ORIGINAL ARTICLE

Utility of Transthoracic Fine Needle Aspiration Cytology in Diagnosis of Pulmonary Lesions

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Abstract

The combination of Fine Needle Aspiration Cytology (FNAC) with radioimaging has revolutionized diagnosis of lung masses.The present study was carried out to assess diagnostic utility of Transthoracic FNAC in lung lesions. The present study comprises 73 patients undergoing the procedure under Computed Tomography (CT) guidancein 57 cases and under Ultrasonography (USG) in 16 cases. With a high sensitivity (95.65%), high specificity (100%) high NPV (83.33%) and high PPV (100%), Transthoracic FNAC is advocated as being highly accurate diagnostic modality.

Key words: *Computed Tomography, Fine Needle Aspiration Cytology, Transthoracic, Ultrasonography*

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Introduction

Last century has seen some pioneering works of Dahlgren and Nordenstrom using Fine needle aspiration cytology (FNAC) for the diagnosis of lung lesions. However, the frequent usage in the diagnosis of lung masses required many decades to get it established as frontline diagnostic modality. Transthoracic FNAC gained momentum when the radioimaging technique advanced and the images allowed precise localization of smallest parenchymal lesion, enriching the specific and adequate sampling of the cells by the needle.

The combination of using FNAC and intensified images has made wonders in bringing the cellular diagnosis with high specificity and safety. The cellular yield can be used for many ancillary studies and also has a definitive value in medical and surgical management. [1, 2]

The present study was carried out to assess Transthoracic FNAC as a diagnostic modality in lung lesions by the cytomorphological features, their relevance in diagnosing inflammatory, neoplastic diseases, specific primary malignancies and metastatic lung diseases and correlating them with that of histological diagnosis. Lastly to compare between both Computed Tomography (CT) guidance and Ultrasonography (USG) for their advantages, disadvantages, complications and their limitations.

Materials and Methods

The present study was carried out in division of Cytopathology at Department of Pathology, Jawaharlal Nehru Medical College and Acharya Vinoba Bhave Rural Hospital, Datta Meghe Institute of Medical Sciences University Sawangi (Meghe) Wardha, from May 2007-September 2009. The study comprises 73 patients who were clinically and radiologically suspected to have lung masses non-neoplastic, primary malignant and metastatic lung lesions. The clinical, radiological and investigation data were recorded.

The patients with prior radio imaging, investigations of X-ray chest and/or investigations of CT showing a definite pulmonary lesion and the results of sputum cytology, bronchial wash cytology and bronchial brush cytology reported negative for malignancy and sputum yielding the case negative for Acid Fast Bacilli on Ziehl-Neelsen

stain were included. The patients, too old to tolerate the procedure, with feeble cough reflex, unconscious or having intractable cough, pulmonary hypertension were excluded. Also excluded were patients with bleeding diathesis, obvious emphysematous changes in the vicinity of lung mass, positive for malignancy on cytology, high suspicious of lesion being parasitic, vascular, deep seated and proximity to vital structures.

The procedure of Transthoracic FNAC was carried out under the guidance of CT in 57 cases and under USG guidance in 16 cases. The complications were noted. The cytology preparations were stained by May Grunwald Giemsa and Papanicolaou stains and broadly categorized as inadequate cellularity for reporting, Inflammatory, or Neoplastic Cytomorphology pattern. The material in 28 cases obtained at Transthoracic FNAC as small tissue fragments and blood clots were simultaneously subjected to histological processing and were reported for diagnosis with standard reference for it and were correlated. The value of correlation such as the sensitivity, specificity, false positivity, false negativity, PPV and NPV was calculated.[1, 2, 3, 4, 5, 6]

Results

Out of 73 cases, there were 43 males and 30 females. The maximum numbers of cases were from age group of 51-60. All 73 patients had the symptoms of breathlessness, expectoration and progressive weight loss. 23 patients had haemoptysis and supra-clavicular lymphadenopathy in 10 cases. All patients had a unilateral lung mass; a single case had Pancoast Syndrome. There were 19 patients who had known extrapulmonary primary, of which 16 were females and 3 were males.

The positive history of smoking over 10 years could be yielded in 30 patients and all these patients were males. Of the 30 primary malignant cyto-diagnoses, 24 were males and 6 were females. Primary malignant lung masses were more common on right lung as compared to left and the peripheral malignant lung lesions were more common on either side of the lung.

