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ORIGINAL ARTICLE

Association of CT Scan Finding of Bronchial Carcinoma with Fiber Optic Bronchoscopy

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Abstract:

Background: *Bronchoscopy is highly sensitive investigation for patients with suspected lung malignancy. Beside histology, a cytological diagnosis is also possible with the help of bronchoscopy.*

Objective: *The main objective of the present study was to evaluate the effectiveness of fiber optic bronchoscopy and CT in the diagnosis of bronchial carcinoma.*

Methods: *This cross sectional study was conducted in the Department of Pathology and Department of Respiratory Medicine, National Institute of Diseases of the Chest & Hospital, Mohakhali, Dhaka, between January 2019 and December 2019. Patients in whom an endoscopically visible lung mass and who had a definite cytological or histological diagnosis of lung cancer were included in the study. The diagnosis of pulmonary malignancy could have been established by bronchoscopy. Out of total 50 patients with suspected bronchial carcinoma were included in the study. A detailed clinical history, physical examinations was done before hand and necessary investigations were also done. Selected patients with chest x-ray and CT scan and clinical findings consisting with lung cancer were subjected for flexible fiberoptic video bronchoscopy after obtaining well informed written consent.*

All flexible bronchoscopies were carried out or supervised by the same bronchoscopist using the Olympus BF-1T150 fiberoptic bronchoscope. Collected data were compiled and appropriate analyses were done by using computer based software, Statistical Package for Social Sciences (SPSS) version 23.0.

Results: *In this study 50 patients with bronchial carcinoma, majority 25 (50.0%) patients belonged to age 41 to 60 years, male: female ratio was 3.5:1. All 50(100.0%) patients were presented with cough followed by 43(86.0%) with fever, 39(78.0%) with haemopytysis, 38(76.0%) with weight loss and 36(72.0%) patients presented with chest pain. Regarding pathologic findings, 18(36.0%) patients was found were squamous cell carcinoma followed by 11(22.0%) were small cell carcinoma, 10(20.0%) were adenocarcinoma and 5(10.0%) were large cell carcinoma. In radiographic findings, 18(36.0%) patients was found in lobar collapse followed by 13(26.0%) were pulmonary masses, 11(22.0%) were pulmonary consolidation, 6(12.0%) were unilateral hilar disease and 2(4.0%) in mediastinal/subcarinal*

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disease. The validity of CT findings evaluation for malignancy was correlated by calculating sensitivity 82.2%, specificity 60.0%, accuracy 80.0%, positive predictive value 94.9% and negative predictive value 27.3%.

Conclusion: *Our results show that lung cancer diagnosis is essentially achieved by CT and bronchoscopic techniques. The association of bronchoscopy and CT is useful in the accurate diagnosis of lung cancer, since the occurrence of false-positive results of CT is minimized, improving the specificity of the method. On the other hand, the utilization of CT to detect the presence of peripheral lesions, which increase the incidence of false-negative results of bronchoscopy, allows a better descission for the OT predictive diagnosis of lung cancer which occasionally gives false positive result is minimized & improved by combination with FOB, increasing the diagnostic accuracy.*

Key words: *Fiber Optic Bronchoscopy, Bronchial Carcinoma, CT.*

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Introduction:

