Efficacy of Bronchial Brushings and Trans-Bronchial Needle Aspiration in Diagnosing Carcinoma Lung

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Abstract

Bronchial brushing (BB) and the more recent trans-bronchial needle aspiration (TBNA) are well established techniques performed using flexible fiberoptic bronchoscope, for sampling trachobronchial lesions suspected of malignancy. Our aim was to assess the efficacy of these two techniques in diagnosing carcinoma lung, when used individually as well as in combination, taking bronchial biopsy as the "Gold Standard" diagnostic test. Of all the cases of suspected lung cancer received between 1st January 2003 to 30th September 2004, 181 cases were selected where flexible bronchoscopic samples of BB, TBNA as well as bronchial biopsy were taken. Samples were processed as per standard procedures of cytology and histology. Squamous cell carcinoma was the most common lung cancer followed by small cell type. Sensitivity of BB was 81.5%; while that of TBNA was 62.5%. Specificity of BB and TBNA was 77.8% and 66.7%, respectively. Efficacy of BB was better than TBNA in diagnosing lung cancers. Combined use of BB and TBNA showed better sensitivity and accuracy than either techniques used individually. Bronchial brushing is a superior technique in the diagnosis of lung cancers than TBNA. Their combined use can further improve the chances of early detection of lung cancers.

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Key Words : Bronchial brushing, trans-bronchial needle aspiration, diagnostic efficacy, lung cancer.

Introduction

The introduction of flexible fiberoptic bronchofibroscope around 1970 revolutionized the cytology of respiratory tract.[1] Various broncho-pulmonary lesions, otherwise unreachable with rigid-body bronchoscope, became more easily accessible with this instrument. Techniques like bronchial brushings (BB), broncho-alveolar lavage and trans-bronchial needle aspiration (TBNA) became popular tools for obtaining diagnostic cytological material from various sites of the tracheo-bronchial passage. Today these cytological procedures constitute the most useful and least expensive investigative tools available for the detection of pulmonary diseases, especially lung cancer.[2]

Respiratory tract, continuously exposed to a wide variety of environmental factors, be it the various air-borne micro-organisms, natural allergens, or the wide variety of pollutants, in particular the products of combustion, like those in tobacco smoke and automobile exhaust fumes, suffers from a wide variety of infective, inflammatory and immunologic primary respiratory diseases, in addition to a variable degree of secondary involvement of respiratory system in virtually all terminally ill patients.[3]

Lung cancer accounts for most deaths from cancer, worldwide.[4] The present study attempts to compare the efficacy of BB and TBNA in diagnosing carcinomas of lung, amongst the patients visiting our hospital for their diagnosis and treatment.

Materials and Methods

From 1st January 2003 till 30th September 2004, cytological samples from tracheo-bronchial lesions suspected to be of carcinoma lung, were collected by BB and TBNA. Detailed history and various clinical and radiological findings were recorded. After excluding samples with inadequate cytological material, as well as cases of carcinomas metastasizing to lung, 181

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cases were included in the present study.

All samples were taken by the pulmonologist. Signed informed consent was taken from patients, after explaining the potential hazards of bronchoscopy and topical anaesthesia. Premedication with atropine was done routinely, the adult dose was 0.6 mg. morphine, given 20-40 min before the procedure in order to reduce euphoria, anxiety, and suppress coughing. 4% xylocaine was nebulised or 2% xylocaine was used as an aerosol spray.

Flexible fiberoptic bronchoscope (Olympus BF IT-30), was used to collect BB, TBNA samples as well as bronchial biopsy where possible. Bronchial brushings were smeared directly on to glass slides and wet-fixed in 95% ethanol. For TBNA, needle of 23 gauge was attached to the distal end of flexible wire of bronchoscope. Aspirated material was made into air-dried or wet-fixed smears. Bronchial biopsies were transferred to glass vials containing 10% formalin. Standard techniques for processing and preparation of histopathological sections were followed.[5]

Papanicolaou and Haematoxylin & Eosin stains were used for wet fixed smears and Leishman and May-Grünwald Giemsa stains for air-dried smears.[5] For biopsy sections, hematoxylin & eosin stains were used.[5]

Observations

In our study group (n=181), 51 cases (28.2%) were found to be positive for primary carcinomas of lung.

Table 1 shows age and sex-wise distribution of carcinomas (n=51). age-wise, maximum number of cases (n=17) were in the 61-70 years group followed by 14 cases in 51-60 years. No cases were recorded in age groups below 30 years and above 80 years. Amongst males largest number of cases (n=15) were in the age group of 61-70 years. Over all, males formed 88.2% (n=45) of all carcinoma cases. Only six females (11.8%) in our study group had carcinomas.

Table 2 shows cyto-morphological spectrum of bronchopulmonary carcinomas (n=51) amongst males and females. Overall male preponderance was seen, male to female ratio (M:F) being 7.5:1. Squamous cell carcinoma formed the largest morphological group (n=11/51 → 21.6%; M: F=10:1), followed by adenocarcinoma (n= 5/51 → 9.8%). Cytologically, 24 cases (47.1%) could be categorized only as poorly differentiated carcinomas. No benign tumours were detected.

