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Original Research Article

Utility of cytological sampling in diagnosing lung masses

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Abstract: Lung masses, as diagnosed clinico radiologically, include both non-neoplastic and neoplastic lesions, and are a cause of great anxiety to both patient as well as treating physician. The present study based on 40 patients with lung masses, who underwent FOB procedure, was aimed to assess the utility of cytological sampling in diagnosing lung masses. In present study, the FOB was used to visualize the tracheao-bronchial tree and simultaneously the cytological samples of washing and brushing as well as biopsy were taken. These cytology samples were fixed and stained with papaniculaou and MGG whereas the biopsies were processed and stained using H & E. In result, neoplastic lesions (62.5%) were more common in presenting as suspected lung mass as compared to non-neoplastic lesion (22.5%). Squamous cell carcinoma came out to be the most common malignancy followed by adenocarcinoma. The results showed bronchial washing samples has a sensitivity of 40% (correctly diagnosing 16 cases) whereas this was 57.05% (correctly diagnosing 23 cases) for bronchial brushing samples. Thus, the present study, although deduced equivocal results of washing, still supports the cytological sampling should routinely recommended to be taken along with biopsy as these in combination increase the diagnostic yield of the procedure.
Keywords: fiberoptic bronchoscope, cytohistological correlation, bronchial washing, bronchial brushing, bronchial biopsy.

INTRODUCTION:

Clinical and radiological evaluations like CT-Scan etc, although playing an important role in diagnosis of lung masses, do not permit a conclusive diagnosis of benignancy or malignancy [1]. So, cytohistological assessment of specimens of the respiratory tract is an important and often the initial diagnostic technique carried out in a patient with suspected lung mass. Fiberoptic bronchoscopy helps the bronchoscopist to visually evaluate the tracheao-bronchial tree and also to obtain samples of bronchial washings, bronchial brushings and bronchial biopsies etc [2]. Both bronchial washing and brushing are very effective in diagnosing lung masses as early diagnostic techniques [3]. The purpose of this study is to evaluate the utility of bronchial cytological specimens of brushing and washing obtained using fiberoptic bronchoscope in the diagnosis of lung masses. Many previous studies were reviewed, and were found supporting the combined use of cytology samples and biopsy to increase the diagnostic yield of FOB [4]. Although a few of them were contrary to this recommendation and they suggested no additional benefit of cytological sampling to the biopsies. The present study concluded that the use of co-analysis of cytological and histological samples should be promoted. This increases the diagnostic yield of the procedure and in near future, it will improve the ability to use cytological samples alone. Upcoming ancillary techniques, which can now be done on cell buttons, cell blocks even on cytology slides, are demanding more introduction and hold over cytological sample assessment. More studies, on bigger sample size, need to be conducted to enforce the above recommendation.

MATERIAL AND METHOD:

The study was conducted in 40 cases. The specimens of washing and brushing for cytological analysis and of biopsy for histologic confirmation of the diagnosis were taken. Brushing material was smeared directly on to the glass slides. They were air-dried and then smears were fixed in methanol for May-Grunwald Giemsa stain. Bronchial washing samples were collected and centrifuged for 5 minutes at 1500 rpm.

Smears prepared from sediments and were stained by Geimsa stain. Bronchial biopsies were fixed in 10% formal saline and then processed subsequently for histopathological examination.

RESULT:

In present study Fourty cases were studied. Out of which 33 (82.5%) were males and 07 (17.5%) were females. Over all male to female ratio was 4.7:1 (table 1). Out of 27 cases of neoplastic origin, 21 were males and 06 were females. The male to female ratio for neoplastic lesions was 3.5: 1 in present study. The age of the patients in the present study varied from 35 years to 82 years. Most cases were in between age of 41-70, peaking at 6^{th} decade (table 2). 82.5% (33 out of 40 cases) were smokers (table 3).