Bronchogenic carcinoma is a primary tumor of lung. Lung cancer is one of the leading fatal malignancies worldwide both in male and female subjects. Primary lung cancer is a leading cause of carcinoma related deaths for both men and women in the developed and developing countries. They are subdivided into four main cell types: squamous cell carcinoma, small-cell carcinoma, adenocarcinoma, and large-cell carcinoma.[1] The incidence and mortality of primary lung cancer began its inexorable rise in the late ninetieth decade. 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.[2] The other causative factors are some industrial materials, particularly asbestos and rising air pollution. Chest computed tomography (CT) plays a relevant role in the determination of presence and extent of lung cancer, demonstrating the size and site of the tumor. However, this method presents some limitations such as high cost, utilization of ionizing radiation, contrast agent nephrotoxicity, besides the necessity of further procedures to confirm the diagnosis.[3] The CT indispensability in the study of lung cancer is associated with the obligatoriness of endoscopy of the respiratory tract with flexible endoscope. Endoscopic signs of cancer are quite variable, from a simple bright loss in a small region of the bronchial mucosa to a typical vegetative mass. Classically, three types of typical lesions or direct signs of tumor are taken into consideration: mass, infiltration and obstruction. The techniques associated with bronchofibroscopy include bronchial wash and brush cytology and bronchial biopsy.[4-6] Fiberoptic bronchoscopy is a procedure that allows a clinician to examine the breathing passages (airways) of the lungs. Fiberoptic bronchoscopy can be either a diagnostic procedure (to find out more about a possible problem) or a therapeutic procedure (to try to treat an existing problem or condition). The bronchoscope is now being used with lasers to help remove and destroy tumor in the lungs. Sometimes, probes can be passed through the scope to freeze bleeding sites or to shrink the tumors.[7] The prognosis of lung cancer is unfavorable, early diagnosis plays an important role in increasing survival in lung cancer patients.[8] The use of various methods can contribute to early diagnosis. Among the most commonly used methods are imaging tests (chest X-ray and CT), sputum cytology, and fiberoptic bronchoscopy. Fiberoptic bronchoscopy is currently considered the primary method for evaluating the tracheobronchial tree in patients with suspected lung cancer.[9] In addition to allowing visualization of the lesion, the method allows the collection of cytological specimens (by bronchial lavage and bronchial brushing) and histological specimens (by endobronchial biopsy and transbronchial biopsy). However, bronchoscopists can face difficulties in describing endobronchial lesions. Such lesions range from a devitalized area showing loss of natural luster to gross presentations of large

exophytic masses obstructing the bronchial lumen. The description of images as seen under the cold light of the endoscope is subjective, reflecting the variability to which any scientific observation is subject. Fiberoptic bronchoscopy reports show a bias in description: the same lesion can be described with different words, and the cold light of the endoscope can cause artifacts (as it often does). In addition, at best, examiners recognize endoscopic signs of malignancy, but no histopathological diagnosis can be presumed from the results of the test.[10] The main objective of the present study was to evaluate the effectiveness of fiber optic bronchoscopy and CT in the diagnosis of bronchial carcinoma.

Materials and methods:

This cross sectional study was conducted in the Department of Pathology and Department of Respiratory Medicine of National Institute of Diseases of the Chest & Hospital, Mohakhali, Dhaka, between January 2019 and December 2019. The diagnosis of pulmonary malignancy could have been established by fiber optic bronchoscopy. Out of total 50 patients with bronchial carcinoma were included in the study. In this study all patients with suspected lung cancer and subjected to fiber optic bronchoscopy were recruited in the study after taking informed consent. A detailed clinical history, physical examinations was done before hand and necessary investigations were carried out for example chest radiography, CT scan of chest, haematological examination, sputum for AFB, etc. Patients with HIV AIDS were excluded from the study. Children less than 18 years of age, patients who did not give consent for the study and patients who had absolute contraindications for performing fibreoptic bronchoscopy were excluded from the study. Fiber optic bronchoscopy and CT studies were considered as either negative or positive according to the data included in the respective reports. Fiber optic bronchoscopy studies and the subsequent reports preparation were performed by a pulmonologist. On average, a two-day time interval was observed between the performance of CT studies and fiber optic bronchoscopy. It is important to mention that chest, upper abdomen and skull CT and fiber optic bronchoscopy were performed for the disease staging. FOB was done in all of these patients through transnasal route. Bronchoscope used was Pentax adult bronchoscope, model no FB-15P. After proper visualization of the tracheobronchial tree to exclude endobronchial growth, mucosal irregularities, ulceration or external compression, BAL fluid was taken from every patient. Bronchitis was diagnosed by bronchoscopic evidence of inflammation in the wall that is redness and edema involving multiple segments with mucosal biopsy report suggesting non specific bronchitis. Collected data were compiled and appropriate analyses were done by using computer based software, Statistical Package for Social Sciences (SPSS) version 23.0. Qualitative variables were expressed as percentage.