Table 3 shows the diagnostic positivity of BB and TBNA techniques, individually as well as in combination; in terms of true positive, true negative, false positive and false negative cases. Only those cases were included where histological findings of bronchial biopsy were available for comparison. Combination of BB with TBNA showed better results than both techniques attempted individually.

Table 4 shows the various parameters of accuracy of BB and TBNA, as well as their combination (BB + TBNA), calculated from the data shown in Table 3.

BB showed better efficacy than TBNA, in terms of the various indices calculated, especially sensitivity, specificity and accuracy. However combination of the two techniques, BB and TBNA, for diagnosing lung carcinomas proved much superior to either technique attempted individually, in terms of sensitivity, positive

Table 1 : Age and sex wise distribution of carcinoma lung lesions (n=51)

Age (Years)	Total (%)	Male (%)	Female (%)
01-30	—	—	—
31-40	03 (6.0)	02 (4.4)	01 (16.6)
41-50	12 (23.5)	11 (24.4)	01 (16.6)
51-60	14 (27.4)	12 (26.7)	02 (33.4)
61-70	17 (33.3)	15 (33.4)	02 (33.4)
71-80	05 (9.8)	05 (11.1)	—
81 +	—	—	—
	51 (100)	45 (88.2)	06 (11.8)

Male : Female = 7.5 : 1 figures in parenthesis indicate percentage

Table 2 : Distribution of carcinomas according to cyto-morphology (n=51)

	Total	Male	Female	M:F Ratio
Squamous cell carcinoma	11	10	01	10:1
Adenocarcinoma	05	05	—	—
Small cell carcinoma	09	08	01	8:1
Large cell carcinoma	02	02	—	—
Poorly differentiated carcinoma	24	20	04	5:1
	51	45	06	7.5:1

Table 3 : Diagnostic positivity of various cytological techniques in carcinoma lung

	Total cases	Case compared with biopsy	TP	TN	FP	FN
BB	109	36	22	07	02	05
TBNA	48	19	10	02	01	06
BB+TBNA	24	14	11	01	01	01

T.P. = True positive, T.N.= True negative, F.P.= False positive, F.N.= False negative

Table 4 : Parameters of accuracy of various cytological techniques in malignant cases

S. No.	Parameter	Formula	BB	TBNA	BB+TBNA
1.	Sensitivity	$\frac{TP}{TP+FN}$ X 100	81.5	62.5	91.7
2.	Specificity	$\frac{TN}{TN+FP}$ X 100	77.8	66.7	50.0
3.	False positivity Index	$\frac{FP}{FP+TN}$ X 100	22.2	33.3	50.0
4.	False negativity Index	$\frac{FN}{FN+TP}$ X 100	18.5	37.5	8.3
5.	Positive predictive Value	$\frac{TP}{TP+FP}$ X 100	91.7	90.9	91.7
6.	Negative predictive Value	$\frac{TN}{TN+FN}$ X 100	58.3	25.0	50.0
7.	Accuracy	$\frac{TP+TN}{TP+TN+FP+FN}$ X 100	80.6	63.2	85.7

T.P. = True positive, T.N.= True negative, F.P.= False positive, F.N.= False negative. All figures are in percentage**.**

predictive value and accuracy, though specificity of this combination was lesser than both BB and TBNA.

Discussion

Lung cancer is the most common malignant disease worldwide; and is a major cause of death from cancer, particularly amongst males.[3,4,6] It was a rare disease until the beginning of 20th century and since then, the occurrence of lung cancer has increased rapidly.[6] The increase in tobacco consumption has been shown to be directly related to lung cancer.[3,4,6] Both number and duration of smoking affect cancer development and this holds good for people from all races, all over the World.[6]

In India, the prevalence of lung cancers shows much variability from one region to other. In a study published from Jammu, in 1993, lung was the most common site for malignancy.[7] Reports of National Cancer Registry Program of Indian Council of Medical Reserch, from Bhopal, Delhi and Mumbai, also show lung to be the top site for malignancy amongst males.[8] In our study, 28.2% cases (n=51/181), were found to be positive for primary carcinomas of lung, the male to female ratio being 7.5:1. Our Institute being the only multi-specialty hospital of the state receives a large number of cases with cancer in advanced stages. The increase in number of lung cancer patients in our study could be a reflection of this factor, in addition to other established causes, the over all low socioeconomic status[6] and highly prevalent habit of smoking bidi and cigarettes,[3,4,6] in the local population.

In our study, there were no cases with lung cancer in the age groups below 31 years of age, for both genders. In both men and women, the incidence of lung cancer has been reported to be low before the age of 40, after which it increased up to the age of 70 years.[6] Worldwide, males suffer from malignancies much more than females. According to WHO, for most part, differences in distribution (of malignancies) between both genders are attributable to differences in exposure to causative agents rather than variations in susceptibility.[6] Since a very large population of males indulges in smoking, they suffer more from lung cancer, compared to females.

