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Diagnostic accuracy of Computed tomography-guided fine needle aspiration cytology of thoracic mass lesions: A study of 33 cases

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Abstract

Aim: The mediastinum harbors a mixed bag of tumors, which may create significant diagnostic dilemmas. These tumors have widely variable therapeutic and prognostic implications. Correct pre-operative cytological diagnosis and trucut biopsy if indicated, may obviate the need of surgical excision of many of these lesions. A stepwise algorithmic approach such as clinical history, radiological localization, salient cytomorphology and ancillary test helps in correct diagnosis of these tumors. This paper discusses the stepwise diagnostic algorithm for fine needle aspiration cytology diagnosis of mediastinal tumors.

Materials and methods: Prospectively thirty-three patients were studied over a year (July 2015 to June 2016) for their age, sex, and topographic distribution, cytological diagnosis and histopathological diagnosis on tru cut biopsy specimen. Thereafterthe diagnosis on the basis of Cytology smears and histological sections were evaluated in all patients.

Results: Among 33 patients, 27 were male and 6 were female. Most mediastinal neoplasm was identified in 3rd to fifth decade of life. Lymphoma and Germ cell tumor are the most common Mediastinal neoplasm. Adequate tissue material was obtained in 32 of 33 cases by CNB. Of these 32 patients, 26(78.79%) cases were diagnosed correctly by FNAC, whereas 7(21.21%) cases were not diagnosed definitely by FNAC. The sensitivity of CNB for mediastinal neoplasm was 87.88%, significantly higher than FNAC (78.79 %) ($P<0.05$). Mediastinum is the common site and tissue diagnoses of mediastinal mass are very important for correct therapeutic decision.

Keywords: CT guided FNAC, lung, thoracic mass lesions.

1. Introduction

The mediastinum comprises a wide variety of tumors with variable cytomorphology and this may lead to diagnostic dilemmas.[1-8] Management strategies are diverse and depend strongly on the pathological diagnosis and the extent of the disease.[1,4,6-8] Procedures for the tumor diagnosis of mediastinal neoplasm have been diverse, including minimally invasive transthoracic or transbronchial fine needle aspiration cytology (FNAC), core needle biopsy (CNB), mediastinoscopy, video-assisted thoracoscopy, and more traumatic open biopsy. Nowadays, computed tomography (CT)-guided FNAC of lesions of the mediastinum is widely practiced in several institutions where the facilities of standard imaging techniques and cytopathology are available. This procedure provides a safe, rapid, and accurate diagnosis in patients having mediastinal mass lesions.[1-3] by avoiding any surrounding blood

vessels and adjacent cardiac structures.[4,5] However, adequacy of cytology samples recovered from FNAC is the critical point of question among pathologists and physicians.[1,6] Repeated FNAC procedure due to inadequate cytological material delays the diagnosis and specific therapy, which increases the risk of invasive surgical approach and prolonged hospital stay.[1,6] A larger tissue sample obtained by CNB allows more architectural, cytological, and immunohistochemical studies, which will increase the diagnostic accuracy. CNB may obviate the need for more invasive diagnostic procedures. [1,6,9-11] There are very few reports available in the literature regarding the diagnostic methods, cyto-histological correlation and changing patterns of mediastinal tumors.[1,4,12] Most groups have used FNAC techniques.[4] We report a prospective study comparing the usefulness of CNB and FNAC under local anesthesia and guidance of CT scan for Mediastinal neoplasm. In our observation, CNB in combination with FNAC has a major role in diagnosis of Mediastinal neoplasm. Most malignant neoplasm can be accurately diagnosed on CNB. We examined cytological features of different mediastinal neoplasm with its histological correlation and immunohistochemistry confirmation in some cases.

