

# A Study of Cytological Evaluation of Bronchial Washing and Brushing In Bronchogenic Carcinoma

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**Abstract-** Bronchogenic carcinoma is undoubtedly one of the major killer diseases worldwide. Pulmonary cytology is a simple and resourceful method of early diagnosis of bronchogenic carcinoma. The use of bronchoscope has increased the variety of diagnostic specimen obtainable and extended the scope of cyto-pathology. We carried out a study to demonstrate the value of cytological examination of bronchial brushing and washing in diagnosis of bronchogenic carcinoma in our settings. 69 patients of clinically and radiologically suspected bronchogenic carcinoma attending the Dr. B. Borooah Cancer Institute (Guwahati) as well as in Dept. of Pathology, Gauhati Medical College and hospital were selected for one year. Out of total 69 cases bronchial brushing carried out in 42 cases and bronchial washing carried out in 27 cases. In bronchial brushing cytology a positive diagnosis of malignancy was established in 30 cases (71.43%) and in bronchial washing diagnosis of malignancy was found in 8 cases. Bronchoscopic biopsy was successfully done in 40 cases and histopathological diagnosis of malignancy was made in 29 cases. Out of 29 cases of carcinoma confirmed by histology, cytology was consistent in 26 cases. The bronchial cytology revealed sensitivity (89.96%), specificity (90.9%), positive predictive rate (96.3%), accuracy (90%), false negative rate (10.34%) and false positive rate (9.1%). During the bronchoscopic procedure there was no major complication or fatality. Thus bronchial brushing and washing has firmly established its role in the early diagnosis of bronchogenic carcinoma because it is safe, rapid and cost-effective and importantly gives a higher rate of sensitivity and accuracy.

**Index Terms-** Bronchogenic carcinoma, bronchial brushing, bronchial washing, cytology, histopathology

## I. INTRODUCTION

The technique of diagnostic cytology has now been widely accepted as a reliable laboratory procedure. Bronchial cytology is a simple and resourceful method of early diagnosis of lung cancer and has evoked a lot of interest. The wide use of sophisticated interventional radiology and flexible fiber-optic bronchoscope, which allows examination of bronchial tree as far as pulmonary parenchyma, has increased the variety of diagnostic specimen obtainable and extended the scope of cyto-pathology. The diagnosis of bronchogenic carcinoma is often obvious from clinical features and radiological examinations. But the final diagnosis should be established by cyto-pathological or histopathological examination of the specimens.

Bronchogenic carcinoma is undoubtedly one of the major killer diseases worldwide. It is number one killer cancer in Industrialized Countries. By far the biggest causal factor in lung cancer is smoking. Links between disease and smoking have been recorded for hundreds of years and link with lung cancer has been reported since Franz Hermann Muller in 1939. A landmark study in U.K was carried by Doll and Hill, reported in the British Medical Journal. This study was repeated once again after 40 years in 1994, estimating the link was in fact even stronger than initially suggested. <sup>[1]</sup>

Bronchoscopy is the examination of airways under direct visualization. It is used primarily as a valuable tool in the diagnosis of lung diseases. The value of bronchial washings and brushings under bronchoscopic control for the cytological diagnosis of lung cancer has been demonstrated by various studies. Cytologic diagnosis is possible in the majority of the patients. At present bronchial washing and brushing are routinely employed to detect pulmonary neoplasm in different parts of the globe as well as in India.

## II. RESEARCH CONCERN

Despite the universal recognition of the relationship of cigarette smoking with lung cancer and attempts to limit tobacco use the incidence of this malignancy continues to rise particularly in the third world countries. Thus with failure of general population to take advantage of preventive measures, methods of early detection and treatment of bronchogenic carcinoma continue to be the major consideration.

The value of bronchial washings and brushings under bronchoscopic control for the cytological diagnosis of lung cancer has been demonstrated by various studies. Bedrossian and Rybka compared the different bronchoscopic techniques and found bronchial brushing and washing cytology to be equally rewarding as diagnostic modalities in the case of bronchogenic carcinoma.<sup>[2]</sup> Conducting retrospective study of bronchogenic carcinoma Mak et al (1990) concluded that for the maximum diagnostic yield of bronchial biopsy should be combining with cytology using both washings and brushings.<sup>[3]</sup> Subsequently Flint (1992) reinforced the conclusion of Clerf & Herbut and refined the techniques of the cell collection by the use of fibre-optic bronchoscopes.<sup>[4]</sup>

This study has therefore been under taken with the following aims and objectives in mind.

