International Journal of Research in Medical Sciences
Raghuvanshi S et al. Int J Res Med Sci. 2019 Mar;7(3):663-668
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20190914

Original Research Article

Computed tomography- guided percutaneous core needle biopsy for diagnosis of intathoracic mass lesions: experience at a tertiary care centre of North India

Shivanjali Raghuvanshi[1], Shalini Bhalla[1]*, Vanshika Shahi[1], Manoj Kumar[2], Sumaira Qayoom[1], Shalini Rawat[1], Anand Srivastava[3], Madhu Mati Goel[1]

[1]Department of Pathology, [2]Department of Radiodiagnosis, [3]Department of Respiratory Medicine, King George's Medical College, Lucknow, Uttar Pradesh, India

Received: 09 December 2018
Accepted: 03 January 2019

***Correspondence:**
Dr. Shalini Bhalla,
E-mail: bhalashalini@gmail.com

ABSTRACT

Background: CT guided core needle biopsy is a less invasive method for initial diagnostic workup in the assessment of intrathoracic masses. This study was conducted to evaluate the diagnostic yield of the procedure as well as to demonstrate the spectrum of various disease in our population.
Methods: Present study was conducted in a tertiary care hospital for a study period of two years. Patients with intrathoracic mass were included and CT guided biopsies were performed following a protocol. The CT guided biopsies received were examined for histological diagnosis. Immunohistochemistry was carried out where ever routine histopathology was not sufficient for diagnosis. Relevant immunohistochemical panels were applied for lung, mediastinal and pleural tumours according to the histological differential diagnosis. Detailed demographic and clinical profiles along with radiological findings were noted.
Results: Total of 138 cases were taken for CT guided FNAC procedure and 123 (89.1%) cases yielded diagnostic biopsy. Lung was the most commonly involved organ followed by mediastinum. Bronchogenic carcinoma was the most common lesion reported in lung and Non-Hodgkin Lymphoma was the most common mediastinal lesion. Lung collapse was most common radiological feature.
Conclusions: CT guided percutaneous biopsy is a valuable diagnostic technique providing for early accurate diagnosis and being minimally invasive procedure. Care should be taken while tissue processing and section cutting of intrathoracic biopsies as the biopsies are small and tissue loss should be prevented so that sufficient material is available for immunohistochemistry.

Keywords: CT guided biopsy, Intrathoracic mass lesions, Lung, Mediastinal, PCNB

INTRODUCTION

Computed tomography-guided percutaneous core needle biopsy (PCNB) is a diagnostic technique for initial assessment of intrathoracic mass lesions. These lesions can involve the lung, mediastinum or pleura; hence a wide spectrum of diseases can be diagnosed by this technique. Correlation of Clinical details, radiology with CT plays an important role in determining the nature of pulmonary nodule (benign versus malignant). Radiological features like lesion size, location, contour and edge, presence or absence of calcifications, necrosis

and contrast enhancement are evaluated. These features alone cannot always distinguish benignity from malignancy, and significant overlapping features exist among different lesions. CT allows the performance of intra thoracic biopsy in situations in which conventional X-rays or ultrasound do not correctly visualize the lesion or the needle tract, as enclosed within the thoracic cage. It is especially useful in mediastinal lesions and centrally placed lung lesions as precise localization of the needle in relation to the lesion can be documented.[1] Reports have shown that PCNB is a widely accepted procedure which is reliable and minimally invasive, however occurrence of complications in this procedure does occur.[2,3]

The accuracy of biopsy has been found to be better than cytology in the evaluation of mediastinal lesions.[4,5] The larger volume of tissue obtained by percutaneous core-needle biopsy (PCNB) plays a vital role in enabling histopathological diagnosis and providing material for immunohistochemical and molecular analysis as required.

