

Role of Multi Detector Computed Tomography in evaluation and staging of Bronchogenic Carcinoma with its Histopathological correlation

Dr. Dharmaraj Meena¹, Dr. Chandraveer Singh Godara², Dr. Sangeeta saxena³,
Dr. Harshvardhan khokhar⁴, Dr. Abhishek Gupta⁵, Dr. Bhajan lal⁶

Professor & HOD¹, resident doctor², senior professor³, assistant professor⁴, resident doctor⁵, resident doctor⁶
Department of Radio-diagnosis, Government Medical College, Kota, Rajasthan, INDIA

Corresponding author: Dr. Chandraveer Singh Godara

Abstract: Introduction: Bronchogenic carcinoma is most common cause of cancer-related mortality in the developed world with incidence rising in developing countries. MDCT is the modality of choice for evaluating the lung carcinomas. The **objectives** of our study are to assess the role of multi detector computed tomography in diagnosis, characterization and staging of lung cancer and their cytopathological correlation.

Methodology: Data was collected from 53 patients with clinically or radiologically suspected pulmonary mass lesion referred for CT scan of chest to Department of Radiodiagnosis GMC, Kota (Rajasthan). Collected data was analyzed based on the variables of the lung lesion seen on CT images followed by CT diagnosis and correlation made with histopathology report. Finally, only those patients with a cytopathologically confirmed diagnosis of lung cancer were included in the final analysis.

Results: The maximum prevalence of bronchogenic carcinoma was seen between 60–69 years of age (37.73%) with male predominance (83.02%). About 77.36 % patients showed positive smoking history. Cough with expectoration (86.79%) was the most common symptom. The most common histological presentation was Adenocarcinoma in 25 patients (47.17%) followed by squamous cell carcinoma in 17 patients (32.08%). Most common tumor among the males was squamous cell carcinoma and among females was adenocarcinoma.

Conclusion: CT is a highly sensitive (96.23%) and highly specific (87.50%) test with high positive predictive value (98.08%) to diagnose Bronchogenic carcinoma in a sample suitably selected and referred for malignancy. MDCT is a useful tool in the staging of Bronchogenic Ca.

Keywords: Bronchogenic carcinoma, Multi Detector Computed Tomography and CT/USG guided FNAC.

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I. Introduction

A status report on the global burden of cancer worldwide using the GLOBOCAN 2018 estimates of cancer incidence and mortality produced by the International Agency for Research on Cancer, with a focus on geographic variability across 20 world regions. There will be an estimated 18.1 million new cancer cases (17.0 million excluding nonmelanoma skin cancer) and 9.6 million cancer deaths (9.5 million excluding nonmelanoma skin cancer) in 2018.

In both sexes combined, lung cancer is the most commonly diagnosed cancer (11.6% of the total cases) and the leading cause of cancer death (18.4% of the total cancer deaths), closely followed by female breast cancer (11.6%), prostate cancer (7.1%), and colorectal cancer (6.1%) for incidence and colorectal cancer (9.2%), stomach cancer (8.2%), and liver cancer (8.2%) for mortality.

Lung cancer is the most frequent cancer and the leading cause of cancer death among males, followed by prostate and colorectal cancer (for incidence) and liver and stomach cancer (for mortality). Among females, breast cancer is the most commonly diagnosed cancer and the leading cause of cancer death, followed by colorectal and lung cancer (for incidence), and vice versa (for mortality).

Burden of the disease in India

It is the second most common cancer in men and the fifth most common cancer in both men and women together.

Table 1: Lung cancer in India (Globocan 2018)

Lung cancer	New Cases	Deaths
Men	48 698	45 363
Women	19 097	18 112
Both sexes	67 795	63 475

Table 2: Incidence & mortality in India due to lung acrcinoma by cancer site (source- Globocon 2018)

	Number	Rank	%	Cumulative risk
New cases	67,795	4	6.45	0.65
Deaths	63,475	3	8.82	0.60

II. Materials & Methods

Source of Data:

This is a diagnostic study. 53 patients with clinical or radiological suspicion of bronchogenic carcinoma referred for CT scan of thorax to the Department Of Radio Diagnosis, Government Medical College Kota (Rajasthan) will be taken.

Study Period: the study was conducted from July 2017 to December 2018. (One and half year)

Design of Study: Prospective Study.

Inclusion Criteria:

1. Patients with clinically or radiologically suspected bronchogenic carcinoma.
2. Patients in whom histopathological correlation is available.

