

Evaluation of Peripheral Lung Masses with Special Reference to Ultrasound-guided Fine Needle Aspiration Cytology: A Clinico-radiological and Pathological Study

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Abstract

Introduction: New developments in the field of thoracic oncology are challenging the pathological diagnostic approach of lung cancer.

Objective: The aim of this study is to correlate the clinico-radiological findings with pathological findings of lung masses and to evaluate diagnostic value of ultrasound (USG)-guided transthoracic fine-needle aspiration cytology (FNAC) in peripheral lung masses.

Design: A prospective study carried out between September 2011 and August 2012 in the Department of Pulmonary Medicine, S. C. B. Medical College & Hospital, Cuttack, Odisha.

Methodology: A total of 40 patients with peripheral lesions adjacent to chest wall with accessibility through USG window were evaluated. FNAC were performed with lumbar puncture needle 20 G under USG guidance. Cytology results correlated with clinico-radiological findings and data analyzed.

Results: Definitive histological diagnosis made in 39 out of 40 patients (97.5%); 30 were malignant lesions and 9 benign. Among the malignant lesions, 13 were adenocarcinoma (33.3%), 9 were squamous cell carcinoma (23.1%), large cell carcinoma 1 (2.6%), anaplastic carcinoma 2 (5.5%), and small cell carcinoma (SCC) were 5 (12.8%). The benign lesion consisted of 7 inflammatory, 1 tubercular, and 1 fungal. In 1 patient diagnosis was inconclusive due to inadequate specimen.

Conclusions: USG-guided FNAC is safe, less expensive, less time consuming, less invasive diagnostic tool with high degree of accuracy and no radiation toxicity.

Key words: Cytology, Fine-needle aspiration cytology, Lung mass, Ultrasound

INTRODUCTION

New developments in the field of thoracic oncology are challenging the pathological diagnostic approach of

lung cancer. Since specific therapies are now available for different histological tumor types diagnosis has to be specific and precise. After discovery of specific molecular alterations that are capable of predicting response to certain drugs, molecular testing of tumor cells is not considered a luxury, but rather necessary. The vast majority of lung cancer is diagnosed in advanced clinical stages, where cytologic or small biopsy material is the only form of tissue diagnosis, thus placing cytology, especially fine-needle aspiration cytology (FNAC) in the frontline for management of patients with lung cancer.¹ FNAC not only distinguishes benign from malignant lesions but also

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helps in tumor typing of lung cancer, thereby avoiding unnecessary delay in initiation of specific therapy such as chemotherapy or surgery.²

Aim and Objective

To study the correlation of clinico-radiological and pathological findings of peripheral lung masses and to determine the utility of ultrasound (USG)-guided FNAC in diagnostic evaluation of such lesions.

METHODOLOGY

The study was conducted in the Department of Pulmonary Medicine, S. C. B. Medical College, Cuttack in collaboration with the Department of Radiodiagnosis and Department of Pathology from September 2011 to September 2012. Patients with chest radiograph finding of mass lesion in peripheral lung fields were considered eligible for the study. The study participants were explained about their clinical diseases, procedure to be carried out and nature of the study in their own language and an informed consent was obtained. Exclusion criteria were mediastinal mass lesion, mass present more than 8 cm deep to skin surface and those who did not give their consent. After patients were enrolled into the study a detailed history was collected followed by thorough clinical examination. Routine blood investigations including coagulation profile and viral markers were performed. The subjects were kept nil per orally for 6 h before procedure. Only mild sedation was used for anxious patients. 22/23 gauge bore needles were used for fine-needle aspiration; 1.5 inch length needle for superficial masses and 8 cm long spinal needle for deep-seated lesions. Aspiration was performed under continuous real time USG visualization, that is, "guidance method" using "free hand approach." The needle was inserted through the skin directly into the plane of view of the transducer. This approach offers great flexibility to the operator by allowing subtle free hand adjustments to be made during the course of the FNAC, thereby compensating for improper trajectory and patient movement. After preparation of the site, 5 ml of 2% xylocaine was infiltrated into the skin, subcutaneous tissue, muscle plane, and parietal pleura. After the needle was visualized at the proper site the inner stylet was removed. A volume of 10 ml syringe was attached to the tail end of the needle. Several 1 cm up and down movements were made within the lesion. 1-2 passes were made most of the time. The suction was maintained for 30-45 s till some material appeared at the nozzle. When aspiration was completed, the negative pressure was slowly released before withdrawing the needle to equalize the pressure in the syringe. The needle was then withdrawn and pressure was applied at the puncture site for 3-5 min with sterile cotton to prevent hemorrhage or formation of

