Original Article

Computed Tomography-Guided Fine-Needle Aspiration and Concurrent Core Biopsy in Diagnosis of Intrathoracic Mass: An Evaluation of 54 Cases in a Tertiary Care Hospital

Abstract

Introduction: Fine-needle aspiration cytology (FNAC) is a simple, safe, and effective tool for cytological diagnosis of different neoplastic lesions. Computed tomography (CT)-guided core biopsy is also essential for tissue diagnosis. **Aims and Objectives:** The aim of this study is to assess the diagnostic value and limitations of fine-needle aspiration and core biopsy in diagnosis of intrathoracic lesions; we have done this retrospective study. **Materials and Methods:** In all 54 cases with mean age of 57.37 years, CT-guided FNAC and core biopsy were performed on same sittings. 20–22 G Chiba needle was used for FNAC, and core biopsy was performed by 18–20 G coaxial automated cutting needle. The cytological and histological evaluations were done in our cytology and histopathology laboratory. Complications were managed by pulmonologists. **Results:** On the evaluation of FNAC smears, diagnosis was done in 44 cases and 10 cases were inconclusive. In core biopsy, five cases were inconclusive. Most of the tumors were of epithelial origin (43 cases, 87.75%) and 95.59% cases were malignant in our series. Sensitivity and diagnostic accuracy of core biopsy (90.38% and 90.74, respectively) were higher than FNAC (84.62% and 85.18%, respectively). **Conclusion:** CT-guided core biopsy was more effective and accurate in diagnosis and tumor classification than FNAC in spite of higher complication rate.

Keywords: *Computed tomography-guided, core-needle biopsy, fine-needle aspiration cytology, intra-thoracic mass*

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Introduction

Lung cancer is the leading cause of cancer-related mortality.[1] Primary as well as metastatic lung malignancies are frequently found in Indian population. Transthoracic fine-needle aspiration cytology (FNAC) is a simple, cost-effective diagnostic technique for evaluation of intrathoracic lesion.[2] However, limitation of FNAC is small sampling, lack of architectural pattern. Core needle biopsy (CNB) is an invasive procedure of obtaining tissue sample with advantage of preserving tissue architecture for histological evaluation as well as immunohistochemistry (IHC).[2,3] CT-guided CNB is a reliable alternative of FNAC in the evaluation of thoracic lesions, especially in the diagnosis of anterior mediastinal lesions, benign lung lesions, and metastatic lung carcinomas where FNAC is less accurate to determine the exact nature of the malignancy.[3] However, controversies exist regarding the value and limitations of core biopsy because of the complications of the invasive procedure.[2,4] Here, we used transthoracic FNAC and concurrent CT-guided core biopsy in thoracic masses to evaluate the value and limitations of both the procedures as diagnostic tool.

Materials and Methods

The present study was a retrospective analysis of 54 cases of thoracic mass during the study period of 3 years (July 2013 to June 2016) in our institute. Ethical clearance was obtained from Institutional Ethics Committee. Written consent was taken from each patient/patient's relative for invasive procedure. Thoracic CT-guided FNAC was performed by 20–22 G needle (Chiba). Average two passes were done and aspirated material is used for preparation of smears. The air-dried smears were stained with Leishman-Giemsa stain and wet-fixed smears were stained by papanicolaou stain.

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For CNB, we used 18–20 G coaxial automated cutting needle biopsy system. On CT scan imaging, the dimension of the lesion and distance from the skin were measured. The exact site of the needle insertion was obtained and marked by surgical pen correlating with axial tomographic section and radiologist's experience. After marking, the skin was infiltrated with 1% lidocaine local anesthetic. The needle was inserted during the expiratory apnea phase of the patient. After the needle insertion, a guiding CT scan was performed to confirm the correct positioning in relation to the lesion. Automated system was utilized and triggered so that the needle tip advanced 15–20 mm depending on the size of the lesion. Collected specimens were delivered to container containing 10% formalin and submitted for histopathology study in our histopathology department. After biopsy repeat, CT was performed to observe any potential complication. If there was no complication, patients were discharged after 12 h of observation. Those patients developed pneumothorax and/or clinically unstable were treated conservatively. Biopsy specimens were processed, and sections were stained with H and E stain. Histological diagnoses were correlated with cytological diagnoses. Statistical analysis was done using SPSS software version 21 (IBM).