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

Method of collection of data:

Data will be 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 16.

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.

III. Results

This study was conducted in the Department of Radiodiagnosis, Government Medical College Kota (Rajasthan) from July 2017 to Dec. 2018. The study comprised of a total of 53 patients.

Among the 53 patients included in this study, 16.98% were females (n = 09) and 83.02 % were males (n = 44). Hence we can conclude that bronchogenic carcinoma has got a slightly more male preponderance over females.

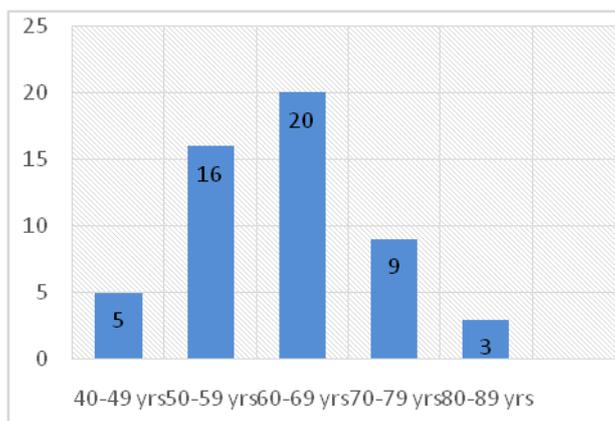


Figure 1: Chart depicting Age Distribution of Bronchogenic Carcinoma.

The age distribution of patients with Bronchogenic carcinoma in our study is between the age group of 40-89 years with a mean age of 65 years. 37.73% of the patients were in the age group of 60–69 years (n = 20), 30.18 % were in the age group of 59 – 59 years (n =16). Thus we have observed that Bronchogenic carcinoma is more common in the age group of 60-69 years and secondly in age group of 50-59 years.

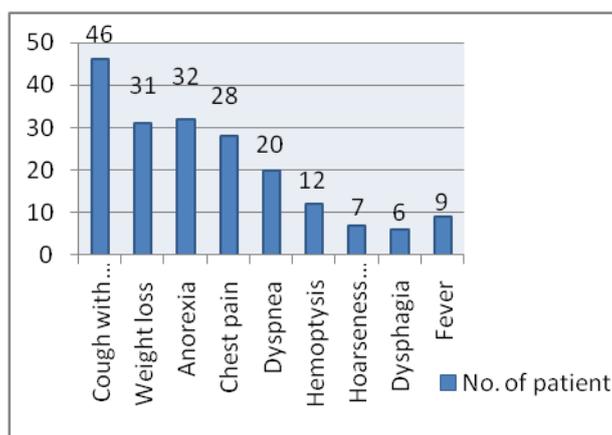


Figure 2: Chart depicting Distribution of Symptoms In patients with Bronchogenic Carcinoma.

In our study involving fifty three patients, 86.79 % of patients had cough with expectoration (n = 46) , 58.49 % patients had weight loss (n = 31), 60.37 % patients had anorexia (n = 32), 52.83% patients had chest pain (n = 28), 37.73 % patients had dyspnea (n = 20), 22.64% patients had hemoptysis (n = 12), 13.20 % patients had hoarseness of voice (n = 7), 11.32 % patients were dysphagia (n = 6) and 16.98 % had fever (n= 9). Therefore from our study it is evident that cough followed by anorexia and weight loss are the most common symptoms of patients with bronchogenic carcinoma.

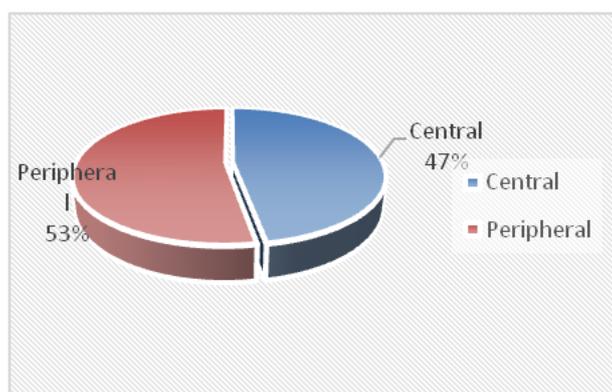


Figure 3: Pie chart depicting location of Bronchogenic Carcinoma

In our study 52.83% lesions were peripheral in location (n = 28) and 47.17 % of lesions were central in location (n= 25). Among the central lesions, 40% was squamous cell carcinoma (n = 10), 40% was adenocarcinoma (n =10) and 20% cases of small cell carcinoma (n=5) respectively and no any case reported with undifferentiated large cell carcinoma. Thus it can be concluded that squamous cell carcinoma and adenocarcinoma are both are located centrally.

