancy.
Lymph node involvement: Nodal spread of the lesion at the time of diagnosis was seen in 59.8% of adenocarcinoma.
Metastasis: More than half of 61.4 % of the cases showed metastasis at the time of diagnosis.

DISCUSSION

Lung adenocarcinoma has typical imaging features like peripheral location, solid density, spiculated margins, associated pleural tag without pleural effusion, absent cavitation and calcifications which will enable radiologists to make an early diagnosis. Adenocarcinoma can also show air bronchogram which mimics infective consolidation. Adenocarcinoma tends to show early nodal and distant metastasis. Points that help in differentiating squamous cell carcinoma from an adenocarcinoma are that the former is more centrally located tumours, causes bronchial cut off and tends to cavitate early. A study by Hollings N et al 2002[8] demonstrated that it is possible to differentiate adenocarcinoma from squamous cell carcinoma through a CT scan.
Most of the studies show that adenocarcinoma is confined to the periphery. The current study also reflects the same result[13]. Over 78% of the lesion lies in the periphery and nearly 21% is confined to the central.

A study by jun-yan-yu et al[10], which correlated the difference between adenocarcinoma and squamous cell carcinoma, revealed that females are more prone to getting adenocarcinoma. However, this study shows that 66% of the affected samples were males. This may be due to the geographical location and the social factors that matter in the disease process.

It is crucial to distinguish salient features of lung malignancy from its morphological mimics such as an area of consolidation caused by an infective or inflammatory aetiology. Delay in

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characterizing the consolidation appropriately as malignant causes, may delay treatment, which may affect the overall survival of these patients.

CONCLUSION

Lung adenocarcinoma has typical imaging features in CT. The salient findings will enable the radiologist to accurately interpret the lung nodule/masses as benign or malignant. Early suspicion of such lesions would help in better management of these cases, and early management will indirectly mean better survival. A CT scan is an effective tool in the early characterization of nodules and masses. A few of the salient findings in our study suggest that even if the size of the lesion is that of a nodule, a peripheral location and spiculated margins should still raise the suspicion of an adenocarcinoma irrespective of air bronchogram signs. Such lesions should be followed up serially with suspicion. This will help in the early-stage detection of malignant lesions, and an early diagnosis will help to provide effective treatment to the patients.

CONFLICT OF INTEREST: Nil

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