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DIAGNOSTIC YIELD AND SAFETY OF CT SCAN GUIDED TRANS THORACIC FINE NEEDLE ASPIRATION CYTOLOGY IN PERIPHERAL LUNG LESIONS

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ABSTRACT

Aims and Objectives: To obtain a sample of tissue by CT scan guided FNAC for pathological (cytopathological and histopathological) and / or microbiological analysis and to evaluate its efficacy to reach a definitive diagnosis. **Material and Methods:** 60 patients comprising 48 males and 12 females between 14 to 85 years with lesions in the peripheral lung fields were subjected to CT guided transthoracic fine needle aspiration (FNA) for a definitive diagnosis of benign or malignant lesion or for microbiological analysis to establish the etiologic agent. The procedures were performed using the siemens somatom AR.C CT unit with 18-22 gauge needles. Smears and tissue sections were evaluated simultaneously to reach at a definite diagnosis. An immediate post biopsy scan along with an expiration PA chest radiograph after 2 hours, were obtained to detect the presence of pneumothorax. **Results:** The commonest lesions diagnosed were inflammatory 41.6% and most of them were non-specific. Among the specific infections, Nocardia was most commonly seen. The post renal transplant – immunocompromised patients were benefited by specific diagnosis in 7 out of 9 patients i.e 77.7%. Primary malignancies were detected in 19/60 patients i.e 31.6% cases. The most common type detected being Non-small cell carcinoma in 17 cases. Secondary deposits were seen in 2 patients. The FNAC showed an overall positivity of 76.6%. In our patients, pneumothorax was seen as a complication in 4 patients i.e. 6.6% only. **Conclusion:** Fine needle aspiration cytology (FNAC) has a good overall yield for diagnosis of focal radiographic lesions. It is safe, accurate, relatively non invasive and cost effective method of obtaining diagnosis.

KEYWORDS: Fine needle sampling, Fine needle aspiration cytology (FNAC), CT-guided FNAC.

INTRODUCTION

Computerized tomography (CT) guided fine needle aspiration cytology (FNAC) of lung lesions has rapidly emerged as a less-invasive, cheap, rapid and fairly accurate diagnostic aid in lung lesions, especially the solitary ones.[1] The role of FNAC in the immunocompromised patient[2] where pulmonary complications are common and opportunistic infections, inflammatory disorders and cancers are all found, has been a new dimension. FNAC can avoid, in these patients, contamination of the culture material by upper respiratory flora.[3] Among the imaging modalities, CT is the most popular.[4] It has revolutionised the detection and localisation of lung lesions. It overcomes several of the disadvantages of ultrasound. The outline of anatomy, internal architecture, vascularity and needle tip visualisation ensures higher accuracy with fewer complications.[5] Fluoroscopic guidance in performing percutaneous transthoracic biopsies has limitation of inaccessibility and small size of certain lesions.[6] Hence, CT-guided FNAC plays an extremely vital role in small thoracic mass lesions and deep mediastinal nodes in which needle placement is correctly possible by avoiding any surrounding blood vessels and adjacent cardiac structures.[7] Thoracotomy is generally contraindicated for small cell anaplastic carcinoma, metastatic tumour or infection and confident diagnosis of benign lesions like tuberculosis makes surgical intervention unnecessary.[8] In such circumstances, FNAC confirms the diagnosis and reveals the lesion type. It is useful in deciding the therapeutic approach in patients in whom results of bronchoscopy and sputum cytological study are not diagnostic. In addition, in candidates for surgery with indeterminate solitary pulmonary nodule (SPN) without clear radiologic signs of malignancy or benignity, findings from FNAC may be diagnostic.[9] Minor complications of FNAC include pneumothorax and hemoptysis. Most authors have reported a pneumothorax incidence of 10-40%.[10] In comparison to FNAC, Core needle biopsy (CNB) is a relatively more invasive procedure for intrathoracic lesions. However, FNAC and CNB have shown comparable results for diagnosing malignant epithelial lesions.[11] We performed a study to evaluate the usefulness of CT-guided FNAC for the

diagnosis of lung lesions as this minimally invasive procedure could be a basis for treatment.