Results:

In this study 50 patients with bronchial carcinoma, majority (50.0%) patients belonged to age 41 to 60 years, 39(78.0%) patients were male with male: female ratio was 3.5:1, 39(78.0%) were married and 28(56.0%) were cultivator (Table-1). All (100.0%) patients were found in cough followed by 43(86.0%) in fever, 39(78.0%) in haemopytysis, 38(76.0%) in weight loss and 36(72.0%) in chest pain (Table-2). Twenty (40.0%) patients had COPD, 6(12.0%) had hypertension, 4(8.0%) had diabetes mellitus and 2(4.0%) had SOL in liver (Table-3). In pathologic findings, 18(36.0%) patients was found in squamous cell carcinoma followed by 11(22.0%) in small cell carcinoma, 10(20.0%) in adenocarcinoma and 5(10.0%) in large cell carcinoma (Table-4). In radiographic findings, 18(36.0%) patients was found in lobar collapse followed by 13(26.0%) in pulmonary masses, 11(22.0%) in pulmonary consolidation, 6(12.0%) in unilateral hilar disease and 2(4.0%) in mediastinal/subcarinal disease (Table-5). CT findings evaluation for malignancy, true positive 37 cases, false positive 2 cases, false negative 8 cases and true negative 3 cases in identification by FOB findings (Table-7). The validity of CT findings evaluation for malignancy was correlated by calculating sensitivity 82.2%, specificity 60.0%, accuracy 80.0%, positive predictive value 94.9% and negative predictive value 27.3% (Figure-1).

Table-I

Demographic characteristics of the study patients (n=50)

	Frequency	Percentage
Age (years)		
≤40	18	36.0
41-60	25	50.0
>60	7	14.0
Sex		
Male	39	78.0
Female	11	22.0
Marital status		
Married	39	78.0
Unmarried	9	18.0
Widow	2	4.0
Occupational status		
Cultivator	28	56.0
Housewife	8	16.0
Service	7	14.0
Business	5	10.0
Driver	1	2.0
Others	1	2.0

Table-II

Complaints of the study patients (n=50)

Complaints	Frequency	Percentage
Cough	50	100.0
Fever	43	86.0
Haemopytysis	39	78.0
Weight loss	38	76.0
Chest pain	36	72.0
Smoker	33	66.0
Breathlessness	28	56.0

Table-III

Co-morbidity of the study patients (n=50)

Co-morbidity	Frequency	Percentage
COPD	20	40.0
Hypertension	6	12.0
Diabetes mellitus	4	8.0
SOL in liver	2	4.0

Table-IV

Pathologic diagnoses of the study patients (n=50)

	Frequency	Percentage
Malignant diseases		
Lung cancer (n=44)		
Adenocarcinoma	10	20.0
Large cell carcinoma	5	10.0
Squamous cell carcinoma	18	36.0
Small cell carcinoma	11	22.0
Metastatic cancer (n=1)		
Colon	1	2.0
Inflammatory diseases (n=5)		
Tuberculosis	3	6.0
Mucous plug	1	2.0
Pneumonia	1	2.0

Table-V

Radiographic findings of the study patients (n=50)

	Frequency	Percentage
Parenchymal disease (n=42)		
Pulmonary masses	13	26.0
Pulmonary consolidation (segmental/subsegmental)	11	22.0
Lobar collapse	18	36.0
Mediastinal and hilar disease (n=8)		
Unilateral hilar disease	6	12.0
Mediastinal/subcarinal disease	2	4.0

Table-VI

Relation of pathologic diagnoses with radiographic findings (n=50)

Pathologic diagnoses	**Radiographic findings**				
	Pulmonary masses	Lobar collapse	Unilateral hilar disease	Mediastinal/ subcarinal disease	Pulmonary consolidation
Adenocarcinoma	5	2	1	0	2
Large cell carcinoma	2	1	1	0	1
Squamous cell carcinoma	4	9	2	1	2
Small cell carcinoma	1	5	2	0	3
Colon	0	0	0	1	0
Tuberculosis	0	1	0	0	2
Mucous plug	0	0	0	0	1
Pneumonia	1	0	0	0	0

Table-VII

Comparison between CT findings and FOB findings evaluation for malignancy

CT findings	FOB findings	
	Positive(n=45)	Negative(n=5)
Positive (n=39)(suggestive)	37(True positive)	2(False positive)
Negative (n=11)(Not suggestive)	8(False negative)	3(True negative)