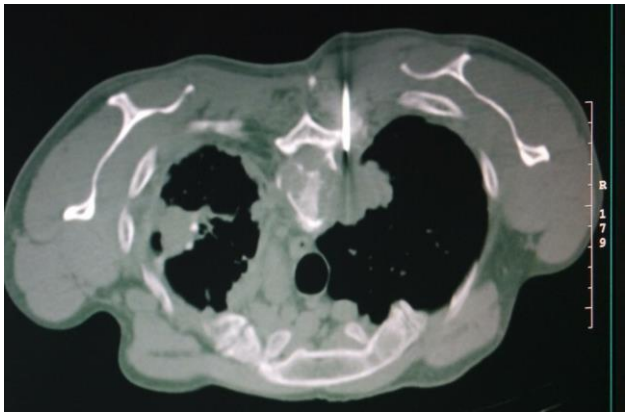
The aim of the present study was to evaluate the diagnostic accuracy of CT guided biopsy and to evaluate the spectrum of benign and malignant lesions in our set up.

METHODS

The present study was conducted in Department of Pathology, Respiratory Medicine and Radiodiagnosis in a tertiary care teaching hospital over a period of two years from June 2016 to May 2018. Patients with Intrathoracic mass lesions diagnosed on radiology were included in the study. Informed consent was obtained from each patient and epidemiological details including gender, age of patient at the time of biopsy were noted. A complete hemogram and coagulation profile was done in all cases. Anatomic location of the lesion in the intrathoracic cavity, size of lesions, complications of the procedure and final histopathological diagnosis were noted in all cases. In those cases where definite diagnosis could not be made on routine histopathology; an immunohistochemical panel was put depending on the differential diagnosis.

Procedure

The diagnostic CT scan of the patient was reviewed and the patient position was decided as prone, supine or oblique depending on the location of the lesion. Preliminary 10mm CT scans were obtained to localize the mass and determine the safest and most direct path for needle insertion. The skin entry point was marked, the localized biopsy area was then cleaned with an antiseptic solution, 2% Xylocaine was injected intradermally and subcutaneously. The distance of the skin entry point and the lesion was measured while the needle was in position. The 18-gauge automated or semi-automated cutting needle system was then introduced at the same point on the skin and into the margin of the lesion. A CT confirmation of the correct position of the needle tip was then done (Figure 1). The patient was asked to either hold breath or shallow breathe and the biopsy system was fired obtaining a core of tissue in front of the needle. Due care was also taken to avoid emphysematous bulla, lung parenchyma and blood vessels.



18-gauge bard biopsy gun used with needle trajectory seen from skin surface to right paravertebral mass lesion shown by arrow.

Figure 1: Right paravertebral mass and left apical mass lesions in prone patient.

The biopsies were fixed in 10% buffered neutral formalin solution and sent for histopathological evaluation to the Department of Pathology. After removal of the biopsy needle, immediate post biopsy pneumothorax or bleeding was checked in CT images around the puncture site. Efforts were made to reduce the occurrence of biopsy-induced pneumothorax by limiting the number of pleural punctures. Tissue received in Department of Pathology was processed and sections of formalin fixed paraffin embedded tissue were stained with Hematoxylin and eosin for histopathological diagnosis.

Cases were classified according to site of lesion and further sub classified into benign, malignant and non-diagnostic. Non-diagnostic category included biopsies with non-specific inflammation, fibrocollagenous tissue, necrosis or lung parenchymal cells only. Special stains like Ziehl Neelsen stain and PAS were put up where an infectious etiology was suspected. Immunohistochemistry was performed in cases where routine histopathological findings were not sufficient to arrive at a diagnosis or further typing of the tumour was required. Immunohistochemistry panel was judiciously decided depending on the site and histological type of lesion.

In case of lung tumours, IHC panel for Adenocarcinoma included were TTF-1, EGFR and ALK. In cases of Squamous cell carcinoma, CK 5/6 and p63 were used as required. For Small cell carcinoma, a panel of Synaptophysin, Chromogranin and additionally CD56 was done. While for Lymphomas LCA, Tdt, CD3, CD20, Ki-67 and other markers as and when required to complete the panel were applied. Additional markers used were CD34 and calretinin.

RESULTS

Among 138 cases of CT guided biopsy received during the study period, 123 (89.1%) biopsies were diagnostic with definite final histopathological diagnosis and 15 (10.9%) were in the nondiagnostic category.