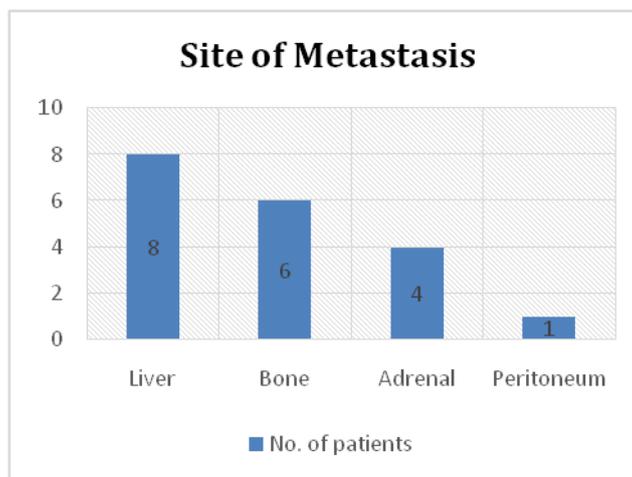


Figure 4: Bar chart showing site of distant metastasis.

In our study of fifty three patients with bronchogenic carcinoma distant metastasis of Bronchogenic carcinoma were seen in 16 patients (30.19 %). Liver is most common site of metastasis with 8 patients (15.09 %) followed by bone in 6 patients (11.32 %), adrenal in 4 patients (07.55 %) and peritoneum in 1 patient (01.89 %) respectively.

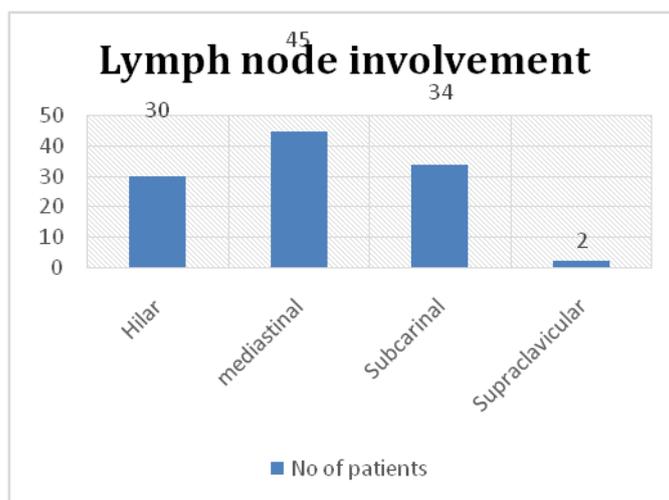


Figure 5: Chart depicting Distribution of Lymph Node Involvement.

In our study of fifty three patients with bronchogenic carcinoma, it revealed that the 84.90 % of patients had mediastinal lymph nodes (n=45), 64.15 % had subcarinal lymph nodes (n =34), 56.60 % had hilar lymph nodes (n=11) and 03.77% had supraclavicular lymph nodes (n=2). Hence mediastinal lymphadenopathy is the most common type of lymph node involvement in patients with bronchogenic carcinoma.

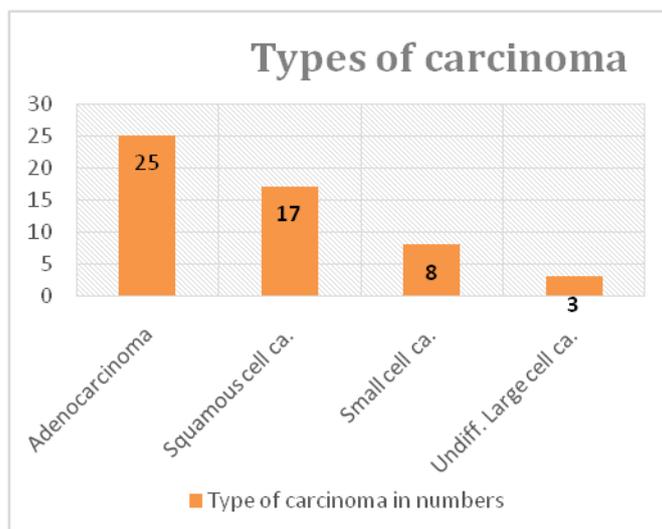


Figure 6: Chart depicting number of patient distribution of histological types of Bronchogenic Carcinoma.

