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Research Article

TO STUDY CYTOLOGICAL VERSUS RADIOLOGICAL CORRELATION OF C.T. GUIDED FINE NEEDLE ASPIRATION CYTOLOGY OF LOCALISED LUNG LESIONS

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ABSTRACT

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. A total of 66 cases presented as localised lung masses out of which 64 cases (96.9%) were consistent with malignancy, and 2 cases (3.1%) benign on clinical and radiological evaluation. On cytological evaluation of 66 cases, 62 cases (93.8%) were considered malignant, 2 (3.1%) of them benign and 2 cases (3.1%) were inadequate for diagnosis.The diagnostic adequacy in current series is 97.0%. Complications were infrequent and included pneumothorax in 4 (6.1%) cases. By cytology, the most common malignant lesion was adenocarcinoma (42.2%)followed by squamous cell carcinoma (31.2%), adenosquamous carcinoma (6.2%), and lymphoid neoplasm (4.7%). Radiological findings were consistent with cytomorphological findings in all cases.Present study thus concludes that CT guided FNA of thoracic lesions is a simple, safe, economically prudent technique associated with low morbidity and leading to quick and early diagnosis. Conclusive diagnosis on FNAC obviates the need for open biopsies. CT-guided FNAC is an extremely valuable and fairly accurate diagnostic aid of intrathoracic mass lesions, with a reasonable rate of complication.

Keywords:-Computed tomography guided fine needle aspiration cytology, lung,mass lesion,Primary Neoplasm, Percutaneous CT guided FNAC, Pulmonary Nodule.

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INTRODUCTION

Guided fine needle aspiration cytology (FNAC) is often the first choice in lesions located in the mediastinum, pulmonary apex, medial upper lobe or periphery – especially small lesions of a few centimeters diameter. FNAC has particular value in those cases in which fiber-optic bronchoscopy and biopsy are non-diagnostic as in centrally placed pulmonary lesions.(!) Recognition of the high accuracy rate of FNAC along with the simpler methods to treat its complications like pneumothorax has increased its popularity among clinicians, radiologists and pathologists.[2-6] Even though FNAC has proven its role in the diagnosis of infections and other diffuse benign processes, the main indication remains the diagnoses of localized intrathoracic lesions suspected of being malignant, particularly when less-invasive investigations prove to be negative.[1] The presence of pathologist at the time of the procedure leads to a reduction in the number of needle passes and may increase the overall sensitivity and accuracy of tumor typing.[7-8].

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Radiologic imaging can very well document the size, shape, contour, edge, density and presence or absence of calcification in the lesion.

These features are not of much help in categorizing the lesions as benign or malignant as there is a lot off overlap.[9-10]CT guided Percutaneous transthoracic FNAC is a safe, effective and relatively simple procedure with high diagnostic accuracy for lung and mediastinal lesions.[11-12]Regardless of the size of the lung and mediastinal lesion CT guidance allows the needle placement in the lesion safely avoiding the vital structures in the vicinity. [13]CT Guided FNAC of lung lesions has achieved widespread recognition as a diagnostic tool in lung pathology. The most common complication is pneumothorax and is easily treated and few cases require active management.[14-16]In a developing country like India and especially in our north eastern region, the poor resources of health care facilities limit us to rely on cytomorphological features and even patients are reluctant for further advanced invasive procedures. Most of the patients presenting in advanced stages of disease and in such cases diagnostic thoracotomy is not advisable and diagnosis is usually established based on small biopsy and cytology specimens. Recently, the 2015 world health organization (WHO) classification of lung tumors is the first WHO classification to provide standardized criteria and terminology for lung cancer diagnosis in small biopsies and cytology. [17]

The purpose of this study is to evaluate the utility and complications of CT guided aspiration cytology in localised lung lesions and to know the pathological spectrum of localised lung lesions along with the correlation of CT findings with cytomorphological reports. Our study aimistostudy the cytological characteristics of various localised lung lesions subjected to FNAC and its correlation with C.T. findings, to study the adequacy of aspirates obtained from localised lung lesions by fine needle aspiration under C.T. guidance,to study the complications consequent upon the procedure,to study the various problems encountered in cytodiagnosis of these aspirates.