1. To ascertain the overall diagnostic yield of bronchial washing and brushing cytology in bronchogenic carcinoma in our setting.
2. To determine the relative incidence of various cytological types of bronchogenic carcinoma diagnosed by these procedures in our populations.
3. To establish the co-relationship among cytological, histopathological and clinical findings.
4. To ascertain the complications associated with the procedure.

### III. METHODOLOGY

This study carried out on 69 patients of clinically and radiologically suspected Bronchogenic Carcinoma attending the Dr. B. Borooah Cancer Institute (Guwahati), a regional institute for treatment and research as well as in Dept. of Pathology, Gauhati Medical College and hospital for one year. All the patients included in this study were subjected to thorough interrogation, clinical examination and investigations. Investigations comprised of routine examination of blood, blood Biochemistry, Chest X-ray & Bronchoscopy. Bronchoscopic procedures included bronchial washing/ brushing & Biopsies.

The skill and experience of the bronchoscopist the material and proper handling of the specimen are the keys to the success of the cytological techniques. Similar to the other forms of cytology, the entire procedure of cytological study of bronchial washings and bronchial brushings consisted of following steps:

1. Collection of materials.
2. Preparation of smears.
3. Fixatives and fixation.
4. Staining.
5. Mounting.
6. Examination of smears.
7. Interpretation and diagnosis.

Bronchial washing was collected at bronchoscopy under general or local anesthesia in the operation theatre with skillful hand under strict aseptic and antiseptic measures. In bronchial washing sterile isotonic saline introduced into the bronchi bronchoscopically and washings from different broncho-pulmonary segments are reaspirated than smears are made from centrifuged deposits. Bronchial brushings can be done following washings. The flexible fiber optic bronchoscope (FFB) is inserted through the mouth or nostril and slowly passed down into the trachea and bronchi. The nylon brushes extended beyond the tip of the bronchoscope and material obtained from lesion not easily visualized or biopsied. Most studies concerning the brush procedure for cyto-diagnosis of bronchogenic carcinoma have emphasized its high accuracy rates and its value in the evaluation of peripheral lung lesions.



Figure 1: Flexible fibre-optic bronchoscope.

Few slides were air dried and fixed in 100% methanol for May-Grunwald Giemsa (MGG) staining. Few slides were immediately fixed in a mixture of equal parts of 95% ethyl alcohol and anesthetic ether for at least 30 min. for Papanicolaou's method of staining (PAP staining) as described by George N. Papanicolaou in 1942. In all ulcerative and necrotic lesions, which are suspected to be inflammatory origin, smears were kept air dried for further Ziehl Neelson staining for AFB. The slides were examined under the microscope first with low power objectives (10X) and then the areas in the slides having cells were focused under the high power objectives (40X) to confirm the cytological features. Interpretation and diagnosis is done according to the new WHO/IASLC, classification of epithelial tumors of the lung, published in 1999 (Travis et al, 1999).<sup>[5]</sup>

#### IV. RESULTS

Samples from 69 patients were evaluated. The age of the cases ranged from 36 years to 78 years. The average age being 58.72 yrs and majority of cases belonged to 60-69 yrs age group. 57 (82.61%) were males and 12 (17.39%) were females, the M: F ratio being 4.75:1. In this study, 48 cases of the patients were smokers and 21 cases were non-smokers. The highest incidence was found among the cultivators and most of them were smokers. Cough and expectoration were the most common presenting symptoms of the patients. The most prominent physical finding on general examination was pallor (69.57%). All the patients in the study had definite localized radio opacities (Figure 1). Most prominent findings of bronchoscopic examination were endobronchial growth and narrowing of bronchial lumen.