In our study of fifty three patients with bronchogenic carcinoma the distribution of various histological types of bronchogenic carcinoma is as follows; 47.17 % of patients had adenocarcinoma (n = 25), 32.08% patients had squamous cell carcinoma (n = 17), 15.09% patients had small cell carcinoma (n = 8), 05.66 % patients had undifferentiated large cell carcinoma (n = 3). Thus in our study it indicates that adenocarcinoma is most common type of Bronchogenic carcinoma.

77.36 % of patients in our study were diagnosed with T4 stage of the tumor at the time of presentation. 16.98% had T3 stage tumor at the time of presentation, 03.77% had T2b stage of tumor, 01.89% had T2a stage of tumor and no patient recorded in T1a, T1b and T1c stages of tumor.

60.38 % of patients in our study were in N2 stage at the time of diagnosis, 26.41% were in N3 stage, 11.32% were in N0 stage and 01.89 % was in N1 stage.

37.73 % of patients in our study were in M1a stage with tumor in contralateral lung or pleural/pericardial nodule/ malignant effusion, 32.08 % were in M0 stage with no evidence of metastases, 20.76% were in M1c stage with evidence of multiple extra-thoracic metastases and 09.43% were in M1b stage with single extrathoracic metastasis intrapulmonary/ pleural metastasis or malignant pleural / pericardial effusion.

Accuracy of MDCT in Evaluation of Bronchogenic carcinoma
Comparison of CT diagnosis with Histopathological diagnosis of bronchogenic carcinoma

Table 3a: Sensitivity, Specificity, Positive predictive value, Negative predictive value and accuracy of CT to diagnose Bronchogenic carcinoma

		Histo-pathological diagnosis for Bronchogenic carcinoma		
		Yes	No	Total
CT diagnosis for Bronchogenic Carcinoma	Yes	51 (True positive)	01 (False positive)	52
	No	02 (False negative)	07 (True negative)	09
Total		53	08	61

Table 3b: Validity Tests Value

Validity Test	Percent
Sensitivity	96.23 %
Specificity	87.50 %
Positive predictive value	98.08 %
Negative predictive value	77.78 %
Accuracy	95.08 %

These validity tests shows CT is a highly sensitive (96.23 %) and highly specific (87.50 %) test and also has a high positive predictive value (98.08%) to diagnose Bronchogenic carcinoma.

Multi Detector Computed Tomography has a high positive predictive value suggestive of great diagnostic accuracy in the evaluation of Bronchogenic Carcinoma.

52.94 % of male patients had adenocarcinoma (n=18) and 47.06 % of male patients had squamous cell carcinoma (n = 16).87.5 % of female patients had adenocarcinoma (n = 7) and 12.5 % of the female patients had squamous cell carcinoma (n = 01)

Chi squared equals 3.210 with1 degrees of freedom. The one-tailed P value equals 0.0366 is considered to be statistically significant.

Hence from our study it is evident that adenocarcinoma is more commonly seen in female patients and squamous cell carcinoma is more commonly seen in male patients.

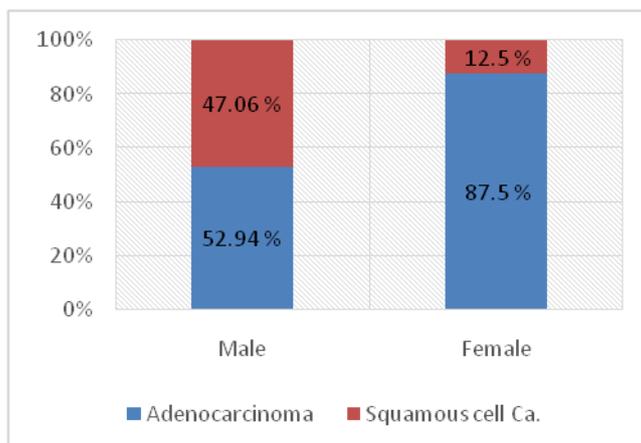


Figure 7: Bar Chart depicting the Distribution of Smokers and non-smokers in patients with Adenocarcinoma and squamous cell carcinoma.

