Role of Core-needle Biopsies in Cases of Mediastinal Mass Lesions as a Primary Diagnostic Modality in Comparison with Fine-needle Aspiration Cytology

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Abstract

Introduction: The spectrum of mediastinal masses comprises of lesions of various origins. Although the clinicoradiological findings and the location of these lesions within different mediastinal compartments help narrow down the differentials, tissue diagnosis remains the gold standard for diagnosis. The image-guided percutaneous transthoracic fine-needle aspiration cytology (FNAC) and/or core-needle biopsy (CNB) of the mediastinal lesions are considered to be cost-effective and safe diagnostic procedures. CNB of mediastinal lesions is found to provide better yield with the accuracy of 75%–90% and is more precise as compared to FNAC. In this article, we study the role of CNB in cases of mediastinal masses as a primary diagnostic modality as compared to FNAC. Materials and Methods: A retrospective observational study was conducted at a tertiary care hospital in Mumbai. All cases with mediastinal mass lesions diagnosed by FNAC and/or CNB over a period of 1 year in a tertiary care hospital were analyzed. Cases were divided into FNAC group or CNB group depending on the primary diagnostic procedure undertaken. Comparisons were made between the two groups. Results: CNB group was found to have better diagnostic yield in benign as well as malignant lesions in comparison with the FNAC group. The time taken to reach the definitive diagnosis was found to be shorter in the CNB group as compared to the FNAC group. Conclusion: The use of CNB as a primary diagnostic modality may provide faster and accurate tissue diagnosis in cases of mediastinal masses of both benign and malignant nature as compared to FNAC.

Keywords: Computed tomography-guided biopsy, core-needle biopsy, fine-needle aspiration cytology, mediastinal masses, tissue diagnosis

INTRODUCTION

The wide spectrum of various benign and malignant lesions presenting as mediastinal masses poses a diagnostic challenge for pulmonologists, radiologists, and pathologists.[1] Although clinical evaluation, imaging findings, and location of these lesions as per various compartments provide clue to differential diagnosis, accurate and reliable tissue diagnostic procedures are the gold standard and facilitate timely management of these lesions. The percutaneous transthoracic fine-needle aspiration cytology (FNAC) and/or core-needle biopsy (CNB) of the mediastinal lesions when performed under image guidance are minimally invasive, cost-effective, and safe diagnostic procedures.[1] Excluding contraindications, the image-guided transthoracic CNB of mediastinal lesions is found to provide better yield with higher accuracy ranging from 75% to 99%[2-5] and is more precise as compared to FNAC.[6,7] In this article, we study the role of image-guided transthoracic CNBs in cases of mediastinal masses as a primary diagnostic modality as compared to FNAC.

MATERIALS AND METHODS

A retrospective observational study was conducted at a tertiary care hospital in Mumbai over a period of 1 year from January 2018 to December 2018. All cases with mediastinal mass lesions...
diagnosed by transthoracic computed tomography (CT)-guided FNAC and/or CNB over a period of 1 year were included in the study. Cases diagnosed by endoscopic Ultrasonography (USG)-guided transbronchial biopsy, open biopsy, thoracoscopy, or mediastinoscopy biopsy were excluded. Institutional ethics committee consent was obtained. The choice of procedure was made by the treating physician/surgeon in consultation with pathologist and radiologist after considering patients’ age, clinical condition, and location of the lesion. In all cases, FNAC/CNB were performed by experienced pathologists and radiologists following standard protocol after patient workup. Written informed consent was obtained from the patients before the procedure.

Transthoracic approach was used under the guidance of CT scan. FNAC was done using 22–24G needle. Smears were air dried and wet fixed (95% alcohol). Cytology smears were prepared and stained by Leishman and Papanicolaou stains.

Core-needle biopsies were performed using a 14- or 16-G semiautomated cut needle to obtain histological tissue. The biopsy tissues were fixed in 10% formalin, processed, and embedded in paraffin; 4-μ thin sections were cut and stained by hematoxylin and eosin stain.