hematoma. Gross evaluation of the aspirate was performed on-site by naked eye examination or by quick differential staining. If samples were inadequate repeat aspiration was done. The participants were kept under observation for 2-3 h. Chest radiographs were done before discharging the patient to rule out any complications of the procedure. For sterility the transducer was cleaned with isopropyl alcohol and placed directly on the skin. Sterile gel was used as an acoustic agent.

Clinico-radiological diagnosis made before FNAC procedure was correlated with cytology results and data were analyzed.

RESULTS

Total number of the study participants in the study were 40; 29 (72.5%) males and 11 (27.5%) females. Half of the subjects, that is, 20 belonged to age group of 45-64 (Table 1). The most common symptom was cough present in 92.5% followed by chest pain in 52.5% of patients. Clubbing was found in 20 (50%), pallor in 21 (52.5%) and superior vena caval syndrome seen in 6 (10%) (Table 2). Nearly 75.9% of male patients (22) were smokers, whereas none of the female patients had smoking history (Table 3). Smoking index of smokers were <300 in 16, 300-600 in 4 and >600

Table 1: Age and sex distribution of cases with lung mass

| Age group (in years) | Number of cases (%) | Male (%) | Female (%) |
|----------------------|---------------------|-----------|------------|
| 25-34 | 6 (15) | 4 (10) | 2 (5) |
| 35-44 | 3 (7.5) | 0 (0) | 3 (7.5) |
| 45-54 | 12 (30) | 8 (20) | 4 (10) |
| 55-64 | 8 (20) | 6 (15) | 2 (5) |
| ≥65 | 11 (27.5) | 11 (27.5) | 0 (0) |
| Total | 40 (100) | 29 (72.5) | 11 (27.5) |

Male: female=2.64:1, maximum numbers of patients belong to age group 45-54 years (12 cases), minimum numbers of patients belong to age group 35-44 years (3 cases)

Table 2: Symptoms and signs in patients of lung mass

| Clinical symptoms and signs | Number of cases (%) |
|-----------------------------|---------------------|
| Cough | 37 (92.5) |
| Hemoptysis | 11 (27.5) |
| Chest pain | 21 (52.5) |
| Breathlessness | 14 (35) |
| Constitutional symptoms | 31 (77.5) |
| Clubbing | 20 (50) |
| Lymphadenopathy | 7 (17.5) |
| Pleural effusion | 4 (10) |
| Pallor | 21 (52.5) |
| Superior venacaval syndrome | 6 (10) |

Distribution of symptoms and signs in patients of lung masses. Most common symptoms were cough and constitutional symptoms. Most common signs were pallor followed by clubbing

in 2 (Table 4). Of 40 FNAC procedures done 39 samples were adequate, that is, 97.5% and only 1 sample was inadequate where diagnosis could not be made. Malignancy was detected in 30 patients (75%) and 9 cases (22.5%) were non-malignant (Table 5). In non-neoplastic samples, 1 was tubercular, 1 fungal, and 7 were inflammatory. Most common type of lung cancer was adenocarcinoma (43.3%) followed by squamous cell carcinoma (30%) and SCC (16.67%) (Table 6). Of 39 patients where USG-guided FNAC could reach a diagnosis clinico-radiological and pathological correlation were seen in 35 cases, that is, 89.74% (Table 6). Complications due to the procedure were observed in 8 patients; 5 patients complained of chest pain whereas vasovagal pain, hemoptysis, and pneumothorax

occurred in 1 patient each. Patient with pneumothorax was managed with intercostal chest tube drainage and was discharged in 3 days after complete lung expansion while other patients were managed conservatively.

