Computed Tomography- Guided Fine Needle Aspiration Cytology of Lung Mass- A 5 Years Study in a Tertiary Health Care Centre

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ABSTRACT

BACKGROUND

Lung cancer is the major cause of cancer related deaths all over the world. Computed Tomography (CT) - Guided Fine Needle Aspiration Cytology (FNAC) of a lung mass is an effective modality to diagnose lung cancer. FNAC is a rapidly emerging diagnostic modality to assess the nature of radiologically demonstrated lung mass lesions. We wanted to study the usefulness of CT-Guided FNAC in the evaluation of cytopathological spectrum in lung lesions.

METHODS

A cross- sectional study was carried out in a total of 150 cases for a period of 5 years from November 2014 to November 2019 on cases of lung mass lesions with a strong clinical suspicion of pulmonary neoplasm. CT-Guided transthoracic FNAC was performed and cytology smears were stained with May-Grunwald-Giemsa (MGG) stain, conventional Papanicolaou (Pap) stain and Ziehl Neelsen (ZN) stain. Smears were examined under microscope and broadly categorized into unsatisfactory, tubercular, benign and malignant lesions.

RESULTS

A total of 150 cases of lung mass lesions were studied, of which 85 were males (78.4%). The mean age of the patients was 67 years. Maximum cases of benign lesions were chronic non-specific suppurative lesions (17.3%, 26 cases) followed by tuberculosis (3.3%, 05 cases). Regarding the malignant categories, adenocarcinoma (22.7%; 34 cases) was the most common malignancy followed by non-small cell carcinoma not otherwise specified (NOS) (14.7%; 22 cases), squamous cell carcinoma (8.0%, 12 cases) and small cell carcinoma (6.7%; 10 cases) respectively.

CONCLUSIONS

CT guided FNAC is a simple, less expensive, and reliable method for diagnosis of pulmonary lesions.

KEYWORDS

Computed Tomography, Fine Needle Aspiration Cytology, Lung Mass

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BACKGROUND

Lung cancer has the highest incidence of invasive cancer in both males and females as per WHO.[1] A variety of benign and malignant lesions can occur in the lung.[2] Lung cancer is the most common cancer in the world today with 2.08 million cases, 36.7% of cancer deaths[1-4] and the leading cause of cancer death in males in 2018 globally. The aetiology of pulmonary carcinoma appears to be multifactorial with both environmental such as use of tobacco and genetic conditions playing a role. Adenocarcinomas now represent the most common histologic type of lung cancer, whereas squamous cell carcinoma is the one that statistically has been more frequently associated with cigarette smoking in the past. More recently, it has been observed that the incidence of lung carcinoma in the general population may have reached a plateau.[5] Percutaneous transthoracic Fine Needle Aspiration Cytology (FNAC) done under the computed tomography (CT) guidance is a relatively safe and reliable diagnostic technique for the lung and lesions. 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.[4] In diffuse parenchymal lung disease the role of FNAC is limited. FNAC plays an important part in the diagnosis of localized lung lesion.[3] FNAC of these lesions can differentiate between benign and malignant lesions and also the small cell carcinoma of the lung from non-small cell carcinoma of the lung which helps in early initiation of the treatment and avoid more invasive surgeries in maximum number of cases specially in patients with inoperable lesions due to patient's general condition and local factors.[5-10,11] 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 of overlap.[8,11,12] CT guided Percutaneous transthoracic FNAC is a safe, effective and relatively simple procedure with high diagnostic accuracy for lung lesions. The diagnostic accuracy and sensitivity of transthoracic CT guided FNAC for malignant lesions in the literature ranges from 64% to 97% and 76% to 97% respectively.[1-8] Regardless of the size of the lung lesion CT guidance allows the needle placement in the lesion safely avoiding the vital structures in the vicinity.[2,4-7,11] CT Guided FNAC of lung lesions has achieved widespread recognition as a diagnostic tool in lung pathology. Pneumothorax, haemorrhage, haemoptysis and chest pain are some common complications of the technique and only a few require active management.

The purpose of the study was to find out the usefulness of CT-guided FNAC in the evaluation of cytopathological spectrum in lung lesions.

METHODS

The present study was a cross sectional hospital-based study conducted in the Cytology section, Department of Pathology, Regional Institute of Medical Sciences (RIMS), Imphal, Manipur, a tertiary care hospital for a period of five years starting from November, 2014 to November 2019 in collaboration with the Department of Radiodiagnosis, RIMS, Imphal. Patients of any age and sex presenting with undiagnosed intrathoracic mass or lesions were included in the study. Patients whose general condition was very poor, highly vascular lesion, chronic obstructive pulmonary diseases (COPD) with documented bullous lesion were excluded from the study.