As per final diagnosis of all fourty cases, 27 were of neoplastic origin, 9 were non-neoplastic and 4 cases were showing normal cytology and histology so were categorised as 'normal' as no pathology could be revealed in them (table 4). In present study, non-neoplastic category was comprised of 2 cases of tuberculosis, 1 case each of abscess and fungal infection and 5 cases were showing non-specific inflammation and 4 cases were concluded as normal. Among the neoplastic cases, 11 (40.7%) were of squamous cell carcinoma, 7 (25.9%) were of adenocarcinoma, 2 cases (7.4%) were of small cell carcinoma, 4 cases (14.8%) were of NSCC,NOS and 3 cases (11.2%) were in the category of 'positive for malignancy'. This category as "positive for malignancy" was made, for the samples that were showing the features of malignancy but had scanty material so; precise categorisation into specific type of tumor was not possible. (Table 5 and 6). Out of 40 cases the diagnosis of 23 cases of brushing and 16 cases of washing were found to be concordant with their respective biopsy findings (table 7). Bronchial brushing detected 2 (18.18%) out of 11 cases of squamous cell carcinoma, 5 (71.4%) out of 7 cases of adenocarcinoma and 1 (50%) out of 2 cases of small cell carcinoma and 1 (25%) out of 4 cases of non-small cell carcinoma. This figure was 2 (18.18%), 2 (28.6%) and 1 (25%) respectively for bronchial washings (table 8). The p value of the present study was found to be 18.07 i.e. insignificant.

Table 1: Gender distribution of cases studied

S.NO.	SEX	NO. OF CASES	PERCENTAGES
1	MALE	33	82.50%
2	FEMALE	7	17.50%
	TOTAL	40	100%

Table 2: Age distribution of cases

S. NO.	AGE GROUPS	NO. OF CASES	PERCENTAGES
1	0 -10	0	0 %
2	11 – 20	0	0 %
3	21 -30	0	0 %
4	31 -40	04	10 %
5	41 -50	07	17.5 %
6	51 -60	10	25 %
7	61 -70	16	40 %
8	71 -80	02	5 %
9	81 -90	01	2.5 %
	TOTAL	**40**	**100 %**

Table 3: Incidence of smoking in the studied cases

CATEGORY	NO. OF CASES	PERCENTAGES
SMOKER	33	82.50%
NON-SMOKER	7	17.50%
TOTAL	**40**	**100%**

Table 4: Categorisation of Lung Lesion on Bronchoscopic Biopsy

CATEGORY	NO. OF CASES	PERCENTAGES
Non-neoplastic	09	22.5 %
Neoplastic	27	67.5 %
Normal histology	04	10 %
Total	**40**	**100 %**

Table 5: Distribution of lung masses based on cytohistological diagnosis

S.NO.	DIAGNOSIS	NO. OF CASES	PERCENTAGES
1	NORMAL	04	10 %
2	NON- NEOPLASTIC		
	Tuberculosis	02	5 %
	Abscess	01	2.5 %
	Fungal	01	2.5 %
	Non-specific inflammation	05	12.5 %
3	NEOPLASTIC		
	Squamous Cell carcinoma	11	27.5 %
	Adenocarcinoma	07	17.5 %
	Small cell carcinoma	02	5 %
	NSCC, NOS	04	10 %
	Positive for Malignancy	03	7.5 %
	TOTAL	**40**	**100 %**

Table 6: Distribution of lung malignancies based on frequency

S.NO.	TYPE	NO. OF CASES	PERCENTAGES
1	Squamous cell carcinoma	11	40.70%
2	Adenocarcinoma	7	25.90%
3	Small cell carcinoma	2	7.40%
4	Non-small cell carcinoma, NOS	4	14.80%
5	Positive for malignancy	3	11.20%
	TOTAL	**27**	**100%**

Table 7: Over all concordance of cytology (brushing and washing) and histology

PROCEDURE	NO. OF CASES IN WHICH CYTOLOGY WERE CONCORDANT TO THEIR HISTOLOGY	PERCENTAGES OF CASES IN WHICH CYTOLOGY WERE CONCORDANT TO THEIR HISTOLOGY
Washings	16	40 %
Brushings	23	57.05 %
Biopsy (Gold Standard)	40	100 %

Table 8: COMPARATIVE STUDY OF DIAGNOSIS BASED ON WASHINGS, BRUSHINGS AND BIOPSIES.

DIAGNOSIS	WASHING	BRUSHING	BIOPSY
Squamous cell carcinoma	2	2	11
Adenocarcinoma	2	5	7
Small cell carcinoma	1	1	2
Non-small cell carcinoma, NOS	1	1	4
Positive for malignancy	1	2	3
Abscess	0	1	1
Tuberculosis	1	2	2
Fungal	1	1	1
Non-specific inflammation	4	4	5
Normal	3	4	4
TOTAL	**16**	**23**	**40**

DISCUSSION:

A total of 40 cases, who presented with lung mass and underwent FOB were studied, out of which 27 were diagnosed as neoplastic and 9 were found to be non-neoplastic whereas 4 cases were showing normal histology, might be a non-representative sample.