2. Material & Method

This prospective study was conducted on 33 patients who had mediastinal mass that were suspected to be neoplastic in most of the cases by chest radiographs and CT scan in the department of pathology, IGIMS, Patna, from July 2015 to June 2016.In evaluating suspected neoplastic mediastinal lesion we obtained both cytologic slides and tissue for histopathology. The patients were informed about the procedure. Coagulation tests were obtained. After skin cleaning, local anesthesia (10 cc of 2%xylocaine) was given, taking particular care to infiltrate the periosteum of the sternal margin. All procedures were performed under guidance of computed tomography (CT) scan. Tumor size ranged from large infiltrative tumor (7 cm) to small nodules (1.5 cm). The area from skin to the mass was evaluated for vessels and the distance from the skin to mass was determined. The second, third, or fourth intercostal space on both sides can be approached, depending on the location and the extension of the lesion. We used a 22-gaugespinal needle (15 cm in length) attached to a 10 ml disposable syringe to obtain cytological material. CNB were performed using a 14- or 16-gauge semi automated cut needle (15 cm in length) to obtain histological tissue. The number of needles passed depended on adequacy of the sample retrieved. Usually one to three passes was made. Air dried cytology smears were prepared and stained by May–Grunwald–Giemsa (MGG). The biopsy tissues were fixed in 10% formalin, processed, embedded in paraffin, 4 micron thin sections were cut and stained by hematoxylin–eosin stain. If the result of histopathologic study was not definite, immunohistochemical studies were performed on biopsies by direct avidin–biotin–peroxidase method using various antibodies. The antibodies like cytokeratins, epithelial membrane antigen, leukocyte common antigen, alpha-fetoprotein, beta humangonadotropins, neuron specific enolase, and chromogranins were used. Diagnostic accuracy of these groups by FNACnd CNB was compared using, Chi-square test. The $P < 0.05$ was considered statistically significant difference. Cyto-histological correlation was done and incorrect cytological diagnoses were reviewed with special attention. The reasons for discordant cytology diagnosis and pitfalls of entities were evaluated. The patients were followed up for their definite diagnosis either by noting their response to therapy or by surgical resection of the masses.

3. Result

Table 1: Age wise Distribution

Age (in years)	No. of pts	%age of pts
10-30	11	33.33%
31-50	13	39.39%
>50	09	27.27%

Age wise distribution of the patients along with different, mediastinal lesion is shown in Table 1. Most mediastinal tumors (39.39%) were identified in the 3rd to 5th decade of life.

Table 3: Sex Distribution

Sex distribution	No. of pts	%age of pts
Male	27	81.81%
Female	06	18.18%

Among 33 patients who underwent FNAC and CNB for their mediastinal lesion, there were 27 male and 06 female with male to female ratio was 4.5:1.

Table 4: Comparison of result of FNAC & CNB

Diagnosis	No. & % age of pts diagnosed by FNAC	No. & % age of pts diagnosed by trucut biopsy
Lymphoma	7&21.21%	8&24.24%
Germ cell tumor	6&18.18%	7& 21.21%
Thymic lesions	3& 9.09%	4& 12.12%
Neural tumor	5& 15.15%	5& 15.15%
Metastasis	4& 12.12%	5& 15.15%
Malignant cells	4& 12.12%	3& 9.09%
Inadequate sample	3& 9.09%	1& 3.03%