MATERIAL AND METHODS

The present study was conducted in Department of Pathology,Tuberculosis and Chest Diseases &Radiodiagnosis at were admitted to Sri Lakshmi Narayana Institute of Medical Sciences, Pondicherry.Fine needle aspiration smears from the cases of localised lung lesions aspirated under computed tomography guidance were received in the cytology section of department of pathology for cytological evaluation.

The criterion for selection of patients was as follows:-

(1) Patients with localised lung lesions on chest x-ray and CT were included in the study.
(2) Patients were co-operative and were able to hold breath for a short while.
(3) Patient had no bleeding tendency or coagulopathy.

Plain and contrast CT of chest was done as an out patient procedure after explaining the risks and benefits and obtaining informed
consent.

First, an axial scan of area of interest only, was done to locate the lesion. The best approach (supine or prone) was judged and the skin puncture site was marked with a radio-opaque dye marker. After cleaning and draping, local anaesthetic (2% xylocaine) was infiltrated at the site of puncture. A 22 – 23 gauge spinal needle was then inserted during suspended respiration, directing the tip of the needle towards the lesion, when the tip of the needle was located in the outer edge of the lesion, a repeat slice of the area of interest was taken to check the exact position of its tip. The stylet was then withdrawn 2 – 3 cm and the needle was then advanced into the mass with a rotating motion during suspended respiration, so that the tip lied within the target lesions at all times. 20 ml syringe was attached to the needle's hub and the plunger was pulled back, and during the continued hard suction, the needle was jiggled to free material from the lesion into the needle's lumen. The aspirated material was expelled into the clean glass slides and smears were prepared. Air dried smears were fixed in methanol for 20 – 30 minutes and then stained with May – GrunwaldGiemsa stain. After drying the smears were mounted with DPX and then scrutinized under the microscope.

A repeat slice in the area of interest was taken to rule out pneumothorax or bleeding in the needle tract. The cytological diagnoses was rendered. The radiological opinion of each individual lesion was also recorded. Both cytological and radiological opinions were tabulated and compared statistically.

RESULTS

A total of 66 fine needle aspiration smears from the cases of localized lung lesions aspirated under computed tomography guidance were received in the cytology section of department of pathology for cytological evaluation.

Sex groups

A total of 66 aspirates were performed, out of which 55 (83.3%) were males and 11 (16.7%) were females.

Age groups

Of the total 66 cases, the age of the patients in the present study varied from 25 years to 85 years. 9 Groups were made from 0 – 10 years to 81 – 90 years.
Of these 64 cases, 2 cases (3.1%) were benign with the diagnoses of reslving phase of neumoniaand granulomatous inflammation .The maximum number of 25 cases (37.9%) lay in the age group of 51 – 60 years, followed by 15 cases (22.7%) in the age group 61 – 70 years and 10 cases (15.2%) in the age group of 41 – 50 years and 71 – 80 years. The aspirates were considered adequate if the cellular elements were sufficient for rendering the diagnosis. The aspirates were considered inadequate (a total of 2 of 66 cases i.e. 3.0%) when they comprised only blood with few nonspecific cellular elements or a variety of normal cell types or few atypical cells, but not suggestive of any specific diagnosis. The smears of 64 cases (97.0%) were adequate and specific non neoplastic and neoplastic diagnoses were rendered.

Cytological diagnosis

The breakup of 64 cases which were adequate for cytological diagnosis on fine needle aspiration was:- 1. Non neoplastic cases – 02 (3.1%), 2. Neoplastic (all malignant) cases – 62 (96.9%)

Squamous cel l carcinoma - R aggedcluster margin, anisochromasia, hyperchromatic nucleus, evidence of keratinization, necrotic background.(Fig. 1a &1b and Fig. 2a &2b)

Adenocarcinoma – Cell aggregates(sheets, rosettes and acinar groupings), rounded nuclei, prominent nucleoli, clean or mucinous background.(Fig. 3a & 3b and fig. 5a & 5b), Adenocarcinoma with lepidic pattern – Flat sheets, papillae, cell balls, acini, intra-nuclear inclusions and grooving, Small cell carcinoma – Artifactually crushed cells and nuclei,
fragile small round cells with extremely scant cytoplasm,stippled chromatin, nuclear moulding.(Fig. 4a &4b),Giant cell carcinoma – Numerous multinucleated loosely cohesive neoplastic giant cells, neutrophil emperipolesis and granular necrotic inflammatory background, Large cell carcinoma – Loose cohesion as well as dispersal, large pleomorphic malignant cells, scattered multinucleate tumour giant cells with inflammatory background,Adenosquamous Carcinoma – Features of dual differentiation (glandular as well as squamous),Metastatic renal cell carcinoma – Aggregates of cells with abundant granular or clear cytoplasm, rounded nuclei and macronucleoli.