DISCUSSION

FNAC was first used by Martin and Ellis as a diagnostic tool.³ Leyden in 1833 and Manbriel in 1986 introduced the technique as diagnostic lung puncture for the detection of malignancy and infections.⁴ In the last decades, FNAC of pulmonary mass has gained popularity as an useful test for cytological analysis of lung and mediastinal pathologies. It has been used successfully as a nonsurgical tool for confirmation of primary as well as metastatic lesions.⁵

The present study constituted 29 males (72.5%) and 11 females (27.5%) out of the total 40 with a male:female ratio of 2.64:1 (Table 1). The age ranged from 26 to 82 years. Although many studies have reported high male: female ratio, attributing it to more exposure to toxic substance and outdoor life of males, some recent documentation shows fall in incidence in males and increases in females.⁶ This study has similar findings as Tan *et al.*, with male:female ratio of 2.53:1 with age ranging from 11 to 82 years.⁷ Most common age group for malignancy in this study is >65 years (23.7%). Tan *et al.*, also found malignant lung tumor most common in people with age of >50 years and more.⁷ Detection of 38.5% of malignancy in <50 years age in this study is close to the finding of

Table 3: Smoking status in lung mass

| Sex | Number of patients | Smoker number (%) | Non-smoker number (%) |
|--------|--------------------|-------------------|-----------------------|
| Male | 29 | 22 (75.9) | 7 (24.1) |
| Female | 11 | 0 (0) | 11 (100) |

Association with smoking habit shows among the 29 males, 22 were smokers (75.9%) and 7 were non-smoker (24.1%). None of the females were smokers

Table 4: Smoking index

| Smoking index | Number of patients (%) |
|---------------|------------------------|
| 0 | 18 (45) |
| 1-300 | 16 (40) |
| 301-600 | 4 (10) |
| >600 | 2 (5) |

Out of 22 smokers, 16 cases (40%) had smoking index in between 1 and 300, 4 cases (10%) had smoking index 301-600 and 2 cases (20%) had smoking index >600

Table 5: Pathological diagnosis of lung mass

| Total number of cases | FNAC | | Pathological diagnosis | Male | Female | Total | Inadequate material/inconclusive cases |
|-----------------------|----------|------|-------------------------|------|--------|-------|--|
| | Not done | Done | | | | | |
| 40 | - | 40 | Adenocarcinoma | 10 | 3 | 13 | 1 case |
| | - | 40 | Squamous cell carcinoma | 7 | 2 | 9 | |
| | - | 40 | SCC | 2 | 3 | 5 | |
| | - | 40 | Large cell carcinoma | 1 | 0 | 1 | |
| | - | 40 | Anaplastic carcinoma | 2 | 0 | 2 | |
| | - | 40 | Fungal | 1 | 0 | 1 | |
| | - | 40 | Tubercular | 1 | 0 | 1 | |
| | - | 40 | Inflammatory | 6 | 1 | 7 | |
| 40 | - | 40 | | 30 | 9 | 39 | 1 |

Results of FNAC: Most common pathological diagnosis was adenocarcinoma lung. FNAC: Fine needle aspiration cytology, SCC: Small cell carcinoma

Table 6: Correlation of clinico-radiological versus pathological diagnosis

| Type of lesion | Clinico-radiological diagnosis | Pathological diagnosis | | | Micro biology |
|------------------|--------------------------------|------------------------|-----------|----------------------------------|---------------|
| | | Correct | Incorrect | Inconclusive/inadequate material | |
| Lung mass (n=40) | | | | | |
| Malignant | 30 | 28 | 2 | - | - |
| Tubercular | 1 | 1 | - | - | Positive |
| Inflammatory | 8 | 5 | 2 | 1 | - |
| Fungal | - | 1 | - | - | Positive |

Clinico-radiological and pathological correlation of lung mass in the present study is 35/39 (89.74%)

Behera and Balamugesh who reviewed data from national research registry program of ICMR and found that 40% of lung cancer occurred in <50 years of age.⁸

The risk of malignancy increases in smoking index. It is the product of average number of cigarettes per day and total period of smoking in years. In the study of Rajseshkharan *et al.*, 73.2% of patients were smokers and 66.4% of smokers had smoking index above 300.⁹ Number of smokers for Guleria *et al.*, were 58% and for Jindal and Behera were 83.5%.^{10,11} In this study, 22 out of 40 male patients (75.9%) were smokers. None of the female patients were smokers (Table 3). 6 patients (27.3%) had smoking index >300 (Table 4).

