Faridpur Med. Coll. J. 2014;9(1):37-41

Original Article

Role of CT scan in the Evaluation of Lung Tumor with Cytopathilogical Correlation

MS Hoque[1], MA Hashem[2], S Hasan[3], AB Siddique[4], A Hossain[5], M Mahbub[6], MIA khan[7]

Abstract :

Lung cancer is an important & widespread disease that contributes a major health problem worldwide. Lung cancer kills over 1 million people per year. Cigarette smoking is the major cause of lung cancer. CT scan is the principal radiological examination adjunct to X-Ray chest examination in diagnosis & management of lung cancer. The main Objective of the study was to assess the diagnostic usefulness of CT scan in evaluating & characterize the different types of lung tumors and to correlate CT findings of lung tumors with that of cytopathology. This study was carried out in the department of Radiology & Imaging, Dhaka medical college hospital, Dhaka during the period from 1st January 2007 to March 2008. It was a cross sectional study. Total 51 patients were selected conveniently, detailed history particularly symptoms related to lung tumors was carefully elicited to obtain maximum possible information regarding the illness. Possible diagnosis was established by the combination of history, physical examination, laboratory & radiological investigations. Then patients were underwent CT examination of lung. Cytopathological sample were obtained from the lesion by guided aspiration. Collected FNAC samples were send for cytopathology & collected reports were compared with CT scan reports. Sensitivity of CT to diagnose lung tumor was 97.4%, specificity 76.9% & accuracy 92.2 %.

Key words : Lung tumor, CT Scan.

Introduction :

Extensive epidemiologic data clearly establish cigarette smoking as the major cause of lung cancer. It is estimated that about 90% of male lung cancer death & 70 - 80 % of lung cancer death in the US are caused by smoking each year[1].

Ninety percent of patients with lung cancer of all histological types are current or former cigarette smokers. Several established or suspected human carcinogens are present in the work environment & it is estimated that 3% to 17% of lung cancers are occupationally related[2].

In 1878, malignant lung tumor represented only 1% of all cancer seen at autopsy in the institute of pathology of the University of Dresden in Germany. By 1918, the percentage had risen to almost 10% & by 1927 to more than 14%. Duration of the disease, from being recognized until death, was usually from half a year to 2 year & in practically all cases there had been a long history of chronic bronchitis[3].

In general nodules with Hounsfield number greater than +175 can be presumed to be calcified. Nodes less than 1.0 cm in diameter are considered as normal, 1.0 - 1.5 cm suspicious for tumor and greater than 1.5 cm have a high probability of being malignant. Node size however, is dependent on location in the mediastinum and whether infection is present in the lung. Size criteria alone should not be used to deny surgery[4].

1. Dr. Mohammad Saiful Hoque, MBBS, MPhil (Radiology & Imaging), Assistant Professor, Department of Radiology, Diabetic Association Medical College, Faridpur.

2. Prof. DR. Muhammad Abu Hashem, MBBS, DMRD, Professor & Head of the Department of Radiology. Diabetic Association Medical College, Faridpur.

3. Dr. Sumaiya Hasan, MBBS, MPhil (Radiology & Imaging), Consultant Radiologist, Ibne Sina Imaging Center, Dhanmondi, Dhaka.

4. Dr. Abu Bakor Siddique, MBBS, MPhil (Radiology & Imaging), Assistant Professor, National Institute of Ophthalmology & Hospital, Dhaka.

5. Dr. Akhter Hossain, MBBS, MPhil (Radiology & Imaging), Assistant Professor, Sylhet MAG Osmany Medical College, Sylhet.

6. Dr. Mahfuja Mahbub, MBBS, MPhil (Radiology & Imaging), Assistant Professor, National Institute of Ophthalmology & Hospital, Dhaka.

7. Dr. Md. Isahaque Ali Khan, M.B.B.S. (Dhaka) D-Card (DU), Assistant Professor (Cardiology), Diabetic Association Medical College, Faridpur.

Address of correspondence :
Dr. Mohammad Saiful Hoque, MBBS, MPhil (Radiology & Imaging), Assistant Professor, Department of Radiology, Diabetic Association Medical college, Faridpur. Mobile 01761523820,
E-mail: drsaif.hoque@yahoo.com

If CT for lung cancer screening becomes widely practiced, we expect an early diagnosis of bronchogenic carcinoma will be dramatically rise and significantly reduce the death rate from this potential malignancy. In addition, computer aided diagnosis (CAD) systems can help to improve radiologists performance for detecting pulmonary nodules[5].