Radiological and Cytological Correlation:

In our present study, 66 cases having localised lung lesions (as seen by computed tomography) were aspirated under CT guidance. The size of the lesions varied from 2.6 x 2.3 cm to 10.7 x 10.3 cm (mean 7.1 x 5.3 cm).

The radiological impression in most of the masses was of an irregular outlined, heterogeneously enhancing i so to hypodensemass(FIG.40); some of them showing extension into the adjacent structures. Frequent association of mediastinal lymphadenopathy was noted. At times, mass affect or infiltration of bronchial tree and major vessels were observed.There was evidence of lymphangitic spread as suggested by nodular and septal thickening in sub pleural or subfissural and peribronchovascular location. 6 cases (9.1%) presented with nodular thickening of pleura or pleural effusion along with a mass. All these lesions were considered to be malignant lesions radiologically and FNAC was recommended for further confirmation.
Of all the 66 cases, 2 cases (3.0%) were known cases of carcinoma and were on chemotherapy / radiotherapy. One was a known case of squamous cell carcinoma and the other was a known case of cases (6.1%) presented with metastatic lesions in liver. 6 cases (9.1%) presented with infiltrative findings (e.g. rib destruction), pleural effusion and symptoms of nerve and vessel involvement.

Table I: DISTRIBUTIONOFCASESACCORDINGTOAGEANDCYTOLOGICALDIAGNOSISINVARIOUSGROUPS

S.No.	AgeGroups	No.ofCases	VariousLesions– Diagnosed	%
1.	0–10	00	-	0.0
2.	11–20	00	-	0.0
3.	21–30	02	Adenocarcinoma	3.0
4.	31–40	01	NH–SRCN*	1.5
5.	41–50	10	Resolving phase of pneumonia,Adenocarcinoma,SCC**,SqCC,Mets-adenocarcinoma,LCC***	15.2
6.	51–60	25	enocarcinoma, NHL, Sq.CC, ASqC,GCC****,LCC***,inadequate	37.9
7.	61–70	15	Sq.CC,Adenocarcinoma,ASqC,Granulomatousinflammation	22.7
8.	71–80	10	Sq.CC,Adenocarcinoma,Adenocarcinomawithlepidicpattern,ASqC, Malignant Mesothelioma	15.2
9.	81–90	03	Adenocarcinoma,inadequate,SqCC	4.5
	TOTAL	66		100.0

TableII: DISTRIBUTIONACCORDINGTOCYTOLOGICALDIAGNOSIS

CytologicalDiagnosis			No.ofCases	%
NonNeoplastic(Resolvingphaseofpneumonia, Granulomatousinflammation)			2	3.1
Neoplastic				
a.Benign			0	0.0
b.	Malignant			
	i.	Squamouscellcarcinoma	20	31.2
	ii.	Smallcellcarcinoma	1	1.6
	iii.	Adenocarcinoma Conventional Adenocarcinomawithlepidicpattern	26 1	40.6 1.6
	iv.	Largecellcarcinoma	2	3.1
	v.	Adenosquamouscarcinoma	4	6.2
	vi.	Giantcellcarcinoma	1	1.6
	vii.	LymphoidNeoplasm	3	4.7
	viii.	Malignantmesothelioma	1	1.6
	ix.	Non-Hematolymphoidsmallroundcellneoplasm (possibly Askintumour)	1	1.6
	x.	MetastaticAdenocarcinoma	2	3.1
	TOTAL		64	100.0

Table III: CORRELATIONOFRADIOLOGICALWITHCYTOLOGICALDIAGNOSIS

S.No.	CytologicalDiagnosis	RadiologicalDiagnosis	No. ofCases	%
1.	NonNeoplastic(resolvingphase of pneumonia,granulomatousinflammation)	Localisedlungmasses ??Malignancy ??Consolidation	2	3.0
2	Neoplastic Benign neoplasm Malignantneoplasm Adequatewithspecificdiagnosis Adequate but nodiagnosisconferred	Neoplastic ?Malignant	0 62 0	0.0 94.0 0.0
3	Inadequate	??Neoplastic	2	3.0
	Total		66	100.0