Out of total 40 cases, 33 were males and 07 were females, with overall male to female ratio of 4.7:1 and this ratio was 3.5:1 for neoplastic lesions with 21 males out of 27 neoplastic cases. Above findings were similar to the findings of the study conducted by Gaur DS *et al.;* [5] with a male female ratio of 3.6:1. In a similar study by Tuladhar A *et al.;* [6], the ratio was 4.3:1 and 3.7:1 for neoplastic and non-neoplastic, respectively. Similarly, Bodh A *et al.;* [7], Kotadia P *et al.;* [8], and Reddy A *et al.;* [9], favoured a male preponderance in lung neoplasias, generating almost comparable results. On contrary, Shiner RJ *et al.;* [10] and Vigg A *et al.;* [11] found ratio reaching upto 6:1 ie. A much more male preponderance.

The age range of the cases in present study was between the age of 35 to 82years. Most cases were reported in between the age of 41-70, maximum cases have fallen in 6 th decade. In a similar study by Tuladhar A et al[6], mean age for non-neoplastic lesion was 50.8± 7 yrs and was 59.5± 11 yrs for neoplastic lesions. In a study by Reddy A et al[9], most lesions occurred during 5th decade. Ahmad M *et al*[12] concluded that peak incidence of lung malignancy occur in 6th-7th decade, age ranging from 50-79 yrs, comparable to the findings of the present study.

In present study, out of total 40 cases, 33 were smokers (82.5%) and to emphasize further, 10 out of 11 cases of squamous cell carcinoma were smokers. Vigg A *et al.;* [12] in their study on neoplastic lesions reported that 62% were ex-smokers, 10% current smokers and 28% non-smokers. In a study by Dragan AM *et al.;* [13] 86.27 % of patient in the study were smokers, a result similar to our present study. Many authors found that 85-90% of the pulmonary cancers can be the result of smoking cigrattes [14, 15].

In the present study, out of total 40 cases, 9 were found to be non-neoplastic and 27 were of neoplastic origin. Similarly, in a study by Tuladhar A *et al.;* [6], 15/50 cases were in non-neoplastic category and other 35 were neoplastic.

In present study, non-neoplastic category was comprised of 2 cases of tuberculosis (fig 1), 1 case each of abscess and fungal infection and 5 cases were showing non-specific inflammation and 4 cases were concluded as normal. Tuladhar *et al.;* [6] concluded that out of 15 non-neoplastic cases, 4 were of tuberculosis, 2 were abscess, 8 were of non-specific inflammation and 1 case concluded as normal. The findings were similar to that of present study. The major value of bronchoscopy in these conditions was to obtain material for cytological and microbiological examination from patients who were unable to expectorate. Sometimes, the procedure was done to rule out underlying lung malignancy in patients who did not respond to empirical drug therapy [6]. Choudhary M *et al.;* [16] in a study, reported that out of 35 cases, 60% were diagnosed as carcinomas, 40% as inflammatory or tubercular or with non-specific diagnosis.

In the neoplastic category, our study showed squamous cell carcinoma (fig 2) as the most common neoplastic lesion followed by adenocarcinoma (fig 3-4). While worldwide, adenocarcinoma has replaced squamous cell carcinoma as being most prevalent lung malignancy, still dominance of the later is seen in few geographical areas including present study population [17]. 11/27 (40.7%) cases turned out to be of squamous cell carcinoma. Second most common was adenocarcinoma with 7 cases (25.9%). Four cases (14.8%) were of NSCC, NOS and small cell carcinoma (fig5-6) comprised only of 2 cases (7.4%). 3 cases were kept in a category of positive for malignancy for the samples that had scanty material and differentiation into specific type of tumor was not possible.

