



## A STUDY ON ETIOLOGY AND DIAGNOSTIC MODALITIES OF CASES WITH SOLITARY PULMONARY OPACITY IN CHEST ROENTGENOGRAM

<b>Dr Ritabrata Mitra</b>	Assistant Professor, Dept of Pulmonary Medicine, IPGME&R, Kolkata.
<b>Dr Puja Trigunait</b>	Postdoctoral Trainee, Dept of Critical Care Medicine IPGME&R, Kolkata.
<b>Dr Arindam Datta</b>	Senior Resident, Dept of Respiratory Medicine, Raghunathpur Sadar Hospital, Purulia.
<b>Dr Manotosh Sutradhar*</b>	Assistant Professor, Dept of Critical Care Medicine IPGME&R, Kolkata. *Corresponding Author
<b>Dr Sayani Lahari</b>	Demonstrator, Department of community, Medicine, College of medicine & JNM Hospital, Kalyani, Nadia.
<b>Dr Debarshi Jana</b>	Young Scientist, IPGME and SSKM Hospital, Kolkata, WB.
<b>Dr Somenath Kundu</b>	Professor and HOD, Dept of Respiratory Medicine, IPGME&R, Kolkata.
<b>Dr Ashutosh Ghosh</b>	Professor and HOD, Dept of Critical Care, Medicine IPGME&R, Kolkata.

**ABSTRACT** **INTRODUCTION:** In various mass screening programmes, 0.09-2% of chest radiographs have revealed solitary pulmonary nodules. This continues to pose a diagnostic challenge and therefore the significance of its proper evaluation to differentiate between benign and malignant causes. **MATERIALS AND METHODS:** The study was carried out in the Department of Respiratory Medicine of IPGME, Kolkata for a period of one & half year (November 16 to May 2018). Help was also sought from various departments of IPGME, specially the Departments of Pathology, Microbiology, Cardiothoracic surgery and Radiotherapy. Fine needle aspiration cytology of lung opacity under guidance of computerized tomography was performed in Radiology Section of the Bangur Institute of Neurology, Calcutta, Department of Radiotherapy, IPGME and The CT-Scan Centre of Medical College, Kolkata. A total of 73 cases showing solitary pulmonary opacity and obeying the selected criteria were selected for the study of which 56 cases are being evaluated in this study as 17 cases were either lost to follow-up or data was incomplete and hence were excluded. **RESULT AND ANALYSIS:** The study showed bronchogenic carcinoma as by far the most common cause of solitary pulmonary opacity occurring in 45% of the total cases. Majority of the cases of bronchogenic carcinoma were of squamous cell variety (48%) followed by adenocarcinoma (36%). Small cell carcinoma (4%) and anaplastic carcinoma (12%) were less common. Among the benign causes, tuberculoma was the commonest cause seen in 21.4% cases followed by metastasis from other sites (9%). Solitary pulmonary opacity due to bronchogenic carcinoma was seen more in elderly subjects (Mean age of the subjects with bronchogenic carcinoma was 58.9 years while for tuberculoma & hydatid cyst cases the mean ages were 43.3 years and 41 years respectively). **CONCLUSION:** The present study showed that meticulous clinical evaluation, careful study of chest roentgenogram coupled with judicious use of investigations like fiber optic bronchoscope and CT guided aspiration cytology make it possible to diagnose the etiology of solitary pulmonary opacities without resorting to major surgical procedures. Although this does not underestimate the need for thoracotomy which is the final answer to the problem of undiagnosed solitary pulmonary opacity, The present study can be regarded as yet another illustration of the current trend of evaluation of pulmonary opacities by increasing use of non-invasive investigation procedures based on recent technological advances.

**KEYWORDS :** Etiology, Diagnostic Modalities, solitary Pulmonary And Chest Roentgenogram.

### INTRODUCTION

In various mass screening programmes, 0.09-2% of chest radiographs have revealed solitary pulmonary nodules<sup>1</sup>. This continues to pose a diagnostic challenge and therefore the significance of its proper evaluation to differentiate between benign and malignant causes. This would therefore help avoiding unnecessary resection surgery. Solitary pulmonary nodule is defined as a single spherical or oval opacity less than 3cm in diameter, which is completely surrounded by lung parenchyma and is not associated with lymphadenopathy or atelectasis.

To confirm the shadow on chest radiograph as pulmonary, a lateral view fluoroscopy or metal markers may be useful. Chest CT scan is the best modality currently. A lesion that is >3cm is designated as lung mass and should be considered malignant unless it is proven otherwise<sup>2</sup>. Most of the screening programs reveal the incidence of malignant solitary pulmonary nodule between 5-69%. While 70-80% of benign solitary pulmonary nodules are associated with infectious granulomas. Hamartomas are the next commonest cause of solitary pulmonary nodule<sup>3</sup>.