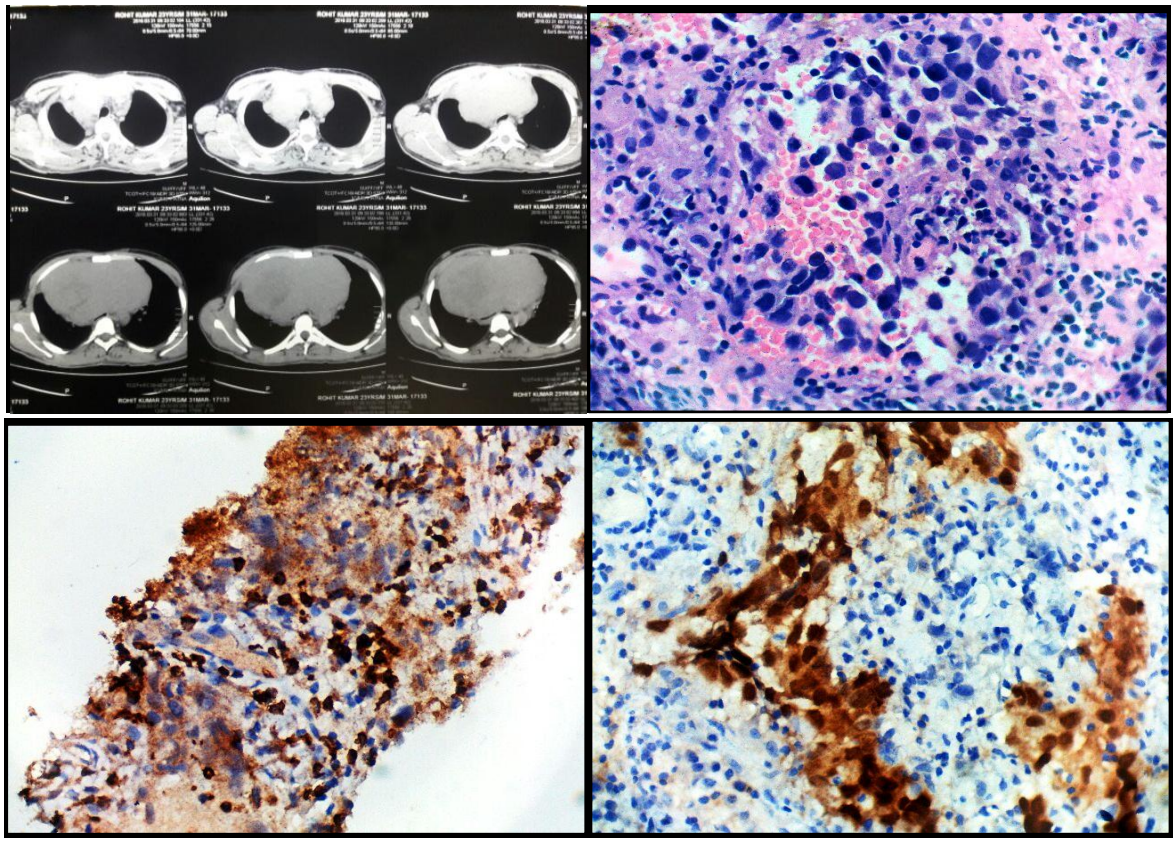

Figure 1.(a) CT of thoracic lesion showing mediastinal mass. 1(b) HPE from lung mass showing sheet of tumor cells with moderate amount of cytoplasm. 1(c) &1(d) IHC showing positivity of Oct ¾ in tumor cells and CD 5, Consistent with Germ cell tumor of mediastinum