Among the smokers, 48.38 % had adenocarcinoma (n =15) and the remaining 51.62 % had squamous cell carcinoma (n = 16).

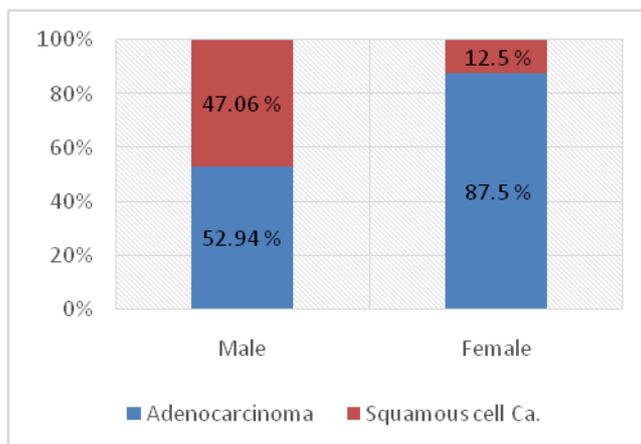


Figure 8: Bar Chart depicting Gender Distribution in Adenocarcinoma and Squamous Cell Carcinoma.

Out of the non-smokers, 90.9 % had adenocarcinoma (n =10) and 09.1 % had squamous cell carcinoma (n = 01).

Chi squared equals 6.093 with 1 degrees of freedom. The one-tailed P value equals 0.0068 is considered to be very statistically significant.

Thus it can be concluded that adenocarcinoma commonly affects non-smokers and squamous cell carcinoma is more commonly seen in smokers

IV. Discussion

In present study of 53 patients, the study group is divided into five age groups (decades) 40 to 49 years, 50 to 59 years, 60 to 69 years, 70 to 79 years and 80-89 years. It was observed that maximum 20 (37.73 %) patients were in the 60 to 69 years age group while age group 50 to 59 years constituting 16 (21%) patients and 70 to 79 years constituting 09 (16.98 %) of patients. This is concordance with study by **Saket RK et al**^[1] (2016) and **Hathila N et al**^[2] (2016) this study is contrary to study done by **Narayanswamy I et al**^[3] (2015) **Yadav D et al**^[4] (2016) and **Dr. Babu S et al**^[5] (2016).

Male to female ratio is 4.89:1 in our study which is similar to the study of **Malik PS et al**^[6] (2013), **Saket RK et al**^[11] (2016), **Shah D et al**^[7] (2017) and **Biswas P et al**^[8] (2016).

Bronchogenic carcinoma is seen more commonly in smokers (77.36 %) than non-smokers (22.64 %). Similar observations have been reported by **Shetty CM et al**^[9] (2005), **Rawat J et al**^[10] (2009), **Saket RK et al**^[11] (2016), **Yadav D et al**^[4] (2016) and **Parvaiz AK et al**^[11] (2010).

In our study there is evidence of a strong association between the occurrence of smoking and squamous cell carcinoma. Similar results were obtained in study by **Krishnamurthy A et al**^[12] (2012) and **Arora VK et al**^[13] (1990).

Our study showed that adenocarcinoma is commonly seen in non- smokers. This is in agreement with the study by **Dey A et al**^[14] (2012), **Behera D et al**^[15] (2004), **Shetty CM et al**^[9] (2005) and **Krishnamurthy A et al**^[12] (2012).

Cough is the most common presenting complaint among patients in our study (86.79 %) followed by loss of appetite (60.37), loss of weight (58.49 %) and chest pain (52.83 %). This is concordance with study by **Saket RK et al**^[11] (2016) **Yadav D et al**^[4] (2016), **Hathila N et al**^[2] (2016), **Quamrul M et al**^[16] (2010).

Tumour Characteristics

In our study it was found that the lesions were slightly more peripherally located (52.83 %) and the rest were found in a central location (47.17 %). This is in concordance with the study done by **Vigg A et al**^[17] (2003), **Dr Adaikkalavan C et al**^[18] (2017), **Biswas P et al**^[8] (2016) and **Narayanswami I et al**^[3] (2015) where peripheral lesions are found to be more common than central lesions.

60.38% of cases in our study have a spiculated contour which is concordance to the study by **Shetty CM et al**^[9] (2005), **Dr. Adaikkalavan C et al**^[18] (2017), **Yadav D et al**^[4] (2016) and **Biswas P et al**^[8] (2016).

