

Original Research Article

# Role of ultrasound guided transthoracic fine needle aspiration cytology in diagnosing various lung lesions

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## Abstract

**Background:** Transthoracic Fine Needle Aspiration Cytology is regarded as the most effective of the cytological methods for diagnosing lung cancer, in particular peripherally-located lesions.

**Aim:** To evaluate the role of sonography in percutaneous Fine needle aspiration Cytology of peripheral pulmonary lesions.

**Materials and methods:** This was the prospective study done in peripheral pulmonary lesions. Total number of patients in the study was 81.

**Results:** 61 patients (75.3%) were Males, while 20 (24.6%) were Female. The Male: Female ratio was 3:1. The mean age of patients in this study was 48. The youngest patient was aged 26 years and oldest was aged 71 years giving an age range of 26 to 71 years. 54(66%) patients of this study were smokers. Only 3 female patients were smokers. The most common symptom was cough and sign was anemia. Left side and Left Upper Zone of lung was most involved area in lung. Squamous cell carcinoma was the commonest cytological type noted accounting for 60% followed by adenocarcinoma. In non-malignant lesions tuberculosis was most commonly observed in total 81 Complications of needle biopsy were 2 cases (2.4%) were with Hemothysis and 3 cases (3.7%) were with Pneumothorax.

**Conclusion:** It is concluded that Ultrasound Guided Transthoracic Fine Needle Aspiration cytology of peripheral pulmonary lesions abutting the chest wall is Acceptable, Simple, Safe, Quick, Accurate and Useful.

## Key words

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Ultrasonography, FNAC, Lung lesions.

## Introduction

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A non-resolving opacity on chest X-ray despite of intensive pharmacotherapy poses a diagnostic problem for the clinician [1]. Radiographic features such as size, location of the lesion, margins, shape, growth rate and presence of calcification are helpful for the diagnosis, and are not confirmative. Sputum cytology requires digestion and centrifugation of the sample which is a tedious procedure, and sometimes fails to yield diagnostic material. With Fibre Optic Bronchoscopy we may not get correct specimen especially in peripherally located lesions.

Fine Needle Aspiration Cytology (FNAC) is a well-established method of diagnosing both neoplastic and inflammatory conditions of the lung, has resulted in a decrease in the need of other procedures that are more invasive. Transthoracic Fine Needle Aspiration Cytology is regarded as the most effective of the cytological methods for diagnosing lung cancer, in particular peripherally-located lesions. Transthoracic FNACs is also useful for the diagnostic evaluation of lung nodules of infective etiology, including tuberculosis, particularly when other noninvasive cytological methods (e.g. sputum cytology) fail to yield diagnostic material. Chest infection by mycobacterium tuberculosis is known to have varied atypical presentation like lung nodules, mass or pneumonia. Fine Needle Aspiration Cytology may be more useful in these cases [1].

Any procedure that is technically simple and easy that doesn't entail undue risk for the patient and yield accurate results will be of great use. Trans-bronchial lung biopsy or brushings via Fibre Optic Bronchoscope and Per-cutaneous transthoracic aspiration under fluoroscopic guidance are the other alternatives. Diagnostic methods which are time consuming and not available in all centers. In such cases Ultrasound guided Fine Needle Aspiration Cytology of

peripheral pulmonary lung lesions using fine needle (22G) is the choice for establishing the diagnosis which is simple and safe. Real time B-mode ultra-sonography which is readily available in most centers is easy to perform and free from radiation, helps in the evaluation of pulmonary lesions and also the needle can be guided under vision and aspirates can be obtained from different sites of the lesion. It is also useful in differentiation between solid and cystic lesions [2].

Ultrasound can clearly demonstrate the depth of the lesion, real time continuous monitoring of the Fine Needle Aspiration Cytology procedure, and free from radiation. Needle can be traversed directly into the lesions with minimal lung injury, decreasing the incidence of pneumothorax. Procedure can be performed at bed side, where portable ultrasound scanner is available and can be repeated if necessary. Fine Needle Aspiration Cytology carries less mortality and morbidity when compared with cutting needle biopsy.

Disadvantage of localization of the lesion is due to presence of bony cage and the aerated lung. In the present study, a 22 Gauge 1<sup>1/2</sup>" needle is used for Fine Needle Aspiration Cytology of peripheral pulmonary lesions under real time B-mode ultrasonographic guidance.