Table 1: Clinical features in patients of intrathoracic mass (n=123).

Clinical features	N (%)
Fever	108 (87.8%)
Cough	95 (77.2%)
Hemoptysis	90 (73.2%)
Chest pain	84 (68.3%)
Expectoration	30 (24.4%)

Table 2: Frequency of lesions of lung (n=104).

Lung lesions	N (%)
Bronchogenic carcinoma	93 (89.2%)
Tuberculosis	4 (3.8%)
Metastasis	4 (3.8%)
Aspergilloma	1 (1.0%)
Hyadatid cyst	1 (1.0%)
Sarcoidosis	1 (1.0%)

Table 3: Frequency of lesions of mediastinum (n=15).

Mediastinal lesions	N (%)
Non-Hodgkin's lymphoma	6 (40.0%)
Thymoma	2 (13.3%)
Neurogenic tumor	2 (13.3%)
Dermoid cyst/benign teratoma	2 (13.3%)
Lipoma	2 (13.3%)
Extra gonadal germ cell tumor	1 (6.8%)

The study group included 123 patients whose age range was from 21-84 years (mean age- 52.56 years), with maximum cases presenting between 51 - 60 years. Male to female ratio was 2.5:1. The clinical features at presentation are shown in Table 1, the commonest symptoms being fever and cough. Of all the diagnosed cases, 84.6% (104/123) cases were localized to the lung followed by mediastinum in 12.1% (15/123) cases and pleura in 3.3% (4/123) Bronchogenic carcinoma was the most common lesion encountered in lung followed by other benign lesions apart from metastasis. Spectrum of benign lesions included cases of Tuberculosis, Aspergillosis, Hydatid cyst and sarcoidosis. Mediastinal lesions included cases of Non-Hodgkin's lymphoma, thymoma, neurogenic tumors, dermoid cyst, lipoma and extragonadal germ cell tumors (Table 2 and 3). The pleural lesions during the study period were only 4 cases, comprising of 2 cases each of mesothelioma and solitary fibrous tumor. Radiological features of all cases were analysed and the mean diameter of the lesions was 5.2cm (Range 2.8 to 10.0cm).

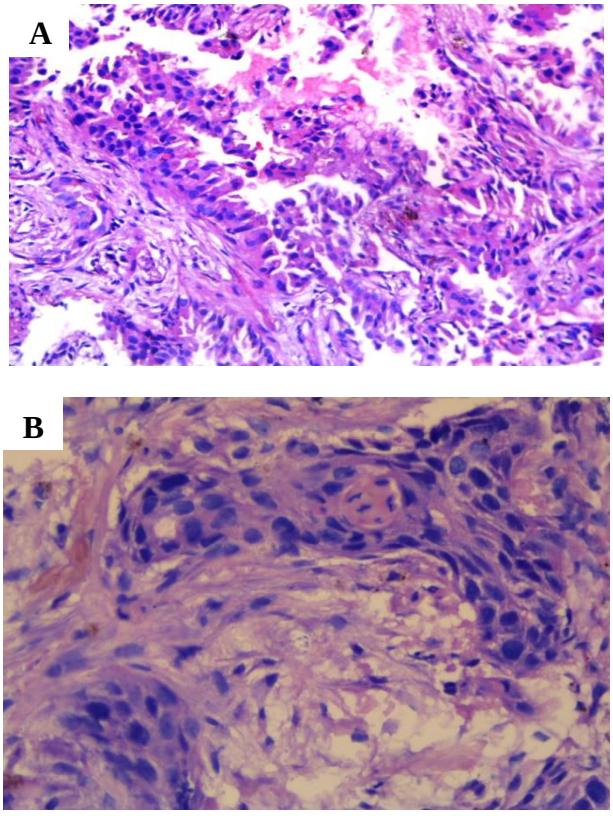


Figure 2: Photomicrograph showing. (A): Primary adenocarcinoma of lung: showing infiltrating neoplastic glands (H&E, 20X) (B): squamous cell carcinoma of lung: infiltrating atypical squamous cells in sheets and clusters. (Hematoxylin and Eosin, 20X).