In studies by Reddy A *et al.;* [9] and Sharma A *et al.;* [18], similar results were reported with around 31.02% and 42.11% cases of squamous cell carcinoma and 34.8 % and 38.84% cases of adenocarcinoma, respectively. Squamous carcinoma was found to be most prevalent in study by Rawat J *et al.;* [19] and Lee GD *et al.;* [20]. Both in concordance with present study. Kotadia P *et al.;* [8] found similar results that squamous carcinoma was the most common (39.39%) followed by adenocarcinoma (21.21%) then by small cell carcinoma (13.63%), consistent with the findings of present study. Tuladhar A *et al.;* [6] found squamous cell carcinoma (51%) was the most common primary bronchogenic tumour, followed by small cell carcinoma (19%) and adenocarcinoma (11%).

The present study was done to evaluate the efficacy of bronchial wash and brush cytology in diagnosing lung masses. In the present study, biopsy was the gold standard for diagnosing the specimens of lung masses and was taken as the comparator for the results drawn through brushing and washing cytology samples. 23/40 cases, in their brushings, were showing findings in concordance to their biopsies and whereas only16/40 cases of washings were concordant. So, brushings showed accuracy in 57.5 % and washings were rendering the diagnosis in 40 % of cases. These findings of the present study were similar to the results observed by Chen WT *et al.;* [21] and Tuladhar A *et al.;* [6]. Previous studies by Buccheri G *et al.;* [22], Park KS *et al.;* [23] and Karahalli E *et al.;* [24] had

found almost similar result of bronchial washing as that of present study.

Bodh A *et al.;* [7] concluded, in their study, that brushing detected the malignancy in 78.06% cases and washings in 36.77% of cases. The findings of washings are similar to the present study but the sensitivity of the present study for brushing was not comparable to this study. Mak VH *et al.;* [25] had similarly recommended combination of biopsy with cytology using both washing and brushing for maximum diagnostic yield.

Few studies like Trevisani L *et al.;* [26] Karahalli E *et al.;* [24] reported that the diagnostic yield did not increase significantly further by the addition of bronchial washing to bronchial biopsy and recommended that washing should not be routinely used. Funashahi A *et al.;* [15], Kvale PA *et al.;* [27] and Karahelli E *et al.;* [24] had also recommended omission of washing in patient with endoscopically visible lesions and found that cytological methods were unlikely to produce any addition benefit to diagnosis. The reason for this variance was the use of different techniques for retrieval and processing of specimens, use and non-use of fluoroscopy, different numbers of biopsy specimens and the experience to handle the small biopsy samples.

Stringfield JT *et al.;* [28], Lam S *et al.;* [29] and Rosell A *et al.;* [14] found that washings conferred an additional yield. Cytological procedures of brushing and washing improved diagnostic yield in both visible and peripheral lesions. Authors like Mak VH *et al.;* [25], Jones AM *et al.;* [30] have suggested that bronchial biopsy, brushing and washing should be performed to obtain optimal diagnostic yield..

Rawat J *et al.;* [19] in their study on 107 cases of endoscopically visible abnormalities, who underwent forceps biopsy, brushing and washing, found that 99 patients had atleast one of the three endoscopic procedures (bronchial washing, endobronchial biopsies and bronchial brushing) positive for lung cancer (92.52%). The sensitivity of endobronchial biopsy, brushing and washing for diagnosing lung cancer was 83.17%, 69.15% and 47.66% respectively.

The study by Lee GD *et al.;* [20] in 611 patients showed that the forceps biopsy were positive in 492 cases (80.5%), and the diagnostic yield of the combination of biopsy with cytological analysis of bronchial washing was 84.1%, that was, a statistically significant increase of 3.6%. Washing cytologic analysis in the case of tumor, infiltrative and necrotic lesion had higher diagnostic yield than that in the case of normal, compressive and nonspecific lesions (41.7% vs 29.3%). So, concluded that the combination of forceps biopsy and washing cytological analysis offered a better diagnostic yield than biopsy alone in diagnosing lung cancers. Both procedures should be performed during bronchoscopy even if no endobronchial lesion was present.

The p value of the present study was found to be 18.07 i.e. insignificant. This difference of sensitivity in our present study to detect the malignant lesions by cytological techniques, using specimens of washings and brushings, reflected a few deficiencies in our system to deal with these cytological specimens as well as small sample size of present study. This suggested a need for improvement from the level of bronchoscopist to the pathologist including the proper execution of the techniques, adequate specimen collection, specimen's preservation and processing and use of new WHO guidelines for reporting of cytological specimens and small biopsies of lung.