There were no procedure-related complications noted in any of the cases.

Cases were divided into FNAC group or CNB group depending on the primary diagnostic procedure undertaken.

Comparisons were made between the two groups according to parameters in the form of the nature of lesions diagnosed (benign/malignant), sample adequacy for diagnosis, repeat procedures done to achieve definitive diagnosis, and time taken to reach definitive diagnosis since the time of doing the procedure [Table 1].

**Results**

A total of 11 cases of mediastinal lesions underwent CT-guided transthoracic FNAC/CNB comprising 6 (54%) males and 5 (45%) females with the mean age of 46 years (range: 21–76 years). Most of the lesions were situated in the posterior mediastinum (5; 45%) and anterior mediastinum (5; 45%), followed by superior mediastinum. Six (54%) lesions were malignant as compared to 5 (45%) that were benign [Table 1]. In 6 (54%) cases, FNAC was done as the primary diagnostic procedure, of which only 2 (33%) cases yielded adequate smears for evaluation [Table 2]. The rest of the 4 (67%) cases had to undergo subsequent CNB to reach the definitive diagnosis. Two (33%) lesions that yielded smears adequate for evaluation were malignant in nature: One being a lymphoma and the other a metastatic deposit from adenocarcinoma [Figure 1a and b]. Both these lesions also required subsequent confirmation on CNB with immunohistochemistry. Among the cases that were diagnosed on CNB, 5 (55%) cases were of malignant nature, whereas 4 (45%) were benign. In 5 (45%) cases out of 11 cases, CNB was performed as a primary procedure (without a prior FNAC) and definitive diagnosis could be achieved in all the 5 (100%) cases.

The time to achieve final diagnosis was recorded as the number of days taken to achieve the final definitive diagnosis following the primary diagnostic procedure (CNB/FNAC). The delay in report in the FNAC group was due to suboptimal cellular yield and subsequent biopsy procedures [Figure 2 and Table 2].

Our study found that diagnostic yield was higher in the CNB group as compared to the FNAC group as primary diagnostic procedure [Table 3a and b]. The time to reach diagnosis was found to be considerably less in cases where CNB was done as a primary diagnostic procedure when compared to FNAC [Figure 3].
Mediastinal mass lesions have a wide spectrum of differential diagnosis. They could be neoplastic, nonneoplastic, benign, malignant, primary, or metastatic in nature. The treatment modalities vary according to the nature of lesions. Early diagnosis is important as these lesions expand inside the mediastinum and can cause damage to adjacent vital structures.

CT is the most important imaging tool in the evaluation of mediastinal mass lesions and is superior to USG. High-resolution CT images have very high levels of noise (due to thin sections and high-resolution algorithm), which may make them nondiagnostic for the soft tissues of the mediastinum.

The percutaneous transthoracic CT-guided CNB/FNAC are minimally invasive procedures that help provide definitive diagnosis for these lesions. Sensitivity and specificity of CNB is found to be higher than that of FNAC.

The time to achieve definitive diagnosis was less in CNB as compared to FNAC. This is in concordance with the study by Protopapas and Westcott, Adler et al., and Tscheikuna et al. These studies found CT-guided transthoracic CNB as a safe and accurate diagnostic procedure that decreases the number of inpatient days. CT-guided transthoracic CNB should be the first invasive diagnostic procedure in patients with mediastinal mass lesions.

The most common reason for inconclusive result of FNAC in these cases was suboptimal cellularity. Other reasons were obscuring with haemorrhage and drying/crushing artefacts. This is in concordance with the findings of the study by Nasit et al.

**DISCUSSION**

Mediastinal mass lesions have a wide spectrum of differential diagnosis. They could be neoplastic, nonneoplastic, benign, malignant, primary, or metastatic in nature. The treatment modalities vary according to the nature of lesions. Early diagnosis is important as these lesions expand inside the mediastinum and can cause damage to adjacent vital structures.