Bronchoscopy is the most useful investigation as it not only visualizes but can also provide tissue for cytopathological diagnosis[6].

Transthoracic FNAC is regarded as the most effective of cytological methods for diagnosis of lung cancer, in particular peripherally located tumour or large tumour[7].

Aim of the study was to assess, to determine and validate the diagnostic accuracy, sensitivity, specificity of CT scan in the evaluation of lung tumor.

Materials & Methods :

This cross sectional study was carried out among clinically suspected patients having lung tumor attended in the department of Radiology & Imaging, Dhaka Medical college hospital, Dhaka during January 2007 to March 2008. Patients unfit for FNAC were excluded. Total fifty one patients with lung tumour were selected conventionally & detailed history, particularly symptoms related to lung tumour are carefully elicited to obtain maximum possible information regarding the illness. Diagnosis was established by combination of history, physical examination, laboratory & radiological investigations. Then the patients were underwent CT examinations of lung. All CT scan were interpreted by investigators. Cytopathological sample were obtained from the lesion by guided aspiration. Collected FNAC samples were send for cytopathology & collected reports were compared with CT scan reports. All data were entered into computer & analyzed with the help of SPSS software programme.

Results :

Total 51 patients were selected with lung tumor diagnosed clinically & with chest X- ray. CT scan & cytopathological examination were done & correlated. Data regarding the CT, cytopathological findings and patient's information presented in tables.

Most common symptoms associated with suspected bronchogenic carcinoma of present series was chest pain observed in 48 (94.1%) patients, 46 (90.2%) patients had cough & 36 (70.6%) had anorexia. Haemoptysis was noted in 27 (52.9%). Weight loss was seen in 25 (49%) patients. Dyspnea, hoarseness, dysphagia, wheezing & horner's syndrome were noted 17.6%, 17.6%, 13.7%, 11.8% & 9.8%, respectively (Table I).

Table I: Clinical presentations of the patients (N-51)

Clinical presentations	Frequency (%)
Chest pain	48 (94.1)
Cough	46 (90.2)
Anorexia	36 (70.6)
Haemoptysis	27 (52.9)
Loss of weight	25 (49.0)
Fever	22 (43.1)
Dyspnea	9 (17.6)
Hoarseness	9 (17.6)
Dysphagia	7 (13.7)
Horner's synd	5 (9.8)

Maximum mass was detected in upper zones of right lung 13 (25.5%) followed by 10 (19.6%) on upper zones of left lung, 8 (15.7%) right mid zones, 6 (11.8%) left mid zones & only 4 (7.8%) had multiple zone involvement (Table II).

Table II: Location of lesion in X-ray.

Lung	Zone			
	Upper No (%)	Mid No (%)	Lower No (%)	Multifocal No (%)
Right	13 (25.5)	8 (15.7)	5 (9.8)	-
Left	10 (19.6)	6 (11.8)	5 (9.8)	-
Both	-	-	-	4 (7.8)

Total 80.4% patient had pulmonary opacity in x-ray, 76.5 % had hilar opacity, 23.5% had pleural effusion, widening of mediastinum & bone destruction, 11.8% had elevated hemidiaphragm & 2% had signs of collapse (Table III).

Table III: X-ray findings of patients (n- 51)

Findings	Frequency (%)
Pulmonary opacity	41 (80.4)
Hilar enlargement	39 (76.5)
Pleural effusion	12 (23.5)
Widening of mediastimum	12 (23.5)
Bone destruction	12 (23.5)
Elevation of hemidiaphragm	6 (11.8)
Collapse	1 (2.0)

On CT scan of chart- Among 51 patients the most common diagnosis was bronchogenic carcinoma, in 34 patients (66.7%). Consolidation found in 06 (11.8%) & tuberculosis was diagnosed in 04 patients (7.8%). Malignant cavitary lesion in 03 (5.9%) & metastasis in 01 (2%) patients. Alveolar cell carcinoma was diagnosed in 02 patients (3.9%). Non specific inflammatory change found in 01 (2%)

Table IV: CT diagnosis of different lung pathology. (n=51)

CT diagnosis	Frequency (%)
Bronchogenic carcinoma	34 (66.7)
Malignant cavitary lesion	03 (5.9)
Alveolar cell carcinoma	02 (3.9)
Metastasis	01 (2.0)
Tuberculosis	04 (7.8)
Pneumonic consolidation	06 (11.8)
Non Specific inflammatory changes	01 (2.0)
Total	51 (100)

Table V shows - Among 51 patients the most common diagnosed lung pathology was Squamous cell carcinoma 12(23.5%). Small cell carcinoma was diagnosed in 9(17.6%) patients. Metastasis & tuberculosis was in 2 (5.9%) patients.