MATERIAL AND METHODS

This was a prospective study conducted in a tertiary care hospital over a period of 1 year. The study was approved by Ethics committee of the institution.60 patients underwent CT guided transthoracic needle aspiration / biopsy of the peripheral lung lesions during this period. The procedure was indicated for evaluating lesions suspected of primary malignancy, to confirm metastasis in known primary, confirmation of diagnosis of benign lesions and to obtain material for microbiological analysis for lesions not responsive to therapy or unconventional lesions. The patients who underwent FNAC for mediastinal or pleural or rib lesions were excluded from the study. Arteriovenous malformation, aneurysm, pulmonary hypertension or histories of bleeding disorder were also ruled out beforehand and the patients were informed regarding the procedure and the possible complications. A written consent was obtained. CT sections were obtained using a SOMATOM AR .C (Siemens) scanner, contiguous CT sections of chest were obtained with 10mm collimation, 2 - 5mm sections were obtained through the region of interest. After the appropriate positioning of the patient a localizing scan was performed with a small 2 x 2 mm lead marker positioned by an adhesive plaster on the selected site of entry. The slices were viewed in both mediastinal and pulmonary windows to ensure that no emphysematous bulla or pleural bleb is in the needle track. 'The needle tip in lesion' localizing scan was obtained for documentation in most of the cases. An immediate post biopsy scan and an expiration PA chest radiograph after 2 hours were obtained, to detect the presence of pneumothorax.

Aspirate was gently spread on slides and few slides placed immediately in 95% alcohol for fixing. The material obtained was subjected to pathological studies (cytopath and / or histopath) and microbiologic studies. Among the 60 cases, adequate material was obtained in 46 cases. Among the cases where diagnosis was inconclusive, other modalities like sputum examination, bronchoscopic biopsy or washings, and pleural fluid analysis were done.

RESULTS

In our prospective study, 60 patients underwent CT guided transthoracic needle aspiration (TNA) from the lesions in the peripheral lung fields. They comprised 48 males and 12 females, between 14 to 85 years of age, majority of them between 50 – 59 years and males predominated. (TABLE 1) In two recent national studies, the percentage of male patients with lung lesions was a little higher than in our series, i.e. 88.0[12] and 80.6%.[13]

TABLE – 1: Demographic description of the study.

Age in years	Total	Percentage
0-9	0	0%
10-19	3	5%
20-29	3	5%
30-39	4	6.6%
40-49	9	15%
50-59	18	30%
60-69	15	25%
70-79	7	11.6%
80-89	1	1.67%
Sex		
Male	48	80%
Female	12	20%

Of the pulmonary lesions diagnosed by FNAC in our study, majority of them were inflammatory 41.6% followed by primary malignancy 31.6%, metastasis 3.33% and the lesions in which no diagnosis could be given with FNAC were 23.33%.(Table 2).

Amongst the 25 inflammatory lesions, 14 cases had nonspecific inflammation and 11 had specific infections. Amongst the proven infections, Nocardia had the highest frequency. (Table 3). Most of the specific infections diagnosed was in the post renal transplantation group. (Table 5) Out of 9 post transplant patients presenting with pulmonary infections, 7 patients could be diagnosed with specific etiologic agents. One patient had both Nocardia and Tuberculosis. One of the patients had E.coli septicemia with E.coli pneumonia proved with FNAC and blood cultures.

Table 2: *Distribution of Lung mass lesions*.

Lesions	No. of patients	Percentage
Inflammatory	25	41.6%
Primary Malignancy	19	31.6%
Metastases	2	3.33%
Inconclusive	14	23.3%

Table 3: Distribution of inflammatory lesions in lung.

Inflammatory Lesions	No. of patients	% of patients
Non specific	14	56%
Specific	11	44%
Tuberculosis	02	8%
Nocardia	04	16%
Aspergillosis	02	8%
Bacteria	03	12%
Total	25	

Among the total 21 lesions detected as malignant with FNAC, Non small cell carcinoma was the most common histologic type among the primary malignancies i.e. 89.4%. Small cell carcinoma was seen in 2/19 patients i.e 10.6%. (Table 4). This result is in agreement with a recent study in which among all 114 cases of malignant pulmonary tumors, the most common was adenocarcinoma (52.63%) and squamous cell carcinoma (22.8%), followed by small cell carcinoma (14%).[14]

Total proven cases of malignant lesions with FNAC was 87.5%.

Table 4: ***Distribution of primary malignant lesions in the lung*.**

(a) Non small cell carcinoma	17	89.4%
i) Undifferentiated	11	57.9%
ii) Broncho alveolar	1	5%
iii)Papillary Adenocarcinoma	4	21%
iv) Squamous cell carcinoma	1	5%
(b) Small cell carcinoma	2	10.6%
Total	19	

Among the 4 patients in whom FNAC was inconclusive initially in post –renal transplant patients, two patients had repeat FNAC. One had both Tuberculosis and Nocardia and the other had fungal infection, one patient improved symptomatically and was diagnosed with polymicrobial pneumonia and one patient was treated as fungal pneumonia and improved.

Table 5: Distribution of lung lesions in post - renal transplant patients.