Results

We have evaluated 54 cases during the study, and final diagnoses were reached in 49 cases by CNB. Remaining five cases were inconclusive in core biopsy. In FNAC, the diagnosis was reached in 46 cases, and 8 cases were inconclusive. Among 54 cases, male cases (38 cases) were predominant with a male-female ratio 2.3:1. Age distribution of the cases has been represented in Figure 1. Age of the patients was ranged from 18 to 81 years with a mean age of 57.37 years. In the present study, we diagnosed 47 cases of malignant (95.59%) and two benign tumors. Most common tumor diagnosed in our series was adenocarcinoma (19 cases, 38.77%) [Figure 2] followed by squamous cell carcinoma [Figure 3]. Most of the tumors were of epithelial origin (43 cases, 87.75%) and six were nonepithelial neoplasms (12.24%) in the series [Table 1]. Among the nonepithelial tumors, lymphoma was the most frequent diagnosis (3 cases, 6.97%). Only two benign tumors were diagnosed in the present series, single case of thymoma and myofibroblastic tumor. Three adenosquamous carcinomas were diagnosed in core biopsy. None of the cases were diagnosed in FNAC. One case was diagnosed as squamous cell carcinoma, and another two were diagnosed as adenocarcinoma in cytology. In cytological evaluation of two metastatic carcinomas, both were diagnosed as adenocarcinoma. On CNB, one was metastatic clear cell carcinoma from kidney, and another was metastasis from rectal adenocarcinoma.

We found one benign spindle cell tumor in cytology. Core biopsy and IHC confirm the case as myofibroblastic tumor.

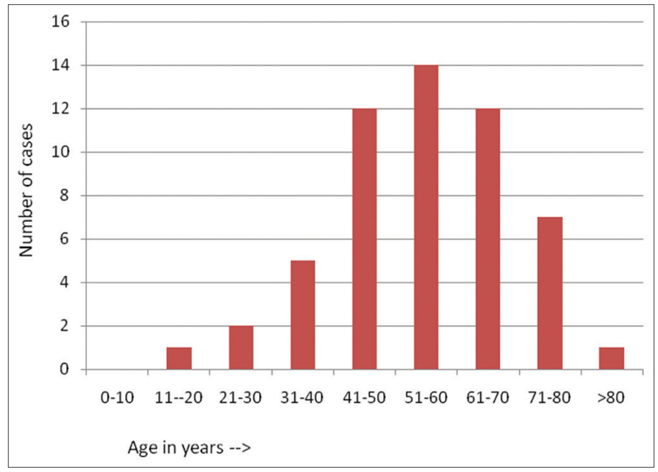

Figure 1: Column diagram representing the age distribution of the cases of thoracic mass

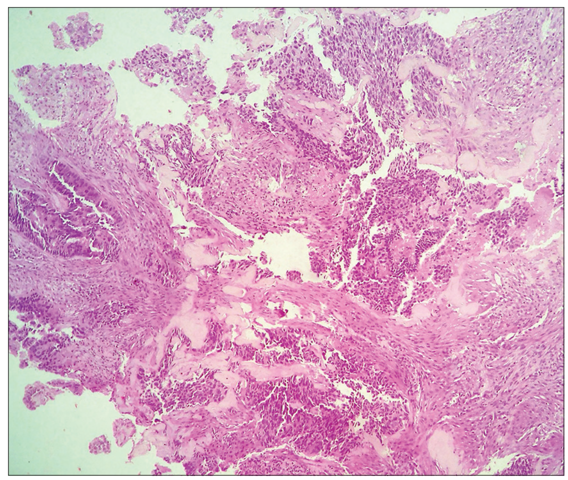

Figure 2: Photomicrograph showing histology of adenocarcinoma of the lung by core biopsy (H and E, low power view)

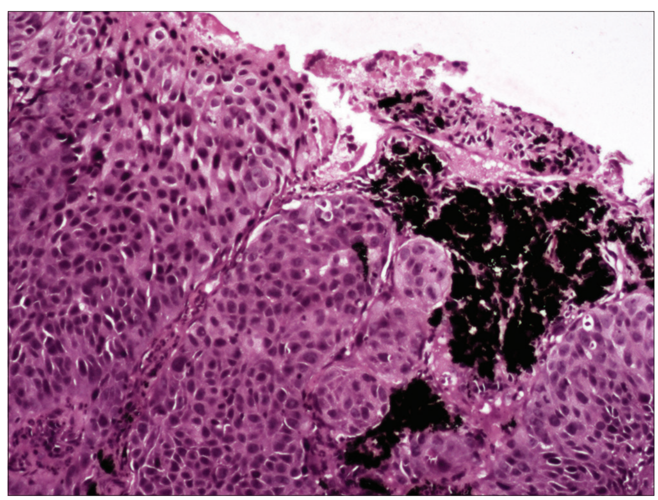

Figure 3: Photomicrograph showing core biopsy of squamous cell carcinoma of the lung (H and E, high power)

Another two nonepithelial tumors, diagnosed as sarcoma in cytology but in core biopsy diagnosed as fibrosarcoma.