It can be concluded that the use of assessing the cytological samples should be encouraged so that our ability of collecting, processing and examining these samples could be enhanced. These three samples of washing, brushing and biopsy complement each other in increasing the diagnostic yield of fiberoptic bronchoscopy procedure.

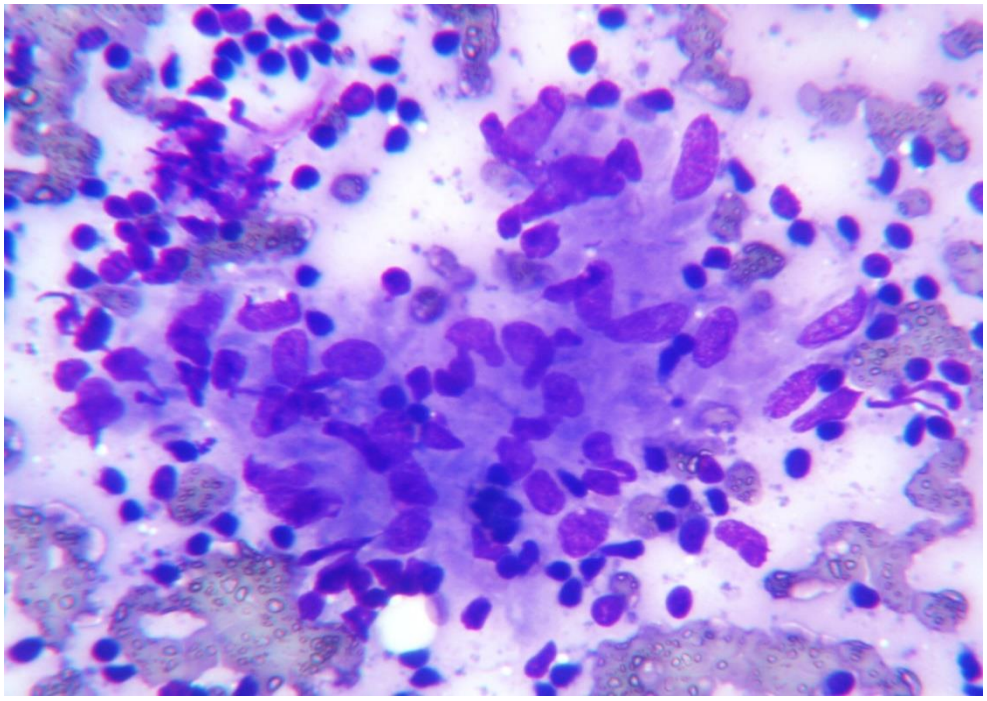

Fig 1: Lung-Epithelioid granuloma Tuberculosis

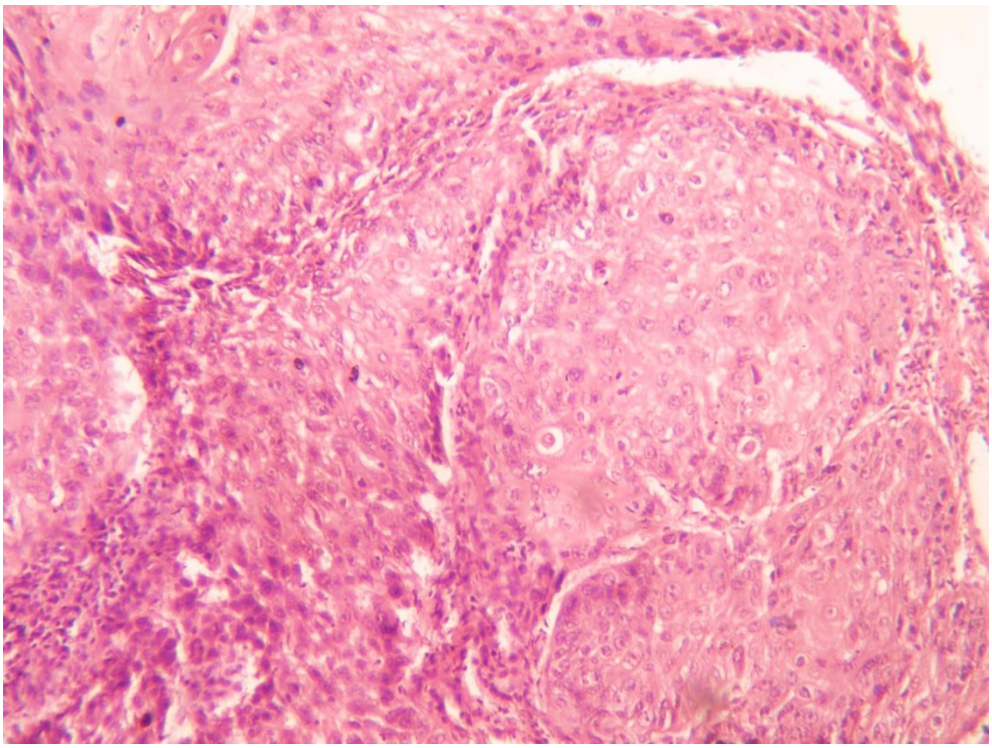

Fig 2: Lung-Squamous cell carcinoma- histology

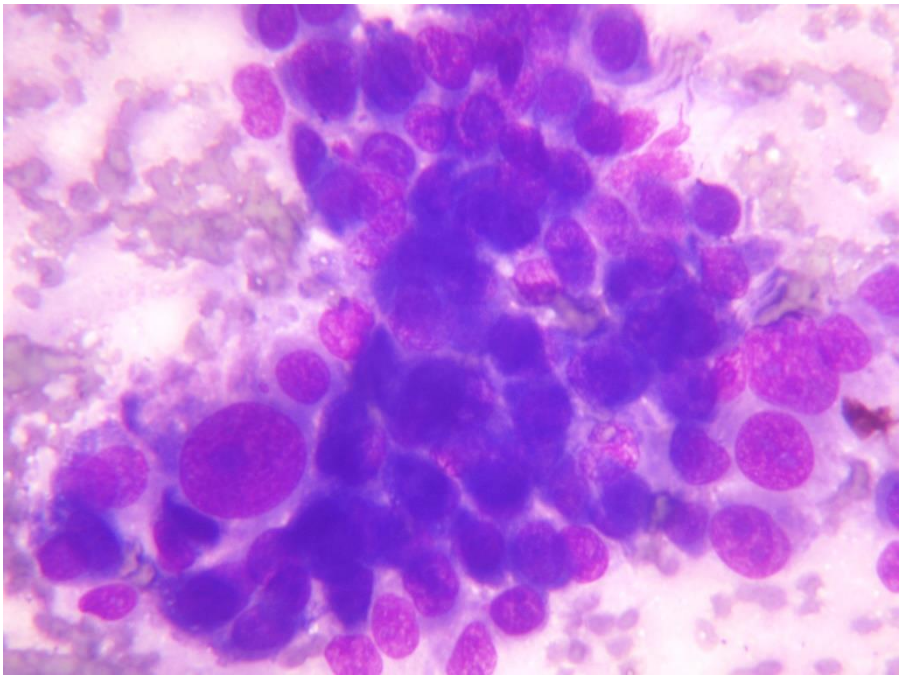

Fig 3: Lung - Adenocarcinoma- cytology