Malignant cases accounted for 91.1% (112/123) cases and benign cases were 8.9% (11/123) cases. The various histopathological subtypes of benign and malignant cases are shown in Table 4 and Table 5. Amongst the benign lesions, Tuberculosis was most common in the spectrum of benign lesions accounting for 36.1% (4/11). Two cases of aspergillosis and 1 of hydatid cyst were reported.

Table 4: Frequency of malignant lesions (n=112).

Type of malignancy	N (%)
Bronchogenic carcinoma	93 (83.0%)
Adenocarcinoma	54 (58.0%)
Squamous cell carcinoma	29 (31.1%)
Small cell carcinoma	7 (7.6%)
Large cell carcinoma	1 (1.1%)
Adenoid cystic carcinoma	1 (1.1%)
Adeno-squamous carcinoma	1 (1.1%)
Non-Hodgkin's lymphoma	6 (5.3%)
Metastasis	4 (3.5%)
Solitary fibrous tumor	2 (1.8%)
Mesothelioma	2 (1.8%)
Thymoma	2 (1.8%)
Neurogenic tumor	2 (1.8%)
Extra gonadal germ cell tumor	1 (1.1%)

Amongst the pathological spectrum of all thoracic lesions, primary bronchogenic carcinoma (n=93) was the most common lesion encountered in lung. Male to female ratio was 3:1. Mean age of presentation was 50 years. Adenocarcinoma was the most common among them accounting for 58.3% (54/93), followed by squamous cell carcinoma31.2% (29/93) and small cell carcinoma 7.5% (7/93) (Figure 2).

Table 5: Frequency of benign lesions (n=11).

Lesion	N (%)
Tuberculosis	4 (36.4%)
Dermoid cyst/benign teratoma	2 (18.1%)
Lipoma	2 (18.1%)
Aspergilloma	1 (9.1%)
Hyadatid cyst	1 (9.1%)
Sarcoidosis	1 (9.1%)

Table 6: Frequency of site of involvement in malignant lung lesions (n=93).

Location	N (%)
Right upper lobe	28 (30.1%)
Right lower lobe	18 (19.4%)
Left upper lobe	14 (15.1%)
Bronchus	13(13.9%)
Left lower lobe	8 (8.6%)
Right upper and lower lobe	8 (8.6%)
Right middle lobe	4 (4.3%)

Table 7: Lymphnode involvement in patients of lung carcinoma (n=18/93;19.4%).

Lymphnode group	N (%)
Mediastinal lymphnode	8 (8.6%)
Ipsilateral Hilar lymphnode	3 (3.2%)
Supraclavicular lymphnode	3 (3.2%)
Contra lateral Hilar Lymphnode	2 (2.2%)
Carinal lymphnode	2 (2.2%)

One case each of rare subtypes was diagnosed like Adenoid cystic carcinoma and adenosquamous carcinoma. Metastasis was seen in 4 cases. Two cases were of metastasis from colon cancer and one from breast and stomach each. Lung carcinomas predominantly involved the right upper and lower lobes (Table 6). Metastasis to lymph nodes was seen in 19.4% cases (18/93). Mediastinal group of lymph nodes were the most common site of involvement (8.6%) followed by Hilar group of lymphnodes (Table 7). CT findings of 108 Lung and pleural masses were compiled and compared (Table 8). Collapse was most common finding noted in benign and malignant lung lesions.

Among 15 mediastinal masses, Non-Hodgkin lymphoma cases were 5.4% (6/15) and thymoma accounted for 1.8% (2/15). Radiology showed cases of lymph nodal masses in anterior mediastinum 4/6 cases and 2/6 in middle mediastinum. Amongst Non-Hodgkin's Lymphoma, 4 cases were subtyped as Diffuse Large B cell lymphoma and 1 case as T- Lymphoblastic lymphoma.

Table 8: Radiological findings in benign and malignant lesions of lung and pleura (n=108).