Detailed clinical history and pre-procedural workup of the patient was done. Pre-procedural investigations like complete blood count (CBC), prothrombin time, International Normalized Ratio (INR) and virology were done. The patient was positioned on the CT table in prone or supine position. The exact position of the lesion was established by the computed tomography (CT) scan study. A needle path which could avoid the injury to the vital structures was selected. Each needle path was chosen so as the needle could be at the most perpendicular angle to the pleura and shortest possible depth could be chosen. FNAC was done following all aseptic precautions. The skin was cleaned with betadine. Local anaesthesia administered using 2% lidocaine. Breath holding technique was employed. 23 gauge 89 mm long spinal needle was introduced through the percutaneous transthoracic approach. The aspirate was obtained by to and fro movement of the needle within the lesion. The negative pressure was released and the needle was removed.

Smears were prepared, air dried and some wet smears were immediately fixed with 95% ethyl alcohol. Smears were stained with May- Grunwald Giemsa, conventional Papanicolaou (Pap) stain and Ziehl Neelsen (ZN) stains were done when needed. Patient was kept under observation for a minimum of 2 hours. Post procedural x- ray was done in all patients to rule out any complications. Pneumothorax was seen in 2 patients and was managed conservatively.

Smears were examined under microscope and according to cytomorphological findings, cases were reported into 3 groups as (i) Malignant when cytology showed diagnostically malignant cells (ii) Benign when cytology did not reveal malignant cells or atypical cells but show only benign cells or nonspecific inflammatory cells and (iii) Unsatisfactory when cytology showed no definite evidences of malignancy or too less cells to give a definite opinion. Lung lesions are reported as small cell lung carcinoma (SCLC), non-small cell lung carcinoma (NSCLC), metastatic lesions when malignant cells were not consistent with the morphological features of lung carcinoma, and benign lesions. NSCLCs cases were further sub-classified as squamous cell carcinoma (SCC), adenocarcinoma and large cell carcinoma (NSCLC-NOS) etc. according to cytomorphology of malignant cells.

Statistical Analysis

The data were collected and checked for completeness and accuracy. The data were be entered into SPSS (IBM) version 21 and descriptive statistical methods like mean, mode,

percentages, etc. were applied. The data are represented using table, pie charts and bar-diagram.

RESULTS

A total of 150 cases of lung mass lesions were included in the present study. The most common clinical presentation was breathlessness (60%) and weight loss (54%) followed by cough (49%) and fever (48%). Adequate aspirate was obtained in a total of 109 patients. The overall adequacy rate was 72.67%. There were 85 males (56.3%) and 65 (43.3%) females with a male to female ratio of 1.3:1. The mean age of the patients was 65 years. Sizes of various lesions ranged from 1.5 cm to 10 cm with mean size of 4.6 cm (SD ± 1.7 cms) in greatest diameter. As for lung lesions, 61 cases (40.7%) were on right side and 89 cases (59.3%) were on left side. Upper lobes were affected the most, right upper lobe. Maximum cases of benign lesions were chronic non-specific suppurative lesions (17.3%, 26 cases) followed by tuberculosis (3.3%, 05 cases). Regarding the malignant categories, adenocarcinoma (22.7%; 34 cases) was the most common malignancy followed by non-small cell carcinoma not otherwise specified (NOS) (14.7%; 22 cases), squamous cell carcinoma (8.0%, 12 cases) and small cell carcinoma (6.7%; 10 cases) respectively. Demographic description of the study is given in Figure 1. Cytological yield is shown in Figure 2. Distribution of disease spectrum in lung lesions is shown in Figure 3. Table 1 shows primary neoplastic lesions in lung.

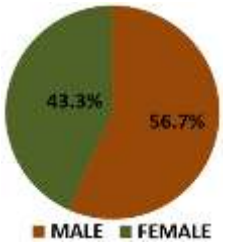

Figure 1. Study Population

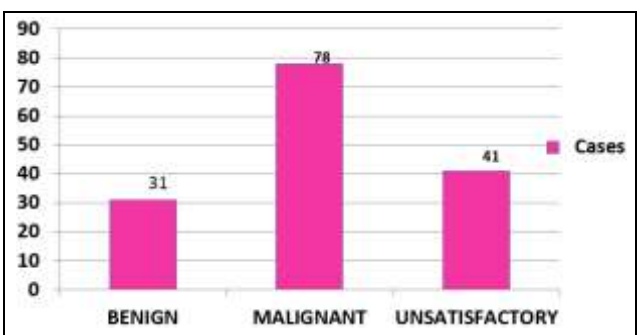

Figure 2. Cytological Yield

The sensitivity, specificity and diagnostic accuracy of CT-guided FNAC of intrathoracic malignant lesions were 96.1% and 92.3% respectively (p<0.0000018). Pneumothorax (2/150; 1.3%), haemoptysis (4/150; 2.6%) and transient pleuritic chest pain (2/150; 2.6%) were the complications encountered during the study period.