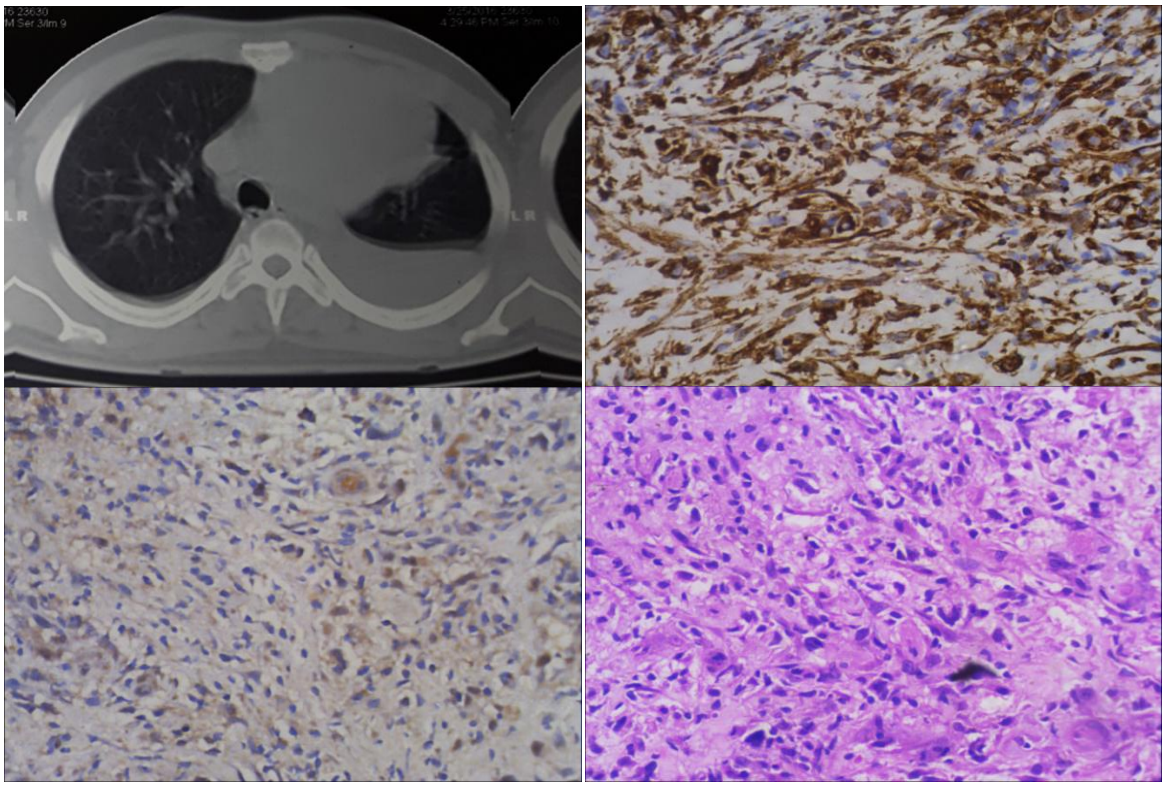

Figure 2(a) CT of lung mass showing hypoechoic lesion. 2(b) HPE of lung mass showing freely scattered and poorly formed acinar pattern of hyperchromatic tumor cells. 2(c) & 2(d) Showing Vimentin and CK 7 Positivity in majority of tumor cells, Consistent with adenocarcinoma, lung

In 32 out of 33 cases, the CNB material was adequate for evaluation. One case had unsatisfactory separated by lymphoid cells material to evaluate both cyto-histological features, in which case repeat core biopsy and IHC was done to come on diagnosis. Histopathologically, 8(24.24%) patients had lymphoma, 7 (21.21%) had Germ cell tumor [Figure 1(a), 1(b), 1(c), 1(d)], 04 (12.12%) had Thymic neoplasm, 5 (15.15%) had neural tumors and mediastinal tumors, 3(9.09%) had diagnosed as malignant lesion only. In these 3 cases panel of immunohichemical markers [Figure 2(a), 2(b), 2(c), 2(d) made a definitive diagnosis. In 33 patients, 30 (90.09.42%) patients were diagnosed correctly by FNAC and cyto-histologic correlation was found; whereas 3 (9.09%) patients were not diagnosed definitely by FNAC. In three patients cytological material was inadequate for examination due to hemorrhagic smear and very scanty cellularity. Hence, overall sensitivity was 90.09% for FNAC. The sensitivity of CNB was 96.97%, significantly higher than FNAC (90.90%) and it was statistically significant ($P < 0.05$). A comparison of the results of FNAC and CNB is presented in Table 3. To further evaluate our results a biopsy was regarded as being accurate as further clinical follow up and subsequent investigation failed to establish an alternative diagnosis.

4. Discussion

Mediastinal tumours are uncommon and represent only 3% of tumours seen within the chest. Mediastinal tumors are usually diagnosed in patients aged 30 to 50 years, but they can develop at any age and from any tissue that exists in or passes through the chest cavity. The location of neoplastic lesions within the mediastinal compartments narrows the list of possible diagnosis. Lesions of the anterior / superior mediatinum are more likely to be thymoma, lymphoma, metastatic lesions, thyroid lesions and germ cell tumors; those in the middle mediastinum likely to be lymphoma and those in the posterior mediastinum, nerve sheath or neuronal tumors. In children, tumors are commonly found in the posterior (back) mediastinum. These mediastinal tumors often begin in the nerves and are typically benign (noncancerous).In adults, most mediastinal tumors occur in the anterior / superior mediastinum and are generally malignant (cancerous). The most common tumor in our series was lymphoma (38%) followed by Germ cell tumor (32%). In the study by Shrivastava *et al*.[2] and Shabb *et al.*, lymphoma followed by metastatic tumors was the most common.).