CT-findings	Malignant	Benign
Collapse	40 (37.3%)	4 (3.7%)
Calcification	29 (26.9%)	0 (0%)
Lymphnode	28 (25.9%)	2 (1.9%)
Effusion	20 (18.5%)	5 (4.6%)
Cavitation	20 (18.5%)	2 (1.9%)
Chest wall invasion	9 (8.3%)	0 (0%)

DISCUSSION

In this study, author reported experience in the utility of CT-guided percutaneous needle biopsy in the diagnosis of both benign and malignant intrathoracic lesions as an initial diagnostic procedure. This method is a minimally invasive safe method especially for diagnosis of lung carcinoma which is the commonest cause of cancer deaths worldwide.[6] The advent of targeted therapy in the last decade also calls for the larger tissue biopsy for initial histological typing, other ancillary studies as well as molecular profiling in cases of lung cancer and lymphomas these cases.[7,8]

In present study, CT-guided PCNB provided adequate specimen material in 123 /138 cases giving an accuracy sample yield of 89.1%, almost in close accordance with study of Zafar et al, who reported 92%.diagnostic material accuracy rate by this technique.[9] Similar findings have been reported by Greif et al, and Loubeyre et al, as 87% and 97% respectively.[10,11] The diagnostic yield was higher in cases of primary tumor diagnosis or cases of relapse than in residual cases especially cases of Lymphoma.[3]

Patients undergoing PCNB are usually those who have solid mass or sometimes cystic lesions where no diagnosis is inferred on sputum, blood culture or bronchoscopy. Predominantly most of these cases are malignant in nature. Even in present study most of the lesions were malignant in nature (84.6%). This is comparable to the study done by de Margerie et al, where 82% lesions were malignant and 18% benign lesions.[3] Bronchogenic carcinoma accounted for majority of cases in the present study. Male predominance in cases of lung cancer continues in India for over the last four decades while in the United States it has been stable in male with increasing incidence in females.[11-15] On review of literature, incidence of various histopathological subtypes of bronchogenic carcinoma varied. Studies with adenocarcinoma as most common subtype while the incidence of squamous cell carcinoma and small cell carcinoma has shown a decreasing trend.[15-17]

Lymphoma was the most common subtype amongst mediastinal masses in the present study. Several studies have reported lymphoma as the most common subtype and subtyping of lymphomas could also be done providing help in further management.[18-20] Anterior mediastinum was most commonly involved by lymphomas. Similar findings have been reported by Rabbani et al.[4]

Handling of core needle biopsy specimens and application of Immunohistochemistry needs a special mention in cases of intrathoracic masses. Present study had many biopsies which were small and had only one or two cores. Prevention of tissue loss should be paid attention to while handling the tissue specimen to retain sufficient tissue in the paraffin block for immunohistochemistry, additional sections on coated slides should be cut simultaneously when asking for serial sections.

Additionally, as examination of morphology may not be always sufficient for making a diagnosis, immunohistochemistry becomes mandatory. This study has its own limitations. Etiological factors like smoking in cases of lung cancer were not available in all the cases. Additionally, our study is a tertiary care centre study so may not be reflective of true population.

As target therapy in lung cancer has rapidly evolved, there is increasing need to establish the procedure of per cutaneous core needle at centres wherever feasible as minimally invasive specification of pulmonary lesions is required for further treatment. Also, the emerging field of lung cancer screening is likely to cause a rising demand for transthoracic lung biopsies, especially when up-front surgical resection is considered inappropriate with minimal invasive diagnostic procedures.[21]

CONCLUSION

To conclude, CT-guided PCNB is a safe and reliable procedure that can provide a precise diagnosis for patients with both benign and malignant mediastinal masses, and it is considered the preferred first diagnostic procedure use for this purpose.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Raghuvanshi S, Bhalla S, Shahi V, Kumar M, Qayoom S, Rawat S, et al. Computed tomography- guided percutaneous core needle biopsy for diagnosis of intathoracic mass lesions: experience at a tertiary care centre of North India. Int J Res Med Sci 2019;7:663-8.