Table V: Cytopathological diagnosis

Cytopathological diagnosis	Frequency (%)
Squamous cell carcinoma	12 (23.5)
Small cell carcinoma	09 (17.6)
Adenocarcinoma	08 (15.7)
Large cell carcinoma	07 (13.7)
Adeno-squamous carcinoma	02 (3.9)
Metastasis	03 (5.9)
Non specific inflammatory change	07 (13.7)
Tuberculosis	02 (3.9)
Tubercular granuloma	01 (2.0)
Total	51 (100)

Tables VI & VII shows - out of all patients, 37 cases were diagnosed as lung tumor by CT & confirmed by cytopathology, they were true positive. Three cases were diagnosed as lung tumor by CT but not confirmed by cytopathology, they were false positive. Of 11 cases of other lesions were diagnosed by CT, of which 1 was confirmed as bronchogenic carcinoma & 10 were as other lesions by cytopathology, they were false negative & true negative respectively. Chi square test was done to know the association between variables.

Table VI: Correlation of CT and cytopathological findings.

CT diagnosis	Cytopathological diagnosis	
	Positive	Negative
Lung tumor (40)	37 (true positive)	03 (false positive)
Others 11	01 (false negative)	10 (true negative)
Total 51	38	13

Table VII: Sensitivity, specificity, accuracy, positive negative predictive values

Validity tests	Percentage
Sensitivity	97.4%
Specificity	76.9%
Positive predictive value	92.5%
Negative predictive value	90.9%
Accuracy	92.2%

Sensitivity of CT to diagnose lung tumors was 97.4%, specificity 76.9%, positive predictive value 92.5%, negative predictive value 90.9% & accuracy 92.2%.

Discussion:

Surgical removal currently is the only reliable method of successfully treating bronchogenic carcinoma. Unfortunately, about 50% of patients with this disease have direct extension into the mediastinum, or mediastinal lymph-node metastases, at the time of initial diagnosis, which most physicians believe precludes attempts at curative resection. Preoperative identification of patients with mediastinal involvement could help to stage the disease better in the patients & possibly avoid the morbidity associated with thoracotomy. Both radiological & surgical procedures have been used in an attempt to identify both direct invasion & mediastinal lymph-node metastases prior to thoracotomy.

A variety of radiological procedures has been used to detect mediastinal involvement by bronchogenic carcinoma, all with inconstant success. Most have

lacked either sensitivity or specificity. Plain chest radiographs detect an abnormality in mediastinal contour in at most 75% of cases with mediastinal lymph-node metastases[10]. Conventional tomography, including sections of the hilum in oblique projections, is effective in disclosing hilar lymph-node enlargement but much less so in assessing the mediastinal nodes[11].

Computed tomography (CT) has several potential advantages over the conventional radiologic procedures, & it might permit more accurate staging & determination of respectability of bronchogenic carcinoma. The mediastinum as imaged on the transverse scans is free from overlapping shadows. Better contrast resolution usually permits separation of the neoplasm from the normal mediastinal fat & vascular structures. The presence & precise anatomic location of any enlarged mediastinal lymph-nodes can be determined, which will help the surgeon to decide whether medaistinoscopy or mediastinotomy would be high-yield procedures, or whether he should proceed directly to thoracotomy[9].

This prospective study was carried out with the aim to establish the usefulness of CT in preoperative clinical assessment of bronchogenic carcinoma & their cytopathological correlation along with its validity tests by calculating sensitivity, specificity, accuracy, positive predictive value, negative predictive value.

Out of 51 patients 29 were male & 22 were female with a male to female ratio was 1.32:1. This finding is compatible with Baron et al[8]. Their finding was 1.97:1.

Age range of all patients of present series was from 38 to 75 years and the mean age ± SD was 56.33 ± 10.09 years. Highest incidence of bronchogenic carcinoma 31.4% was found in 46 to 55 years age group followed by 29.4 % between 56 - 65 years. Statistical analysis of patients of both sexes revealed that male patients had significantly higher age distribution than female (p value < 0.001). Mean age of male was 60.38 years with SD ± 9.09 whereas female was 51.0 years with SD ± 8.94 years. Median age of both male & female was 60 & 49 years respectively. These findings are nearly similar to Bhuihan et el where mean age of the study subject was 60.74 ± 13.02 years. Male 61.7 ± 12.8 and female 55.0 ± 13.9 years[9].