For the clinical evaluation of an solitary pulmonary nodule on chest radiograph, history, clinical examination and further investigations are required. Age (especially more than 35 years), history of smoking, hemoptysis and history of previous malignancy are important points in history taking that favor a malignant etiology<sup>4</sup>. Contrast enhancement

pattern: Lack of enhancement (less than 15HU increase after contrast administration) generally indicative of benign etiology<sup>5</sup>.

Lung cancer is the commonest cause of cancer related death in men and third most common cause in females. 5 year survival is as low as 15% but if it was diagnosed in early stage (stage IA, T1N0M0), early resection can achieve 5 year survival rate as high as 80%. Air bronchogram (bronchoalveolar carcinoma), thick walled cavity (more than 15mm), ground glass opacifications (bronchoalveolar carcinoma) are more suggestive of malignancy. Presence of focal fat density is more suggestive of benign lesion.

### MATERIALS AND METHODS

The study was carried out in the Department of Respiratory Medicine of IPGME, Kolkata for a period of one & half year (November 16 to May 2018). Help was also sought from various departments of IPGME, specially the Departments of Pathology, Microbiology, Cardiothoracic surgery and Radiotherapy. Fine needle aspiration cytology of lung opacity under guidance of computerized tomography was performed in Radiology Section of the Bangur Institute of Neurology, Calcutta, Department of Radiotherapy, IPGME and The CT-Scan Centre of Medical College, Kolkata.

A total of 73 cases showing solitary pulmonary opacity and obeying the selected criteria were selected for the study of which 56 cases are

being evaluated in this study as 17 cases were either lost to follow-up or data was incomplete and hence were excluded.

#### INCLUSION CRITERIA:

- i. The opacity must be solitary
- ii. It must be situated in the substance of the lung
- iii. The opacity may be of any size or shape but must be well-circumscribed.
- iv. It may contain calcification in chest X-ray or computerized tomography
- v. There must not be any cavitations within the opacity
- vi. Other pleuropulmonary conditions may be present.
- vii. Over 18 years of age
- viii. Willing to sign the informed written consent for the study.

#### EXCLUSION CRITERIA:

- i. Below 18 years of age.
- ii. Not willing to give consent for the study.
- iii. Complete adherence to the study protocol could not be achieved i.e. lost to follow-up.
- iv. Not conforming to any of the above inclusion criteria.

#### Scheme of Study:

The age and sex distribution among the cases selected were recorded carefully. The cases were then studied by a meticulous history taking and physical examination. This was followed by appropriate investigations to arrive at an etiological diagnosis.

#### RESULT AND ANALYSIS

The study showed bronchogenic carcinoma as by far the most common cause of solitary pulmonary opacity occurring in 45% of the total cases. Majority of the cases of bronchogenic carcinoma were of squamous cell variety (48%) followed by adenocarcinoma (36%). Small cell carcinoma (4%) and anaplastic carcinoma (12%) were less common. Among the benign causes, tuberculoma was the commonest cause seen in 21.4% cases followed by metastasis from other sites (9%). Solitary pulmonary opacity due to bronchogenic carcinoma was seen more in elderly subjects (Mean age of the subjects with bronchogenic carcinoma was 58.9 years while for tuberculoma & hydatid cyst cases the mean ages were 43.3 years and 41 years respectively).

We found that the male preponderance was seen in the series as a whole (64.3% cases). 78% of the total cases of bronchogenic carcinoma in present study were males. Male preponderance was specially evidenced in squamous cell carcinoma (11 out of 12 cases i.e. 91.6%). However in adenocarcinoma, of 9 cases females were 4. Particularly in squamous cell carcinoma, 75% patients had smoking history. Among non smokers adeno carcinoma was more common than squamous cell carcinoma (60% versus 30%). The following clinical signs were corroborative with malignant solitary pulmonary nodule, clubbing (72.72%), lymphadenopathy (66.66%), superior vena caval syndrome (5.7%), left recurrent laryngeal nerve palsy (4%). The study showed 76.92% opacity larger than 6 cm in diameter were malignant.

Our study showed that the distribution of bronchogenic carcinoma: Right upper and mid zones accounted for 5 & 8 cases respectively (25% & 32%) followed by left upper and mid zones (5 and 4 cases respectively). In one case (case 10) both left upper and mid zone were occupied by the opacity. The left lung was involved in 19 cases (60%) and the right lung in 12 cases (40%). The lower zones were involved in 2 cases only. Case 38 had opacity in the left lower zone and case 34 in the right lower zone. The study showed the importance of simple sputum examination in the etiological diagnosis of solitary pulmonary opacity. Microscopic examination of sputum yielded positive bacteriologic results in 50 cases of tuberculoma. Also 15% cases of bronchogenic carcinoma showed positive results in papanicolaou stain of sputum samples. Most of these cases had squamous cell carcinoma with central location of the tumor.