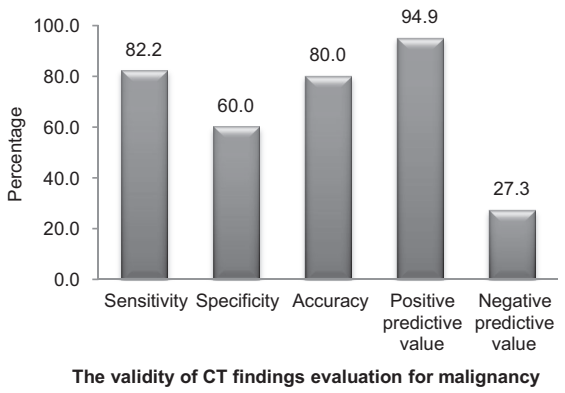

Fig.-1: *Bar diagram showing the validity of CT findings evaluation for malignancy*

Discussion:

A common problem in clinical practice is high-risk patients presenting with symptoms compatible with lung cancer. The first step in the diagnosis of a suspected lesion is the imaging of the chest. Chest CT scan is a valuable tool which has demonstrated high sensitivity and specificity rates. Over the years, various advanced techniques have been developed aiming to a more detailed assessment of the lungs and chest, using 2-D and 3-D reconstruction algorithms.[11] With these techniques, a clinician can interpret more accurately the information obtained by the axial CT.[12] Although chest CT can offer valuable information for suspected endobronchial lesions, fiberoptic bronchoscopy (FOB) usually represents the first choice diagnostic modality for the accurate diagnosis.[13,14]

In this study out of total 50 patients with bronchial carcinoma, half (50.0%) of the patients belonged to age 41 to 60 years. Hathila and Goswami[1] reported that the maximum prevalence of bronchogenic carcinoma was seen between 60–69 years of age (50.76%). Oliveira and Saraiva[15] observed that the mean age was found 66.24 years. Rabahi et al.[10] also documented that the mean age was 66 years (range, 34-88 years) for the male patients and 64 years (range, 14-89 years) for the female patients.

In the present study 39(78.0%) patients were male with male: female ratio was 3.5:1. Oliveira and Saraiva[15] consisted that 23(62.2%) patients were male and 14(37.8%) were female, male-female ratio was 1.6:1. Studies in the literature report that male individuals are most affected by lung cancer, despite the increase observed in the number of cases among women in the last decades.[16,17] Hathila and Goswami[1] also found that male patients were predominance, that was (90.76%).

Regarding complaints in this study, all (100.0%) patients were found in cough followed by 43(86.0%) in fever, 39(78.0%) in haemopytysis, 38(76.0%) in weight loss and 36(72.0%) in chest pain. Oliveira and Saraiva[15] consisted that most of the patients smoked or had ever smoked, corresponding to 55.7% (n = 39), while the number of the non-smoking ones corresponded to 44.3% of the whole study sample. Another study conducted by Hathila and Goswami[1] where they observed of the total 65 patients, 60 (92.31%) patients showed positive smoking history. The most common complaint was cough with expectoration (93.84%). The other common complaints were weight loss (81.53%), anorexia (67.69%) and chest pain (56.92%).

Regarding pathologic findings in this study, 18(36.0%) patients was found in squamous cell carcinoma followed by 11(22.0%) in small cell carcinoma, 10(20.0%) in adenocarcinoma and 5(10.0%) in large cell carcinoma. In a study done by Oliveira and Saraiva[15] where they found histologically 40.54% were adenocarcinoma, followed by squamous carcinoma (32.43% cases) and small-cell lung cancer (18.92%). Rabahi et al.[10] also reported that 199 were evaluated for tumor histological type and the results were as follows: squamous carcinoma in 39%, adenocarcinoma in

21%, small cell carcinoma in 12% and large cell carcinoma in 1%.