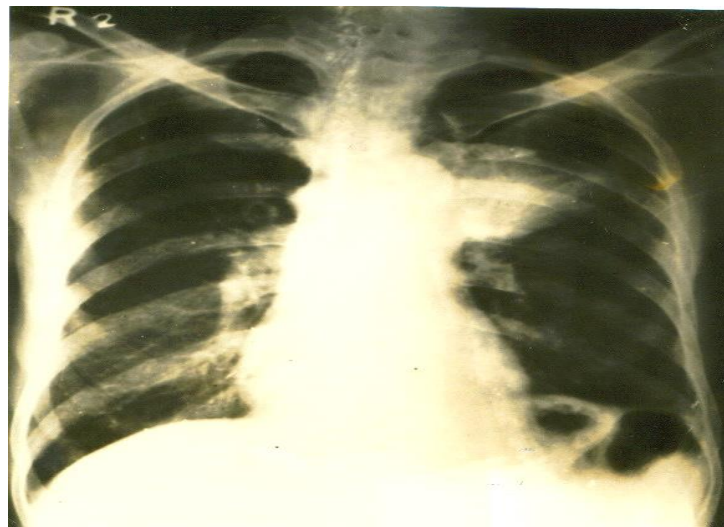


Figure 1: P/A view Chest X-Ray showing left sided radio opacities of bronchogenic carcinoma.

Out of total 69 cases bronchial brushing carried out in 42 cases and bronchial washing carried out in 27 cases. In bronchial brushing cytology a positive diagnosis of malignancy was established in 30 cases (71.43%), out of 42 cases. Out of 30 positive cases of malignancy 11 cases were Squamous cell carcinoma, 12 cases were Adeno carcinoma, 4 cases were small cell carcinoma and 3 cases were large cell undifferentiated carcinoma. Bronchial washing was carried out in 27 cases and diagnosis of malignancy was found in 8 cases. Out of 8 positive cases of malignancy 5 cases were Squamous cell carcinoma, 2 cases were Adeno carcinoma and 1 case was small cell carcinoma. Bronchoscopic biopsy was successfully done in 40 cases and histopathological diagnosis of malignancy was made in 29 cases. Out of 29 cases of carcinoma confirmed by histology, cytology was consistent in 26 cases. The results of cytological examination of total bronchial cytology material shown that out of total 69 cases a diagnosis of malignancy was possible in 38 cases (55.07%), which were all bronchogenic carcinoma(**Table1**). 19 cases (27.54%), were diagnosed as inflammatory origin which include tuberculosis 12 cases (14.49%) and non specific inflammatory 7 cases (10.15%). In remaining 12 cases (17.39%) diagnosis was inconclusive.

**Table I:** Cytological diagnosis of all 38 cases of bronchogenic carcinoma

Cytological diagnosis	No. of cases	Percentage (%)
Squamous cell carcinoma	16	42.11
Adeno- carcinoma	14	36.84
Small cell carcinoma	05	13.16
Large cell carcinoma	03	07.89
Total	38	100.00

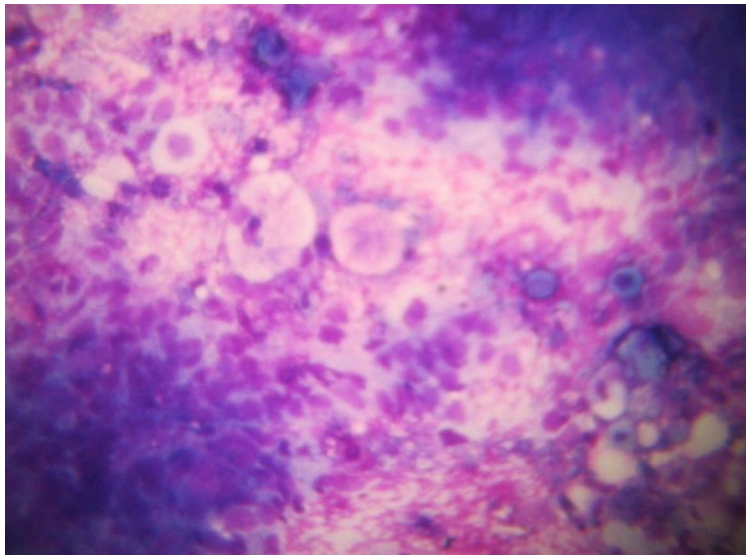


Figure 1: Photomicrograph of bronchial washing showing squamous cell carcinoma (400X)