TableIII: COMPARISONOFMALIGNANTLESIONS

S.No.	Malignantlesions	Literature(%)	Presentstudy(%)
1.	Squamouscellcarcinoma	12.5- 58.3	31.2
2.	Smallcellcarcinoma	1.5–34.1	1.6
3.	Adenocarcinoma(Bronchogenic)	14.6–54.2	40.6
4.	Adenocarcinomawithlepidicpattern	1.0–5.0	1.6
5.	Largecellcarcinoma	1.1–7.3	3.1
6.	Adenosquamouscarcinoma	0.4–0.7	6.2
7.	Giantcellcarcinoma	0.0–0.0	1.6
8.	Lymphoidneoplasm	0.7–6.1	4.7
9.	Malignantmesothelioma	0.0- 3.8	1.6
10.	Non-hematolymphoid small round cellneoplasm	0.0–0.0	1.6
11.	Metastaticadenocarcinoma	1.1–29.1	3.1

Figure:1a – HRCT chest axial image showing a large ovoid soft tissue density mass lesion with speculated margins seen in right upper lobe and reaching up to the hilum.
Figure:1b – Photomicrograph showing well differentiated keratinizing squamous cell carcinoma (MGG, 10X40).

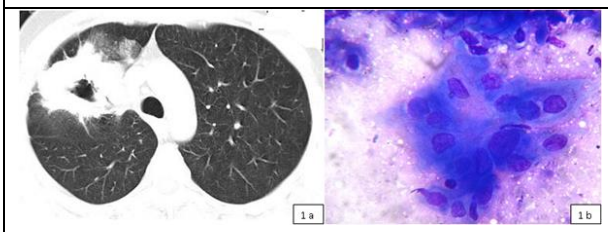


Figure:2a – CECT chest axial image showing a large round, peripherally enhancing mass lesion noted in left upper lobe with internal large necrotic areas and a small cavity within.
Figure:2b - Photomicrograph showing focus of squamous differentiation in a poorly differentiated squamous cell carcinoma (MGG, 10X40).

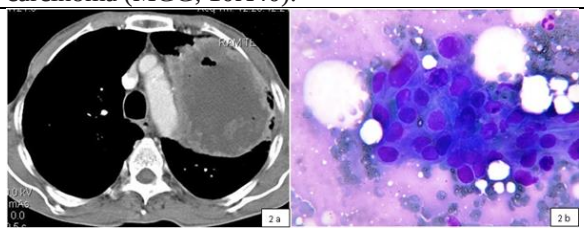


Figure: 3a - HRCT chest axial image showing a ovoid soft tissue density mass lesion with speculated margins present in apico-posterior segment of left upper lobe.
Figure:3b - Photomicrograph showing adenocarcinoma: extracellular mucin (MGG, 10X10).

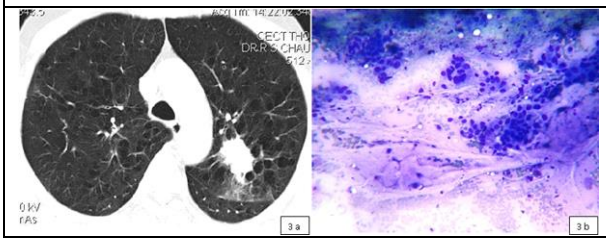
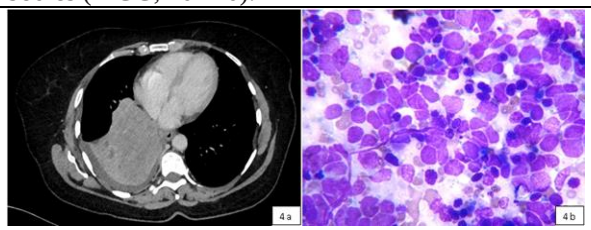


Figure: 4a - CECT chest axial image showing a heterogeneously enhancing mass lesion in right lower lobe extending upto hilum.
Figure: 4b - Photomicrograph showing small cell carcinoma: loosely cohesive to dispersed small cells with scanty/ absent cytoplasm, nuclear moulding and apoptotic bodies (MGG, 10X40).