Table 1: Distribution of cases according to cytodiagnosis and core biopsy diagnosis

Total case (*n*=54)	FNAC (*n*=46)	FNAC (%)	Core biopsy (*n*=49)	Core biopsy (%)
Epithelial tumor				
Adenocarcinoma	19	35.18	19	35.18
Squamous cell carcinoma	8	14.81	8	14.81
Small cell carcinoma	5	9.25	5	9.25
Adenosquamous carcinoma	0		3	5.55
Neuroendocrine tumor	1	1.85	1	1.85
Mesothelioma	1	1.85	1	1.85
Poorly differentiated carcinoma	5	9.25	5	9.25
Metastatic carcinoma	1	1.85	1	1.85
Nonepithelial tumor				
Non-Hodgkin lymphoma	3	5.55	3	5.55
Thymoma	1	1.85	1	1.85
Myofibroblastic tumor	1	1.85	1	1.85
Sarcoma	1	1.85	1	1.85

FNAC: Fine-needle aspiration cytology

In core biopsy, final diagnosis was possible in 49 cases, and 5 cases were inconclusive. Sensitivity and specificity of CT-guided FNAC in the present study were 84.62% and 100% with a diagnostic accuracy of 85.18%. CT-guided core biopsy had sensitivity and specificity of 90.38% and 100%, respectively. Core biopsy had high-diagnostic accuracy of 90.74% respectively.

In the present study, we found pneumothorax in 19 patients (35.18%) after core biopsy, and all the cases were treated conservatively and observed closely. Chest drain was given in seven patients (12.96%) to get complete cure. In CT-guided FNAC, only five cases (9.25%) had pneumothorax as complication, and all were cured completely by conservative management.

Discussion

Diagnosis of thoracic mass depends on accurate pathological diagnosis, either by cytology or histology or both.[2] Histology and IHC are the gold standard for definitive diagnosis. Tissue sample can be obtained by resection, CNB, transbronchial, and endobronchial biopsy.[5] CNB avoids the risk associated with open surgical biopsy.[5] Accurate diagnosis depends on the skill of operator of CNB, experience of the interpreter, use of ancillary studies such as special stains, immunohistochemistry, and molecular analysis.[1,2,6]

In most of the previous studies, core biopsy had diagnostic accuracy of 80%–95% in the diagnosis of lung carcinoma.[3,7] The accuracy of benign and nonneoplastic conditions is significantly lower in many series.[5,8] Klein *et al*. found sensitivity and specificity of 95% and 91%, respectively, and diagnostic accuracy of 88%.[9] Yu *et al*. found very high accuracy of CNB (97.2%) in their series with sensitivity and specificity of 96.8% and 100%, respectively.[10] In the present study, core biopsy had sensitivity and specificity of 90.38% and 100% respectively, comparable with previous studies. We had diagnostic accuracy of 90.74 in core biopsy, which is also similar with other similar studies.

Diagnostic accuracy of FNAC varied widely in different previous studies. In different studies, FNAC of pulmonary lesions has sensitivity of 82% to 99%, specificity of 86% to100%, and accuracy of 64%–97%.[3] Multiple series reported higher false-negative rate especially in smaller lesion (<3 cm diameter).[3] Negative predictive value has been recorded as 66.67%, 73.3%, and 69.6%, respectively by Mukherjee *et al*., Montaudon *et al*., and Kothary *et al*.[11-13] Accuracy of FNAC in benign lung lesion ranged from 12% to 57%.[14] Diagnostic accuracy of FNAC is also lower in metastatic lung carcinoma (33%) and mediastinal tumors such as lymphoma, thymoma and germ cell tumors.[3]

In comparison between two procedures, most previous authors found core biopsy is more effective and accurate in the diagnosis of the thoracic mass lesion.[2,15-17] Laurent *et al*. and Ohno *et al*. found the high accuracy of core biopsy than FNAC in the diagnosis of lung lesions.[15,17] In the present study also, we found core biopsy had greater sensitivity and efficacy in comparison to CT-guided FNAC in the diagnosis of thoracic lesions.

Pneumothorax and bleeding are commonly encountered complications in different studies.[3,18] In previous literature, rate of pneumothorax in CT-guided FNAC of lung ranges from 8% to 61% and 1.6% to 17% of the cases need chest drainage.[3,7,19,20] Core biopsy has been documented with greater incidence of pneumothorax.[3] In the present study, the incidence of pneumothorax is 35.18%, similar to the finding of Liang *et al*. (31.4%).[1] The incidence of pneumothorax is more where number of passes is greater and wider needles have been used.

The reasons for inadequate material in FNAC and core biopsy are technical difficulties (small lesion, subpleural location, close location to large vessels), which causes poor yield. FNAC is quick and cost-effective than core biopsy.[2] In addition, FNA sample is ideal for flow cytometry and cytogenetic analysis. CNB has improved diagnostic accuracy for mediastinal masses such as classification of lymphoma, thymoma and mesenchymal tumors.[2,21]

Conclusion

CNB had greater sensitivity and diagnostic accuracy in the diagnosis of intrathoracic mass. Core biopsy is better in classification and categorization of mediastinal masses such as thymoma, lymphoma, and soft-tissue masses.

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Conflicts of interest

There are no conflicts of interest

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