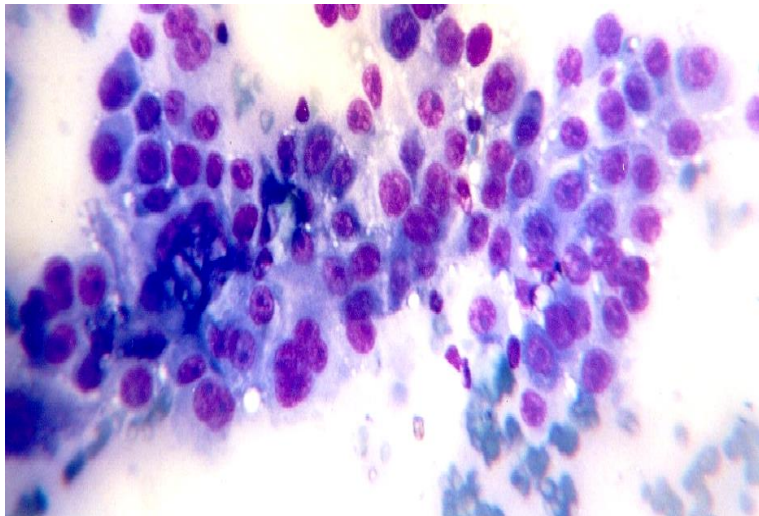


Figure 2: Photomicrograph of bronchial brushing showing adeno-carcinoma. (400X)

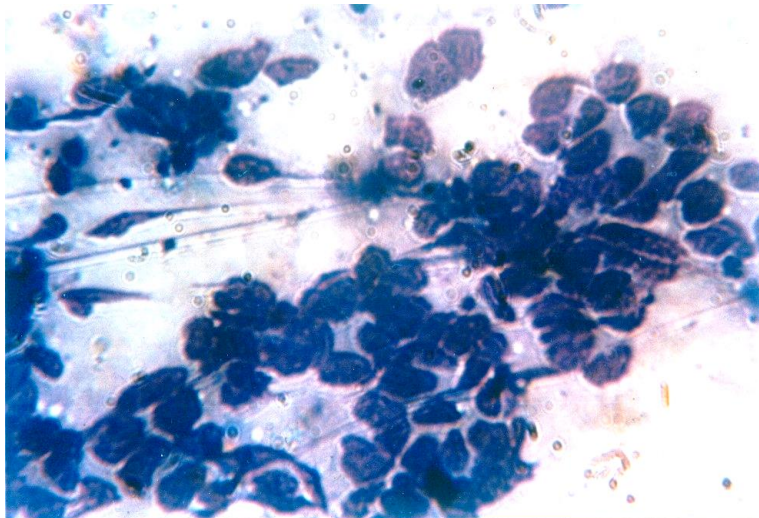


Figure 3: Photomicrograph of bronchial brushing showing small cell carcinoma. (400X)

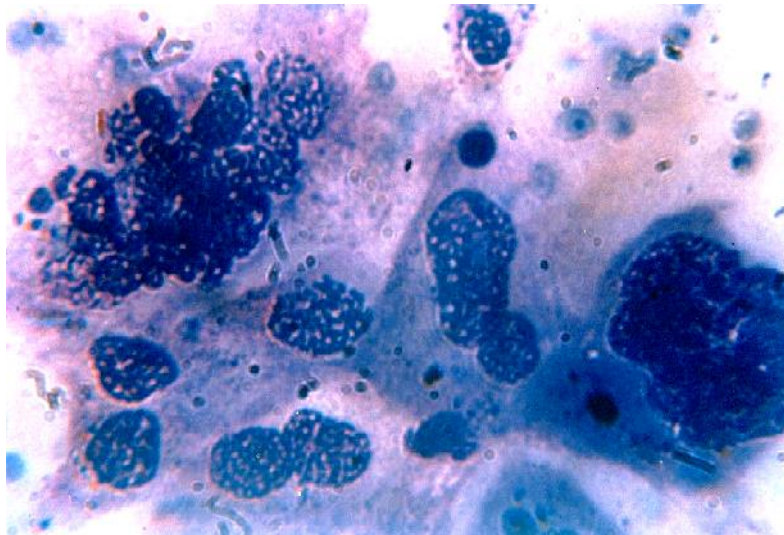


Figure 4: Photomicrograph of bronchial brushing showing Large cell undifferentiated carcinoma. (400X)