All 100 % cases showed heterogeneous contrast enhancement. This is concordance with the study by **Dr Adaikkalavan C et al**^[18] (2017), **Hathila N et al**^[2] (2016) and **Shah D et al**^[7] (2017).

30.19 % of patients in our study had distant (extrathoracic) metastasis at the time of presentation. This is in concordance with the study by **Saket RK et al**^[11] (2016).

In our study the most common site for metastasis was seen to be liver (15.09 %) followed by bone (11.32 %). This is concordance with study by **Shah D et al**^[7] (2017), **Dr. Modi M et al**^[19] (2016) and **Sawhney M et al**^[20] (2017).

Mediastinal lymph node involvement was seen in 84.90% of cases with bronchogenic carcinoma in our study. Similar findings were seen in studies by **Yadav D et al**^[4] (2016).

In the present study, majority of patients were diagnosed at latter stage of disease. The majority of Bronchogenic carcinoma patients had advanced stage disease (IIIB and IV). Similar observation reported by **Prasad R et al**^[21] (2009), **Malik PS et al**^[6] (2013), and **Shah D et al**^[7] (2017).

Histopathology

In our study adenocarcinoma was seen to be the most common histological subtype accounting for 47.17% of cases. This is in concordance with the study by **Malik PS et al**^[6] (2013), **Krishnamurthy A et al**^[12] (2012), **Shad D et al**^[7] (2017), **Dr. Modi M et al**^[19] (2016) and **Dr. Babu S et al**^[5] (2016) which showed an increasing trend in the incidence of adenocarcinoma.

However, our findings are contrary to the studies done by **Dr. Adaikkalavan et al**^[18] (2017), **Rawat J et al**^[10] (2009), **Saket RK et al**^[11] (2016) and **Yadav D et al**^[4] (2016) which revealed that squamous cell carcinoma was the most common histological subtype followed by adenocarcinoma.

V. Conclusion

- CT is a highly sensitive and highly specific test and also has a high positive predictive value to diagnose Bronchogenic carcinoma.
- Multi Detector Computed Tomography has a high positive predictive value suggestive of great diagnostic accuracy in the evaluation of Bronchogenic Carcinoma.
- There is significant correlation with the MDCT diagnosis of Bronchogenic carcinoma with that of histopathology.
- Computed tomography is the most sensitive and non-invasive imaging modality that provides valuable information of the tumor characteristics and its extent.
- MDCT is a useful tool in the staging of Bronchogenic Carcinoma.

Case-1

70 year old male patient presenting with cough with hemoptysis and weigh loss since last one year.