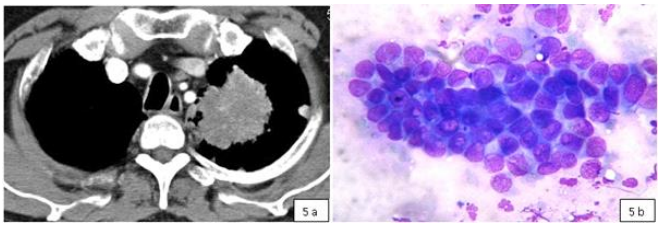


Figure: 5a - CECT chest axial image showing a ovoid heterogeneously enhancing mass lesion with speculated margins noted in posterior segment of left upper lobe.
Figure: 5b - Photomicrograph showing adenocarcinoma: cell cluster showing cells with delicate cytoplasm, rounded nuclei with single prominent central nucleoli (MGG, 10X40)

DISCUSSION

Fine needle aspiration is generally applied to localized lesions of lung, its use being limited to diffuse parenchymal disease. 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. [18] Among the imaging modalities, CT is the most popular. [19].FNAC was also repeated in one out of the two cases reported as suspicious of malignancy, but was not beneficial.

Repeated aspiration was also of no use in the two cases where inadequate material was obtained in the first instance. Perhaps the greatest advantage of fine needle aspiration is safety. However, pneumothorax remains the most common complication of CT-guided lung FNAC. Review of the existing literature reveals variable rates of pneumothorax, ranging from 5 to 64%.(20). Location of the lesion, needle size, number of pleural passes and level of training were not correlated with pneumothorax rate.

A major diagnostic problem for the clinician is a non-resolving opacity on the chest imaging study.8 Evolution of the extremely sophisticated radiologic imaging techniques and the reestablishment of sampling technique of the well visualised lesions lead to revolutionising the cytology of respiratory track. Computed Tomography (CT) is the most prominent imaging modality used in the study of lung lesions.(9-10). Diagnostic lung puncture technique was introduced by Leyden in 1883 and Menbriel in 1986 which has long been used for the identification of infections and malignancy.FNAC can differentiate between small cell carcinoma, lymphoma very appropriately. This is a major advantage of FNAC making the early treatment possible. These conditions are treated by chemotherapy rather than surgery. [19-20]Evolution of highly sophisticated radiologic imaging techniques makes possible the precise visualization and localization of masses in the lungs.Among the other imaging modalities, CT is the most popular.

A total of 66 cases presented as localised lung masses out of which 64 were consistent with malignancy, and 2 cases benign on clinical and radiological evaluation. On cytological evaluation of 66 cases, only 62 cases were considered malignant, 2 of them benign and 2 cases were inadequate for diagnosis. The adequacy rate in the present series is 97%, the values were very near the values of [21] (95.0%), [22] (95.0%) and(96.3%) [23]. Other workers have reported diagnostic yield ranging from 44% to 96.3% when fine needle aspiration cytology was combined with imaging modalities i.e.computed tomography.

In the current study lesions were divided into non-malignant which accounted for 2 of 64 cases (3.1%) and malignant lesions, which accounted for 62 of 64 cases (96.9%). The distribution of benign and malignant lesions in the literature varied from, 7.8% - 37.8% for benign and 62.2% - 96.3% for malignant cases. Our findings were very (12) near to [24-25]. In the present study, there was a disproportionately high figure for malignant cases as compared to other series; maximum of the latter were from outside India. This could be attributable to the fact that our's is a developing country and health care is of low priority. Thus only when the individuals were seriously inconvenienced (as is likely in malignant lesion) did they seek medical help.

In the present series, spectrum of malignant lesions were very near the figures reported in the other series in literature except for adenocarcinoma, non-hematolymphoid small round cell neoplasm and giant cell carcinoma.

The majority of the lung masses in our series were diagnosed as adenocarcinoma (40.6%), which was very close to the figures quoted (45.6%) [26-27] (54.2%) . Two cases (3.1%) were diagnosed as secondary, rest were considered primary. The number of secondaries diagnosed by fine needle aspiration cytology in our study was disproportionately lower than (24) most other workers – (17.6%), (26) (29.1%). One of the reasons for this was that the patients with suspected lung secondaries were not referred for FNAC, as the combination of previous case record of malignancy elsewhere and subsequent clinico-radiological features were considered sufficient. The aim of transthoracic fine needle aspiration in such cases is to confirm that the lung lesion is indeed neoplastic, not inflammatory, and to eliminate the potentially treatable new primary tumours[28].