Correlation with sex has shown that out of 38 cases of bronchogenic carcinoma diagnosed in bronchial cytology 31 cases were male and 7 cases were female. (Fig.5) Out of 31 cases of male patients majority had Squamous cell carcinoma (13) and out of 7 cases of female patients majority had Adeno carcinoma (4).

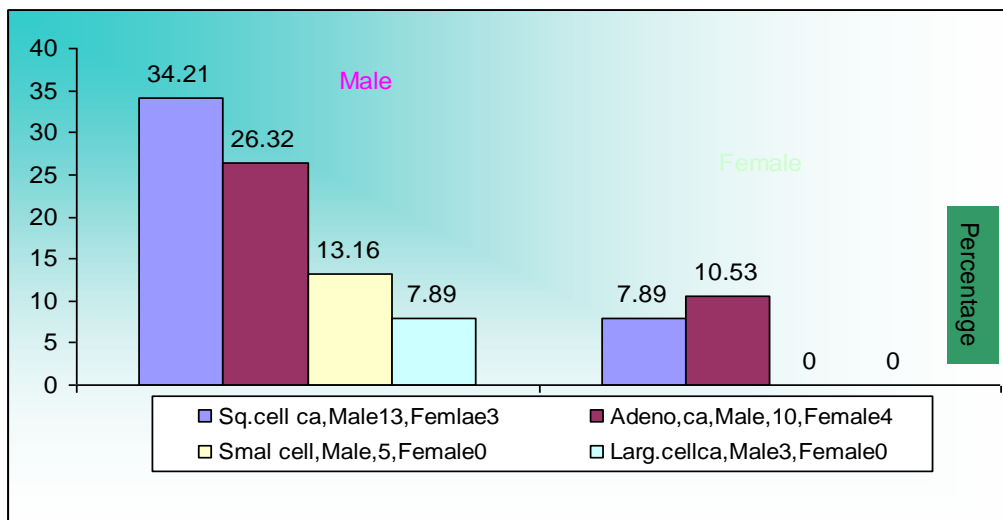


Figure 5: Sex incidence of various cytological types of bronchogenic carcinoma.

Age distribution of 38 cases of bronchogenic carcinoma diagnosed by bronchial cytology has shown the maximum numbers of patients belong to the 6<sup>th</sup> followed by 5<sup>th</sup> decades of life. In the study among the smokers, squamous cell carcinoma was found in majority (55.56 %) and adeno carcinoma was the highest (90.91 %) in non-smokers.

The bronchial cytology revealed sensitivity (89.96%), specificity (90.9%), positive predictive rate (96.3%), accuracy (90%), false negative rate (10.34%) and false positive rate (9.1%). During the bronchoscopic procedure patients were closely observed for any complications. Out of total 69 cases minor complications occurred in 5 cases (7.25%) which include 3 cases of broncho spasm with respiratory distress and 2 cases of respiratory tract infection. There was no major complication or fatality.

## V. DISCUSSION

In the present study the average age being 58.72 yrs and majority of cases belonged to 60-69 yrs age group. Vital statistics of the United States (1997) reported that majority of bronchogenic carcinoma from the age group of 55-74 years of age. Kakha Vacharadze and associates (1999-2003) in a study recorded the average age being 65.3 years. [6]

In this study 57 (82.61%) were males and 12 (17.39%) were females, the M: F ratio being 4.75:1 and majority of the patients 48 (69.57%) was smokers. A. Vigg and associates of Apollo Hospital Hyderabad during the period 1989-2000, reported out of confirmed

cases of lung cancer 439 were males and 73 females with male to female ratio of about 6:1 and 62% ex-smokers, 10% current smokers and 28% non-smokers amongst males.<sup>[7]</sup>