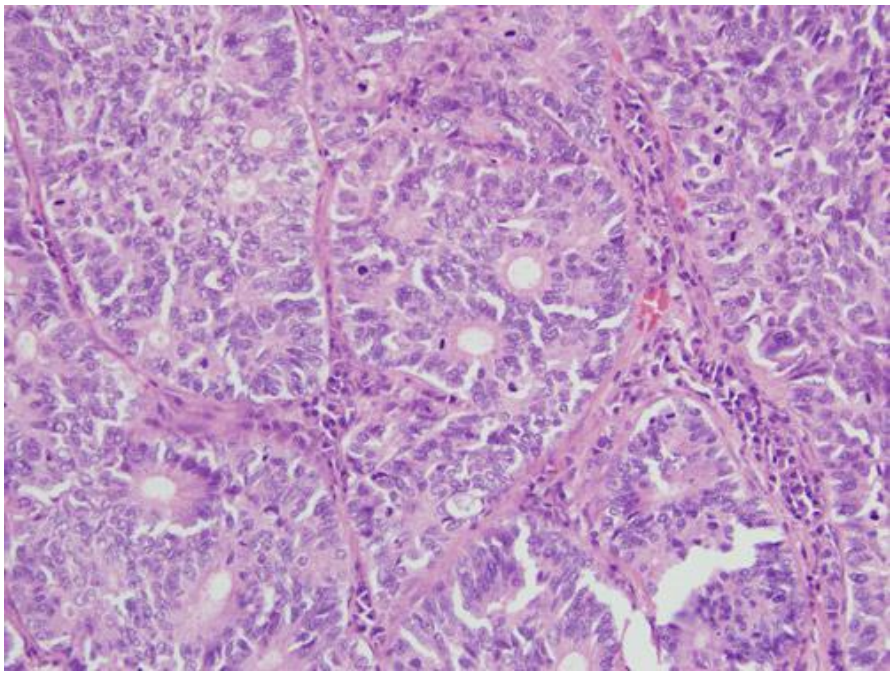

Fig 4: Lung- Adenocarcinoma-histology

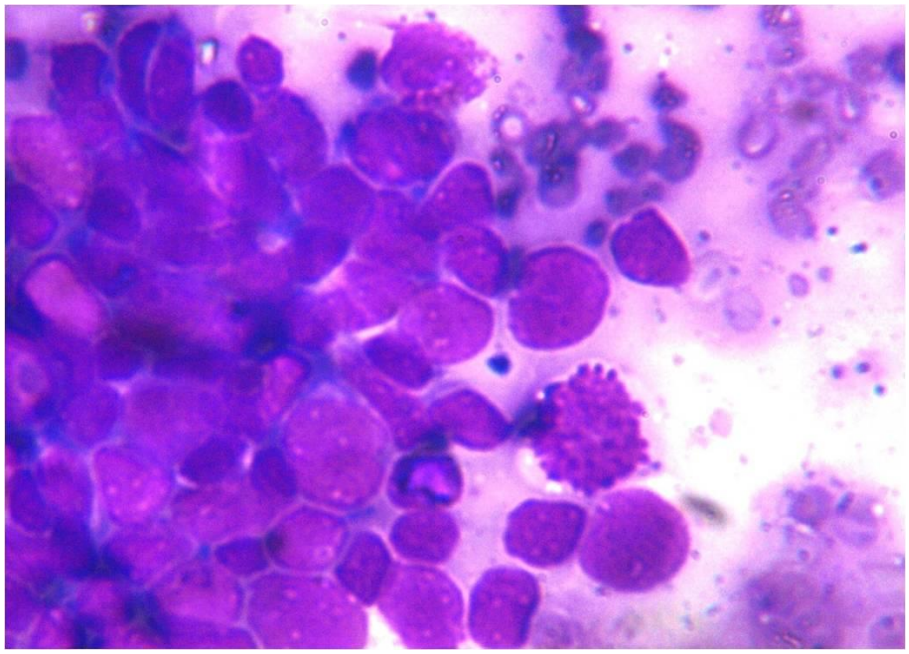

Fig 5: Lung-Small cell carcinoma- cytology

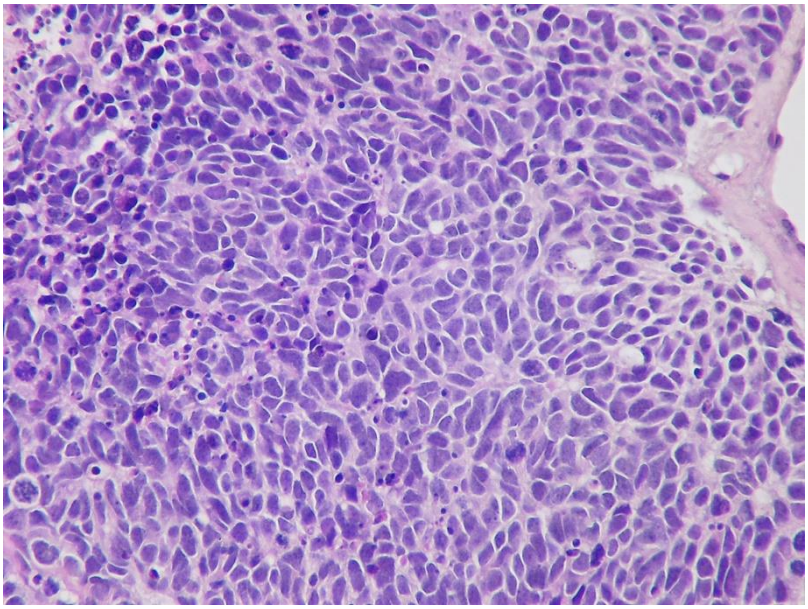

Fig 6: Lung-Small cell carcinoma -histology

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