Of all the major types of lung carcinomas, small cell carcinoma was diagnosed least frequently (1.6%) in the current study. This may at first glance seen somewhat surprising in view of the fact that small [29]cell lung carcinoma accounts for about 20% of all lung cancers .Detection of tumor types like small cell carcinoma and lymphomas helps as these are more appropriately treated by chemotherapy than surgery. Therefore,cytological diagnosis by CT guided FNAC leads to initiation of specific therapy without unnecessarydelay.

Review of the cytologic literature reveals frequencies ranging from [30-31]1.5% to 34.1%. This under-representation in lung FNA smears is probably due to the fact that most cases of small cell lung carcinoma have extrathoracic dissemination at the time of diagnosis and can thus be diagnosed by aspiration from more accessible sites, for example supraclavicular lymphnodes, thus obviating the need for sampling the lung. In few cases , overlapping of cytological features were seen leading to misdiagnoses that were later corrected by thorough screening of slides, and correlation with clinical features, CT findings and ancillary studies (immunocytochemistry, cytogenetic analysis and electron microscopy) were suggested for definitive diagnosis. Diagnosis and can thus be diagnosed by aspiration from more accessible sites, for example supraclavicular lymphnodes, thus obviating the need for sampling the lung.

In present study, a solitary case of resolving phase of pneumonia was diagnosed. CT finding was focal lung consolidation, possibly secondary to an underlying mass. So, CT guided FNAC was planned but the

centrally located mass could not be accessed and thus the aspirate was from the suspected area of consolidation. Had the FNA been carried out from the centrally located mass, a tumour may have been discovered. Some smears showed paucity of material, be it normal tissue and/or viable material. This was due to the inability of the needle to reach the centre of the lesion. There was one case which when aspirated on first instance, showed only normal benign epithelium (probably bronchiolar). Later on reaspiration, the case was diagnosed as adenocarcinoma.

Adenocarcinoma was the most common type of lung malignancy and Non Hodgkins Lymphoma was the most common malignancy in the mediastinum. Inflammatory lesions.In this case the previous aspiration was from the periphery of the tumour (to avoid the necrotic centre) and later reaspiration was done from the centre of the lesion which procured sufficient material for diagnosis. Later all the smears of previous aspiration was stained; among them, one smear showed features of adenocarcinoma. Hence all smears should be stained to avoid false negative reporting. Primary neoplastic lesions in lung. The most common primary lung malignant neoplasm was adenocarcinoma. The smears showed malignant cells in clusters, acinar and at places glandular pattern. Cells were of moderate to large size having moderate to abundant amount of cytoplasm, round eccentric nuclei with prominent nucleoliof the 66 cases, 4 cases i.e. 6.1% (on repeat scan after fine needle aspiration) developed pneumothorax. None of the case required intrathoracic chest tube drainage. The pneumothorax rate in different studies reported in the literature varied from 1.5% -69%. [32] Our results matched the result of (6%), and(6%).

CT guided FNAC of lung and mediastinal lesions is a safe, less invasive procedure with a high diagnostic accuracy. [33] This can help in early initiation of the specific therapy avoiding the major surgical procedure like thoracotomy. Most common complication being pneumothorax which can be treated. The pit falls in the diagnosis can be prevented by proper clinical and radiological correlation.

CONCLUSION

Computed tomography guided fine needle aspiration cytology is a safe and reliable method for the diagnosis of lung and mediastinal lesions. It can help in early diagnosis and initiation of the treatment avoiding major surgical procedures.

Percutaneous, transthoracic FNAC is a relatively simple procedure with good patient acceptance and low morbidity. It is an accurate, safe and repeatable procedure in the diagnosis of difficult lung lesions. CT scan has enabled the visualization of previously inaccessible tumors, which can now be guided by this procedure, leading to a greater yield of cytological material and a significantly greater predictability of true positive cases in malignant lesions. FNAC should be
used earlier and more frequently to shorten the diagnostic interval and allow more prompt therapy for persistent lung lesions. It is concluded that C.T. guided FNAC of localized lung lesions is an extremely useful procedure which furnishes adequate and diagnostic material in the vast majority of subjects without significant complications. Cytodiagnostic problems are rather trivial and largely surmountable.

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