The smallest nodule aspirated in the study was 2 cm in diameter and the largest was 16 cm in diameter with average nodule size of about 5 cm. 5 patients had multiplicity of the lesions within the same lobe. 57 patients underwent aspiration under the guidance of CT. It was observed that the location of needle within the tumor mass could be visualized clearly even when the lesions were deep beyond to 3 cm from pleura. To complete the technicality of CT guided aspiration, time of about 30-40 minutes was taken. The real time procedure of aspiration could not be performed by CT.

In 16 patients the lung masses were aspirated under USG guidance. These masses were close to pleura or chest wall on prior radiographic examination. The procedure of aspiration under guidance of USG could be performed in real time which took approximately five minutes. Therewere no significant complications observed in transthoracic FNAC in present study. Only 4 patients complained of local site pain which was well tolerated and required no medication. Chest X rays of these patients at the interval of one hour and three hour showed no significant pneumothorax.

None of the aspirates were inadequate for cytological reporting. The aspirates of 14 cases which were purulent, at Ziehl Neelsen staining were positive for Acid fast bacilli in 2 cases. The appreciation of the nuclear and cytoplasmic features as well as the extra-cellular background was well highlighted with both the stains.The broad categorization of cytological examination of transthoracic FNAC & specific lesions within are depicted in table 1.

Table- 1: The Distribution of Cytodiagnosis

Broad Cytodiagnosis	Specific Cytodiagnosis	No of Cases
Inflammatory	Non Specific Pneumonia	07
	Tuberculosis (TB)	11
	TB with Aspergillosis	01
	TB with Nocardiasis	01
	Hydatid Cyst	02
Neoplastic Benign & Malignant	Cystic Teratoma	01
	Squamous Cell Carcinoma	02
	Adenocarcinoma (Primary and Metastatic)	39
	Adenosquamous	02
	Small Cell Carcinoma	03
	Large Cell Carcinoma	01
	Non Hodgkins Lymphoma	01
	Thymic Carcinoma	01
	Malignant Fibrous Histiocytom	01
Total		**73**

Of the 49 malignant Cytodiagnoses, 30 were primary lung malignancies and 19 were metastatic with known primaries. Among 30 primary malignancies commonest were Adenocarcinoma (21 cases), Small cell carcinoma (3 cases), Squamous cell carcinoma (2 cases), Large cell carcinoma (1 case), Adenosquamous carcinoma (2 cases) and primary pulmonary Non-Hodgkin's Lymphoma (1 case). Extrapulmonary primary malignancies metastatic to lungs were reported in 19 cases. Distributions of the histopathological diagnoses in 28 cases were as follows: Adenocarcinoma (18 cases), Squamous cell carcinoma (3 cases) and Small cell carcinoma (2 cases) and nonspecific pneumonia (5 cases).

There were no false positive cytodiagnoses and one false negative cytodiagnosis when compared with histological diagnosis. A single case that was reported as pneumonia on cytology was later cyto-diagnosed as the squamous cell carcinoma on histological examination. The sensitivity and specificity of transthoracic FNAC over lung mass were 95.65% and100% respectively. NPV and PPV were 83.33% and 100% respectively.

Discussion

The indication for transthoracic FNAC has been cited to diagnose the inflammatory as well as neoplastic process especially when other diagnostic modalities have failed to establish the cause of lung lesions by various techniques of cytology (sputum, bronchial lavage and bronchial brushing) and radio imaging. The frequency of primary lung cancer has been reported high over the age of fifth decade of life. Smoking is closely related cause in the development of lung cancer, in the present study, out of 30 patients who were smokers, 23 were cyto-diagnosed having primary lung malignancy and right lung was highly involved. Our findings are in accordance of other authors. [2, 4, 5]

The comparison of CT guidance (57 cases) and USG guidance (16 cases) in aspiration of lung masses in present study has shown that the CT guidance is more suitable to the deep seated lung masses and gives precise needle location within the tumor. On the other hand the USG guidance was found to be suitable in transthoracic FNAC of peripheral lung masses only because of the limitation of the probe maneuver and the limited resolution of the needle. However, USG has a distinct advantage of performing as a real time procedure which was not the case with CT guidance. The present study further observed that the time taken to complete the procedure of transthoracic fine needle aspiration by CT guidance is more than that of USG guidance. Similar findings have been made by Gorduner and Obata. [7] The value in aspirating deep seated and small lung masses in high resolution CT have been quoted by Singh, Saha, Wallace and Ohno. [1, 2, 6] A few studies like of Singh, Basnet, Saha and Sonnenberg [1, 2, 5, 8] have suggested CT guidance for transthoracic FNAC to increase the sensitivity of the diagnosis and lowering of inadequacy rate, because of proper localization of the needle within the lung mass.