We found the previous x-rays were available in 14 cases for comparison with recent films. Among them 5 cases revealed no abnormality in the previous films. 2 cases revealed evidence of tuberculous scars in previous chest x-rays. 1 case revealed evidence of hyperinflation in x-rays taken within previous 15 months. 6 cases showed that they had gradually increasing pulmonary opacity in their previous x-rays. Among them 3 had x-rays upto previous 6 months. 1 had x-rays upto previous three and a half month, 2 cases had x-rays of

previous one month only. 10 cases could not produce any previous x-rays at the time of examination. CT scan was performed in all 25 cases of bronchogenic carcinoma presenting with pulmonary opacity chiefly to obtain material for cytological diagnosis. CT scan findings corroborated with the findings of conventional radiology in all cases. In 8 cases it yielded information not apparent in straight x-ray of chest. CT-scan revealed small pleural effusion not visible on X-ray. One case showed speckled calcification on CT-thorax which was not evident on an X-ray.

We found that the study revealed CT scan of the thorax as an invaluable tool in the diagnosis of pulmonary opacities. The most important role of CT scan was its ability to guide fine needle aspiration cytology from the desired site of the pulmonary opacity. Positive cytological diagnosis was obtained from all the 18 cases of bronchogenic carcinoma with solitary pulmonary opacity in whom CT guided FNAC was done. Also there was good cytohistological concordance in all the cases in 13 cases where both CT-FNAC and histopathological studies were done. The same holds good for lymph node biopsy & bronchoscopic biopsy as well. Besides guiding FNAC, CT Scan of thorax yielded useful information by ascertaining cyst and by detecting calcifications not apparent in chest roentgenograms in cases of tuberculoma. Fibre optic bronchoscope was another essential tool in the diagnosis of solitary pulmonary opacity. Endoscopically visible tumor opacity was seen in 62.5% cases of bronchogenic carcinoma and positive yield in biopsy was obtained in all of them. Complications of both CT-FNAC and bronchoscopy were minimal. Only minor complications occurred in 3 and 2 cases respectively. The study also shows lymphoma as a cause of solitary pulmonary opacity in 2 cases (Hodgkin's disease mixed cellularity in one case and non-Hodgkin's lymphoma intermediate grade in the other). Clinical and radiological features were largely nonspecific, diagnosis was made by lymph node biopsy and CT guided cytological study from the pulmonary opacity.

#### DISCUSSION

The present study involves evaluation of patients with solitary pulmonary opacity on chest x-ray. It is worthy to discuss the results of the present study in the context of vast literature that is available on this topic.

This study showed that primary carcinoma is the commonest cause of pulmonary opacity. 45% of the entire solitary pulmonary nodule was diagnosed as bronchogenic carcinoma. This finding is also corroborated with various previous studies<sup>6</sup>. Among the cases of bronchogenic carcinoma, we had found squamous cell carcinoma as the commonest one followed by the adeno carcinoma, which is supported by maximum published literatures. But Higgins et al had reported adeno carcinoma as the commonest type of carcinoma presenting as solitary pulmonary nodule.<sup>7</sup>

In this study, tuberculoma was the commonest benign disease found. But the previous studies showed infective granuloma as the most common benign cause. This disparity may be due to the location of the present study which is a tubercular endemic region.<sup>8</sup>

In this study we had observed that the probability of solitary pulmonary nodule to be malignant was directly related to age. Mean age of the patients with carcinoma was 58.9 years. Steele et al reported that 83% of cases of bronchogenic carcinoma were aged beyond 50 years<sup>9</sup>. Kumar et al described that only 2% of the cases of bronchogenic carcinoma had occurred below 40 years.<sup>10</sup> Cummins et al observed that malignant potential of a nodule increase with age<sup>11</sup>.

In this study male predilection was seen (64.3% of total cases, 78% of total cases of bronchogenic carcinoma & 91.6% of all squamous cell carcinoma, which was corroborated by maximum reported studies. Among the adeno carcinoma patients male: female ratio was 1.25:1.

The present study had showed that 76.92% of the opacities larger than 6 cm in diameter were malignant. A lot of published studies also showed the same finding and smaller opacities were generally associated with benign diseases.

In our study we had observed that benign nodules remained static up to 1-2 years, whereas 6 out of 14 cases of bronchogenic carcinoma showed gradual increase in size over 6 months to 2 years. Previous studies also showed that lack of growth in preceding 2 years is a very important criterion for benignity.