**Table 2: Comparison between core-needle biopsy and fine-needle aspiration cytology procedure**

| Procedure | CNB | FNAC |
|-----------|-----|------|
| Total number | 5   | 6    |
| Malignant lesions | 3  | 4    |
| Benign lesions | 2  | 2    |
| Unsuccessful procedures due to sample inadequacy, requiring CNB | 0  | 4*   |
| Lesions with adequate sample, requiring CNB to achieve definitive diagnosis | 0  | 2**  |
| Time to reach definitive diagnosis from the time of procedure (average number of days) | 4  | 7    |

*2 malignant lesions, 2 benign lesions, **Malignant lesions.

**Table 3: Diagnostic Yield**

(a) Diagnostic yield in the fine-needle aspiration cytology group

| Nature of lesion | FNAC group |     |     |
|------------------|------------|-----|-----|
|                  | Benign     | Malignant | Total |
| Number of cases  | 2          | 4      | 6    |
| Conclusive and concordant | Nil | 2      | 2    |
| Inconclusive     | 2          | 2      | 4    |

(b) Diagnostic yield in the core-needle biopsy group

| Nature of lesion | CNB group |     |     |
|------------------|-----------|-----|-----|
|                  | Benign    | Malignant | Total |
| Number of cases  | 2          | 3      | 5    |
| Conclusive and concordant | Nil | 3      | 5    |
| Inconclusive     | Nil       | Nil    | Nil  |

CNB: Core-needle biopsy, FNAC: Fine-needle aspiration cytology

**Figure 2:** Mature cystic teratoma (left) and ganglioneuroma (middle) diagnosed with core-needle biopsy (H and E stain, 40×); fine-needle aspiration cytology with suboptimal cellular yield in these cases (right) (Leishman stain, 40×)

**Figure 3:** Time taken to achieve the final diagnosis in the fine-needle aspiration cytology group and core-needle biopsy group

The diagnosis requires an integrated clinical, radiological, and histological approach.

The percutaneous transthoracic CT-guided CNB/FNAC are minimally invasive procedures that help provide definitive diagnosis for these lesions.

Sensitivity and specificity of CNB is found to be higher than that of FNAC.

Our study found better diagnostic yield and high concordance rate with CNB as compared to FNAC when performed as a primary diagnostic procedure. This is in concordance with studies by Protopapas and Westcott, Nasit et al., and Adler et al.

The time to achieve definitive diagnosis was less in CNB as compared to FNAC. This is in concordance with the study by Protopapas and Westcott, Adler et al., and Tscheikuna et al. These studies found CT-guided transthoracic CNB as a safe and accurate diagnostic procedure that decreases the number of inpatient days. CT-guided transthoracic CNB should be the first invasive diagnostic procedure in patients with mediastinal mass lesions.

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**Limitations of the study**

This study is limited by a small sample size; still, conclusion can be drawn as the cases show equal distribution in malignant
and benign categories and an even gender and age distribution. Findings are concurrent with other studies done on these lesions as cited. The conclusion of this study may prove beneficial to patients with mediastinal lesions in terms of cost and patient safety. It may help in formulating an early and definitive diagnosis by instituting CT-guided transthoracic CNB as the primary diagnostic procedure which will help in early treatment.

**Conclusion**

Mediastinal mass lesions comprise of various neoplastic and non-neoplastic lesions requiring different treatment modalities. Early diagnosis is important as the lesions can cause damage to adjacent vital structures within the mediastinal compartment.

CT-guided transthoracic CNB when performed as a primary diagnostic procedure in cases of mediastinal lesions has been found to be a safe, cost-effective, time-saving, and definitive diagnostic procedure with higher yield and higher rate of conclusive, concordant results with minimal requirement for repeat invasive procedures. FNAC is often limited by inadequate sample and requires subsequent biopsy procedures for confirmation.

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**Conflicts of interest**

There are no conflicts of interest.

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