## Materials and methods

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The study group consisted of patients who are admitted in Department of Tuberculosis and Chest Diseases, Sree Balaji Medical College and Hospital in the years 2014 to 2015. The patients were subjected to real time ultrasonography who found to have demonstrable radiographic intrathoracic lesion where conventional investigations of sputum, blood are inconclusive. Ultra sound guided percutaneous fine needle aspiration was performed, if the lesion was solid and satisfies inclusion criteria.

The procedure work up consisted of admitting the patient, taking a detail history, clinical examination, routine hemogram including Hb%, Total Leukocyte Count, Differential Leukocyte Count, Bleeding time and Clotting time. Sputum for cytology on five consecutive days and sputum for acid fast bacilli was performed for three days. Chest skiagram PA view and lateral view are taken showing the lesion en-face and in profile.

### **Patient preparation**

Usually the patient was scheduled for biopsy in the morning, so that follow up care be provided. Patient was informed well regarding the biopsy procedure. Films were reviewed, mechanics of the procedure discussed, and risks and complications were explained. Alternatives to Fine Needle Aspiration biopsy of thoracic lesions were discussed as part of informed consent. Then an informed written consent was obtained from the patient. Patient's coagulation profile was checked.

### **FNAC Technique**

The patient pulse, Blood pressure and Respiratory rate were recorded. Initially ultrasound localization and planning of the biopsy was done. A 3.5 MHz sector transducer was used for localization and FNAC. Longitudinal and transverse scans were obtained with the patient in supine or in sitting posture to get good inter costal window and the exact site and depth of the lesion from the skin. The procedure was deferred if the lesion was cystic. The exact skin site was marked and the skin is prepared with aseptic precautions.

In this study, a disposable single pass 22 G needle attached to a 20cc syringe was used. The patient was asked to hold breath and the needle inserted to the lesion. Aspiration was accomplished by creating a vacuum in the needle by drawing back the plunger of the syringe. A vacuum was created by pulling the plunger to 1 ml mark after the tip of the needle is within the lesion, several in and out motions are made with the needle in the lesion, while suction was

applied. Before the needle was withdrawn from the lesion suction was released. After the needle was removed from the patient the needle and syringe were separated and about 5 to 10 ml of air was drawn into the syringe and reattached to the needle. The material from the needle was ejected on to the microscopic slide. The biopsy procedure was repeated with the same needle and syringe until satisfactory specimen was obtained. Aspirate was spread onto the pre-labelled slides kept ready for smearing. Few slides were air dried, while other slides were fixed for 20 minutes in a jar (Copley's jar) containing methanol. Later the methanol fixed slides were dried and all the slides were sent for cytological examination. The air-dried slides were stained by Leishman's stain and the methanol fixed slides were stained by Hematoxylin and Eosin stains. The slides were read in high power microscope.

### **After care of the procedure**

Blood Pressure, Pulse was monitored for every 2 hours for the first 24 hours. Patients were kept for bed rest for 24 hours. Patient was assured if hemoptysis occurs. An analgesic was given if the patient complains of pain. Check X-ray was taken if necessary. A repeat ultrasound scan was done to note the fluid collection if any into the pleural cavity. Facility for underwater seal was made available routinely for the management of pneumothorax. Chest skiagram was ordered only when there is clinical or sonographic suspicion of pneumothorax. Proved malignant cases were treated accordingly.

If the Fine Needle Aspiration Cytology did not confirm the diagnosis in first attempt, the procedure was repeated. Even with repeated Fine Needle Aspiration Cytology, if the diagnosis was not confirmed, patients were subjected to other alternative methods of investigations.