In this study radiographic findings, 18(36.0%) patients was found in lobar collapse followed by 13(26.0%) in pulmonary masses, 11(22.0%) in pulmonary consolidation, 6(12.0%) in unilateral hilar disease and 2(4.0%) in mediastinal/subcarinal disease. Naidich et al.[18] had observed that only limited conclusions can be drawn concerning the potential of CT as a screening procedure. As discussed previously, in this series all cases with positive FOB had correspondingly abnormal chest radiographs. From this select population it can be concluded that CT may be of value as a screening technique. The airways were interpreted as normal in only five of 64 cases in which focal disease was identified at FOB. This suggests that CT may provide adequate screening in patients for whom bronchoscopy is either contraindicated or refused. In their opinion these results also support selective use of CT in screening patients for whom there is a low clinical suspicion of endobronchial disease, especially in young patients presenting with either infection or hemoptysis.[19,20] Another study conducted by Hathila and Goswami[1] where they found 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%).

In this study CT findings evaluation for malignancy, true positive 37 cases, false positive 2 cases, false negative 8 cases and true negative 3 cases in identification by FOB findings. Naidich et al.[18] studied observed that CT detected 59 of 64 cases confirmed to be abnormal by FOB. For individual airways, CT identified 88 (90%) of 98 lesions visualized bronchoscopically. CT incorrectly predicted the presence of focal airway disease in only three of 38 cases subsequently confirmed as normal at FOB. Among 24 patients who had FOB, a total of 40 abnormalities were detected either by CT or bronchoscopy. In 25 of 40 cases there was general agreement between CT and FOB.[21] In three, CT failed to detect lesions identified at FOB, including one case in which tumor involved the middle lobe bronchus in a patient with distal atelectasis. In 12 cases, CT detected abnormalities not seen at FOB. This included three cases in which the lesion was distal to a proximally abnormal bronchus verified by FOB and two cases in which the CT abnormality was confirmed by bronchial washings obtained at the site of the specified airway. Unfortunately, in seven cases there was no pathologic confirmation, making an accurate determination of sensitivity difficult. Colice et al.[22] studied the potential role of CT by retrospectively comparing scans with bronchoscopic findings in 53 patients with known or suspected lung cancer. The authors reported considerable interobserver variation with sensitivities ranging from 63% to 85% and negative predictive values ranging from 67% to 80%. Oliveira and Saraiva[15] reported that among the 42 CT studies interpreted as positive, 30 (71.4%) corresponded to a positive diagnosis of lung cancer, and 12 (28.6%) corresponded to a negative diagnosis of the disease. As regards the 28 tomographic studies interpreted as negative, 21 (75%) really corresponded to absence of lung cancer, while 7 (25%) ended up demonstrating the presence of disease. In these 7 cases, the final diagnosis was achieved by means of bronchial biopsy in 6 cases, and by means of transthoracic biopsy in 1 case.

The validity of CT findings evaluation for malignancy in this study was correlated by calculating sensitivity 82.2%, specificity 60.0%, accuracy 80.0%, positive predictive value 94.9% and negative predictive value 27.3%. Oliveira and Saraiva[15] reported that the CT sensitivity was of 81.1%, specificity, 63.6%, and accuracy, 72.8%. False-positive results corresponded to 36.4% and false-negative results, to 18.9%. Another study conducted by Choe et al.[23] where they found the diagnosis compatibility was 95.8% and 59.7% by CT and FOB respectively. The diagnosis compatibility in cases with central airway disease was 96.3% and 100.0% by CT and FOB respectively. CT has higher sensitivity and diagnostic compatibility than FOB for identifying the causes of hemoptysis and is more helpful for patients with hemoptysis from parenchymal or airway disease.

Conclusion:

Lung cancer diagnosis is essentially achieved by CT and bronchoscopic techniques. The association of bronchoscopy and CT is useful in the accurate diagnosis of lung cancer, since the occurrence of false-positive results of CT is minimized, improving the specificity of the method. On the other hand, the utilization of CT to detect the presence of peripheral lesions, which increase the incidence of false-negative results of bronchoscopy, allows a better management of patients, increasing the diagnostic accuracy. Bronchoscopic technologies are the safest and most precise apparatus to assess both central and distal airway mucosa. The association of these two methods, besides the discussion between pulmonologists and radiologists constitute the best approach for lung cancer patients. Proper screening and early diagnostic methods should be applied on a large scale to find out suspected patients who are at risk of developing lung cancer.

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