In this present study we had found maximum benign lesions had smooth margin ( 3/3 cases of hydatid cyst, 8/12 cases of tuberculoma) ,this did not consider margin as a significant radiological criterion.

The study revealed CT scan of the thorax as an invaluable tool in the diagnosis of pulmonary opacities. Besides guiding FNAC, CT Scan of thorax yielded useful information by ascertaining cyst and by detecting calcifications not apparent in chest roentgenograms in cases of tuberculoma. This finding was corroborated by various previous studies.

Complication of both CT guided FNAC and bronchoscopy were minimal in this study. Whereas most of the previous literature showed a frequency of 5-10% of pneumothorax as a complication of CT guided FNAC.<sup>12</sup>

In this study we had found lymphoma presenting as solitary pulmonary nodule(2cases) . Filly et al and Mc Donald et al had described this finding as a rare clinical entity.<sup>13</sup>

**Table 1 - Sputum status among cases of bronchogenic carcinoma.**

Suggestion of Malignancy	Chest X-Ray	CT-Scan
Any sign	7	25
Pleural effusion	5	8
Speckled calcification	0	2
Hilar LN	4	8
Invasion into adjacent structure	0	3
Involvement of other organs	0	3
Increase in size	6	0
Rib erosion	1	2

**Table 2- Features Suggestive of Malignancy on chest X-ray and CT-scan**

Histology	Total Case	FOB done in	Positive Yield
Squamous cell carcinoma	12	6	3
Adenocarcinoma	9	6	5
Small cell carcinoma	1	1	1
Anaplastic carcinoma	3	3	1

## CONCLUSION

The present study showed that meticulous clinical evaluation, careful study of chest roentgenogram coupled with judicious use of investigations like fiber optic bronchoscope and CT guided aspiration cytology make it possible to diagnose the etiology of solitary pulmonary opacities without resorting to major surgical procedures. Although this does not underestimate the need for thoracotomy which is the final answer to the problem of undiagnosed solitary pulmonary opacity, The present study can be regarded as yet another illustration of the current trend of evaluation of pulmonary opacities by increasing use of non-invasive investigation procedures based on recent technological advances.

## REFERENCES

- Comstock GW, Vaughan RH, Montgomery G. Outcome of solitary pulmonary nodules discovered in an x-ray screening program. *N Engl J Med* 1956;254:1018-22.
- Swensen SJ, Morin RL, Schueler BA, et al. Solitary pulmonary nodule: CT evaluation of enhancement with iodinated contrast material—a preliminary report. *Radiology* 1992;182:343-7.
- Ray JF, Lawton BR, Magnin GE, Dovenbarger WV, Smullen WA, Reyes CN, Myers WO, Wenzel FJ, Sautter RD. The coin lesion story: update 1976, twenty years' experience with early thoracotomy for 179 suspected malignant coin lesions. *Chest* 1976;70:332-6.
- Gurney JW. Determining the likelihood of malignancy in solitary pulmonary nodules with Bayesian analysis. Part I. Theory. *Radiology* 1993;186:405-13.
- Zhang M, Kono M. Solitary pulmonary nodules: evaluation of blood flow patterns with dynamic CT. *Radiology* 1997;205:471-8.
- Linder F, Jagdschian V. Rundherde der Lunge 1959; *Arch Klin Chir* 292 : 371.
- Taft PD, Sztelbein WM, Greene R. A study of variability in cytologic diagnosis based on pulmonary aspiration specimens. *Am J Clin Pathol* 1980;73 : 36-40.
- Sherrier RH, Chiles C, Johnson GA, Ravin CE. Differentiations of benign from malignant pulmonary nodules with Digitized chest radiology. 1987;162, 645-649.
- Steele JD, Buell P. Asymptomatic solitary pulmonary nodules. Host survival, tumor size, and growth rate. *J Thorac Cardiovasc Surg* 1973;65:140-51.
- Alkhaldeh K, Bural G, Kumar R, Alavi A. Impact of dual-timepoint (18)F-FDG PET imaging and partial volume correction in the assessment of solitary pulmonary nodules. *Eur J Nucl Med Mol Imaging* 2008;35:246-52.
- Cummings SR, Lillington GA, Richard RJ. Managing solitary pulmonary nodules: The coin of strategy is a 'close call'. *Am. Rev. Resp Dis* 1986;134 : 453-460.
- Harter LP, Moss AA, Goldberg HI, et al. CT guided fine needle aspiration for diagnosis of benign and malignant disease. *Am J Roentgenol* 1983; 140 : 363-367.
- Filly R, Blank N, Castellino RA. Radiographic distribution of intrathoracic disease in previously untreated patients with Hodgkin's disease and non-Hodgkin's lymphoma. *Radiology* 1976; 120 : 277-281.