Studies have used spinal needles with gauges from 20-25 to obtain adequate cell yield, with an adequacy rate ranging from 82 % to 94.7 %. [1, 2, 5, 9, 10] Complications reported by these authors were post procedural pain, mild puncture site bleeding, hemoptysis, pneumothorax, vasovagal reaction, hematoma of lung parenchyma along the needle tract.The present study used 23 gauge spinal needles for transthoracic FNAC and recorded 100 % adequacy without any significant complications except for 4 patients who complained for local site pain which required no medication. The adequate diagnostic cell yield by 23-25 gauge spinal needles has been observed in the present study similar to Sonnenberg. [8]

Studies have reported the commonest primary malignant tumor reported in various studies being Squamous cell carcinoma or Adenocarcinoma. [2, 9] The present study observed the most common being adenocarcinoma (21 cases). These observations may not conclude the frequency of the most common primary malignancy of the lung, but the higher frequency of reporting adenocarcinoma is quoted by studies of Tan. [9] The cytomorphology typical for diagnosis of the adenocarcinoma (not otherwise specified) has been quoted by Sterrett and Flint. [11, 12] The present study encountered similar features. The difficulty to differentiate a primary adenocarcinoma from that of the metastatic adenocarcinoma in the lung on cytologic

preparations of transthoracic FNAC has been quoted by Flint. [12] Similar difficulty has been recorded in present study while suggesting a primary or metastatic adenocarcinoma of the lung. The cytomorphology of adenosquamous carcinoma comprised dual cell differentiation of malignant squamous and glandular cells as is quoted by Sterrett. [11] The present study has made similar observations. In smears of these cases, differentiation of both squamoid and glandular type was present in same sheet of cells.The typical signet cells could be appreciated easily on cytologic preparation in diagnosis of signet cell carcinoma. The cytomorphology of serous adenocarcinoma frequently showed papillae, which is similar to the observation of Manek. [13]

Variable false negative Cytodiagnosis have been quoted on transthoracic FNAC of lung masses in literature reviewed for the present study ranged from 6% - 28%. [14] The present study had a single false negative cytodiagnosis when compared with histological diagnosis in 28 cases. This observation showed low value of false negative diagnosis in comparison of above studies. A single case which was reported as pneumonia predominated by leukocytic exudates, on histological examination showed cells of squamous cell carcinoma in groups. This false negativity of cytodiagnosis is attributed to non sampling of the tumour. This was because of cystic necrosis within the tumor mass that sanded the tumour cells.

The sensitivity of transthoracic FNAC in diagnosis of the lung lesions in various studies ranged from 88% to 93.4%. [1, 5, 10].The present study had 95.65% sensitivity at cytodiagnosis of lung masses which is similar to Singh andTan.[1, 9] The specificity of transthoracic FNAC in diagnosis of the lung lesions in various studies ranged from 84% to 100%. The present study had 100 % specificity at cytodiagnosis of lung masses which is similar to Singh and Diacon [1, 10] thus suggesting the high efficacy of recognizing cell types and features in specifying the lesions. The NPV and the PPV for malignancies on transthoracic FNAC quoted in various studies as follows: Singh quoted 75% NPR, 100% PPR. Basnet quoted 81% NPR, 90% PPR, Tan quoted 82.1% NPR, 98.6% PPR. [1, 5, 9] The present study recorded NPV of 83.33% and PPV of 100% in the diagnosis of malignancies of lung by transthoracic FNAC which were compared, and found similar to the observation of Singh and Tan. [1, 9]

Conclusion

Transthoracic FNAC has a defining role in the diagnosis of pulmonary lesions with the modalities yielding sufficient and representative diagnostic material for cytomorphologic examination as well as histomorphologic examination. A CT guidance is preferable for deep seated masses butcomparatively time consuming. The real time procedure for Transthoracic FNAC cannot be performed under CT guidance. USG guidance is suitable for peripheral lung masses with a disadvantage of limited visualization of needle, unsuitable for deep seated lung masses but has an advantage of performing in real time.

With a high sensitivity (95.65%), high specificity (100%), a high NPV (83.33%) and PPV (100%), Transthoracic FNAC is therefore advocated to be highly accurate and safe diagnostic modalityand will be the best available diagnostic procedure for years to come with little limitations, for its greatest advantage of bringing out the diagnosis which is comparable with the tissue diagnosis.

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