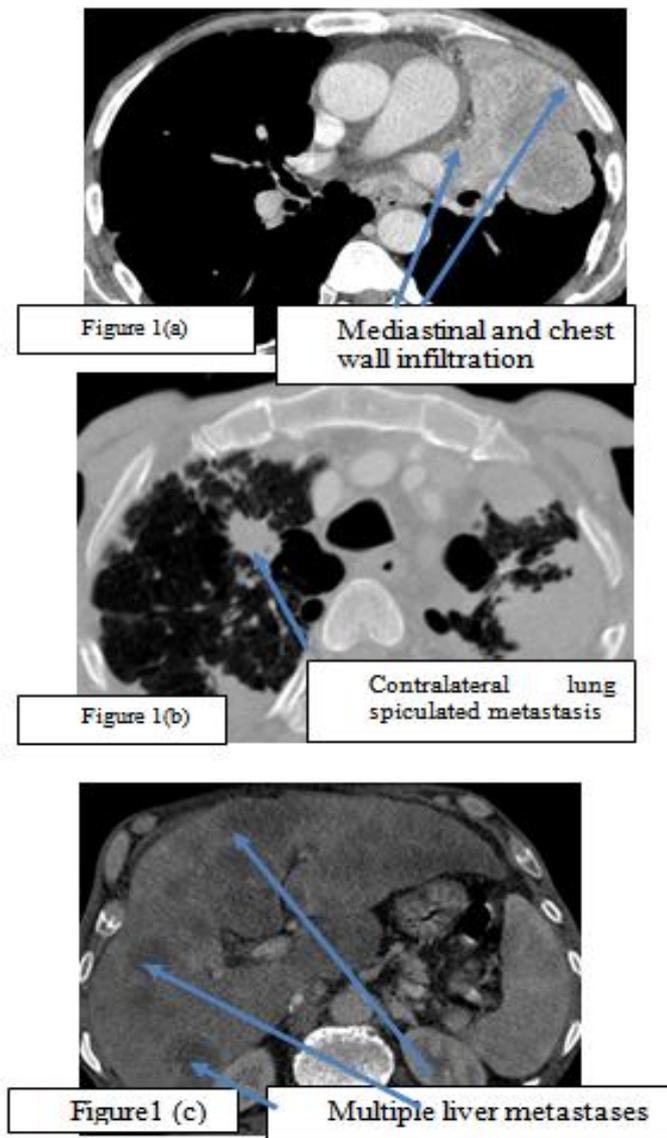
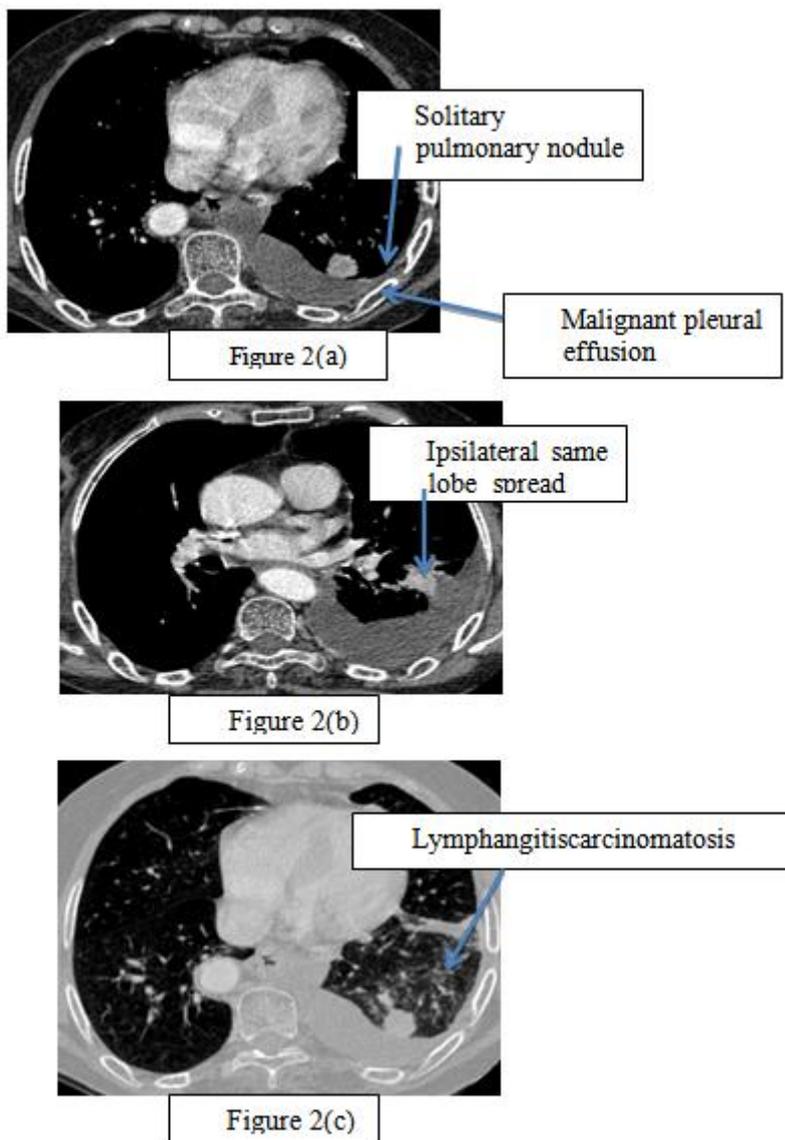


Figure: 1

(a).Contrast enhanced CT chest axial scan showing chest wall and mediastinal invasion by mass.
(b).CECT chest axial view lung window showing contralateral lung metastasis as spiculated nodular margin.
(c). in same patient CECT abdomen showing multiple diffuse liver metastases.
On HPE, mass was diagnosed as adenocarcinoma lung.

Case-2

64 years female came with cough, loss of appetite, chest pain and fever since 3 months.



- (a). CECT chest axial view showing solitary pulmonary nodule along with ipsilateral malignant pleural effusion.
(b). CECT chest axial view showing spread of lesion in ipsilateral lung lobe.
(c). CECT chest lung window showing lymphangitic carcinomatosis spread of malignancy.
On HPE, mass was diagnosed as adenocarcinoma

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