In our study the most common symptoms were cough (95.65%), expectoration (91.3%), chest pain (56.52%), hemoptysis (52.17%) and most common physical findings were pallor (69.57%), clubbing (52.17%), lymphadenopathy (26.09%). Arora et al (1990) reported the common symptoms cough (92%), hemoptysis (29%), chest pain (52%), breathlessness (40%) and common physical findings were clubbing (35%), lymphadenopathy (26%).<sup>[8]</sup>

In general, epidermoid carcinomas have a central location and are characterized by atelectasis, pneumonia, hilar adenopathy and a tendency to cavitate. Adenocarcinoma gives rise to a well-defined nodule in a peripheral location with pleural and chest involvement. Large cell carcinomas have a large mass in a peripheral location with hilar adenopathy and small cell carcinoma present as a central lesion with atelectasis, pneumonia and mediastinal adenopathy (Minna et al, 1985).<sup>[9]</sup>

A study evaluated the diagnostic yield of cytologic analysis of bronchial washing in addition to forceps biopsy on the basis of bronchoscopic appearance and histologic type in lung cancer. The forceps biopsy were positive in 492 cases (80.5%), and the diagnostic yield of the combination of forceps biopsy with cytological analysis of bronchial washing was 84.1% (514/611 cases), that is, a statistically significant increase of 3.6% ( $P < 0.001$ ). It was concluded that the combination of forceps biopsy and washing cytologic analysis offers a better diagnostic yield than biopsy alone in diagnosing lung cancer. Both procedures should be performed during bronchoscopy even if no endobronchial lesion is present.<sup>[10]</sup>

Karahali et al (2001), in a study evaluated the value of various diagnostic techniques following fibre-optic bronchoscopy in the diagnosis of in the diagnosis of endoscopically visible lung cancer. They found the addition of brushing increased the diagnostic yield of bronchoscopy from 80.8% to 85.3% and concluded that combination of forceps biopsy and brushing is the best strategy.<sup>[11]</sup>

In a study to evaluate bronchial wash cytology with histology, 73 specimens were obtained by flexible fiberoptic bronchoscope at pulmonology department of Military Hospital Rawalpindi. The bronchial wash cytology revealed sensitivity (80.5%), specificity (96.6%) and accuracy (87.3%). As far as malignant and benign lesions are concerned, complete cytological and histological concordance was observed in 55 cases (77.4%). True positive along with suspicious/atypical were 33 and true negative cases were 29. False positive was one case only whereas false negative cases were eight. The bronchial wash cytology showed sensitivity (80.5%), specificity (96.6%) and accuracy (87.3%). Positive predictive value and negative predictive value were 97% and 78.4% respectively. It was concluded that bronchial wash cytology is a valuable tool and yields almost same information as biopsy.<sup>[12]</sup>

Tamboli P and Ro. J.Y (Lung cancers, M.D. Anderson Cancer care series, 2003) stated squamous cell carcinoma used to be the most common type of lung cancer accounting for 25-45% of all lung tumors but the incidence of adeno-carcinoma has significantly increased in the last two decades; 25-40% of lung carcinoma are now classified as adeno-carcinoma and this tumor is now the most common form of lung cancer in women and in many studies, in men as well.<sup>[13]</sup>

From management point of view, lung tumours are generally separated into small cell carcinomas and non small cell carcinomas. For small cell carcinomas intensive chemotherapy is advised whereas the non-small cell carcinomas are better treated surgically. More than 80% cases have been correctly typed by Truong and co-workers with sputum, washing or brushing cytology.<sup>[14]</sup>

## VI. CONCLUSION

From the present study it can be inferred that bronchoscopy is an important diagnostic modality in the early diagnosis of bronchogenic carcinoma. In addition to direct visualization of the lesion, brushing and washing of the bronchial secretion for cytological examination and tissue for histopathological examination can be obtained. Thus bronchial brushing and washing has firmly established its role in the early diagnosis of bronchogenic carcinoma because it is safe, rapid and cost-effective and importantly gives a higher rate of sensitivity and accuracy.

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