Among the study population, 47.1% patients were smoker & 43.1% were non smoker & 9.8% were ex smoker. Mean duration of smoking of present smoker group was 29 years. Persons with history of smoking showed a risk of having bronchogenic carcinoma 1.7 times higher than those of persons without smoking history (odds ratio=1.79 & 95% confidence interval=0.503-6.368 (p<0.001).

Most common symptom associated with bronchogenic carcinoma in present series was chest pain (94.1%), 90.2% had cough and 70.6% had anorexia. Haemoptysis was noted in 52.9%, weight loss by 49%. Dyspnea, hoarseness, dysphagia, wheezing and Horner's syndrome were noted 17.6%, 17.6%, 13.7%, 11.8% and 9.8% respectively.

Out of 51, 36 (92.3%) patients of bronchogenic carcinoma & 3 (7.7%) of other lesions had hilar enlargement. Other common CT findings were mediastinal enlargement, chest wall invasion, bone destruction contrast enhancement etc.
Among 51, 12(23.5%) patients were diagnosed histologically as squamous cell carcinoma. Small cell carcinoma was diagnosed in 9 (17.6%) patients, adenocarcinoma in 08 (15.7%), large cell carcinoma in 7 (13.7%) patients & non specific inflammatory lesion in same number of patients. Metastasis was present in 3 (5.9%). Adenosquamous carcinoma & tuberculosis was in 02 (3.9%) patients. Uddin and Akhtar found 157 cases (51.82%) of squamous cell carcinoma in their series followed by 19.14% small cell carcinoma, 13.86% adenocarcinoma, 7.26% large cell carcinoma, 6.6% undifferentiated carcinoma, 0.66% bronchioalveolar carcinoma, 0.33% adenosquamous carcinoma & 0.33% malignant fibrous histocytoma[12]. Among the lung cancer cases squamous cell carcinoma was predominating (41.1%), next small cell carcinoma (30.4%), 10.8% patients had adenocarcinoma and only one had adenosquamous cell carcinoma in a study conducted by Quiyyum et al[13]. Hasanat et al described histological pattern of their study population of lung cancer. They found 45% squamous cell carcinoma, 23.4% small cell carcinoma, 21.5% adenocarcinoma, 6.3% large cell carcinoma, 0.3% adenosquamous cell carcinoma, 0.7% alveolar cell carcinoma and 0.3% fibrocytoma[17]. Shetty et al found 44.4% of their patients had squamous cell carcinoma, 18.5% had adenocarcinoma, 17.2% small cell carcinoma, 9.8% large cell carcinoma, 2.4% bronchiolo-alveolar carcinoma[19]. Gupta et al found 42% squamous cell carcinoma, 36% adenocarcinoma, 25% small cell carcinoma, 6% large cell carcinoma, 2% bronchiolo-alveolar cell carcinoma[16].

Out of all patients, thirty seven cases were diagnosed as bronchogenic carcinoma by CT and confirmed by cytopathological evaluation. They were true positive. Three cases were diagnosed as bronchogenic carcinoma by CT but not confirmed by cytopathological findings. They were false positive. Of 11 cases of other lesions, which were diagnosed by CT, 5 were confirmed as bronchogenic carcinoma and 10 were other lesions by cytopathology. They were false negative and true negative respectively. Chi square test was done to know the association between variables (CT and histopathological findings).

Sensitivity of CT to diagnose bronchogenic carcinoma was 97.4%, specificity 76.9%, positive predictive 92.5%, negative predictive value 90.9% and accuracy 92.2%. Colice et al found that CT was a moderately accurate modality in predicting the presence of air way abnormalities with sensitivity from 63 to 85% and specificity from 61-77%[14]. Mayr et al evaluated the bronchial lumen on CT scans. Observer A of their study classified 341 and observer B classified 327 bronchi as narrowed or occluded. In each of those bronchi the narrowing was caused by a mass in the bronchial wall or by a mass not separable from the bronchial wall. Observer A identified 1,386 and observer B identified 1,390 bronchi as having a normal lumen: Concerning the width of the bronchial lumen, a sensitivity of 94% and a specificity of 99% were calculated for observer A and a sensitivity of 91% and a specificity of 99% were calculated for observer A and a sensitivity of 91% and a specificity of 99% were calculated for observer B[18]. The overall sensitivity and specificity of CT scan in the detection of tracheobronchial malignancies were 59% and 85% as stated by Finkelstein et al[15].

Conclusion :

CT findings of the present study correlated well in most of the cases with the cytopathological results. It can therefore be concluded that CT scan is useful modality in the evaluation of lung tumour.

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