Amongst cases that could be cytologically diagnosed on the basis of their morphological features, squamous cell carcinoma formed the largest group (21.6%) of all lung cancers in our study, with the male: female ratio of 10:1 (Table 2).

Studies have shown the incidence of squamous cell carcinoma of lung, to be around 29-30% on the basis of histology.[9,10] In our study, on the basis of histological biopsy, it was 28.1%, which is in accordance with the above mentioned studies. On the basis of cytology, 21.6% cases were categorized as squamous cell carcinoma. The reason for this lesser percentage of squamous cell carcinoma by cytodiagnosis could be due to the reason that 47.1% cases (n=24) of lung cancer could not be classified into any specific morphological category, on the basis of cytology, and thus were categorized as poorly differentiated carcinomas (Table 2). Adenocarcinoma of lung has been reported to be on the rise by many workers.[3,4,6,9,10] However in our study, small cell carcinoma formed the second large specific morphological group (17.6%) of lung cancer (Table 2). This could be a unique feature of the population of this region and needs further study.

Cytologically, 51 cases were reported as malignant, but only 36 cases of BB, 19 cases of TBNA and 14 cases where both BB and TBNA were done, were taken up for studying efficacy, as only in these cases the bronchial biopsy was available for comparison of results (Table 3). Based on their true positive, true negative, false positive and false negative results, sensitivity, specificity and other parameters of accuracy were calculated (Table 4).

In our study, the sensitivity of BB was reported as 81.5% (Table 4). Studies from various authors show the range of sensitivity for BB from 67% to 97.3%.[10-12] Shroff et al[12] have reported the sensitivity of BB as high as 97.3%. In a study by Samreung et al,[13] bronchial brushing was found to be the only promising cytological method with a sensitivity of 80% in comparison to other non-brush techniques. The specificity of BB in our study was 77.8% (Table 4). Bibbo et al[14] reported a higher sensitivity of 98% in their study, while none of the other authors have commented on the specificity of their studies.[10-13] In our study, the overall accuracy of BB was 80.6% (Table 4).

The sensitivity for TBNA in our study was 62.5% (Table 4). Other authors have reported sensitivity of TBNA from 51% to 85%.[15-17] TBNA allows sampling of mediastinal nodes as well as paratracheal masses producing narrowing of bronchi. This technique is beneficial for some parenchymal lesions located beyond the reach of biopsy forceps too.[16] Secondly, most often the malignant bronchial lesions are necrotic superficially, so this technique helps in deeper penetration by needle into the lesion and sample the viable cells of the tumour, which show better preserved morphology, helpful in diagnosis. However since TBNA is a "blind" procedure like other needle aspirates, sometimes aspirate might not be representative of the malignant lesion.[18] The specificity for TBNA in our study was 66.7% (Table 4). Other studies[15-18] included for comparison of our results did not comment upon the specificity of their studies, so comparison could not be made. The accuracy of TBNA in our study was 63.2% (Table 4).

Thus we observed that BB showed better sensitivity, specificity as well as overall accuracy in the diagnosis of lung malignancies, in comparison to TBNA (Table 4).

The combination of TBNA with BB technique for sampling bronchial lesions showed dramatic improvement in the diagnostic efficacy, increasing the sensitivity of BB from 81.5% to 91.7%; and its accuracy, from 80.6% to 85.7% (Table 4). The main advantage of this combination is that, whether the malignant lesion is epithelial or subepithelial, this combination yields more diagnostic cytological material in comparison to BB or TBNA used alone; in addition to better preservation of morphological features.[19,20] Other authors have reported a sensitivity of 69.2% to 72.0% for the combination of TBNA with BB.[19,20] Our sensitivity was higher than them. Apparently in this combination, the positive aspects of both procedures add up together, thereby reducing the chances of failure of the procedures, when performed on their own. This was evident by the superior positive predictive value (91.7%) and very low false negativity index (8.3%). The accuracy of BB and TBNA combination (85.7%) was again much better than either technique used separately. However the specificity of this combination was 50% only. Since the number of cases in this group was only 14, a larger study sample in this category would have been helpful in better interpretation of this parameter (Table 4).

Thus we found combination of TBNA with BB a very advantageous combination, which could be done in the same bronchoscopic procedure by the pulmonologist, saving valuable time otherwise lost in re-exploration and re-sampling, thus helping in the overall improvement of diagnosis and management of patients suffering from lung cancer.

Conclusion

Bronchial brushing is a better technique than TBNA in diagnosing lung cancer. If both techniques are used simultaneously, the efficacy of this combination in diagnosis of lung cancer proves much superior to either techniques used alone, probably by addition of their advantageous features, and reducing the chances of their failure, thereby helping in early diagnosis of lung cancer.

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