Tumors in the mediastinum have variable therapeutic management and prognosis and hence it is very important to reach the correct diagnosis by FNAC of mediastinal lesions. After imaging , FNA is generally the first line diagnostic method, although some suggest that core biopsy gives higher rates of specific tumor typing for lymphoma, thymoma and neural tumors Tissue diagnosis of Mediastinal tumors can be performed by a variety of techniques ranging from FNAC and CNB to surgical procedures allowing biopsy as well as resection.[1,4,6-9] The first priority is to provide positive histological diagnosis with the lowest possible risk.[8] Procedures like mediastinoscopy, thoracoscopy, mediastinotomy, orthoracotomy are traditionally used for determining the nature of these tumors, which require intubation and general anesthesia.[6,7,9,10] Open biopsy can certainly assure a definite histological diagnosis. Although the diagnostic rate might be as high as 100%, they are associated with significant morbidity, increased chance of pleural dissemination, and poor long-term results.[7,8,10] For this reason, the surgically oriented strategies are no longer considered suitable for malignancies of the mediastinum.[3,6,7,11] An ideal diagnostic procedure should have a high yield and as minimally invasive as possible.[7,8]. In our study, cyto-histologic correlation was found in 90.09 % cases, similar to study by Desai *et al*. [4] Sensitivity of CNB in the diagnosis of neoplastic mediastinal lesions was 96.97%, which was similar to study by Annessi *et al*. [9] and higher than study by Hsu *et al*. [16] and Safavi *et al*. [6] The sensitivity of FNAC in our series was 90.09 %, significantly lower than CNB (96.97%). FNAC seems to be the least invasive diagnostic measure than CNB. However, they were usually associated with unsatisfactory results like in other studies. [6,7,17-19] The failure was due to the minimal amount of tissue harvested through fine needle aspiration. In many studies, making a specific diagnosis is not possible by FNAC, and only classification into “malignant cells” or “non malignant cells” will be achieved. FNAC may suggest a diagnosis of lymphoma, but differentiation between Hodgkin’s disease, NHL, and thymoma can be difficult.[6,17-19]. In such instances larger core specimens by CNB are usually required for more precise diagnosis, allowing histological rather than cytological evaluation and special staining methods including immunohistochemical techniques.[6-8,11,20-22] It is possible to establish the histological subtypes on CNB.[9,10] We found that most malignant lesions can be diagnosed on CNB more accurately than FNAC. Hence, CNB may be alternative to surgical procedures with high diagnostic accuracy and less morbidity. A major advantage of FNAC was that immediate cytological examination of the specimen was possible and then pathologist can direct the clinician appropriate.

5. Conclusion

The rates of nonsurgical tumors such as lymphoma are higher and the rates of traditionally surgical diseases such as thymomas are lower. Prompt and correct diagnosis of neoplastic mediastinal lesions is the key process in therapeutic decision. The precise nature of mediastinal tumors cannot be determined without histology examination of the tissue. In variety of mediastinal tumors, an extensive resection without a definitive preoperative diagnosis is not indicated. In such instances, FNAC and CNB under guidance of CT scan guidance allows adequate sampling of tissue with lowest possible risk and discomfort to patients. This procedure is safe, easy, and may obviate the need for more extensive diagnostic surgical procedures while yielding comparable results. When many etiologic cells of origin cannot be diagnosed accurately by cytology alone, the CNB for small histology section is recommended as an initial investigation method with FNAC. The advantage of CNB over FNAC is high diagnostic yield and sensitivity. We recommend the use of FNAC as the initial procedure when the probability of carcinoma is high. The use of CNB to obtain larger tissue specimens is recommended when cytology diagnosis is uncertain. In a very few case were CNB fail to confirm the diagnosis, a panel of IHC required to make a diagnosis.

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