In the present study of adequacy of sampling was 97.5%. Adequacy of sample in more than 90% of cases was also reported in previous studies, that is, Clee *et al.*, Hollings and Shaw, Behera and Balamugesh.^{8,12,13} The cytology specimen evaluated in our study (Table 5) showed definite malignancy in 75%, inflammatory lesions in 17.5%, tuberculosis in 2.5%, and fungal in 2.5%. Similar observations were made by Bandyopadhyay *et al.*, with malignant lesions in 67.4%, benign and inflammatory lesions in 19.5%, atypical cells in 5.8% and granulomas in 7.8%.¹⁴ Tan *et al.*, also observed 65.8% malignant lesions, 25.4% inflammatory/nonmalignant lesions and TB in 5.3%, with an yield of 93%.⁷ Dahlstrom *et al.*, Gouliamos *et al.*, reported 64.6% and 61% malignant lesions, respectively.^{15,16} A higher value was reported by Ahmad *et al.*, with malignancy in 78% of cases and TB in 12% of cases.⁵ Distinction of nonsmall cell lung carcinoma (NSCLC) from SCC was important as most of the therapeutic decision needed this degree of differentiation and it was highlighted by previous studies.^{7,17,18} Pathak *et al.*, observed NSCLC in 75-80% of malignant lesions with increasing the incidence of adenocarcinoma which is similar to this study.¹⁹ An update on non SCCs attributed this increasing incidence of adenocarcinomas to use of filter cigarettes which are of low tar and tend to be inhaled deeply resulting in carcinogen to be deposited more peripherally. Tan *et al.*, also reported a high incidence of adenocarcinomas in 49.4% of cases, where the most of lesion were peripheral in distribution.⁷ They reported squamous cell carcinoma in 12%, SCC in 9.4% and metastatic lesion in 8% of cases.

Needles of 22-23 G were used for most aspirates in the present study with a reproducibility percentage of 97.5%. The Papanicolaou Society of Cytopathology Task Force (1999) also opined the use of 22 G Chiba or Grenne needle. It was found that by using 25 G needle for emphysematous lung, COPD and coagulopathy, the sample was adequate in 88.5%,²⁰ also pneumothorax was avoided by use of thinner needle.²¹ The complication recorded in the present study

was only in 8 cases. Chest pain was the most common complication observed in 5 (12.5%). Pneumothorax was observed in 1 case (2.5%), vasovagal reaction in 1 case (2.5%), and hemoptysis in 1 cases (2.5%) which were mild enough to be managed conservatively. Near similar complication rate was noted by few earlier studies.^{14,22}

The clinico-radiological diagnosis was compared with the pathological diagnosis in 39 cases. In 35 cases, the clinico-radiological diagnosis was well correlated with the pathological diagnosis. Clinico-radiological suspicion was proven wrong pathologically in 4 cases; 1 suspected lung malignancy reported fungal, another suspected lung malignancy reported benign, and 2 suspected benign lesions were malignant. Diagnosis was inconclusive in 1 case due to inadequate specimen. The clinico-radiological and pathological correlation of Thoracic mass in this study is 89.74% which is statistically significant ($P = 0.0001$) with a sensitivity of 93.33% and specificity of 77.77% (Table 6). Torkian *et al.*, observed that of all radiologically indeterminate solitary pulmonary nodules, 50% were malignant and of all the lesion <5% lung neoplasm were benign. So when a clinician suspects neoplasia, then there is a high probability that the lesion is malignant.²³

CONCLUSION

Although thoracotomy and biopsy is the most accurate method of diagnosis, USG-guided FNAC is a safe, less expensive, less time-consuming, less invasive diagnostic tool with high rate of accuracy. Such procedure can be adopted safely by the physicians and the coordination of pulmonologist, radiologist and pathologist is highly essential for better yield.

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