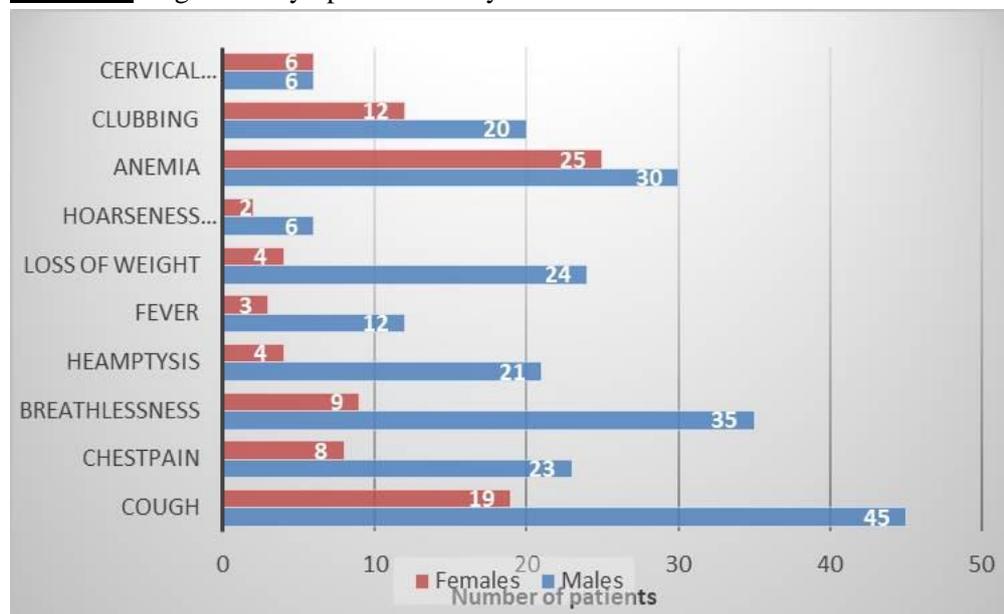
### **Results**

61 patients (75.3%) were Males, while 20 (24.6%) were Female. The Male: Female ratio was 3:1. The mean age of patients in this study was 48. The youngest patient was aged 26 years

and oldest was aged 71 years giving an age range of 26 to 71 years. 54(66%) patients of this study were smokers. Only 3 female patients were

smokers. The most common symptom was cough and sign was anemia (**Figure – 1**).

**Figure - 1:** Signs and Symptoms in study.



Left side of lung was more involved in present study (**Table – 1**). Left Upper Zone was most involved area in lung (**Table – 2**). Cytopathological diagnosis was as per **Table – 3**. Squamous cell carcinoma was the commonest cytological type noted accounting for 60% followed by adenocarcinoma (**Figure – 2**).

**Table - 1:** Side of lung involved and associated radiological findings of the lung.

Side of the lung involved	No. of Cases	%
Right	29	36%
Left	52	64%
<b>Radiological lesion</b>		
Diaphragmatic elevation	4	4.9%
Rib erosion	2	2.4%
Hilar nodal enlargement	6	7.4%

In non-malignant lesions tuberculosis was most commonly observed (**Figure – 3**). In total 81 Complications of needle biopsy were 2 cases (2.4%) are with Hemoptysis and 3 cases (3.7%) were with Pneumothorax (**Table – 4**).

**Table - 2:** Zone or zones of lung involved.

Zone of lung involved	No. of Cases	%
Right Upper Zone	6	7.4%
Right Middle Zone	4	4.9%
Right lower Zone	7	8.6%
Right upper & middle zone	7	8.6%
Right middle & lower zone	5	6.1%
Left Upper Zone	18	22.2%
Left Middle Zone	10	12.3%
Left Lower Zone	7	8.6%
Left upper & middle zone	12	14.8%
Left middle & lower zone	5	6.1%

**Table - 3:** Cytopathological diagnosis.

Type	No. of Cases	%
Malignant	45	55.5%
Non-malignant	26	32%
Inconclusive	10	12.3%