TYPE OF INFECTION	NO. OF PATIENTS	PERCENTAGE OF CASES
E.Coli	01	9.1%
Klebsiella	01	9.1%
Nocardia	04	36.4%
Fungus	01	9.1%
Aspergillus	01	9.1%
Tuberculosis	01	9.1%
Inconclusive	02	18.2%
Total	11	

Various studies have shown the rate of inadequate sampling to vary from 8.8 to 25.4%.[15] For the 14 cases where sampling material was inadequate, other modalities like sputum examination, bronchoscopic biopsy or washings and pleural fluid analysis were done and a further 7 patients could be given definite diagnosis. Among other 7 patients, 2 patients were lost on follow up, 4 patients were treated empirically for infective process and 1 patient expired without a specific diagnosis.

DISCUSSION

Transthoracic FNAC of the lung is an effective technique for sampling focal peripheral lung lesions.[16] The main objective of guided FNAC is to diagnose malignancy although it can be used for definitive diagnosis of some benign neoplasms and infections such as Kochs.[17]

In our prospective study of 60 patients undergoing CT guided needle biopsies from the lung, 48 were male and 12 were females. The patient's age group ranged between 14 to 85 years. Majority of patients were between 50 to 59 years – 18/60 i.e. 30% (Table 1).

With improved fine needle techniques and with greater degree of visualization and accurate localization of lesion and documentation of needle tip by CT, most of the lesions are now amenable to guided biopsy avoiding thoracotomy and open biopsy.[18] [19] The pattern of first diagnostic testing has shifted away from sputum cytology towards FNAC.[20] Further, FNAC has no absolute contraindications but a few relative ones given due consideration are coagulopathy, pulmonary hypertension, arteriovenous malformations, hydatid cyst, lesion surrounded by bullae. In our study we did not come across any contraindications except for a few patients with emphysematous bullae and one patient was biopsied after the resolution of initial pneumothorax.

In our study 3 patients presented with symptoms not related to the pulmonary etiology and were diagnosed on evaluation. A post operative patient of carcinoma oesophagus being treated for pulmonary kochs had been asymptomatic. Routine evaluation revealed nodular densities in the lung fields which later proved to be metastatic adenocarcinoma. In another patient with a mass lesion in the palate, preoperative evaluation revealed nodular shadows in right upper lobe which proved to be fungal in etiology. A 16 years old patient

with non specific complaints was later evaluated to have pulmonary kochs based on FNAC and T.B serology report.

Of the pulmonary lesions diagnosed by CT-guided FNAC in our series, majority of them were inflammatory followed by primary malignancy. Out of 25 inflammatory lesions diagnosed in our study, 14 cases showed nonspecific inflammation and 11 had specific infections. (Table 3). Amongst the proven specific infections, Nocardia had the highest frequency and a total of 4 cases of Nocardia were detected.

Most of the specific infections diagnosed were in the post renal transplantation group. The choice of diagnostic procedure in an immunocompromised (post-renal transplant group) patient must be based on the yield for the most likely pathogens and the safety of procedure in the circumstances.[21] Here FNAC has an advantage because the specimen can be obtained directly from the radiologically focal abnormal area. The significance of recovery of some pathogens, such as bacteria and candida, can be more correctly interpreted because of uncontaminated samples. FNAC is a relatively reliable, safe and quick method of diagnosing pulmonary infection in immunocompromised patients. Cytomorphological features, when aided by special stains, can accurately detect the specific infection which is potentially treatable.[22] A total of 9 post transplant patients presented with pulmonary infections and 7 patients could be proved with specific etiologic agents i.e.77.8%.(Table 5).

Literature reveals that 70% of the primary lung cancers are diagnosed as non-small cell carcinomas, whereas small cell carcinomas are found to comprise around 20% of all primary lung tumors.[23] In this series, the same pattern was observed. Among the total 21 lesions detected as malignant, 19 had primary malignancy of the lung and Non small cell carcinoma was the most common histologic type among the primary malignancies. Two patients had secondaries in the lungs. (Table 4).

The study was negative i.e the tissue obtained during FNAC could not be commented upon in 14 out of 60 procedures i.e 23.3%. The overall diagnostic yield in this study was 76.6%.

In our study most of the procedures were done by single pass of the needle. The second pass if at all required, was done after an interval, to reduce the risk of pneumothorax. In one of the studies, the incidence of pneumothorax has been reported to be 1.57%.[24] Same pattern was observed in the present study, where pneumothorax was seen as a complication in 4 patients ie 6.6% only. Of these 4 patients, one patient required intercostal tube drainage. Hemoptysis was encountered in 1 of our patients (1.6%) and one of the patients had vasovagal episode, a complication less frequently described.

CONCLUSION

Fine needle aspiration cytology (FNAC) has a good overall yield for diagnosis of focal radiographic lesions. It is relatively non invasive and cost effective method of obtaining diagnosis. FNAC should be considered a useful tool for evaluating focal pulmonary abnormalities and may be indicated in almost all pulmonary lesions where diagnosis in unclear. In addition, information obtained by FNAC must always be correlated with clinical judgement and with other investigations.

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