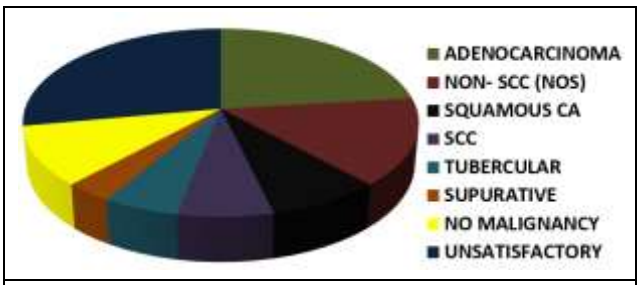

Figure 3. Distribution of Disease Spectrum in Lung Lesions

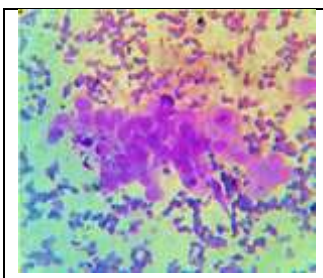

Figure 4a. ADENOCARCINOMA- Monolayered Sheets of Large Cells With Abundant Delicate Cytoplasm and Enlarged Hyperchromatic Nuclei

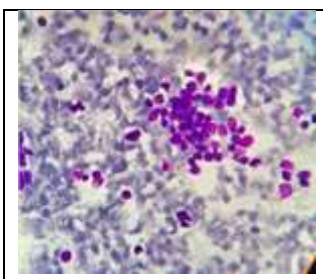

Figure 4b. Small Cell Carcinoma- Loose Clusters of Small Cells with Little Cytoplasm and Irregular or Molded Nuclei

Type of Malignancy	Number / 78	Percentage/78 (100%)
Adenocarcinoma	34	22.7
Non- Small cell carcinoma (NOS)	22	14.7
Squamous carcinoma	12	8.0
Small cell carcinoma	10	6.7

Table 1. Primary Neoplastic Lesions in Lung

DISCUSSION

Non-small cell carcinoma not otherwise specified (NOS), and small cell carcinoma 10 cases. A solitary pulmonary nodule is a common manifestation of a benign condition but nodules larger than 2 cm, the incidence of a primary lung cancer ranges from 64 to 82%.[13,14] It is very important to have an early and accurate diagnosis for starting specific treatment for malignant lesions, and for avoiding unnecessary surgical procedures for benign conditions. Exact subtyping of NSCLC is now crucial owing to current treatment regimens and emergence of evidence-based medicine. Cough with haemoptysis and shortness of breath were the most common presenting symptoms in patient with lung lesions. Weight loss, chest pain, chest discomfort and fever were common symptoms. General weakness and loss of appetite were less common symptoms. Age range from 45 to 89 years with overall mean age of presentation was 67 years.

The present study was carried out to study the cytomorphology of lung lesions. There were 150 patients and adequate aspirate was obtained in 109 cases giving an adequacy rate of 72.67%. It was comparable with other

studies.[1,3-5,7-11,15] The size and depth of the lesion affects the adequacy of the aspirate. The high diagnostic accuracy is best achieved in large nodules.[2] 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 visualized lesions leads to revolutionizing the cytology of respiratory track. Computed Tomography (CT) is the most prominent imaging modality used in the study of lung lesions.[3,10] 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.[1-10] Lung was the most commonly aspirated site similar to otherstudies.[1,9,11,16,17] The number of male patients were more in the study and the male to female ratio was 1.3: 1. Other studies also showed predominance of male patients.[3,4,5,9,10,11,15] The clinical presentation of the patients with lung lesions is variable. These patients presents with cough, chest pain, shortness of breath, loss of weight., haemoptysis, fever and sometimes with hoarseness of voice.[1,3,4,6,8,11,15] The most common clinical presentation was shortness of breath and weight loss followed by cough, chest pain and fever in our study.

Benign Lesions

There were 31 benign lesions. In six cases the cytological diagnosis was tuberculous granulomatous lesions with AFB positive bacilli. Granulomatous lesions were confidently diagnosed on cytology. Nonspecific inflammatory lesions were seen in eight cases which showed plenty of polymorphs and necrotic fibrinous background. These are nonspecific findings.

Malignant Lesions

Malignant lesions were the most common accounting for 52%. This is similar to the other studies.[1,3,4,5,6,7,8,11] Adenocarcinoma was the most the common malignancy in our study similar to the other studies.[3,4,5,9,11,16,17] In some studies squamous cell carcinoma the most frequent type of carcinoma.[1,7,8,11,15] In the present study the sensitivity and specificity was 92.31% and 100% respectively compared to other studies. Various complications like pain, pneumothorax, haemorrhage and haemoptysis can occur during the procedure. Other rare complications are haemothorax, pulmonary embolism and very rarely needle tract implantation. We encountered pain as the most common complication followed by pneumothorax. No patient required chest tube insertion in our study.

CONCLUSIONS

CT guided FNAC is a simple, less expensive, and reliable method for diagnosis of pulmonary lesions. CT guided FNAC of lung lesions is a safe, less invasive procedure with a high diagnostic accuracy. This can help in early initiation of the specific therapy avoiding the major surgical procedure like thoracotomy. CT-guided transthoracic FNAB is an accurate method to rule out malignancy with reasonable rate of complications such as pneumothorax and pulmonary haemorrhage. The pit falls in the diagnosis can be prevented by proper clinical and radiological correlation.

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