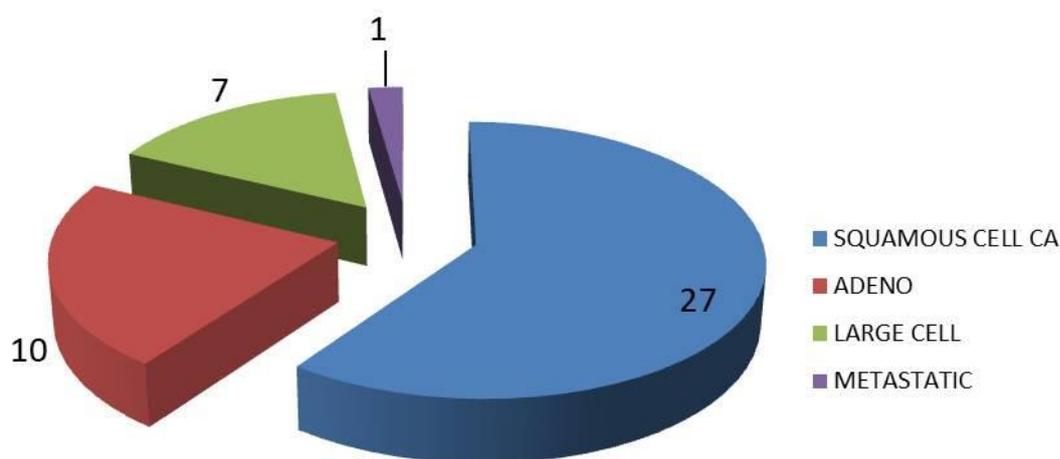
## Discussion

This study of Ultrasound Guided Percutaneous Transthoracic Fine Needle Aspiration Cytology has demonstrated that the technique is useful in diagnosing a variety of intrathoracic lesions,

including malignant and nonmalignant diseases. The present study was designed to evaluate the safety of Ultrasound guided Percutaneous Transthoracic Fine Needle Aspiration Cytology

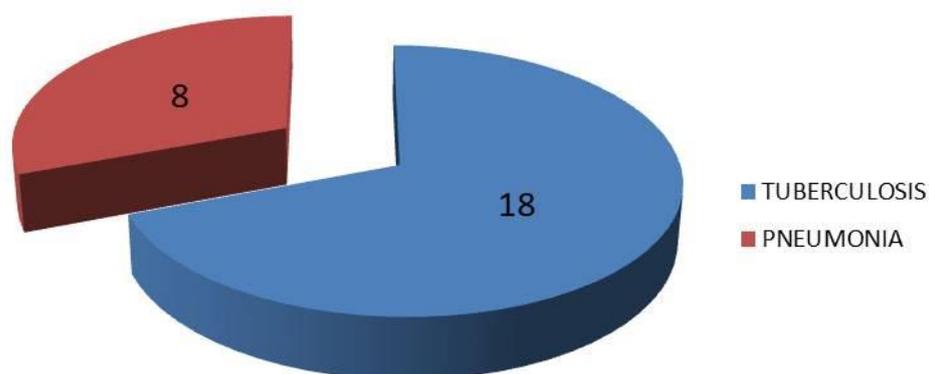
and its efficacy to establish the diagnosis. In this study Male: Female ratio is 3:1 similar to the study of Knudsen, et al. [3]. In most of the previous studies the ratio is between 5:1 and 2:1.

**Figure - 2:** Cytopathological diagnosis of various lung cancers.



**Figure - 3:** Non-malignant lesions by FNAC.

### NON-MALIGNANT LESIONS



**Table - 4:** Complications of needle biopsy of lung.

Complication	Number of Cases	Percentage %
Hemoptysis	2	2.4%
Pneumothorax	3	3.7%

54(66%) patients of this study were smokers. Only 3 female patients were smokers. Pathological diagnosis of malignancy is more among smokers indicating the risk of smoking for the etiology of malignancy. Out of 27 nonsmokers, malignancy is confirmed in 4 cases. 3 out of four cases are adenocarcinoma and one is Squamous cell carcinoma. In the present study, diagnostic yield of Percutaneous Transthoracic Fine Needle Aspiration Cytology was 87.6%, comparable with most published reports of Percutaneous Transthoracic Fine Needle Aspiration Biopsy done with guidance where the yield ranged from 80-97%. Diagnostic yield in Sinner study is 90.7% and in Junpei Ikezoe, et al. [4] (1989) study is 90%. Ang Yuan, et al. [5] in 1992 reported that confirmative diagnosis is obtained in 27 out of 30 patients. The

high success rate achieved in my study may be due to selection of cases as most of the cases had lesions of more than 3 cm diameter, while other studies included smaller lesions.

The principal reason for failure to diagnose was inadequacy of the aspirate due to small size of the lesion and depth of the lesion. In this study, no conclusion was reached in 10 cases out of 81. Of the 10 patients, 1(one) was later diagnosed as Brachial Plexus Schwannoma by excision biopsy and remaining cannot be followed up. Thus, a positive result by Percutaneous Transthoracic Fine Needle Aspiration Biopsy is of immense value, a negative result does not exclude the presence of disease. The present study is though small is comparable with previous studies (**Table - 5**).

**Table - 5:** Present study with comparison with other studies.

Author	Year	No. of Patients	% correlation	Complications
Chadrsekhar, et al. [6]	1976	4	75%	Nil
Sinner [7]	1979	2726	90.7%	Pneumothorax 27.2% Hemoptysis 2.5%
Afschrift M, et al. [8]	1981	20	87.4%	Pneumothorax 8%
Izumi, et al. [9]	1982	16	16%	Nil
Dorothy Cinti, et al. [10]	1983	12	12%	Pneumothorax 10%
Pan Chyr Yang [11]	1985	25	84%	Pneumothorax 8%
Jonpei Ikezoe, et al. [4]	1989	124	90%	Pneumothorax 4%
Ajay K, et al. [12]	1991	57	80%	Pneumothorax 4%
Chen, et al. [13]	1996	40	87.5%	Pneumothorax 3.7%
Knudsen, et al. [3]	2001	268	93.2%	Pneumothorax 3.7%
Present study	07-09	81	94%	Pneumothorax 3.7% Hemoptysis 2.4%

Major presenting symptom was cough in 64(80%) of the patients. Around 44% of patients presented with cough associated with nonspecific symptoms like weight loss and loss of appetite. Signs of Breathlessness, chest pain, Hemoptysis, fever and Hoarseness of voice are in decreasing order of frequency. In general examination, common findings were anemia in 68%, followed by clubbing in 40% cases. In the present study, left side of the lung was involved in 64% of cases, and Right in 36% of cases. Associated radiological findings were presence of Hilar

adenopathy, Diaphragmatic elevation and rib erosion.

In the present with 81 patients of peripheral pulmonary lesions, 71 were diagnosed by Fine Needle Aspiration Cytology, reflecting high success rate of 87.6%. Similar results were reported in Afschrift M, et al. [8] study and in study done by Robert D, et al. [14]. Repeated needle aspiration from different parts of the lesion increased the cell yield.

Among the 81 patients that were biopsied, repeat biopsies were performed in 16 patients. According to Khouri Nagi, et al. [15] (1995), repeat biopsies after primary negative biopsy procedures, may also increase the success rate considerably. Repetition can be avoided by the presence of the cytologist during the session of by Fine Needle Aspiration Cytology in order to review the slides under the microscope. Definite diagnosis cannot be made in ten cases by Fine Needle Aspiration Cytology indicating the limitation of the procedure.

Fine Needle Aspiration Cytology provides good sampling of cell. The main limitations are insufficient sampling rate and inability to diagnose invasion. In Fine Needle Aspiration Cytology diagnosed malignancies, cytopathological types encountered are Squamous cell carcinoma (27 cases), Adenocarcinoma (10 cases) and Large cell carcinoma (7 cases) and metastatic lesion in one case. This is in concordance with previous studies, as Squamous cell carcinoma is the commonest malignancy in Indian sub-continent. Adenocarcinomas are more often peripherally located and thus more amenable to diagnosis by transthoracic Fine Needle Aspiration Cytology.

This study reaffirms the use of Fine Needle Aspiration Cytology in the diagnosis of Pulmonary Tuberculosis. Tuberculosis constituted 22.2 % of all Fine Needle Aspiration Cytology cases. In various studies reported in India, the corresponding figures range from 2.1% to 20 %. Complications were observed in 6.1% of patient, similar to reports of other studies. In fact, Chandrasekhar, et al. [6] observed no complications. Pneumothorax occurred in three cases (3.7%), did not required intercostal drainage and managed conservatively. Minimal hemoptysis occurred in two cases (2.4%), none required treatment.

These complications were dependent on the bore of the needle used, duration of the procedure. The risk also increases if the patient is uncooperative or he or she coughs or cannot hold

breath. Implantation of tumor cells in the path of needle tracts was experienced only in one case in Sinner's series of 5300 cases. Mortality due to Fine Needle Aspiration Biopsy reported in the literature was because of intrapulmonary hemorrhage, air embolism, and untreated pneumothorax. In my study, these complications were not seen. No mortality in present study.

## Conclusion

The procedure is well tolerated with less morbidity and negligible mortality. It can accurately sub-classify the type of Bronchogenic carcinoma. The majority of lung malignancies can be confidently diagnosed with cytomorphological characterization in the right clinical context. It is time saving procedure for both the patient and the clinician because; a report can be obtained in a few hours. The technique and the equipment are simple. No anesthesia is required. It can be performed in the Out-Patient basis. It is relatively less expensive. The exact cytological diagnosis is available before definite treatment is planned. It lessens the need of other procedures like BAL, FOB and cutting biopsy procedures etc.

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